3600 FINANCE COMMUNICATION SYSTEM

PURPOSE

Programming support in the central processor for the 3600 Finance Communication System consists of an OS/VS or DOS/VS assembler, support programs used exclusively with 3600 systems (i.e., the 3600 Host Support Independent Release-IR), and the Subsystem Support Services used in common by 3600 systems and other subsystems. This programming support enables the user to: Define the configuration for each 3601/3602 controller and 3694 Document Processor... Customize each 3614 or 3624 Consumer Transaction Facility ... Write 3601/3602 application programs ... Create and maintain a library for the 3600 system at the central computing system ... Transmit 3601/3602 and 3694 Document Processor configuration images, 3614 or 3624 customization images, and 3601/3602 and 3694 Document Processor application program images to 3601s/3602s /3694s and 3614s and 3624s ... Test these images, using special debugging commands, from a 3270 display/printer ... Print dumps of 3601/3602 /3694 application program storage and diskette files ... Convert assembly listings of 3601/3602 /3694 application programs into a more meaningful format ... Generate personal codes for 3614 and 3624 users ... Encipher and decipher messages transmitted to or from 3614s or 3624s.

3600 HOST SUPPORT (Independent Release)

The assembler creates configuration data from 3601/3602 /3694 configuration macro instructions, creates customization data from 3614 and 3624 customization instructions, and creates 3601/3602 /3694 application program object modules from programs written in 3600 Assembler Language.

3601/3602 /3694 Configuration Definition macro instructions: These are used to specify the physical and logical configuration of each 3601/3602 /3694 and its associated user workstations. The macro instructions are assembled into configuration data by the macro facility of the OS/VS or DOS/VS Assembler. The configuration macro instructions describe: User-defined parts of 3601/3602 /3694 storage (called segments) ... Files to be created on the 3601/3602 /3694 diskette ... Loops by which terminals are attached to the 3601/3602 controller ... The link between the 3601/3602 /3694 and the telecommunication network ... Translation tables for the keyboards, printers and displays of terminals attached to the 3601/3602 /3694 ... Terminals, storage, application programs, and operators associated with the workstations for the 3601/3602 /3694.

3614 and 3624 Customization Image Definition macro instructions: These specify the physical and logical configuration for each 3614 or 3624. The macro instructions are assembled into customization data by the macro facility of the OS/VS , DOS/VS or DOS/VSE Assembler.

3600 Assembler Language: This is the set of macro instructions used to write application programs for execution in a 3601 or 3602 controller or 3694 Document Processor. Programs written in this language are assembled into object modules by the OS/VS or DOS/VS Assembler.

3600 Post-List Processor: This program can be used after a 3601/3602 /3694 application program has been assembled to delete unnecessary assembler statements and make the assembly listing more readable.

3600 Host Support Program (HSP): Beginning with IR4, this program is used to link edit (1) any subsections of the 3601/3602 /3694 application programs into a single application program module and (2) the application program modules, controller configuration module and controller data into a single 3601/3602 /3694 diskette image. The 3601/3602 /3694 images are then put into the Subsystem Library. In addition, HSP will ADD/REPLACE image subsections and provide a facility for patching these images. These functions also apply to 3614 or 3624 customization images.

3600 Host Diskette Image Create (HDIC): This program can be used as an alternative to transmitting the diskette image to the 3601/3602 /3694 by SSS (see below) during the diskette create process. HDIC takes the diskette image from the Subsystem Library, processes it and writes it to a sequential host data set. Further processing could include (1) transmitting the complete image, via user application, to a 3601/3602 /3694 to complete diskette creation, or (2) spooling the complete image to a removable medium for further processing at another host.

3600 Program Validation Services (PVS): After the 3601/3602 configuration and 3601/3602 application program have been assembled and Link Edited, the user test them with 3600 Program Validation Services. These services use VTAM and a local or remote 3277 mdl 2, or a 3274 and 3278 mdl 2 or a 3276 mdl 2 or mdl 12 and, optionally, a 3284 mdl 2 or 3286 mdl 2 printer attached to a S/370 Processor, and provide special debugging commands for the testing. See the appropriate SCP section on terminal support for compatible devices supported.

3614 and 3624 Hard Error Recovery Modules: These can be used to indicate the recovery action that should be taken after a hard error status occurs in a 3614/3624 causing it to close. The user furnishes the recovery analysis program with the maintenance data from the 3614/3624 and a risk acceptance level associated with reopening the 3614/3624. The hard error routine performs a rather complex analysis of the maintenance data to recommend a recovery action. The recovery action recommended is based on severity of errors, previous error history, and the acceptable risk level. Based on this analysis three possible actions may be taken by the user's program:

- Attempt to reopen the 3614/3624.
- Inform the operator that manual service is required by a representative of the operating institution.
- Inform the operator that service is required by a hardware service representative (IBM CE or equivalent).

This facility is available in both the 3600 sub-host and the S/370 host support code.

3614 Control Data Format Service Routine: Beginning with the availability of the 3600 Host Support Independent Release 3, 3614 control data tapes for Version 4 and earlier 3614s must be re-formatted by this service routine before further processing by 3600 Host Support programs.

3614 and 3624 Host Support: The following two sets of programs provide host Processor data encryption support for the 3614 and 3624 Consumer Transaction Facility. Source listings are not orderable for, nor supplied with, these modules. Customers should be informed of this fact before the 3614 or 3624 is ordered.

Personal Identification Number (PIN) Generation Program: The 3614 and 3624 user is identified by an account number encoded on a magnetic stripe on his identification card and by a PIN entered at the 3614 or 3624. The PIN is issued to the user by the financial institution and can be freely selected if the financial institution chooses to write its own host application programs to generate and check the PINs. As an alternative, PINs can be generated using the PIN Generation Program and the codes entered at the 3614 or 3624 can be checked automatically by the 3614 or 3624. When this option is chosen, the PINs have a special, complex relationship to the account number on the identification card. The two versions of this program (BQKPERS and BQKDPERS) allow the financial institution to generate PINs under either the 3614 Alternate Encryption Technique (AET) or the U.S. Federal Information Processing Data Encryption Standard (DES) respectively. In addition, the DES version allows greater flexibility in PIN and offset number generation.

Cipher Program: The cipher program is used by the host application program to encipher and decipher messages and by Subsystem Support Services to encipher the 3614 or 3624 customization image before transmitting it. The integrity of the enciphering and deciphering process depends upon adequate safeguarding of the user-supplied cryptographic key used by the cipher program. The two versions of this program (BQKCIPH and BQKDES) allow the financial institution to encipher the 3614 customization image and other data under either AET or DES, respectively.

SUBSYSTEM SUPPORT SERVICES - SSS

SSS provides support for the creation and maintenance of the 3600 library and for transmitting load images to the 3601, 3602 and 3614 or 3624 and 3694. The host processor creates the load images which are than transmitted by SSS to the 3601, 3602, 3614 or 3624 and 3694. SSS also supports a dump of an application program storage segment from the 3601 or 3602 controller or 3694 Document Processor and of the user's 3601/3602 /3694 diskette files. SSS uses a special dump-formatting program. It can also receive data specified by the system monitor's 888 command.

DOCUMENTATION (available from Mechanicsburg)

Title	Number.
SSS User's Guide	GC30-3022
3600 System Summary	GC27-0001
Instructions and Macro Reference	GC27-0003
Programmer's Guide and Component Description	GC27-0004
Host Service Programs Reference	GC27-0005
DOS/VS 3600 Host Support IR Release 6	5747-BR1
OS/VS 3600 Host Support IR Release 6	5744-CA3

3630 PLANT COMMUNICATION SYSTEM (PCS)

PURPOSE

Programming support in the S/370, 3031, 3032, 3033, 4331, 4341, 4361 or 4381 central processors for the 3630 PCS consists of an OS/VS or DOS/VS Assembler, VTAM, ACF/VTAM, ACF/VTAME, TCAM or ACF/TCAM Subsystem Support Services and the 3630 Host Service Programs. This support is required for program preparation and test of all 3630 systems whether operationally attached to the S/370, 303X, 4300 or 8100 systems.

HOST SERVICES PROGRAMS

The 3630 Plant communication System Host Services Programs are made up of:

3630 Application and Configuration Macros
3630 Post List Processor
3630 Host Support Program
3630 Program Validation Services (PVS)
3644 Translation Services
3630 Dump Formatting Program
3630 Host Diskette Image Create (HDIC)

The 3630 Plant Communication System Host Service is System Control Programming designed to support the IBM 3630 Plant Communication System consisting of:

3631 Plant Communication Controller
3632 Plant Communication Controller
3604 Keyboard Display (Operators Console)
3641 Reporting Terminal
3642 Encoder Printer
3643 Keyboard Display
3644 Automatic Data Unit
3645 Printer
3646 Scanner Control Unit
3647 Time and Attendance Terminal
7430 Document Printer (RPQ)

This support enables the user to: Define the configuration for each 3631/3632 controller, write 3631/3632 application programs, create 3644 programs, create and maintain a library for the 3630 system at the central computing site; transmit 3631/3632 configuration images, 3644 programs and 3631/3632 Application Programs to the 3631s/3632s, test at the central system using special debugging commands from a 3270 display/printer, print dumps of 3631/3632 Application Program storage and diskette files and convert assembly listings of 3631/3632 Application Programs into a more meaningful format.

Descriptions of these Host Service Programs follows:

- **3630 Application and Configuration Macros:** A set of assembler macro instructions which allow for: (1) the coding of 3630 Application Programs for execution in the 3631/3632 controllers; (2) the definition of 3631/3632 configurations. The Application Programs written with these macros are assembled into object modules by the OS/VS or DOS/VS Assembler.

  Macro instructions provide arithmetic, logical, data movement and data transmission capabilities. Additional miscellaneous functions are provided such as: table look-up, editing, overlay control, field translation, dynamic control of priority dispatching, dynamic instruction modification, data decompression/decompaction and data compression/compaction.

  Other macro instructions are used to specify the physical and logical configuration of each 3631 or 3632 controller such as: model of controller, loops by which terminals are attached to the 3631/3632 controller, terminals attached to the loops, the link between the 3631/3632 and the host system, the layout of user storage, the files to be created on the 3631/3632 diskette, etc.

  Included in this macro set are members containing the source code for the disk Services Program.

- **3630 Post List Processor:** The Post-List Processor provides the programmer with a listing of 3631/3632 controller Application Programs that is easier to read than the Standard assembly listing. The Post-List Processor simplifies and clarifies the assembly listing of Application Programs by:
  - Deleting define constants (DCs) and define storage statements (DSs) from the listing.
  - Renumbering the lines remaining in the listing.
  - Creating an accurate cross-reference by converting all line number references from the old to the new line numbers.
  - Printing from 1 to 99 lines per page.
  - Aligning the object code at the left side of the page.

  The Post-List Processor uses the listing data set produced by the assembler for 3631/3632 Application Programs as input.

- **3630 Host Support Program:** This program is used to add and maintain application program data, configuration data, 3644 Parameter Table Load data and IBM-supplied controller and 3644 Control Storage Load data on the 3630 Subsystem Library (SSSSIL). Its functions provide: SSSSIL maintenance (including an application program and controller data patching ability), link-editing of application program sections and load image creation. The link-edit facility allows an application program to be split into sections, as appropriate, and each section assembled separately.

  Note: the IBM supplied controller data and 3644 Control Storage Load data is ordered by specify code on the appropriate machine.

- **Program Validation Services (PVS):** Program Validation Services (PVS) is a host service program that simulates the 3630 controller subsystem via a 3270 Information Display System, locally or remotely attached to a S/370 by means of VTAM, ACF/VTAM or ACF/VTAME. The 3270 system used by PVS consists of a 3271 or 3272 mdl 2 Control Unit, one 3277 mdl 2 Display Station and optionally, a 3284 or 3286 Printer mdl 2. A 3274 Control Unit and 3278 Display Station mdl 2 or 3276 Control Unit/Display Station mdl 2 or mdl 12 can also be used with VTAM, ACF/VTAM or ACF/VTAME.

  Using PVS, controller application programs can be tested at the host. PVS creates a debugging environment that puts the user in control of a PVS session. This session is a dialog between the application programmer and PVS using the 3270 system for communication.

  To assist the user in debugging the controller application program, PVS offers a set of powerful and flexible commands to:
  - Halt the execution of the program at specified addresses.
  - Display the contents of registers and storage areas.
  - Alter the contents of registers and storage areas.
  - Obtain a list of instructions in the program with indicators that tell which instructions were executed (mapping function).
  - Display instructions as they are executed (tracing function).
  - Print, optionally, on the 3284 or 3286 printer, user data that is otherwise displayed on the 3274/3278/3276.
  - Print, on the system printer, copies of the 3270 panels.
  - Print, on the system printer, dumps of the Application Programs resources, for example, the PVS Status Listing.

- **3644 Translation Services:** This program allows the user to customize the operation of the IBM 3644 Automatic Data Unit. The 3644 Translation Services executes on the host system to translate user defined entries from the 3644 Worksheets into the Parameter Table Load (PTL) format for use by the 3644.

  The functions provided by the 3644 Translation Services include:
  - Editing of the source statements on an element by element and total table basis to check the consistency of the selected parameters.
  - Converting of the source statements into the table format required by the 3644.
  - Listing of the source statements.
  - Listing of messages for any error conditions encountered during the editing operation.

  The resulting PTL, along with the IBM-supplied Control Storage Load (CSL), is stored in the Subsystem Library at the host by the 3630 Host Support Program, for subsequent transmission by Subsystem Support Services (SSS) to the 3631/3632 controller where it will be stored on the permanent file by the System Monitor and eventual loading into the 3644 from the controller upon demand from the 3644.

- **3630 Dump Formatting Program:** This program is used in conjunction with the Subsystem Support Services printing routines to provide dumps of Application Programs storage and diskette files in a readable format by:
  - Translating the data into printable hexadecimal.
  - Converting the data into EBCDIC characters (or periods for nonprintable characters).
  - Converting register contents to decimal.
  - Determining where each page of the dump begins and ends.
  - Adding headings and footings to each page of the dump printout.

  The input to the Dump Formatting Program consists of dump data transmitted from a 3631/3632 controller and stored in a SSS work file.

- **3630 Host Diskette Image Create (HDIC):** This program can be used as an alternative to transmitting the diskette image to the 3631/3632 by Subsystem Support Services (SSS) Interactive during the diskette create process. HDIC, replaces SSS - Interactive, and gets the diskette image from the Subsystem

3630 PCS (cont'd)

Library, processes it, and writes it to a sequential host data set. This sequential data set may be transmitted by a user written host application program to a 3631/3632 for normal diskette creation by the 3630 System or transmitted to a user written 3632 application program for storage on a 3632 disk file and subsequent copying onto a diskette. If the diskette image has been spooled to a removable medium, it can be further processed and/or transmitted by another processor. HDIC also permits the user to include permanent file data, including 3644 CSL and/or PTL data, during the diskette image creation process.

SNA/SDLC SUPPORT

The standard telecommunication support for attaching a 3630 System to a host system is via SNA/SDLC Data Link Utilizing VTAM, ACF/VTAM, ACF/VTAME, TCAM, ACF/TCAM, ACF/NCP/VS and NCP/VS. The 3631/3632 controller supports the SNA functions including: Inbound pacing, SIGNAL (host to 3631/3632 controller, BIND parameters - passed to application, and UNBIND - need not be preceded by CLEAR. The 8100 Information System attachment is via the 8130, 8140, 8101 units using SDLC transmission protocols. Programming support on the 8100 system is provided by the DPPX/BASE or DPPX/SP program product.

3630 BSC RPQ SUPPORT

RPQ 810660 enables the 3631 or 3632 to attach to a S/370, 303X or 4300 via binary synchronous communication facilities. This RPQ is supported by BTAM on DOS/VS, OS/VS1 and OS/VS2; also by BTAM-ES on DOS/VSE. A prerequisite for this RPQ is the BSC Starter Diskette (RPQ 810659) in lieu of the standard Starter Diskette.

In addition, a host programming BSC module is provided to replace the SNA/SDLC transmission module of SSS for host to controller communication. Similarly, BTAM is used by PVS to communicate with the locally attached 3270 Information Display System. The 3270 System used by PVS consists of a 3272 Control Unit mdl 2, one 3277 Display Station mdl 2, and optionally, a 3284 or 3286 Printer mdl 2.

SUBSYSTEM SUPPORT SERVICES

SSS provides support for the initialization of the 3630 library, printing the contents of 3630 libraries and for transmitting load images and 3644 data to the 3631 or 3632. SSS also supports a dump of an application program segment from the 3631 or 3632 controller and of the 3631 or 3632 diskette files. SSS uses a special dump formatting program to make the dump listing easier to use. See B.O. Guide to Ordering Programs to order this support. (Available as an independent release for DOS/VS and DOS/VSE - Program No. 5747-CC6).

Note: For descriptions of other host programs, see the appropriate sections of these pages.

DOCUMENTATION: (available from Mechanicsburg)

Title	Number
3630 Programmers Guide	GC24-5174
3630 Plant Communications System Description	GC24-3652
3630 Instructions and Macros Reference Manual	GC24-5173
3644 Programming Guide	GC24-5178
3630 Independent Release Guide (IR 2.0)	GC31-0006
3630 Host Services User's Guide	GC24-5177
3630 Program Validation Services User's Guide	GC24-5176
3630 Controller Operating Guide	GC24-3678
3630 Host Services Program Logic Manual	SY24-5201
3630 BSC3 Communication Feature Description	GA24-3720
3630 Programmers Reference Digest	GX24-3727
SSS User's Guide	GC30-3022

5744-BQ3 - 3650 RETAIL STORE SYSTEM (OS)
5747-BJ3 - 3650 RETAIL STORE SYSTEM (DOS)

PURPOSE

3650 RSS Programming Support consists of SPPS and Host Support, both of which operate in conjunction with SSS Global support provided by the operating systems.

SUBSYSTEM PROGRAMMING PREPARATION SUPPORT - SPPS

The Subsystem Programming Preparation Support (SPPS) provides the capability of writing programs for execution in the 3651 mdls Store Controller mdls A50 and B50.

The customer program may have two parts: a procedural part, and a data format and transformation part.

The procedural part provides the programmer with the capability to perform: Arithmetic ... Logic ... Program Control ... Input/Output operations.

The data format and transformation part provides the programmer with the capability of specifying data formats on 3275 Display Stations mdl 3, and transformations to be applied to such data (including checks and edits) during Input/Output operations which were specified in the procedural part of a program.

Devices supported by SPPS are the 3651, host communication, 3275 Display Station mdl 3 and 3284 in Screen Image mode.

3650 Release I (OS/VS1 and DOS/VS only) supports the 3651 and the capability to write the procedural part. 3650 Release II (OS/VS1, OS/VS2 MVS, DOS/VS) supports the capability to write the data format and transformation part for the 3275 mdl 3 [Program Numbers: DOS (5747-BJ2) - OS (5744-BQ2)].

SUBSYSTEM SUPPORT SERVICES and RETAIL STORE SYSTEM SUPPORT

In support of the 3650 Retail Store System and residing in a host S/370, 30XX or 4300 is RSS Host Support, which operates in conjunction with SSS Global support to maintain system libraries, tailor and transmit controller data from a host S/370, 30XX or 4300 to a 3651, generate tables for use in the 3651, create all format controls and space allocation for files, and provide problem determination aids.

Note: Subsystem Support Services (SSS) are no longer supplied as components of DOS/VS, but are available as an independent release (Program No. 5747-CC6).

3650 Release I (OS/VS1 and DOS/VS only) uses BTAM and supports the initial functions available on the 3651 which include basic sales and logging support, negative in-store credit, support of all terminals and the interface for user program execution. 3650 Release II (OS/VS1, OS/VS2, DOS/VS) uses VTAM and supports the functions available on the 3651 mdl 50 which include basic sales and logging support, negative in-store credit, support of all terminals, and interface for user program execution, as well as the expanded functions available on the 3651 files, and additional interfaces for user program execution. It also supports 3653 functions associated with the functional expansion feature, the 3651 9.3 megabyte disk storage, direct attachment for 3651 to 3704/3705 and the 9600 bps loop transmission speed.

A minimum 3650 Retail Store System requires support from one S/370 or 4300 with the following minimum configuration:

	BTAM	VTAM
DOS/VS	128K	160K
OS/VS1	240K	256K
OS/VS2 MVS	N/A	768K

Additional storage will be required based on application requirements and performance considerations.

- An IBM 3704 or 3705-I or 3705-II Communications Controller in emulation mode using BTAM (OS/VS1 and DOS/VS only) or network control mode using VTAM.
- A telecommunications access method (BTAM for BSC, VTAM for SDLC).
- The Virtual Storage Access Method (VSAM).
- The IBM Subsystem Support Services (SSS).
- The IBM 3651 Store Controller
- An IBM 3653 Point of Sale Terminal or an IBM 3275 Display Station mdl 3.

Additional terminal devices may be added (see appropriate "Machines" pages.)

DOCUMENTATION: (available from Mechanicsburg)

Title	Number
3650 Introduction	GA27-3075
3650 Administrative Operations Guide	GA27-3088
3650 Sales Operations Guide	GA27-3089
3650 PDP's and Operator Messages	GA27-3089
3650 Host Logic (Release 2)	SY30-3025
SPPS Logic	SY30-3024
3650 SSS User's Guide	GC30-3022
3650 SSS Logic (Release 2)	SY30-3017
3650 SPPS Programmer's Guide	GC30-3024

5744-BR2 - 3660 SUPERMARKET SCANNING (OS/VS2)
5744-BK2 - 3660 SUPERMARKET SCANNING (DOS/VS)

PURPOSE

IBM programming support for the 3660 Supermarket Scanning System consists of the Subsystem Support Services (SSS). The SSS program is required in configuring and supporting individual 3651 Store Controllers mdls A60 and B60 - Supermarket. For configuring, the user creates Input Statements which select the options and create certain tables that are necessary to the operation of the 3660 system. These statements are edited and translated into "System Definition Records" (SDR) by SSS. Using the appropriate telecommunications access method, the SDRs are transmitted to the selected 3651 to complete the tailoring of the 3660 system. For support, any IBM-supplied changes or subsequent changes required to the SDR are applied through SSS.

Note: Subsystem Support Services (SSS) are no longer supplied as components of DOS/VS, but are available as an independent release Program No. 5747-CC6).

A minimum 3660 Supermarket Scanning System requires the support from one S/370, 30XX or 4300 with the following minimum configuration:

	BTAM	VTAM
DOS/VS	128K	160K
OS/VS1	240K	256K
OS/VS2 MVS	768K	768K

Additional storage will be required based on the application requirements and performance considerations, particularly in a VTAM environment.

- An IBM 3704 or 3705-I or 3705-II in emulation mode using BTAM or network control mode using VTAM or a S/370 ICA using BTAM.
- BTAM telecommunications access method (using BSC) or VTAM telecommunications access method (using SDLC).
- The Virtual Storage Access Method (VSAM).
- The IBM Subsystem Support Services (SSS).
- An IBM 3872 modem or equivalent, or an IBM 2400 bps Integrated Modem feature in the 3704 or 3705.
- BSC compatibility (if using BTAM) or SDLC compatibility (if using VTAM).
- An IBM 3651 Store Controller - Supermarket.
- An IBM 3669 Store Communications Unit.
- Customer supplied Store Loop.
- At least one IBM 3663 Supermarket Terminal.

Additional terminals and devices may be added (see appropriate sales manual "machines" pages.

To further support the 3660 System, it will be necessary for the user to create host S/370, 30XX or 4300 programs. This user-written code is necessary to organize, preformat and transmit data records to be used in the 3651 mdl A60/B60 Supermarket Controller. This includes any changes to these data records. These records are for price/description, check authorization, and operator authorization data. The user will also need to instruct the 3651 to execute certain tasks, accept miscellaneous messages, or transmit data held within the controller back to the host S/370, 30XX or 4300 for application processing. The user is responsible for interfacing directly with the telecommunications access method.

The *IBM 3660 Supermarket Systems Programmers User's Guide* contains the programming information necessary for the user to establish his 3660 system including those functions described immediately above, required to be built into user-written code.

DOCUMENTATION: (available from Mechanicsburg)

Title	Number
IBM System/370 Subsystem Support Services Logic Manual	SY30-3017
IBM 3660 Supermarket Systems Sales Operations Guide	GA27-3090
IBM 3660 Supermarket Host Program Logic Manual	SY30-3019

3660 SUPERMARKET KEY-ENTRY SYSTEM

PURPOSE

The 3660 Supermarket Key-Entry System does not require the support of the Subsystem Support Services (SSS). It does require support from user-created host S/370 programs. This user-written code is necessary to organize, preformat and transmit data records to be used in the 3661 Store Controller. This includes any changes to these data records. These records are for price/description, check authorization, operator authorization and system parameter records (SPR). The user will also need to instruct the 3661 Store Controller to execute certain tasks, accept miscellaneous messages, or transmit data held within the controller back to the The *IBM 3660 Supermarket Systems Programmers User's Guide; Key-Entry System* contains the information necessary for the user to establish his 3660 Supermarket Key-Entry System, including those functions described immediately above, required to be built into user-written code.

A minimum 3660 Supermarket Key-Entry System requires the support from one S/370 and:

- A virtual storage operating system (OS/VS1 or OS/VS2 MVS or DOS/VS)
- An IBM 3704 or 3705-I or 3705-II in emulation mode using BTAM or in network control mode using VTAM or a S/370 ICA using BTAM
- BTAM telecommunications access method with RFT option (using BSC) or VTAM telecommunications access method (using SDLC)
- 1200 bps Integrated Modem feature in the 3704 or 3705-I or 3705-II, or ICA
- BSC compatibility (if using BTAM) or SDLC compatibility (if using VTAM)
- An IBM 3661 Store Controller
- An IBM 3663 Supermarket mdl 2 Terminal locally attached to the 3661
- A customer supplied Store Loop for the attachment of additional Supermarket Terminals, if required

Additional terminals may be added. See appropriate sales manual "Machines" pages.

3730 DISTRIBUTED OFFICE COMMUNICATION SYSTEM

PURPOSE

The 3730 Distributed Office Communication System is a distributed document preparation system designed for the office environment. The system consists of the 3732 Text Display Station and the 3736 Printer, both of which attach to a 3791 Controller.

Support for the 3730 system is provided by VTAM using the S/370 Local Channel Attachment, or by VTAM (and TCAM/NCP Direct in OS/VS1 and OS/VS2) over switched or nonswitched communication lines using SDLC. Nonswitched lines can be either point-to-point or multipoint. Batch and/or inquiry sessions may use the physical line concurrently. Program-controlled or manual procedures can be used at the host system to establish physical connections over switched lines for batch sessions, with auto or manual answer at the 3791. Manual procedures are used at the 3791 to establish physical connections over switched lines for inquiry sessions with auto or manual answer at the host system.

USER-DEVELOPED 3730 PROGRAMS

Users can write 3730 application programs to extend and customize the system-provided functions. 3730 programs are prepared at the host system using a S/370 assembler, a set of 3730 programming statements together with a subset of 3790 programming statements, and an IBM-supplied macro-instruction library.

User-written 3730 programs are processed in a similar way to 3790 programs. Programs are first assembled in a host system, then processed by Program Validation Services (PVS) to validate the assembly and format it for storage in a host program library, and for later transmission to a controller. (The 3730 version of PVS is similar to that used for 3790 except that PVS has been extended to allow validation of 3730 programming statements and to format 3730 programs for transfer to a controller, and that the batch simulation phase and Interactive PVS are not supported.) The programming statements and PVS, together with a 3790 Industry-unique function applicable to SSS and appropriate inner programming statements necessary for independent link-editing of these functions to the operating system, are packaged as a Host Support SCP component. The component, called 3790 Host Support has the program number: DOS/VS - (5747-BQ1); OS/VS1 - (5744-BZ1); OS/VS2 - (5744-BZ2).

Host program libraries are controlled by Subsystem Support Services (SSS). Programs and data set specifications are transferred from the host system to a controller:

- Via a local channel attachment or communication line using SSS, or
- Via a diskette using PVS Batch Data Exchange Services (BDES)

Debug facilities for 3730 programs are available at the controller using the 3790 Program Execution Monitor.

3770 DATA COMMUNICATION SYSTEM

PURPOSE

The 3770 Data Communication System is a family of terminals. Teleprocessing support for SDLC line control is provided by RES or JES2 (MVS) or POWER/VS (non-programmable 3770 models only, except 3777-2), VTAM, TCAM nonswitched (OS/VS1 and OS/VS2 MVS only) and 3704/3705 NCP/VS. An appropriately configured 3770 system (except 3777-2) operates on nonswitched lines, switched point-to-point lines and nonswitched multipoint lines, using SDLC or BSC or either under manual switch control. An appropriately configured 3777-2 operates on nonswitched point-to-point lines and switched point-to-point lines using RES BSC or JES2/360-20 MULTI-LEAVING Workstation support for the S/360 mdl 20 Submodel 5.

The RES-JES2-POWER/VS support provides for remote entry from the non-programmable models of the 3770 SDLC terminals in a terminal-sharing environment, where multiple applications may establish logical connections with the terminal on a per-session basis.

The 3770 system consists of the 3771, 3773, 3774, 3775, 3776 and 3777 Communication Terminals. All except 3773P, and Multiple Logical Unit (3776-3,-4,3777-3), and the 3777-2 models can operate under RES-JES2-POWER/VS support for the 2772 Multipurpose Control Unit. In addition, the 3776/3777-1 can operate under RES-JES2-POWER/VS support for the 3780 Data Communications Terminal. Additional 3770 products include the 3784 Line Printer, the 3521 Card Punch, the 3501 Card Reader, the 2502 Card Reader and the 3203 Printer.

Users may develop, test and run terminal programs for programmable models of the 3773, 3774 and 3775 Communication Terminals. 3770 programs are prepared at the host using a S/370 assembler, 3790 programming statements, and an IBM-supplied macro instruction library. Program Validation Services (PVS) validate and format 3770 terminal programs for storage at the host and for later transmission to the 3773, 3774 or 3775 under control of user-written host application programs.

The macros and PVS support for programmable models of the 3773, 3774 and 3775 Communication Terminal (3773P/3774P/3775P) is packaged as a Host Support SCP component. The component called 3790 Host Support - OS/VS (or DOS/VS) carries the program number 5744-BZ3 (or 5747-BQ1).

3790 AND 8100/DPCX SYSTEMS

PURPOSE

Support for the 3790 system is provided by VTAM and TCAM through VTAM using the S/370 Local Channel Attachment, or VTAM, TCAM through VTAM and TCAM/NCP Direct over nonswitched communication lines using SDLC. VTAM and TCAM through VTAM are supported using switched communications facilities with SDLC. Nonswitched lines can be either point-to-point or multipoint. Batch and/or inquiry sessions may use the physical line concurrently. Program-controlled or manual procedures can be used at the host to establish physical connections over switched lines for batch sessions, with auto or manual answer at the 3791. Manual procedures are used at the 3791 to establish physical connections over switched lines for inquiry sessions with auto or manual answer at the host. The initial release of 3790 support requires a special, system operator-assisted procedure to use switched communication lines.

The JES2 support when used with the 3790 RJE Function provides the user with a Remote Job Entry capability.

USER-DEVELOPED 3790 PROGRAMS

Users may develop, test and run programs for the 3790 which do not use the 3760 or 3762.

3790 programs are prepared at the host using a S/370 assembler, 3790 statements, and an IBM-supplied macro instruction library.

Program Validation Services (PVS) allows validation of the 3790 program statements at the host to assist in 3790 program development. PVS also formats 3790 programs for storage at the host and later transmission to the 3791. The macros and PVS, along with a 3790 Industry Unique function applicable to SSS and appropriate inner macros necessary for the independent link-editing of these functions to the Operating System, are packaged as a Host Support SCP component.

Subsystem Support Services (SSS) controls 3790 program libraries at the host and controls the transmission of 3790 programs and data set specifications from the host to the 3791 via VTAM and NCP/VS.

8100 INFORMATION SYSTEM with DISTRIBUTED PROCESSING COMMUNICATION EXECUTIVE (DPCX)

The VTAM, TCAM via VTAM and TCAM communication services for the 3790 supports the 8100/DPCX Information System. Local Channel Attachment of 8100/DPCX is not included.

3790 Program Validation Services (PVS) supports 8100/DPCX.

Subsystem Support Services (SSS) and Distributed System Executive (DSX 1.0) which support the 3790 also support the 8100/DPCX.

DATA ENTRY BATCH TRANSFER PROGRAM (BTP)

5747-BW1	DOS/VS and DOS/VSE
5744-CG1	OS/VS1
5744-CG2	OS/VS2 (MVS)
5744-CH1	OS/VS2 (SVS)

The Batch Transfer Program is a program which supports, using VTAM, the extraction of data sets from a 3790 Communication System/Data Entry Configuration (Configuration Support **#9175** and **#9195**) to a S/370, 303X or 4300 virtual storage system.

This program allows the customer to specify jobs of data to be transferred from the 3791 to the host and vice versa. A request for a specific job will result in the transmission of all batches flagged as available for transmission within that job. When jobs are received at the host, they are written to disk or tape into user-named sequential data sets for subsequent processing by an application program. Route jobs (messages to the host operator) are sent to either the operator's console or the printer. List format jobs, print jobs and report jobs are sent to a host printer, tape or disk.

The Batch Transfer Program, through a user exit, provides for the inclusion of a user-written routine for data jobs. This facility allows a user to modify or delete records that are received at the host, or provide additional records himself for inclusion within the output data set.

Multiple batches from more than one 3791 may be combined at the host to produce a single job data set during one execution of the Batch Transfer Program.

With the Full Function Reverse Extract function the Batch Transfer Program provides the capability to transfer a host-created data set via the S/370 Local Channel Attachment or SDLC to the 3791 for updating by a 3760 operator. The data sets will be transferred in a similar manner by specifying the job name and the 3791 address to the Batch Transfer Program.

The Batch Transfer Program will also provide the capability to include certain control information in the data transfer from host to 3791 and vice versa. Information gathered in the statistics data sets on the 3791 may be transferred to the host for processing by an application program.

SYSTEM/32

PURPOSE

The System/32 is a low-cost general purpose computer system. Teleprocessing support for SDLC line control is provided by RES-JES2-POWER/VS, VTAM, and the 3704/3705 NCP/VS when the System/32 is specified as a 3770. Teleprocessing support for BSC line control is provided by RES-JES2-JES3-POWER/VS, VTAM, BTAM, TCAM (OS/VS1 and OS/VS2 only), and EP/VS with PEP when the System/32 is specified as a System/3. An appropriately configured System/32 operates on a nonswitched point-to-point line, a switched point-to-point line, or as a tributary station on a nonswitched multipoint line, using SDLC or BSC. Operation of System/32 is under control of an SCP-supplied utility or user-written program.

The System/32 consists of a processing unit, keyboard, display, disk storage, line or serial printing facility, diskette drive and optionally a data communications adapter (SDLC or BSC).

Note: The diskette drive is not supported by BSC or SDLC communications programs.

SYSTEM/34

The System/34 is a low-cost general purpose computer system, with attached display stations. Teleprocessing support for SDLC line control is provided by JES2, VTAM and the 3704/3705 NCP/VS when the System/34 is specified as a 3770.

Teleprocessing support for BSC line control is provided by HASP, ASP, RES, JES2, JES3, VTAM, BTAM, TCAM (OS/VS1 and OS/VS2 only and the 3704/3705 EP/VS with PEP An appropriately configured System/34 operates on a nonswitched point-to-point line, a switched point-to-point line, or as a tributary station on a nonswitched multipoint line, using SDLC or BSC. Operation of System/34 is under control of an SSP supplied utility or user-written program.

The System/34 consists of a processing unit, keyboard display workstations, disk storage, line or serial printing facility, diskette drive and optionally a data communications adapter (SDLC or BSC).

Note: The diskette drive is not supported by BSC or SDLC communications programs.

SYSTEM/36

The System/36 is a low-cost general purpose computer system, with attached display stations. Teleprocessing support for SDLC line control is provided by RES, JES2, JES3, POWER/VSE, CICS/VS, IMS/VS, VTAM/VSE, and the 3704/3705 NCP/VS when the System/36 is specified as a 3770, 3790 or SLU-type P/O.

Teleprocessing support for BSC line control is provided by RES, JES2, JES3, RSCS, CICS/VS, IMS/VS, VTAM, BTAM, and the 3704/3705. EP/VS with PEP. An appropriately configured System/36 operates on a switched or nonswitched point-to-point line, or as a tributary station on a nonswitched multipoint line, using SDLC or BSC. Operation of System/36 is under control of a System Support Program (SSP).

The System/36 consists of a processing unit, keyboard display workstations, disk storage, line or serial printing facility, diskette drive and optionally a data communications adapter (programmable for SDLC and BSC).

Note: The diskette drive is not supported by communications programs.

8100/DPPX INFORMATION SYSTEM

PURPOSE

DPPX, and the various licensed programs which operate under it, can communicate with a range of host S/370 programming. The major facilities which support communication between a host S/370 and the 8100 under DPPX are described briefly below. See the appropriate pages for more detail.

GENERAL LINK SUPPORT

SDLC

Supported by VTAM (VTAM2, ACF/VTAM) or TCAM (TCAM Direct, ACF/TCAM) and NCP/VS over switched or nonswitched communication lines using SDLC. Nonswitched lines can be either point-to-point or multipoint. Any combination of functions or programs in 8100/DPPX which communicate with S/370 may use the physical link concurrently.

BSC

Supported by BTAM, VTAM, TCAM, RES, JES2 and JES3 and VM/RSCS over nonswitched communication links.

MAJOR FACILITIES

Migration Aids

- 3270 Data-Stream Compatibility (DPPX/DSC) (8100 licensed program 5760-PC1).

  Permits 3270 terminals and printers attached to the 8100 to communicate with S/370 over BSC or SDLC links through S/370 3270 programming support.

- Remote Job Entry Workstation Facility (DPPX/RJE) (8100 licensed program 5760-XC1).

  Provides MULTI-LEAVING BSC and multiple logical unit SDLC transmission for remote job entry from 8100/DPPX.

Network Management Aids

- Distributed Systems Executive Release 2.0 (DSX) (S/370 program product 5748-XXG, Release 2.0).

  Provides central library maintenance at a S/370 for a SNA network of distributed systems. Facilities to receive and transmit programs and data sets, and to transmit command lists for subsequent execution, are included.

- Host Command Facility, (S/370 licensed program 5735-XR1)

  Permits a host S/370 3270 terminal user to communicate with an 8100 in the SNA network as if the 3270 terminal was connected to the 8100. Allows central control and operation of a connected 8100/DPPX system.

Host Application Support

- Host Transaction Facility (Included in 8100 DPPX/BASE, licensed program 5760-010)

  Permits DPPX/DTMS applications to send transactions to and receive replies from IMS/VS and CICS/VS via SNA. Inquiry, update, message integrity and resynchronization are provided.

- Host Presentation Services (Included in 8100 DPPX/BASE, licensed program 5760-010)

  Host Presentation Services provides an access method for transmission between DPPX applications and IMS/VS and CICS/VS applications via SNA. Host Presentation Services is used by Host Transaction Facility and is also available to user applications to minimize communications programming.

- SNA Data Stream Interface (Included in DPPX/BASE, licensed program 5760-010)

  Permits DPPX Assembler applications to communicate with VTAM or TCAM applications or subsystems via SNA.

Data Transfer Between S/370 and 8100/DPPX

- Distributed Systems Executive Release 2.0 (DSX)

  DSX can transfer data sets from and to 8100/DPPX. Since most DPPX data (program load modules, panels, executable command lists, profiles) are stored as data sets, virtually all DPPX data can be transferred in this manner.

- Basic Exchange Diskettes

  A utility to read and write Basic Exchange Diskettes (IBM Diskette Type 1) is part of the 8100/DPPX/BASE licensed program.

- Tape Exchange

  DPPX supports standard S/370 tape formats and labels.

8100/DPPX/SP INFORMATION SYSTEM

PURPOSE

DPPX/SP, and the various licensed programs which operate under it, can communicate with a range of host S/370, 30XX or 4300 programming. The major facilities which support communication between a host S/370, 30XX, 4300 and the 8100 under DPPX/SP are described briefly below. See the appropriate pages for more detail.

GENERAL LINK SUPPORT

SDLC

Supported by VTAM (VTAM2, ACF/VTAM) or TCAM (TCAM Direct, ACF/TCAM) and NCP/VS over switched or nonswitched communication lines using SDLC. Nonswitched lines can be either point-to-point or multipoint. Any combination of functions or programs in 8100/DPPX/SP which communicate with S/370, 30XX or 4300 may use the physical link concurrently.

BSC

Supported by BTAM, VTAM, TCAM, RES, JES2 and JES3 and VM/RSCS over nonswitched communication links.

MAJOR FACILITIES

Migration Aids

- 3270 Data-Stream Compatibility (DPPX/SP/DSC).

  Permits 3270 terminals and printers attached to the 8100 to communicate with S/370, 30XX or 4300 over BSC or SDLC links through S/370, 33XX or 4300, 3270 programming support.

- Remote Job Entry Workstation Facility (DPPX/SP/RJE).

  Provides MULTI-LEAVING BSC and multiple logical unit SDLC transmission for remote job entry from 8100/DPPX/SP.

Network Management Aids

- Distributed Systems Executive Release 2.0 (DSX) (S/370, 33XX or 4300 program product 5748-XXG, Release 2.0).

  Provides central library maintenance at a S/370, 30XX or 4300 for a SNA network of distributed systems. Facilities to receive and transmit programs and data sets, and to transmit command lists for subsequent execution, are included.

- Host Command Facility, (S/370, 33XX, 4300 licensed program 5735-XR1)

  Permits a host (S/370, 33XX, 4300) 3270 terminal user to communicate with an 8100 in the SNA network as if the 3270 terminal was connected to the 8100. Allows central control and operation of a connected 8100/DPPX/SP system.

Host Application Support

- Host Transaction Facility (Included in 8100 DPPX/SP, licensed program 5660-281)

  Permits DPPX/SP/DTMS applications to send transactions to and receive replies from IMS/VS and CICS/VS via SNA. Inquiry, update, message integrity and resynchronization are provided.

- Host Presentation Services (Included in 8100 DPPX/SP, licensed program 5660-281)

  Host Presentation Services provides an access method for transmission between DPPX/SP applications and IMS/VS and CICS/VS applications via SNA. Host Presentation Services is used by Host Transaction Facility and is also available to user applications to minimize communications programming.

- SNA Data Stream Interface (Included in DPPX/SP, licensed program 5660-281)

  Permits DPPX Assembler applications to communicate with VTAM or TCAM applications or subsystems via SNA.

Data Transfer Between S/370,33XX or 4300 and 8100/DPPX/SP

- Distributed Systems Executive Release 2.0 (DSX)

  DSX can transfer data sets from and to 8100/DPPX/SP. Since most DPPX/SP data (program load modules, panels, executable command lists, profiles) are stored as data sets, virtually all DPPX/SP data can be transferred in this manner.

- Basic Exchange Diskettes

  A utility to read and write Basic Exchange Diskettes (IBM Diskette Type 1) is part of the 8100/DPPX/SP licensed program.

- Tape Exchange

  DPPX/SP supports standard S/370,33XX and 4300 tape formats and labels.

SUBSYSTEM INFORMATION RETRIEVAL FACILITY R 1-3 RELEASES 1, 2 and 3 for the IBM 3790 (CONFIGURATION SUPPORT #9169) and the IBM 8100 INFORMATION SYSTEM

PURPOSE

The Subsystem Information Retrieval Facility is a part of the Host Support Independent Release (IR) for the 3790 (Configuration Support **#9169**) and 8100/DPCX systems. The subsystem Information Retrieval Facility provides the host location with the ability to retrieve incident and status information, the ability to execute problem determination tools and to modify with appropriate control, distributed system control code. It establishes in one product a broad range of functions required to help isolate and act on problems in a distributed system network.

SPECIAL SALES INFORMATION

This program is applicable to the IBM 3791 systems with Configuration Support **#9169** and IBM 8100 systems with Distributed Processing Control Executive (DPCX) that have the capability of communicating with a S/370 host using Type 1 batch.

HIGHLIGHTS

- Host Initiated Data Link Data Trace
- Host Retrieval of 3276 Error Log
- Host Retrieval of:
  - Program Abend Dumps
  - Condition Incident Log
  - Control Code Configuration for 3791
  - Selected Data Set Records
- Host Initiated Wrap Test
- Host PTF Distribution and Control
- Host Initiated Data Link Protocol Trace
- Interactive Control
- Host Retrieval of Formatted 8100/DPCX System Dump

Subsystem Information Retrieval Facility Highlights in Detail

- **Host Distribution and Control of Requests for Engineering Action** - REA files can be built in the host or can be retrieved from a 3791. The 3791 REA status can be queried, one or multiple REAs sent to any or all network 3791s and indicators set for automatic or manual application of selected REAs.
- **Host Initiated Data Link Data Trace** - A data link message trace can be initiated or terminated by the host. The trace data will be spooled to a 3791 data set for printing at the 3791 or for transmission to the host for printing.
- **Host Retrieval of 3276 Error Log** - Status and statistical information contained in the Error Log of the 3276 Display Units connected to a distributed system may be retrieved by the host.
- **Host Retrieval of Program Abend Dumps** - Available Program Abend Dumps may be retrieved by the Host for central site analysis.
- **Host Retrieval of Condition Incident Log** - Available Condition Incident Log records are retrieved from the distributed systems for analysis at the host.
- **Control Code Configuration** - The Control Code feature, configuration and quantity are retrieved at the host. The configuration data is extracted from a system file that was loaded during the system installation. In addition to the configuration, the file contains the serial number of the machine and the EC level of the code.
- **Selected Data Set Records** - Selected records from the Transaction, Print and Message Data Sets can be retrieved at the Host.
- **Host Initiated Wrap Test** - Test data is transmitted to the distributed system and then queried by the host to test the communication path. The duration of the wrap test can be modified to support physical testing of the line.
- **Host Initiated Data Link Protocol Trace** - A trace facility can be initiated or terminated from the host that will provide all pertinent incoming and outgoing SDLC command and address bytes and SNA headers between the 3791 and 3276.
- **Host PTF Distribution and Control** - PTF files can be built in the host or can be retrieved from an 8100/DPCX. The PTF status of 8100/DPCXs can be queried, one or multiple PTFs sent to any or all network 8100/DPCXs and indicators set for automatic or manual application of selected PTFs.
- **Interactive Control** - 3270 Display (1720 character screen) support is provided for input and editing of control statements and the presentation of retrieved information.
- **Host Retrieval and Formatting of 8100/DPCX System Dumps** - System dumps can be retrieved from 8100/DPCX systems and presented for display and/or printing in a formatted manner at the host.

CUSTOMER RESPONSIBILITIES

For the REA and PTF files, customers must acquire the necessary information from Field Engineering and load the required data. Communication between the customer and Field Engineering must be sustained to ensure that the REA and PTF information is kept current and accurate.

SPECIFIED OPERATING ENVIRONMENT

System Configuration: The Subsystem Information Retrieval Facility may be used on any S/370 mdl 125 or larger capable of operating with OS/VS - VTAM, OS/VS - ACF/VTAM, OS/VS - TCAM Level 10, OS/VS - ACF/TCAM, DOS/VS - VTAM, DOS/VS - ACF/VTAM and DOS/VS - EXTM.

DOCUMENTATION: (available from Mechanicsburg)

Subsystem Information Retrieval Facility Guide and Reference Manual (SC27-0497).

Ordering Information

Subscribers to the 3790 Communication System and 8100/DPCX Host Support Release for DOS/VS 5747 BQ1 and OS/VS 5744 BZ3 will automatically receive the Subsystem Information Retrieval Facility Releases.

APARs and PTFs: Consult the program directory, available with appropriate IR for the APAR corrections and PTFs included in this feature.

5652-VS1 - OS/VS1
OPERATING SYSTEM/VIRTUAL STORAGE 1
5741-VS1 (Through Release 6.7)
5652-VS1 (Release 7 on)

PURPOSE

The Operating System/Virtual Storage 1 (OS/VS1, also known as VS1) programs perform the systems control programming functions for the S/370 mdls 135, 135-3, 138, 145, 145-3, 148, 155II, 158, 165II, 168, the 3031, 3032 and 3033 Processors, and the 4331 (Model Group 11 is not supported) and 4341 Processors utilizing Dynamic Address Translation (DAT), and the Extended Control Mode (EC) of these systems.

DESCRIPTION

The maximum size real storage supported by OS/VS1 is 8,388,608 bytes.

The minimum systems supported by OS/VS1 are the 3135 mdl GD (147,456 bytes), the 3138 mdl I (524,288 bytes), the 3145 mdl GE (163,840 bytes), the 3148 mdl J (1,048,576 bytes), the 3155II mdl H (262,144 bytes), the 158 mdl I (524,288 bytes), the 3165II mdl J (1,048,576 bytes), the 3168 mdl J (1,048,576 bytes), the 3031 mdl 2 (2,097,152 bytes), the 3032 mdl 2 (2,097,152 bytes), the 3033 mdl U4 (4,194,304 bytes) the 4331 mdl 11 (524,288 bytes), the 4341, mdl L1 (2,097,152 bytes), and 4381 Processors. Processors.

A system with processor storage size of 160K bytes of available real storage is sufficient for all VS1 standard features, but the use of optional SCP features will probably require additional real storage. In general, function, advantages and performance depend upon the amount of real storage available; therefore, most users will find a processor storage size of 240K bytes or larger to be more effective for their VS1 system.

The virtual storage size which can be supported is highly dependent on a number of factors, such as application characteristics, programming techniques, and system resources. VS1 supports a maximum virtual storage size of 16,777,216 bytes provided there are enough system resources to support the workload.

Smaller Main Storage Considerations: Lack of available real storage reduces the capabilities and performance of OS/VS1. The following restrictions apply to the 144K real storage programming design point:

The release 6 or later starter systems are not supported.
Two-partition support is the recommended maximum.
The external trace option of the Generalized Trace Facility is not supported.
Two megabytes of virtual storage is the recommended maximum.
Only one partition is allowed if the system includes RES.

OS/VS1 is a compatible extension of OS/360 Multiprogramming with a Fixed Number of Tasks (MFT), providing up to 16,777,216 bytes (hereafter referred to as 16 million or 16 megabytes) of virtual storage for a customer's installation independent of the real main storage size of his installation. Virtual Storage is the name given to the address space referenced by a S/370 or 4300 processor that is equipped with the Dynamic Address Translation feature. This address space may be as large as the logical addressing capability of the system; that is, if a user can write an address, the location addressed can be included in virtual storage.

Although the addressing range of virtual storage is equal to the address range of the system, the user is limited to a virtual storage capacity that is determined by the installation at System Generation time or at IPL on the basis of such factors as real storage capacity, job characteristics, number and size of virtual partit ions, secondary storage capacity, and control program storage requirements.

OS/VS1 virtual storage organization is similar to OS/360 MFT real storage organization. OS/VS1 virtual storage is divided into two main areas: the Control Program area (containing the supervisor and Job Entry Subsystem - JES) and the Problem Program area. The Problem Program area is divided into fixed partitions (maximum of 15) at 64K bytes (or multiples thereof) or system task partitions (maximum of 37), with a total maximum of 52 partitions.

As in OS/360 MFT, the partition size, class, and other attributes can be changed by the operator while the system is in operation. Partition allocation appears to the problem programmer and to the operator just as it appears in OS/360 MFT with one exception: maximum partition size is not limited by the real storage size, but by virtual storage size as defined at System Generation or IPL. Partitions must be allocated in 64K multiples with a minimum of 64K.

Real storage in OS/VS1 is automatically managed by the operating system in discrete blocks of 2K bytes called pages. As a page in virtual storage is referenced, it is brought into real storage for processing, if it is not already in real storage. When pages are not being used and the processor storage is needed for another task, they are written out to auxiliary storage unless an exact copy already exists (i.e. the page was not modified during execution). Some sections of the control program are not paged but are fixed in real storage. OS/VS1 divides real storage into two sections: one fixed and the other paged.

The fixed section of real storage contains the resident supervisor. Any jobs that are currently executing in the "Virtual Equals Real" mode are also fixed in re al storage. This "Virtual Equals Real" mode makes provision for the types of programs that cannot run in a paged environment: programs that modify the channel program while it is active; programs that are highly time-dependent; programs that have user written I/O appendages to support EXCP where the appendages do not adhere to VS1 appendage programming rules; and programs that require all of their pages in processor storage while they are executing.

The paged section of real storage contains the active pages of the virtual tasks and the active portions of the paged section of the supervisor.

A section of the supervisor called the Page Supervisor is responsible for allocating and deallocating pages in real storage and for initiating page-in and page-out operations between auxiliary storage and processor storage.

OS/VS1 includes features to improve the security/integrity of the system: Fetch Protect, DEB Validity Checking, Password Protected Page File, Protected TIOT (Task I/O Table), and APF (Authorized Program Facility). Fetch Protect is optional support that combines hardware and software support to protect a user's main storage from disclosure to any task but a system task. The entire dynamic storage area (virtual partitions assigned to job steps and system tasks) and all region key subpools are protected. The Data Extent Block (DEB) Validity Checking is an option that prevents the user from unauthorized modification of direct access extents or gaining control in the supervisor state. Password Protection capability for the Page File available in VS1 also includes special processing to allow the size of a protected SYS1.PAGE to be varied at IPL time. Protected TIOT prevents a problem program from accidentally or intentionally storing into the TIOT. APF (Authorized Program Facility) is a function that permits designated problem programs access to certain restricted system functions.

The SUs integrated into Release 6.7 and 7.0 are shown in Chart 1 of the Announcement Letter for Release 6.7.

Additional OS/VS1 Facilities: I/O Load Balancing in VS1 provides a method of allocating non-specific requests for data sets based upon the utilization of devices across the entire configuration.

Dynamic Dispatching provides for the alteration of the dispatching priorities of selected users tasks. Processor and I/O characteristics of these tasks are constantly monitored during execution and changes are dynamically taken into account in the dispatching process.

Automatic IPL can be performed when system initialization parameters have been included in a data set (SYS1.PARMLIB). The operator can avoid keying in responses to system initialization message requests by indicating a list of SYS1.PARMLIB members which contain most of the necessary system initialization parameters needed for a particular IPL.

The time of day can be requested in Greenwich Mean Time (GMT). Interrupts can be requested at a specific time of day based on Greenwich Mean Time.

ISSP (Installation Specified Selection Parameters) permits system programmers to control the handling of job input and output classes, job priorities and message classes.

VS1 can execute as a virtual machine under VM in an arrangement called *VM/VS Handshaking.* Some of the most significant features include: Closing of CP (Control Program) spool files at job end instead of virtual machine termination; elimination of VS1 paging control, which would otherwise be redundant with similar VM function; and the ability to perform task switching within the VS1 subsystem during VM processing of VS1 real page faults caused by VS1 real page faults.

The 4341 Processor, the S/370 mdls 135-3, 138, 145-3 148, 158 and the 3031 Processor are provided with OS/VS1 hardware assists that provide improved supervisor performance. These assists, to which access is generated at SYSGEN time, are designed to be executed only by the VS1 supervisor. This hardware is a standard feature on all of the processors mentioned, except for the 158, where it is optional. These assists may be used if VS1 is running native or under VM/370. In the S/370 Processors, a VM assist is provided as part of the feature, but the benefits of the assists will not usually be additive. For the 4341 Processor, two mutually exclusive assists are provided: ECPS:VS1 and ECPS:VM/370. The former is usually recommended for VS1 native; the latter when VM/370 is run dedicated or when OS/VS1 operates under VM/370.

The preceding is summarized in the following table:

Processor	Feature Name	Std/Optional	Recommended for
135-3,138 145-3,148	Extended Control Program Support	Standard	OS/VS1 native OS/VS1 under VM/370

OS/VS1 (5652-VS1) (cont'd)

158,158-3	OS/VS1 ECPS	Optional (#8750)	OS/VS1 native or OS/VS1 under VM/370
3031	OS/VS1 ECPS	Standard	OS/VS1 native or OS/VS1 under VM/370
4341*	ECPS:VS1 Assist ECPS:VM/370 Assist	Standard Standard	OS/VS1 native OS/VS1 under VM/370

* These features are mutually exclusive at SYSGEN. The benefits realized may vary in individual situations according to workload and environment with the result that the recommended application and use of assists may not be the most appropriate one for the customer. It is the customer's responsibility to make this determination

This hardware assist provides improved supervisor performance. The assist may be used if VS1 is running native or under VM/370. The VS1 hardware assist is designed to be executed only by the VS1 Supervisor. Access to the assist is generated at SYSGEN time.

Supervisor: The OS/VS1 Supervisor is a part of the System Control Programming that monitors each unit of work being done in the system. The Supervisor, in general, controls the use of the processor, I/O, and real and virtual storage automatically or as requested by a user through system macro instructions or higher level language statements. It provides a variety of services such as allocating virtual storage space, performing I/O operations, loading programs into virtual storage, moving pages of programs into and out of real storage, and maintaining the address space (virtual storage) on an auxiliary storage device. To perform its function, the supervisor receives control of the processor following an interruption which may have resulted from a specific service request or through an asynchronous interruption by the computing system.

The OS/VS1 Supervisor performs the same functions as the OS/360 Supervisor. In addition to interruption handling, the OS/VS1 Supervisor performs: Task Dispatching in up to 15 problem program partitions ... Task Supervision ... Fetch ... Contents Supervision ... Timer Supervision ... Storage Supervision (virtual) ... I/O Supervision ... Exception Condition Handling ... System Management Facilities (SMF).

Functions that have been added to support Dynamic Address Translation are real storage supervision and paging supervision.

OS/VS1 is designed to take advantage of Dynamic Address Translation hardware. The system operates on the basis of virtual storage and real storage. Real storage is the storage of S/370 from which the central processing unit can directly obtain instructions and data and to which it can directly return results. Virtual storage is address space that appears to the user as real storage. From this address space, instructions and data are mapped into real storage locations. Partitions are assigned from available virtual storage; the system assigns real storage only as it is actually needed for program use.

The OS/VS1 relocate concept operates through Dynamic Address Translation. When a program is executing, the system translates each virtual address into a corresponding real storage address as the instruction is executed.

With address translation, all 24 bits of an address are usable. Thus virtual address space can be (and real storage can appear to be) 16,777,216 bytes. This address space is divided into 256 segments of 64K bytes each. The segments are subdivided into 32 pages of 2K bytes each.

OS/VS1 real storage contains a fixed section and a paged section. The fixed section located in the lower portion of real storage contains the resident supervisor and any jobs executing in a virtual= real (V= R) mode. The size of the fixed area depends on the amount of storage the user requires to execute his programs in (V= R) space (which is fixed only while the V= R program is executing), the resident supervisor requirements, the System Queue Area (SQA), and the Recovery Management Support (RMS) area. In OS/VS1, the fixed area is that part of real storage into which the nucleus is loaded at IPL.

The Paged section in the upper portion of real storage contains portions of the problem programs currently executing and the pageable portions of the Supervisor as they are needed. It also contains, as needed, two transient areas: the SVC transient area and the I/O transient area. JES is also located in this section.

Before an instruction can be executed, it must be brought into real storage. As instructions are required, the addresses are translated and the page(s) containing the instructions is moved into real storage. When pages are not being used and the real storage space is needed by another task, the page is written out onto auxiliary storage unless an exact copy already exists (i.e. the page was not modified during execution). This procedure is called demand paging. The Page Supervisor task for OS/VS1 consists of a set of functions that efficiently manages the contents of real storage as tasks are executing in a multiprogrammed, demand paging environment. It is responsible for: Ensuring that the contents of real storage are addressable through the hardware DAT feature ... Exchanging virtual pages between auxiliary storage and real storage on a demand paging basis ... Keeping the most frequently referenced pages in real storage where possible ... Interfacing with and servicing auxiliary requests such as fixing virtual pages in real storage prior to I/O ... Providing these additional SMF statistics: Number of page-ins; Number of page-outs; Number of reclaimed pages.

The Page Supervisor task directly initiates page movement from real storage to auxiliary storage, when required. All other page movement comes about as a consequence of an implicit or explicit request from an external source. Thus, OS/VS1 is able to assume the image of a large contiguous real storage by keeping only required virtual pages in real storage during execution.

The default size of the allowable virtual equals real area is equal to 512K or the real storage size of the machine, whichever is smaller. Users with systems larger than 512K may set a higher (than 512K) upper boundary of the virtual equals real area so that large V=R programs can be run.

In addition to the paging support provided by OS/VS1, the user can elect to utilize the virtual= real execution facility. This allows him to specify that real storage should be made available in which to run programs that cannot run in the paged environment or those that the installation determines should not be executed in the paged portion of real storage. Real storage will be allocated at the time of job execution for the equivalent amount of storage he has defined on the JOB or EXEC card for the partition (and task) involved.

Thus the job of the supervisor is to provide the resources and services that programs need in such a way that at any given time as many services and resources as possible are in use.

Scheduler/JES: The OS/VS1 scheduler is an extension of the OS/360 MFT scheduler. It provides an integrated Job Entry Subsystem (JES) for efficient job submission and control. The job scheduling services direct and control the flow of one or more jobs through the system. In general these services are: Analysis of the input stream ... Allocation of I/O devices ... Selecting jobs for execution ... Reading and writing job data ... Communication between the operator and the system.

Job Entry Subsystem: The Job Entry Subsystem is a standard centralized facility that provides spooling and scheduling of OS/VS1 primary input and output streams. The Job Entry Subsystem contains many features of the Type III HASP program of OS/360 MFT. The Scheduler/JES of OS/VS1 is pageabl e and will only occupy as much real storage as is necessary to execute a specific function.

JES performs three basic functions: All primary input streams are read from the input device and stored on a direct access storage device (DASD) in a format convenient for later processing by OS/VS1 and problem programs ... System (and selected user) print and punch output is similarly stored on DASD until a convenient time for producing a hard copy on a printer or punch device or via 3540 Diskette Input/Output Unit ... If system resources are in contention, JES schedules its activities to best utilize these resources.

JES is responsible for getting jobs into and out of the system as quickly as possible to enhance system throughput and performance. It accomplishes this by reading jobs into the system, dividing them into various segments (job control statements and data, for example), and storing them. When the jobs are selected for execution, the JCL is interpreted separately. This procedure reduces the need for executing system reader and interpreter functions sequentially when jobs are first read into the system, as in past operating system environments.

During execution of a job, JES spools the output into a data set; that is the data is stored on a DASD device in a manner that reduces the movement of the access mechanism.

JES supports a Logical Cylinder function that provides the user with the ability to more efficiently use the DASD workspace that is allocated for spooling.

JES supports a Writer Checkpoint function that provides the user with the capability of checkpointing his SYSOUT data sets.

JES supports an Output Separator facility that provides a means of identifying and separating the output of various jobs that are processed by the same output device.

JES also supports a Checkpoint/Restart Capability, thereby complementing other RAS facilities to ensure continuous operation.

JES supports a Job Log Facility that collects all WTOs, WTORs and replies to WTORs and includes them in the JCL listing.

The two components of JES are the Job Entry Peripheral Services (JEPS) and the Job Entry Central Services (JECS).

The functions provided by JEPS are System READER and System WRITER. All input to OS/VS1 except console entered commands, passes through the JES Reader(s). OS/VS1 allows as many readers and writers as can be contained within the limits of the virtual storage allocation made for the JES area during SYSGEN. The readers/writers are part of JES and do not occupy separate partitions. They are

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resident in the JES area of storage and operate concurrently with problem programs.

All resource management for JES is consolidated in the Job Entry Central Services facility. JECS has three logical functions, each of which provides a management service for JES:

Buffer Management - A central buffer handling facility for JES
Spool Management - Has the responsibility to logically handle data such as JCL text, in line input data, procedure libraries, system messages, WTP, and spooled output data.
DASD Work Area Management - Suballocates DASD work space and performs I/O operations on DASD work space for JES.

All other scheduler operations such as interpretation, allocation, command processing, initiation and termination of system and program tasks, data management and system management facilities (SMF) interface with JES.

Remote Entry Services - RES: RES is a logical and functional extension of the Job Entry Subsystem (JES). It extends the JES functions so that remote users can be attached to OS/VS1. Using RES, jobs and commands can be submitted from remote terminals, and output can be routed back to the terminals. RES makes OS/VS1 available to teleprocessing terminals so that more users can have direct access to the central system for their job submission.

RES provides all remote batch processing facilities. Using normal JCL (no special statements or parameters), the user can submit a job or a batch of jobs from his terminal directly into the system. He avoids the inefficient procedure of putting the jobs together, submitting them to the computer center, having the operator enter the jobs into the computer, and waiting for his output to be processed on the same local facilities as the output from other users' jobs. By using a true subset of system operator commands, the remote user can inquire about and manipulate his jobs. Remote Entry Services supports the following stand-alone workstations and features:

BSC Terminals
2772 Multipurpose Control Unit
2780 Data Transmission Terminal
3741 Data Station, mdl 2 (in basic communications mode)
3741 Programmable Work Station, mdl 4 (in basic communications mode)
3771 Communication Terminal, mdls 1,2,3 (as a 2772)
3773 Communication Terminal, mdls 1,2,3 (as a 2772)
3774 Communication Terminal, mdls 1,2,P1,P2, (as a 2772)
3775 Communication Terminal, mdl 1,P1 (as a 2772)
3776 Communication Terminal, mdls 1,2 (as a 2772/3780)
3777 Communication Terminal, mdl 1 (as a 2772/3780)
3777 Communication Terminal, mdl 2 (as a S/360 mdl 20 MULTI-LEAVING Workstation)
3780 Data Communications Terminal
6670 (as a 2772)
1131 Central Processing Unit
5110 Computer (as a 2772)
5280 Distributed Data System (as a System/3)
System/3
System/32 (as a System/3)
System/34 (as a System/3)
System/34 (as a System/3 with multileaving)
System/36 (as a System/3 with multileaving)
System/38 (as a System/3)
S/360 mdl 20
S/360 mdls 25-195 (mdl 25 requires ICA - #4580)
All virtual storage S/370 Processor in BC (Basic 360 Control) mode only (115, 125 with 1052 Compatibility Feature)
All S/370, 303X, or 4300 Processors with the DOS/VSE RJE Workstation Program Product (5746-RC9)
S/370 mdl 195
8100 with DPPX (as a S/360 mdl 25 MULTI-LEAVING Workstation)
8100 with DPPX/SP (as a S/360 mdl 25 MULTI-LEAVING Workstation)

SDLC Terminals
3771 Communication Terminal, mdls 1,2,3
3773 Communication Terminal, mdls 1,2,3
3774 Communication Terminal, mdls 1,2
3775 Communication Terminal, mdl 1
3776 Communication Terminal, mdls 1,2,3,4
3777 Communication Terminal, mdls 1,3
3791 Controller, Configuration Feature **#9165** or **#9169**
5280 Distributed Data System (as a 3770)
8130 Processor with DPCX, mdls A21, A23 (as an MLU SNA device)
8140 Processor with DPCX, mdls A31, A33, A51, A53 (as an MLU SNA device)
System/32 (as a 3770)
System/34 (as a 3770)
System/34 (as an MLU SNA device)
System/36 (as an MLU SNA device)
System/38 (as a 3770)
S/8100 - DPPX (as an MLU SNA device)
S/8100 - DPPX/SP (as an MLU SNA device)
6670 Information Distributor *

* The SNA attached 6670 requires the OS/VS1 Information Distribution Workstation Support program product (5740-XYE) for support. See Program Product pages for additional prerequisites.

Features
Point-to-point nonswitched lines.
Point-to-point switched lines.
Line error recovery.

RES supports the SDLC non-programmable models of the 3771, 3773, 3774, 3775, 3776 and 3777 Communication Terminals, the 5285 and 5288 (as a 3770), the S/32 (as a 3770), the System/34 (as a 3770) and the System/38 (as a 3770). Transmission to the 3770 terminals (except 3777-2) is via Synchronous Data Link Control (SDLC). This provides RES remote entry support for SDLC terminals in a terminal-sharing environment where multiple applications may establish logical connections with the terminal on a per-session basis. To achieve this flexibility of terminal-sharing, RES uses the VTAM application program interface for the support of the SDLC terminals which are attached to a 3704/3705 in network control mode.

Functional characteristics of the RES support for SDLC terminals are as follows: Half-duplex flow ... Multipoint operation ... Serial data transmission operation - e.g., no concurrent operation of printer and punch on the outbound flow from RES to the SDLC terminals ... 3770 disk operation is transparent to RES ... Data stream provides compression of repeated characters. SDLC Terminals supported by RES are the non-programmable models of the 3771, 3773, 3774, 3775, 3776, and 3777-1,3 Communication Terminals,the S/32 (as a 3770), and the S/34 (as a 3770). Additional 3770 products include the 3784 Line Printer, the 3521 Card Punch, the 3501 Card Reader, the 2502 Card Reader, and the 3203 Printer.

Multiple Logical Unit (MLU) 3776 mdls 3,4 and 3777 mdl 3, with up to six independent and concurrent sessions are supported.

RES communication with the System/34 uses VTAM SDLC. A System/34 can support a single RJE workstation which will allow spooling of output data, batching of input data. Up to three readers, three writers, and three punches in SNA are supported on System/34.

RES communication with the System/36 uses VTAM SDLC. A System/36 can support a single RJE workstation which will allow spooling of output data, batching of input data. Up to 7 readers, 7 writers, and 7 punches in BSC and up to 15 readers, 15 writers and 15 punches in SNA are supported on System/36.

RES communication with the 8130/DPCX, 8140/DPCX and 3791 uses VTAM/SDLC. An 8100 or 3790 system can support a single RJE workstation which will allow spooling of output data, batching of input data, and editing of input data. A work station can support up to five logical concurrent sessions with RES. Workstations will accept compacted and compressed RES output.

The 3790 and 8100 RJE workstations have Network Control Program (NCP) support in the 3704/3705.

System Requirements - For BSC Transmission, Remote Entry Services (RES) requires a 2701, 2703, 3704/3705 (in emulation mode), or mdl 135 Integrated Communications Adapter (#4640) equipped for Binary Synchronous Communications. A minimum processor storage size of 144K bytes will allow the use of one terminal subject to the restrictions that apply to the 144K-real storage design point (see Smaller Main Storage Considerations). However, to obtain more effective function and performance it is recommended that a processor storage size of 240K bytes or larger be available. For SDLC transmission, RES requires a 3704 or 3705 in network control mode and a minimum processor size of 384K of real storage. The real storage requirements are dependent upon the user's definition of VS1 and the RES line and terminal configurations.

Job Scheduling: The Initiator for OS/VS1 is pageable and has no resident modules. When the command is entered from the console specifying an Initiator procedure, the initiating task is established in the specified partition to schedule job execution. The Initiator job selection routine dequeues the highest priority job from the first job input queue associated with its partition.

A program required for execution is fetched from the program library and placed in virtual storage. It is paged as needed and execution begins after the entire program's relative addresses (created by the Linkage Editor) are resolved into absolute virtual addresses.

When the final step of the job is terminated, or if the job is bypassed, any temporary or deleted data sets are returned to the system and the Initiator is ready to select another job.

The OS/VS1 Interpreter operates as a subroutine of the Initiator. Its function is to analyze the contents of job control statements and build tables that are used during the initiation and execution of job steps.

The Allocation function operates as a subroutine to the Initiator. Its function is to analyze the I/O device requirements of job steps, allocate

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devices to them, issue volume mounting instructions, and verify that the volumes were mounted on the correct device. OS/VS1 Allocation also supports dedicated data sets. The use of dedicated data sets reduces the time required to schedule a job step by eliminating the time normally required for allocating prespecified data sets.

When a job completes execution, the OS/VS1 termination routines free (deallocate) all resources used by the program and performs the necessary "cleanup" operations to allow the system to continue functioning for other problem programs.

Command Processing: Programmer and operator commands can be entered into the system via the console or the input job stream. Some commands may be entered only through the console. Others may be entered through either the console or the input job stream. OS commands are compatible with OS/VS1 with one notable enhancement: The WRITER command provides the ability for the operator to manipulate printed output.

This command can only be entered from the console and enables the user to: Obtain multiple copies of job output on a data set or job basis, within a job output class ... Immediately stop the job output stream and start writing again from the beginning ... Forward space and back space the output data ... Go to the next data set or restart the output writing of the current data set ... Suspend the writing of a job's output data and requeue it on the output queue to be written out later.

OS compatible command facilities available in OS/VS1 include:

Providing the flexibility to manipulate jobs by displaying the class, priority, and the number of jobs to be processed; suspending the execution of certain jobs or classes of jobs; releasing jobs that have been suspended; direct canceling of a particular job; and changing the priority or class of a particular job.

Redefining the size of a partition. In a virtual storage environment, the partitions actually reside in virtual storage so that the change in partition size is made in virtual storage and not in real storage as in OS.

Preparing for shutting down the system at the end of the day by enabling the operator to save important statistics and data records.

Modifying certain processing characteristics such as: changing output writer classes and conditions under which the output writer pauses for servicing; changing job classes associated with direct system output processing (DSO); changing programmer-specified values providing the programmer has set the proper indicators in his program to allow such revision.

Starting a job called via the console from a procedure library to override the normal selection of jobs entered via the input job stream.

Establishing the date, time of day, or the device to be used as the input work queue and whether this queue is to be formatted, as well as specifying the location of the library containing certain program procedures (procedure library), and which automatic commands the user wishes to override.

Mounting an input/output device for all job steps that require a particular volume, without intervening demountings and remountings of the volume. (The volume must be removable).

Placing input/output devices (other than a communication line) into an online or offline status.

System Management Facilities - SMF: System Management Facilities (SMF) is an optional support in OS/VS1 that collects and records system information. The information obtained can be used in management information reports that describe system efficiency, performance and usage. The SMF records collect such data as: System Configuration ... Job and job step termination ... Processor wait time ... Processor and input/output device usage ... Temporary and non-temporary data set usage and status ... Virtual and real storage usage ... Status of removable direct access volumes ... Paging statistics.

SMF provides exits to installation-supplied routines that can monitor the operation of a job or job step and generate the installation's own SMF records. The exit routines can cancel jobs, write records to the SMF data set, open and close user-defined data sets, suppress the writing of certain SMF records, and enforce installation standards (such as identification of users). Dummy routines are automatically provided for all unused exits.

Recovery Management Support: OS/VS1 recovery management consists of five functions: machine check handling, channel check handling, dynamic device reconfiguration, alternate path retry, and missing interrupt checker.

The Machine Check Handler (MCH) records all machine checks and determines if recovery from a malfunction was made by the Instruction or Micro Instruction Retry or Error Checking and Correction facilities of the Processor. If the malfunction is not corrected by the machine facilities, MCH assesses the damage and attempts to repair intermittent real storage errors. If recovery is not possible, MCH determines whether operation can continue either in full or degraded mode and isolates the failure to a task for orderly selective termination of the task. Failing real storage is isolated on a page size basis.

The Channel Check Handler (CCH) analyzes information which results from Channel Data Checks, Channel Control Checks, and Interface Control Checks. CCH attempts to have the error corrected and determines whether or not the system can continue operation. In all cases, the channel check handler passes data to OBR for formatting and recording appropriate error records.

Dynamic Device Reconfiguration (DDR) allows a demountable volume to be moved from one device to another. The request to move a volume may be initiated by the system or by the operator. The system will initiate a DDR request to the operator upon detection of a permanent error. This support may be deleted at the user's option. Additional support for non-standard tape labels may be included at the user's option.

Alternate Path Retry (APR) automatically retries input/output operations in error and marks offline those data paths that are unusable. APR is automatically included when optional channel paths are specified.

The operator may vary paths online and offline by using the VARY path command. He may not vary the last remaining path to a device offline, nor may he vary teleprocessing paths or paths to shared DASDs.

The Machine Check Handler and Channel Check Handler are standard parts of the OS/VS1 control program. They reside in the control program area of virtual storage and operate in the fixed section of processor storage. Dynamic Device Reconfiguration is a user option while Alternate Path Retry is an optional extension to the Input/Output Supervisor.

The Missing Interrupt Checker (MIC) polls active I/O operations to determine if a channel end and/or device end interruption has been pending for more than a three (3) minute period. In this manner, it provides the operator a reminder message for outstanding mount requests.

Operator Communications: Communications Task - The communications task processes communications between the operator and the operating system via the system console. Write-to-operator (WTO) and write-to-operator with reply (WTOR) macro instructions, operator commands and replies, and switching from the primary console to an alternate are all processed by this task. JES supports a Job Log Facility that collects all WTOs, WTORs and replies to WTORs and includes them in the JCL listing.

Optional Multiple Console Support (MCS) enables systems to be configured with a Master Console and one or more secondary consoles with each console dedicated to one or more system facilities. The Multiple Console user, by selecting which routing codes each console is to receive, tailors his system to his requirements. Through the use of routing codes, both system and problem programmers can indicate to which functional area(s) a message is to be sent.

A hard copy log may be selected to record system and problem program messages and operator commands and responses. The hard copy log can be either a console or the System Log (SYSLOG). Multiple copies of the System Log can be obtained at the option of the user.

The hard copy log is mandatory when (1) there is more than one active console in the console configuration, or (2) a graphic console is being used as the Master Console.

Device Independent Display Operator Console Support (DIDOCS) is an additional option under Multiple Console Support that provides uniform operator console support for graphic display units.

Status Display Support provides for writing multiple-line messages to the operator using the WTO macro instructions. It also provides time-interval updating for the display of active job status, and provides a means of separating status displays and certain WTO messages from operator's message traffic. This is done by designating certain consoles or separate areas of the display console screen exclusively for these displays and messages. Console device support is summarized in the following matrix.

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SYSTEM CONSOLE SUPPORT

Console Type	Standard (Single Console)	Multiple Console Support (8)	MCS with DIDOCS (8)
3215	X	X	X
3210	X	X	X
1403 (1)	X	X	X
3203-4, -5 (1)	X	X	X
4245-1	X	X	X
3262-5 (1)	X	X	X
3286-2 (9)	X	X	X
3211 (1)	X	X	X
2540 (1)	X	X	X
2250 (2)			X
2260 (3)			X
2740		X	X
3274 (4)			X
3277 (4)			X
3066 (5)	X	X	X
138 Console	X	X	X
148 Console	X	X	X
158 Console (6)	X		
3213-1 (6)	X		
1052-7/2150 (7)	X		
3278-2A (10)	X	X	X

Notes:

(1) A console must consist of a printer-keyboard or a card reader and printer to simulate the actions of a printer-keyboard.
(2) 2250 mdls 1 and 3.
(3) 2260 mdl 1 on a 2848 mdl 3 (local attachment).
(4) Support for the 3270 under DIDOCS. The 3277 mdl 1 attaches via a 3272 mdl 1 or 2. The 3277 mdl 2 attaches via a 3272 mdl 2 only. The 3278 mdls 1-4 are only supported in default mode via 3274 mdl 1B.
(5) Mdl 165 II and mdl 168 only.
(6) Printer-Keyboard mode only and only on mdl 158.
(7) Mdl 155 II, 165 II, and 168.
(8) Maximum of 32 devices.
(9) When attached to mdl 138, 148.
(10) With 4300 Processors.

Data Management: Data management controls all operations associated with input/ output devices, such as allocation of space on volumes, storing, naming, and cataloging data sets, and movement of data between main and auxiliary storage.

Virtual Storage Access Method - VSAM: VSAM is an access method designed to operate with direct access devices and to support both direct and sequential processing by means of either an index key (keyed accessing) or by means of relative byte address (addressed accessing). (Relative byte address refers to the displacement of a stored record, or control interval, from the beginning of the storage space allocated to the data set to which it belongs.)

Three types of data sets are provided: key-sequenced data sets, which are ordered by a key field in the data record, entry-sequenced data sets, which are ordered by the sequence in which the records were loaded, and relative record data sets which are ordered by record number. Keyed accessing is used to access key-sequenced or relative record data sets, and addressed accessing is used to access both key-sequenced and entry-sequenced data sets. Key-sequenced and entry-sequenced data sets may be either fixed or variable length records, relative record data sets are fixed length records only.

VSAM is composed of two major elements: a data organization which minimizes data movement and which is suitable for data base applications; and routines for creating data sets in the VSAM organization, adding and deleting records, and performing other data management functions. Because the VSAM data organization and the access method routines are supported for both OS/VS and DOS/VS, VSAM provides full data portability between these systems.

The VSAM user can expect to see performance improvements relative to OS/VS ISAM and DOS ISAM. Performance gains with VSAM can become increasingly significant as the number of insertions to the data set rises. This is due to the elimination of the "chained record overflow" concept employed by ISAM. VSAM effectively maintains its sequential, non-inserted performance as records are added to the data set. Also, VSAM requires less time to perform a record insert than does ISAM. These factors, coupled with the efficient VSAM index structure and with the VSAM performance options, offer the potential of performance improvements relative to ISAM.

VSAM Highlights

- Access to data via VSAM is controlled by macro instructions written under the conventions of Assembler language. Access to data sets may be either direct or sequential, and may either be keyed (controlled by index key) or addressed (controlled by relative byte address).
- With VSAM, certain device-dependent calculations such as the optimum block sizes for a given device type are carried out automatically and all data addressing is by relative bytes within the storage space allocated to the data set. These features minimize programmer effort when he wants to change device types.
- Most existing and new COBOL, PL/I, and Assembler language programs written for use with ISAM data sets may be used with VSAM data sets by means of the VSAM ISAM Interface Program. The ISAM Interface Program maps ISAM macro instructions into the corresponding VSAM requests. Refer to the Program Product section of the sales manual for details regarding COBOL and PL/I support of VSAM.

  VSAM functional extensions relative to ISAM include concurrent direct and sequential processing, expanded catalog support for OS/VS and enhanced device independence. A single VSAM OPEN macro instruction may be used to initiate both direct and sequential accessing, without the need of issuing an intervening CLOSE instruction.
- VSAM offers a multi-function service program (Access Method Services) to facilitate overall management of data. Such services as defining data sets initially, deleting VSAM data sets from the VSAM catalog, printing and copying data, listing the VSAM catalog, and providing backup and portability features are controlled by this multi-function program. Converting data sets from the VSAM or SAM format to the ISAM format is another important function of this program.
- A significant feature of VSAM is that of data set and volume portability between DOS/VS and OS/VS systems. Portability of data sets and volumes is made possible by the user catalogs and the multi-function service program, Access Method Services.
- VSAM offers multiple levels of password protection to enhance data set security. VSAM also offers a user exit so that user-written security routines may be included.
- VSAM operating under OS/VS1 establishes its own master catalog independently from the OS/VS1 catalog. VSAM operating under OS/VS1 also supports user catalogs to reduce contention for the master catalog and to enhance data set integrity and portability. Each VSAM catalog defines VSAM volumes, whether mounted or not. This enhances space allocation because it is not necessary to mount a volume in order to determine whether or not space is available. Each VSAM catalog also supports non-VSAM data sets. Volumes may contain a mixture of VSAM data sets and non-VSAM data sets.

The primary objective of these features is to provide functions which reduce the need to schedule redundant work. These optional features are:

Alternate Indexes

This new feature permits application programs to access the records of a VSAM entry or key sequenced data set on the basis of keys other than the prime key. These alternate keys may be non-unique and must be contained in the base data record. Once an Alternate Index has been constructed by using Access Method Services, it may optionally be automatically updated whenever a data record is changed in the base data set to which it relates.

Relative Record Data Set

With this feature the data set is viewed as a numbered sequence of fixed length slots. Records may be inserted, updated, read, or erased in these slots using VSAM keyed processing, with the slot (i.e., record) number as the key. No index is used since each record's physical location is calculated directly by VSAM from its record number and the characteristics of the data set.

Get Previous

This feature permits retrieval and update processing on the basis of descending key values, relative record numbers, or relative byte addresses. Processing may begin either within or at the end of the data set.

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Reusable Data Set

This "new" capability allows a data set to be reused (i.e., reset to "empty" when opened and reloaded) many times without being deleted and redefined. A reusable data set may be any key sequenced, entry sequenced, or relative record data set that does not have an alternate index associated with it and that does not reside on unique space. However, an alternate index may be a reusable data set.

Spanned Record

Originally VSAM did not permit a record to exceed a control interval in size. The Spanned Record feature removes the restriction, allowing a record to occupy multiple control intervals within a control area. If indexed, the keys must be in the first control interval.

Recovery

Extensions to the facilities within VSAM Catalog Management and Access Method Services will now permit limited access, via Access Method Services, to data that is not addressable by the catalog (due to the loss of, or damage to, the catalog). Further, the user can restore addressability of the data and reconstruct the associated catalog entries.

Improved Control Interval Processing

This feature is designed to reduce processor utilization for users of control interval processing with user buffers and with minimal processing options.

VSAM Shared Resources

This option provides new interfaces to allow the user to create and control his own resource pool, permitting buffers and control blocks to be shared among data sets. Its use minimizes the storage requirement in a data base environment in which a large number of data sets may remain open over an extended period.

Catalog Recovery

Additional catalog recovery capability has been added to Access Method Services for VSAM users on OS/VS1 Release 6. The RESETCAT command provides the capability for validity checking and rebuilding a VSAM catalog from information contained in its catalog recovery areas without the necessity of moving VSAM data Sets.

VSAM Minimum System Configuration

These VSAM options retain the same general system configuration requirements as the original version, however, one of the following no charge special features is required for either S/370-135 or S/370-145.

#1001 Advanced Control Program Support*
S/370-145 mdls IH, J2, JI2, or K2
(*standard on 145-3 and 148)

#1051 Conditional Swapping**
S/370-135 All mdls
S/370-145 All mdls
(** standard on 135-3 and 138)

Note: Insert PSW Key and Set PSW Key from Address which are part of Advanced Control Program Support are standard on the S/370 135-3 and 138 and are called PSW Key Handling.

VSAM coexists with existing data management access methods. The data management functions supplied by VSAM are: opening data sets, closing data sets, end of volume processing, cataloging VSAM data sets, allocating space, Checkpoint/Restart processing, and processing records by index key or by address.

The operating system job control language (JCL) is expanded to include VSAM catalogs and access method parameters.

Sequential Access Methods: In the Basic Sequential Access Method (BSAM), data is sequentially organized and physical blocks of data are stored or retrieved. The READ/WRITE macro instruction causes the initiation of an input/output operation. The completion of these operations is tested by using synchronization macro instructions. Automatic translation between EBCDIC and ASCII codes is provided for magnetic tape labels and record formats.

In the Queued Sequential Access Method (QSAM) logical records are retrieved or stored as requested. The access method anticipates the need for records based on their sequential order, and normally will have the desired record in virtual storage, ready for use, before the request for retrieval. When writing data, the program normally will continue as if the record had been written immediately, although the access method routines may block it with other logical records and defer the actual writing until the output buffer has been filled. As with BSAM, automatic translation between EBCDIC and ASCII codes is provided for magnetic tape labels and record formats.

Basic Partitioned Access Method - BPAM: This access method, when used in conjunction with BSAM, is designed for efficient storage and retrieval of discrete sequences of data (members) belonging to the same data set on a Direct Access device. The data set includes a directory that relates the member name with the address where the sequence begins. Each member has a simple name. Members may be added to a partitioned data set as long as space is available in the directory and the data set. Other than directory manipulation, all I/O is performed by BSAM.

Basic Direct Access Method - BDAM: In the Basic Direct Access Method (BDAM), records within a data set are organized on direct access volumes in any manner chosen by the programmer. Storage and retrieval of a record is by actual or relative address within the data set. This address can be that of the desired record or a starting point within the data set where a search for the record, based on a key furnished by the programmer, begins. Addresses are also used by BDAM as a starting point for searching for available space for new records.

Indexed Sequential Access Methods: Sequential and direct processing are provided by the Indexed Sequential Access Methods (ISAM). Records are maintained in control field sequence by key. A multilevel index structure is system maintained, allowing retrieval of any record by its key. Additions can be made to an existing ISAM data set without rewriting the data set.

The Basic Indexed Sequential Access Method (BISAM) stores and retrieves records randomly from an indexed sequential data set. Selective reading is performed using the READ macro instruction, and specifying the key of the logical record to be retrieved. Individual records can be replaced or new records added randomly.

The Queued Indexed Sequential Access Method (QISAM) is used to create an indexed sequential data set or to retrieve and update records sequentially from such a data set. Synchronization of the program with the completion of input/output transfer, and record blocking/deblocking are automatic. QISAM is also used to reorganize an existing data set.

3850 Mass Storage System - MSS: OS/VS1 supports attachment of a single 3850 Mass storage System MSS (up to two A mdl 3851s).

The 3850 Mass Storage System (MSS) programming support includes an MSC (Mass Storage Control) Table Create program, Access Method Services functions to aid in mass storage volume management, and a Mass Storage System Communicator (MSSC) which communicates the Staging/Destaging commands to the MSC and contains Mass Storage Volume Control (MSVC) functions to assist in volume management. In addition, most of the facilities available for the control and management of real 3333/3330 Disk Storage drives and the data sets contained on 3336 mdl 1 and 11 Disk Packs are applicable to virtual 3333/3330 addresses and the data sets contained on mass storage volumes. Brief descriptions of the significant areas of support follow. More detailed information can be found in the publication *OS/VS Mass Storage System (MSS) Planning Guide.*

MSC Table Create: Creates and initializes the tables required by the Mass Storage Control (MSC). The tables are of four types:

Configuration Information: describes the hardware present in the 3850 Mass Storage System and the interconnections between the various hardware components.

Cartridge Information: describes the locations and volume serial numbers of the mass storage volumes in the 3851 MSF.

Activity Information: describes the status of staging and destaging of data.

Control Information: contains information required to locate all the above tables and also the basic information required to start the MSC initial microprogram load.

This program must be run at the initial installation of the 3850 MSS and whenever the configuration changes. It must be run prior to an OS/VS1 System Generation, if the 3851 IODEVICE macros are being changed, because it generates IODEVICE and UNITNAME card images to be used in Stage I of SYSGEN.

OS/VS1 (5652-VS1) (cont'd)

OS/VS1 System Generation: The 3851 Mass Storage Facility is a new device type for which an IODEVICE macro must be included. The number of virtual 3333/3330 addresses will be limited by the OS/VS1 UCB limit (see *OS/VS1 System Generation Reference*) and by the available subchannels (see appropriate Processor or channel functional characteristics manual). An IODEVICE macro for each virtual 3333/3330 address is required. Certain system data sets must reside on real direct access units known to OS/VS1. The four real unit addresses 0, 1, 8 and 9 on Staging Adapter 0 and Staging Adapter 1 are reserved for direct access to the MSC tables. More detailed information can be found in the publication *OS/VS1 Planning & Use Guide,* GC24-5070. If the only direct access units in an installation are the 3333/3330 Disk Storage drives included in the 3850 MSS, then one or more of these 3333/3330 drives must be assigned addresses that have been identified to OS/VS1 as real 3333/3330 units. These 3333/3330 drives can then be used for the system data sets. For further information on system generation, refer to the publication *OS/VS1 System Generation Reference,* GC26-3791.

Staging/Destaging Initiation: Staging and destaging is based upon Job Control Language (JCL) Data Definition (DD) statement parameters. UNIT = 3330V indicates that the data set defined by DSNAME resides on a mass storage volume whose serial number is identified either by the VOLUME parameter or in the catalog. This mass storage volume is "mounted", i.e. made active, by the Mass Storage Control at job step initiation. If DISP = OLD, SHR, or MOD is specified, the staging of the data set is initiated when the data set is OPENed. Staging will be initiated for new data sets only when the space request is not on a cylinder boundary. Destaging of new data sets for which DISP = KEEP or CATALOG and the portions of old data sets that were modified is initiated when the mass storage volume is demounted.

Mass Storage System Communicator (MSSC): The MSSC includes *Mass Storage Volume Control* (MSVC) functions to assist users of the 3850 MSS to control and manage the use of mass storage volumes. MSVC centers around a new system data set, usercat.MSVI, which is a keyed sequential VSAM data set containing space and activity information about mass storage volumes and groups of mass storage volumes. It is created, initialized, and maintained by the user via the Access Method Services functions for creating a VSAM data set and for the manipulation of mass storage volumes. Usercat.MSVI is used by OS/VS1 for the allocation of mass storage volumes to satisfy non-specific volume requests for new data sets. An Access Method Services function which produces a report of the status of mass storage volumes and groups of mass storage volumes is available. Access Method Services also list information concerning cartridges similar to the information listed concerning volumes. Included are two commands which enable the user to list or scratch and uncatalog non-VSAM data sets according to his specified criteria (e.g., creation date, expiration date or name qualifier). Access Method Services also list information on cartridges similar to the information listed on volumes. Included are two functions which enable the user to list or scratch non-VSAM data sets according to specified criteria such as: creation date, expiration date or name Qualifier. It is an installation responsibility to analyze these reports to determine the extent of space utilization on mass storage volumes and then to initiate the appropriate utility functions to scratch or copy inactive data sets.

Data Management Support: BSAM, QSAM, BPAM, BDAM, VSAM, EXCP, and XDAP may be used for data sets contained on mass storage volumes. The staging of such data sets is initiated at OPEN. ISAM data sets can be contained on mass storage volumes. However, staging for ISAM data sets is not initiated at OPEN but, rather, at the time a data record is accessed. One cylinder at a time is staged as requested by the "cylinder fault" mode of operation. The Direct Access Device Space Management (DADSM) facilities are applicable to mass storage volumes as well as to real direct access volumes. All of the catalog facilities of OS/VS1 can be used for data sets contained on mass storage volumes.

Data Sharing: The catalog, user program libraries, and user data sets can be accessed by any processor. If 3333s are shared between hosts, the 3330V devices with paths to the shared 3330 drives may be SYSGENed as shared or unshared at user option.

Data Security: The password protection data security facilities of OS/VS1 can be used to control access to MSC tables and data sets contained on mass storage volumes.

Data Set Utility Programs: All non-standalone OS/VS1 Data Set Utilities can be used with data sets contained on mass storage volumes.

System Utility Programs: All non-standalone OS/VS1 System Utility Programs except IEHDASDR and IEHATLAS can be used on mass storage volumes.

IEHDASDR Utility Function: OS/VS1 System Utilitity Program IEHDASDR provides support for formatting the DASD volumes as Staging volumes. This utility function can only be performed external to the MSS.

Access Method Services Functions: Access Method Services provides mass storage volume commands which allow a user to initialize, modify, copy, and scratch mass storage volumes, to add and remove mass storage volumes from the 3850 MSS, and to convert real 3336 Mdl 1 Disk Packs to mass storage volumes and back again. There are commands which allow a user to create, modify, and scratch groups of mass storage volumes in usercat.MSVI, and to list the contents of usercat.MSVI.

Additional Commands allow the user to copy, swap, and compare the Mass Storage tables, to dump portions of the MSC or Staging Adapter storage, to dump the MSC tables, to audit cartridge locations within the MSF, and to check the consistency of the MSC tables, SA tables and Mass Storage Volume Inventory data set.

VIRTUAL TELECOMMUNICATIONS ACCESS METHOD - VTAM: (Also refer to the Program Products section for licensed options provided for TCAM).

A functionally superior alternative to BTAM, VTAM provides telecommunications support for the 3704/3705 in network control mode and for locally attached 3270s, 3730s and 3790s. In addition, VTAM controls the sharing of telecommunication resources between application programs and supports the concurrent execution of multiple teleprocessing applications.

VTAM provides for the direct transmission of messages between application programs and terminals. Using NCP/VS, it makes the lines and communications controllers transparent to the application program; thus, the application program need only be responsible for device control characters in data streams.

The expanded interface for application programs allows the user to control connections between application programs and terminals, as well as to request data transfer. A single request for connection or input can be directed simultaneously to more than one terminal.

For SS and BSC terminals, VTAM supports switched networks as point-to-point, manual dial, automatic dial, and automatic answer. Nonswitched networks are supported as point-to-point or multipoint, as appropriate for the device.

For SDLC terminals, VTAM initially supports switched and nonswitched lines. A switched line connection requires system operator assistance. Manual dial service is supported. Nonswitched networks are supported as point-to-point or multipoint, as appropriate for the device. VTAM subsequently supports SDLC terminals in switched networks as point-to-point, manual dial, automatic dial, and automatic answer. Each station has a unique transmission identification within the network, as defined by the installation.

The VTAM application program interface is upward compatible for DOS/VS, DOS/VSE, OS/VS1, and OS/VS2. It is designed for long-term stability and to aid user teleprocessing growth.

VTAM and VSAM are companion access methods on which to build customer data base/data communications systems. TCAM application programs can use certain VTAM facilities through TCAM Message Control Program.

Network operator control facilities are provided, enabling the user to monitor and reconfigure his network to meet fluctuating requirements.

The program operator facility allows an authorized user-written application program to enter VTAM Network operator commands and receive VTAM Network operator messages.

Configuration Restart Facilities allow the VTAM Network to be reinstated after a failure or a normal deactivation occurs. Manual switching support to a backup Processor or 3704/3705 is provided.

VTAM's modular design and use of tailored OS/VS1 RAS facilities provide a reliable telecommunications system and assist in maintenance.

A 3790-SNA System Installation Package, consisting of a 3790 Sample Installation test program with appropriate supporting code and control statements, and a 3790 Installation Guide, is provided to facilitate installation of 3790 Communication Systems and the host communications subsystem.

OS/VS1 (5652-VS1) (cont'd)

To aid in installing the 8100 Information System with DPPX or DPPX/SP, the Host Command Facility licensed program with an SNA 3270 display station running under VTAM or TCAM, can be used to:

- Remotely operate an 8100/DPPX or 8100/DPPX/SP system from a 3270 display station.
- Run 8100/DPPX or 8100/DPPX/SP checkout routines remotely.
- Verify the operation of a link connecting S/370 and 8100 DPPX or 8100/DPPX/SP.
- Modify DPPX or DPPX/SP Network profiles.

VTAM System Requirements: VTAM operates in OS/VS1 on a S/370 and requires the Compare and Swap and the Compare Double and Swap instructions. These instructions are provided via the Conditional Swapping feature (#1051) for the mdl 135, and via the Advanced Control Program Support feature (#1001), or the Conditional Swapping feature (#1051) for the mdl 145, (see **Note**). The minimum OS/VS1 system under which VTAM operates is 256K of real storage.

See "Terminal Support Chart 1" for the devices supported by VTAM with OS/VS1.

Note: Conditional Swapping is standard on the mdls 135-3 and 138. Advanced Control Program Support is standard on the mdls 145-3 and 148. Insert PSW Key and Set PSW Key from Address, which are part of Advanced Control Program Support, are standard on the S/370 135-3 and 138 and are called PSW Key Handling.

Teleprocessing Online Test Executive Program - TOLTEP: TOLTEP is a component of VTAM and is designed to control the selection, loading, and execution of teleprocessing online terminal tests (OLTTs) for all control units and terminals in a VTAM network. It uses VTAM capabilities for line sharing, remote reporting, and remote test requests. TOLTEP performs control services, device accessing, and configuration-update functions for teleprocessing OLTTs of devices supported by VTAM.

TOLTEP allows the operator or IBM representative to run teleprocessing OLTTs concurrently with other processing programs, with VTAM, and with the operating system. TOLTEP is automatically included in a system when VTAM is generated. It is initiated when VTAM is initiated and stopped when VTAM is stopped.

TOLTEP does not support the dedicated testing of a locally attached 3704/3705 Communications Controller. Dedicated testing of the local 3704/3705 is handled by OLTEP.

Although TOLTEP provides testing facilities for the VTAM network, TOTE and OLTEP are still required for testing appropriate non-VTAM networks.

TOLTEP requires the configuration data set (CDS) and the OLTT data set.

Telecommunications Access Method - TCAM: (Also refer to the Program Products section for licensed options provided for TCAM).

The Telecommunications Access Method (TCAM) is a teleprocessing support program which may execute in conjunction with VTAM or as a separate access method. It provides:

Providing facilities that permit exchange of data between a central OS/VS1 Processor and remote terminals.

A computer's resources in a real-time teleprocessing environment. Resources optimized include processor time, real-storage space and I/O paths (lines and channels).

- A high-level language composed of macro instructions designed specifically to facilitate the construction of a TP message control program. Please refer to the TERMINAL SUPPORT CHART(S) in this section for specific terminals and how supported.

TCAM provides unified management of terminal devices, local and remote, including BSC and SDLC devices, through a single Message Control Program. The TCAM application-program interface has been defined to provide maximum compatibility with BSAM (READ/WRITE level) and QSAM (GET/PUT level), yet provide the ability to identify or specify source and destination of terminal I/O. Network control functions may be provided in an application program able to issue TCAM operator control commands.

Teleprocessing applications using TCAM are constructed by providing a Message Control Program and one or more TCAM application programs.

TCAM does not provide emulation of the QTAM interface.

TCAM Message Control Program: The TCAM Message Control Program (MCP) serves as an interface between remote terminals, user-written application programs, and secondary storage devices on which messages are queued until their destinations are available to receive them. The MCP's job is to control the flow of messages to and from these terminals, application programs, and queuing media, in a manner that optimizes allocation and scheduling of the computer's resources.

By handling all line control and scheduling of I/O operations for remote terminals, the TCAM MCP insulates user-written application programs from the complex device-dependent considerations inherent in a TP environment.

In TCAM, messages entered by remote terminals or application programs are queued by destination. Queuing by destination permits overlap of line usage in I/O operations; messages having a common destination may be received simultaneously from more than one source, even while the destination itself is busy sending or receiving a message. Disk queuing permits a high volume of concurrent terminal operations to proceed without requiring excessive real storage for buffering. TCAM destination queues may be located in main storage or on disk.

A TCAM MCP contains one or more message handlers. These are user-coded sets of routines that process messages as they enter and leave the TCAM MCP. Message handler functions are included by the selection and coding of TCAM supplied macros; among these functions are the following: message editing ... validity checking ... message routing ... record keeping ... error handling ... system control.

Special message-handler facilities are furnished for inquiry and conversational applications. The path of a message through a message handler may be varied dynamically based on the source or destination of the message, or on the presence or absence of certain character strings in the message header. To supplement TCAM-provided functions, the user may code open or closed subroutines consisting of assembler macro instructions and include these in his message handlers. Assembly, linkage-editing, and execution of the MCP is similar to that for any other problem program. For performance reasons, the MCP is usually executed as the highest priority user task in the system, but this is not a requirement.

TCAM Application Programs: TCAM permits the user to code one or more application programs and interface these with the MCP. Application programmers are insulated from the TP environment; they issue ordinary GETs and PUTs or READs and WRITEs to move data between the MCP and application program work areas.

TCAM application programs can be SAM compatible, and may be debugged in a non-TP environment using BSAM or QSAM as the access method, and a tape, card-reader, disk, card punch, printer, etc., as I/O devices. Once debugged, many application programs can be plugged into TCAM without reassembly by changing a single job-control statement. The user can specify that either messages or user-defined records be transferred when he issues his GET/READ or PUT/WRITE macros.

TCAM application programs can be attached dynamically during execution by the MCP.

TCAM Service Facilities: TCAM offers an extensive set of service facilities. Among these are:

- A set of operator commands allowing the user to determine the status of his TP system and alter, activate, or deactivate portions of that system by entering appropriate commands from the system console, remote terminals, or application programs. An NCP may be referred to by its NCP name, and SNA entities are allowed as operands where applicable.
- A checkpoint/restart facility which allows the user to specify that his MCP environment be restored following system failure or closedown.
- A facility for selectively logging incoming or outgoing messages or message segments.
- Comprehensive debugging aids, including error-recovery and event-recording facilities, and utilities which permit debugging information to be dumped to tape or disk and then printed out.
- An online test facility (TOTE) that allows the user to test transmission control units (270X and 3704/3705) and remote terminals without closing down the MCP or deallocating the device being tested. When TCAM uses VTAM, TOLTEP provides testing facilities for the VTAM network.

OS/VS1 (5652-VS1) (cont'd)

TCAM MFT, MVT/VS Compatibility: OS TCAM Message Control Programs must be reassembled to run in the OS/VS environment. This reassembly allows the MCPs to benefit from the virtual storage capability of OS/VS. Under OS/VS, TCAM runs as a subsystem in a virtual partition. Certain TCAM elements, such as the buffer pool, I/O appendages, control blocks, and tables are fixed in main storage for the duration of the TCAM task.

System Requirements and Device Support: TCAM operates under OS/VS1 on a S/370 having at least 144K bytes of main storage or on any 4300 Processor. Normally space on one or more 2314 or 3330/3333/3340 DASD units will be needed for intermediate storage of message queues.

TCAM supports a wide variety of start/stop and binary-synchronous terminals attached remotely via a 2701, 2702, 2703, 3704/3705 (in emulation mode) or S/370 mdl 135, 138 with ICA (#4640) or 4331 with Communications Adapter (#1601) for remote terminal and network configurations supported by OS/VS1. TCAM in this fashion is itemized in *Terminal Support Charts 1 and 2.* In addition to remotely attached terminals, OS/VS1 TCAM supports direct attachment to either the multiplexer or selector channel of the 2260-2848 Display Complex (Local), and direct attachment to the multiplexer channel of the 7770 mdl 3 Audio Response Unit. These devices are not supported by TCAM when running through VTAM.

TCAM/VTAM Relationship in OS/VS: VTAM controls the telecommunications environment that includes 3704/3705s in network control mode and, optionally for TCAM, locally attached 3270s. VTAM permits sharing of this telecommunications network among different applications including those applications which used TCAM 3704/3705 network control mode support in previous releases of the operating system. When the TCAM Message Control Program schedules a read or write operation for a station in the TCAM/VTAM network, this I/O request is routed to VTAM. To the TCAM applications, the message looks as if it were handled only by TCAM.

If a TCAM application program or a TCAM terminal operator issues TCAM 3704/3705 control commands, a unique return code and a response message is provided. This code and message indicate the command has been intercepted and cannot be executed. Similar 3704/3705 control functions are available through VTAM network operator commands. TCAM now shares this network with VTAM and is no longer the sole "owner" of the telecommunications network.

The installation can provide an interface to the terminal user similar to the TCAM interface by using the "simulated logon" capability of VTAM. However, to use the full sharing capabilities of VTAM, the installation instructs the terminal user to enter an installation-defined sequence requesting logon to TCAM and includes in the system the VTAM facility to monitor logons.

This VTAM facility provides the capability to interpret the sequence entered by the terminal user and to route the interpreted logon request to the appropriate VTAM application (e.g., TCAM).

Note: A TCAM MCP must be re-assembled for proper operation through VTAM.

Basic Telecommunications Access Method - BTAM: The facilities of the Basic Telecommunications Access Method (BTAM) are designed chiefly to provide the basic tools required to write a telecommunications program. BTAM provides support for terminals attached other than to the 3704/3705 in network control mode. These include facilities for creating terminal lists and for performing the following operations: Initiating and answering calls to and from terminals on switched networks ... Polling and addressing terminals on nonswitched multipoint lines ... Changing the status of terminal lists ... Transmitting and receiving messages ... Code translation ... Retransmitting messages which are received with detected errors ... Providing online terminal test facilities ... Keeping error statistics.

The support of Binary Synchronous Communications combined with that of the various start/stop devices gives BTAM a varying degree of applicability and flexibility. BTAM supports low, medium, and high speed devices.

BTAM supports Binary Synchronous Communication over nonswitched (leased or private direct connection) and switched (dial) networks in a S/370 to terminal communication.

All terminals (except Binary Synchronous Communication) on a multipoint nonswitched line must be the same type. Terminals may be mixed within the same problem program.

Further information on terminal support is provided by *Terminal Support Charts 1 and 2.*

Optional communication serviceability facilities are available in BTAM including error recovery procedures, diagnostic error information, error counts, and online terminal tests. It is strongly recommended that these facilities be included since they increase system availability.

OS/VS1 BTAM supports the same functions as OS BTAM and, therefore, requires no additional programmer training. The user is cautioned regarding any internal changes that he may have made to OS/MFT BTAM.

Graphic Programming Services: Graphic Programming Services consists of the functions necessary to handle graphic input/output, and a set of macro instructions and problem oriented routines that can be used as building blocks in the construction of graphic processing programs. These services support the 3250 Graphic Display System, the 2250 Display Unit, mdls 1 and 3, and the 2260 direct attachment (local). This access method includes:

Macro instructions to generate orders for the 3250 and the 2250 mdls 1 and 3, including the mdl 1 with the graphic design feature ... Data handling aids for arranging orders and data in virtual storage prior to transferring them to the graphic display buffer ... Problem-oriented routines that dynamically generate orders and data for displaying on the 3250 and the 2250 mdls 1 and 3: alphameric characters, rectangular grids (linear or semi-log), polar coordinate grids (linear or semi-log) and circles and arcs ... Input to these routines can be either fixed point or floating point and can be scaled by the routines ... Graphic Data Generation Subroutine to generate data, during program execution, for use with the 2-byte incremental data modes of the 3250 and the 2250 mdl 1 with the Graphic Design Feature and the 2250 mdl 3 ... Light Pen Tracking Subroutine - Generates a buffer subroutine during program execution which may be used on a 3255 or a 2840 mdl 2 to track the pen movement on the CRT and display a pattern showing its current position ... The Graphics Access Method (GAM) includes: Read/Write level macro instructions for transferring data between real storage and the graphic display buffer; Buffer management facilities that allocate, control, and protect sections of the 3255 or the 2250 mdl 1 or 2840 buffer; Routines that facilitate man-machine communication using 3250, or 2250 or 2260 local, at both the express and basic attention handling levels (provides synchronous attention handling).

Graphic Subroutine Package - GSP: The Graphic Subroutine Package provides support for graphic programs written in Assembler Language or for the following compilers:

FORTRAN IV E, G or H
PL/I (F)
FORTRAN IV H-Extended or G1 (Program Products)
PL/I Optimizing or Checkout Compilers (Program Products)

These services consist of subroutines and functions that enable a programmer to create a display on one or more 3251 Display Stations or 2250 Display Units (mdls 1 and 3) under OS/VS1. The displays produced consist of any figures that can be constructed with points, lines, or characters, including charts, circles, arcs, rectangles, etc. The subroutines are requested through the use of CALL statements in a sequence that produces desired characters or graphic forms on the 3251 or 2250 screen, and that provide two-way communication between the user's program and the 3251 or 2250 operator (if desired). In producing desired displays, the subroutines automatically: Generate necessary graphic orders and and data for the displays ... Transfer the generated orders and data to the 3255 or the 2250 buffer for execution, relocating them as necessary ... Allocate, control and protect sections of virtual storage and of the 3255 or the 2250 buffer as required by the user's application program ... Diagnose asynchronous errors and accomplish necessary error handling.

Features available are:

- Two levels of graphic order and data grouping, each of which can be referenced by an entity: (1) element - all orders and data produced as one call to a GSP subroutine, and (2) sequences - all orders and data produced by several calls to GSP subroutines.
- Acceptance of input data in any two-dimensional rectangular coordinate system; the data is scaled as appropriate for use by the graphic subroutine package.
- Provision for temporarily removing an image from a display while its associated orders and data are in the buffer, and later redisplaying the image.
- Modification of graphic orders and data produced by a single call wherever they are located (in real storage or in a buffer) by another call to the same subroutine.
- Display of alphanumeric characters using either the character generator of the 3250, or 2250 or a series of lines called strokes.
- Capability to read information from the buffer into real storage.

OS/VS1 (5652-VS1) (cont'd)

- Capability to locate the position of the light pen on the screen even if the light pen is pointed to a blank portion of the screen.
- Capability to place a tracking symbol on the screen and follow its motion as it is moved by a 3250 or 2250 operator with the light pen (restricted to 3250 or 2250 mdl 3).
- Allowance for in-buffer subroutines that can be repeatedly invoked through in-buffer linkage (restricted to 3250 or 2250 mdl 3).
- Ability to check the status of the program while it is being processed.
- Calling any of the subroutines from an assembler language program.
- Single and multiple queueing of attention information, and inline processing of that information.
- Access to the enhanced features of the 3250 Graphics Display System, including 4 character sizes, character-string rotation through 90 degrees counter clockwise, 4 line types, 8 intensity levels, and entity blinking.

Shared DASD: A pool of direct access storage devices may be shared by two to four S/370 or 4331-2, 4341, 4361, 4381 Processors. Devices supported are 2314/2319, 3333 mdls 1 and 11, 3330 mdls 1, 2 and 11, 3340 mdls A2, B1 and B2, 3344 mdls B2 and B2F, 3375 mdls A1 and B1 and 3350 mdls A2, A2F, B2 and B2F. Two S/370 mdls 145, 148, 155II, 158, 165II, 168, 4341 and 4381 Processors can share a pool of 2305-2 DASD. Two S/370 mdl 165II and 168 Processors can also share a pool of 2305-1 DASD. A 4331 Processor with 3340/3344 directly attached may share these devices with another processor. The catalog, program libraries, and user data sets may be accessed by any processor. Advantages are reduced file maintenance, improved operational flexibility, and reduced disk space requirements. The system establishes access for each catalog generation. Exclusive access for all other data sets is controlled by using the RESERVE macro.

System Support Programs Linkage Editor

The Linkage editor combines separately compiled or assembled object modules into one or more load modules that is in a format suitable for loading by the control program and for subsequent execution. It also combines previously edited load modules with each other or with object modules.

Features - Although linking or combining of program modules is its primary function, the linkage editor also:

Provides CSECT ordering and page boundary alignment facilities.

Incorporates modules from data sets other than those in its primary input, either automatically or upon request.

Aids program modification by replacing and deleting control sections as directed by linkage editor control statements.

Defines the storage requirements for the common control sections generated by the assembler and by FORTRAN compilers, and the static external areas generated by PL/I compilers.

Provides processing options and logs diagnostic error messages.

Maintains an audit trail of compilation, linkage editing dates and levels and modifications on a CSECT basis within a load module via the Identification Record (IDR).

System Requirements - The linkage editor is designed for a virtual partition of 192K bytes, but can operate in the minimum virtual partition of 64K bytes.

Loader: The Loader combines the basic editing and loading functions of the linkage editor with program loading (fetch) in one job step. It loads object modules produced by a language processor and load modules produced by the linkage editor directly into virtual storage for program execution.

System Assembler: The OS/VS1 System Assembler is a programming tool for the implementation of programs using the S/370 instruction set. The System Assembler gives the user access to hardware and operating system functions and permits the user to generate and maintain the Operating System/Virtual Storage 1. Among the features supported by this assembler are:

Macro Instructions - The macro capability provided by the assembler is a programming tool providing interfaces to the OS/VS1 Input/Output Supervisor by means of Data Management macros, access to the complete OS/VS1 capabilities through the use of Supervisor Macros, and the ability to include programmer defined macros in assembler programs for special applications.

Conditional Assembly Statements - Conditional assembly statements are used to alter the sequence in which statements are processed, or to specify selective assembly of instructions. The conditional assembly mechanism is a key element in the macro feature.

Private Libraries - A private library may contain assembler language statements. These can be macro definitions or code that is to be inserted into the program by the COPY statement.

Dynamic Work Areas - The assembler provides a mechanism for establishing addressability to independently allocated storage areas.

System Requirements - The OS/VS1 System Assembler uses the S/370 Standard Instruction Set. This assembler runs efficiently in 128K of virtual storage and requires a minimum of 64K of virtual storage. In addition to the standard OS/VS1 requirements, the System Assembler requires space in auxiliary storage for the following data sets: System Input and three Intermediate data sets for work storage.

Depending on program requirements, additional data sets may be needed for Macro Definition library, print output, object module output, and punch output.

The OS/VS1 System Assembler contains the following enhancements to OS Assembler F: SETC values and character relation terms may be up to 255 characters in length (the old limit was 8 characters) ... Fewer restrictions and extended functions for conditional assembly language ... Three additional system variable symbols (&SYSPARM, &SYSTIME and &SYSDATE) ... Extended mnemonics for RR-type branch instructions ... Improved diagnostics and debugging facilities.

System Utilities: These programs are used to maintain system control data at an organizational or system level. The functions performed by the system utility programs are:

- **IEHPROGM** - Builds and maintains system control data and modifies the password data set.
- **IEHMOVE** - Moves or copies logical collections of S/370 OS/VS1 data.
- **IEHLIST** - Lists system control data such as data sets cataloged in the system catalog, directory entries of partitioned data sets, and VTOC entries.
- **IEHIOSUP** - Updates entries in the supervisor call library.
- **IEHDASDR** - Initializes direct access volumes for use with the operating system and dumps data to or restores data from these volumes. Central and local service will be discontinued on January 22, 1981.
- **IFCDIPOO** - Reinitializes the system data set, SYS1.LOGREC.
- **IEHINITT** - Writes volume label sets in EBCDIC, in BCD, or in ASCII code on magnetic tapes.
- **IEHATLAS** - Locates and assigns an alternate track to replace a defective track.
- **IFHSTATR** - Selects, formats, and writes information from Type 21 (error statistics by volume) records.
- **Device Support Facilities** - Initializes direct access storage volumes for use with the Operating System, inspects count-key-data DASD volumes for defective tracks, conditionally reclaims tracks previously flagged as defective and analyzes the operational status of the 3350, 3344 and 3350, and 3375, drives and the data and control paths. This aids the user in determining whether an error situation is drive or media related so the appropriate recovery procedures can be initiated. For the IBM 3340, 3344, 3350 and 3375, Device Support Facilities utilizes the skip displacement bytes in an attempt to recover a defective track before assigning an alternate. This utility is used to create a VTOC index when a volume is initialized on count-key data devices. The building of an index over existing volume VTOCs may be done via this utility on systems that have the Data Facility / Device Support program product installed.

System Data Set Utilities: These programs reorganize, change or compare data at the data set and/or record level, and are required for the proper generation and maintenance of the system control program. The following general functions are performed by these utilities:

- **IEBCOPY** - Copies, compresses, merges, loads, and unloads partitioned data sets.
- **IEBGENER** - Copies a sequential data set or members of a partitioned data set, or converts a data set from sequential to partitioned organization.
- **IEBPTPCH** - Prints or punches records residing in a sequential or partitioned data set.
- **IEBUPDTE** - Updates a symbolic library.

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- **IEBEDIT** - Edits input job stream data set from a master input job stream.
- **IEBTCRIN** - Constructs records from input read from the 2495 Tape Cartridge Reader. Generation of a 2495 is required for the inclusion of the IEBTCRIN utility into the operating system.
- **IEBDG** - Can create output data sets either with internally generated test data or externally supplied input. These data sets can be sequential, indexed sequential, or partitioned.
- **IEBCOMPR** - Compares two identically organized sequential or partitioned data sets at the logical record level.
- **IEBISAM** - Can copy, reorganize, load, or unload an indexed sequential data set.
- **IEBIMAGE** - New 3800 Utility provides means for the user to create or modify and to store in SYS1.IMAGELIB Forms Control Buffer records, Copy Modification records, Graphic Character Modification records, and Character Arrangement tables. Input to the Utility consists of simple control statements. User can specify for FCB records forms sizes, number of lines at each vertical spacing, and line positions for simulated channel control punches. For Copy Modification, control statements include the text and its position within each copy of the pages of a data set. Existing Copy Modification records can also be modified. Graphic Character Modification statements provide means for combining and naming groups of graphic characters, including any characters already in SYS1.IMAGELIB, and to assist in storing in the system new graphic characters of user's own design. Character Arrangement tables can be created or modified to print with different character sets, to include Graphic Character Modifications, and to assign data codes to graphics or to change existing assignments.
- **IEHDASDR** - Dumps and restores data sets. Central and local service will be discontinued on January 22, 1981.

Independent Utilities: The following independent utilities do not operate under the OS/VS1 control program, but they support OS/VS1 with the following services:

- **IBCDASDI** - Initializes direct access volumes for use with the operating system. Central and local service will be discontinued on January 22, 1981.
- **ICAPRTBL** - Performs stand-alone buffer loading for the 3211 and 3203-4 printers.
- **IBCDMPRS** - Performs unloading and loading of data between DASD and a removable volume.
- **Device Support Facilities** - Initializes direct access storage volumes for use with the Operating System, inspects count-key-data DASD volumes for defective tracks, conditionally reclaims tracks previously flagged as defective and analyzes the operational status of the 3340, 3344, 3350 and 3375, drives and the data and control paths. This aids the user in determining whether an error situation is drive or media related so the appropriate recovery procedures can be initiated. This utility is used to create a VTOC index when a volume is initialized on count-key-data devices. Device Support Facilities will utilize the Skip Displacement bytes in an attempt to recover a defective track before assigning an alternate track for the IBM 3375 users.

An online test facility (TOLTEP) is provided for telecommunications networks under VTAM. See *Virtual Telecommunications Access Method - VTAM* for a description of TOLTEP.

Online Test Executive Program - OLTEP: The Online Test Executive Program (OLTEP) is a function designed to direct the selection, loading and execution of the Online Test sections (OLT's) in OS/VS1.

OLTEP with the related OLT allows the testing of Input/Output Hardware components of a system, concurrent with the running of customer jobs. Concurrent debug with OLTEP is supported in OS/VS1 for systems with 144K or more.

The OLTEP/OLT system is designed for: Diagnosing I/O errors ... Verifying I/O hardware repairs and Engineering Changes ... Exercising a device requiring dynamic adjustments ... Checking I/O Hardware ... Integrity of customer data.

As a job under OS/VS, it is called by standard Job Control Language and is under the control of the operating system at all times. It uses the facilities of OS/VS to accomplish the testing and competes with other jobs in the system for use of these facilities when running in a multiprogramming environment.

Definition of Test Runs can be entered via console or non-console devices. Prompting is available on consoles to aid in defining tests to be run.

Customer Engineering will supply the OLTs to the customer on magnetic tape or cards. The OLTs must be reformatted and link edited into a partitioned data set in order to be used under the operating system.

OLTEP executes in the pageable area of real storage. It requires a minimum of 64K of virtual storage for the OLTEP modules, and a minimum of 4K of real storage for the OLTs to be loaded and executed.

Dynamic Support System - DSS: Dynamic Support System (DSS) is no longer supported on OS/VS1 and is deleted from the distribution libraries for OS/VS1 Release 6.7 and subsequent releases.

Additional Service Aids: The following service aid facilities are also available under the Operating System/Virtual Storage 1. These programs aid in the diagnosing of system or application program errors by: Gathering information about the cause of a failure ... Formatting and printing information in a form that makes it easy to use ... Aiding in the development and application of a fix for a given problem.

HMAPTFLE - This program aids in the application of a PTF to the system by producing the JCL statements that are required for the proper application of the temporary fix. When a PTF is to be applied to a module, the user supplies information on the module and CSECT to which the PTF is to be applied. The program then either produces the necessary Job Control Statements for application of the PTF; or, if specified, dynamically invokes the Linkage Editor to update the operating system. The program executes in the paged section of real storage and requires a virtual partition of 64K bytes unless the Linkage Editor is dynamically invoked, then a 128K virtual partition is required.

IFCEREPO - Edits and prints environment error records.

HMBLIST - This Linkage Editor service aid program produces various formatted listings which may be used for system serviceability and diagnostic purposes. Depending on options specified on HMBLIST control statements, the following listings may be produced: Formatted load module listings ... Formatted object module listings ... Load module map and cross-reference listings ... Map and cross-reference listings of the system nucleus ... Listings of the data stored in the CSECT Identification records of load modules ... Load module map and cross-reference listings showing relocated addresses ... Load module summary data including alias names entry point address(es), module attributes, and the contents of the module's System Status Index (SSI) ... Listing of program modifications to a load module library ... Map of the resident reenterable load module area.

The minimum virtual storage requirement for HMBLIST is 64K bytes. In addition to the standard system residence, HMBLIST requires space in auxiliary storage for at least the following data sets: System Input, Print Output, and one or more load modules and/or object module data sets (load module data sets require DASD).

HMASPZAP - This service aid program assists user authorized personnel to: Inspect and modify instructions and data in any load module that exists as a member of a partitioned data set ... Inspect and modify data in a specific data record that exists in a direct access data set ... Dump an entire data set, a specific member of a partitioned data set, or any portion of a data set residing on a direct access device.

HMDSADMP - This service aid is a macro instruction that allows the user to generate a stand-alone dump program that is specifically tailored to his needs. HMDSADMP can generate two types of dump programs: one high-speed, the other low-speed. The high-speed version can write the control registers, contents of real storage, and, optionally, the page data set onto a tape volume in large blocks. The low-speed version can write the control registers and the contents of real storage to a printer or tape volume in unblocked, printable format.

HMDPRDMP - This service aid allows the user to format and print a storage dump of either virtual or real storage when utilizing the dump tape produced by the high-speed version of the HMDSADMP service aid, dumps in the SYS1.DUMP data sets, or print a real storage dump when utilizing the tape produced by the low-speed version of HMDSADMP. It also edits and prints the Generalized Trace Facility trace data set and formats the SYS1.DUMP data set.

IMCJOBQD - This service aid produces a formatted copy of the contents of the job queue data set and related scheduler work area data sets. This program operates independent of the OS/VS1 control program, and does not alter the existing status of the records that are displayed.

JESDUMP - This service aid provides selective, non-destructive main storage dumps of JECS and Queue Manager errors. This facility should only be used when a spool or Queue Manager error is suspected.

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JOB LIST VERIFICATION - A service aid that provides selective non-destructive main storage dumps of Job List Manager errors. This facility should only be used when a Job List Manager error is suspected.

HMASMP - This program is used for the application of Program Temporary Fixes (PTFs) prepared in the new Systems Modification Program format. It is designed to improve the quality and reliability of the support process by recording the status of the system so that modifications will not be applied where inappropriate. Also, updating will be easier since libraries, modules, macros, and PTFs can all be updated and applied via one programming procedure.

Analysis Program-1 (AP-1) aids the operator in analyzing 3350 or 3344 DAS error situations and in isolating such errors into hardware or media related areas.

AP-1 may be directed to test for hardware errors only or hardware and media errors. Simple result messages appear on the operator console. Detailed error-related data are directed to SYSPRINT.

AP-1 will only analyze errors associated with 3350 or 3344 devices and requires that one of these devices be on the system. Central and local service will be discontinued on January 22, 1981.

Display Exception Monitoring Facility: The Display Exception Monitoring Facility (DEMF), Selectable Unit (SU) 24 is a serviceability aid, which offers users of 3270 Information Display Systems in local or BSC mode assistance in locating a hardware problem in a communication network. In remote mode, the 3270 must communicate through a 270X or 370X on E.P. mode.

DEMF is logically composed of two tasks: a logging function and a display function. The logging function runs as a system task under OS/VS1. It is passed communication error records created for the SYS1.LOGREC data set. The display function is a component that runs under TCAM, CICS/VS, or IMS/VS. It presents a structured display of the errors accumulated by the logging function at the user request.

Generalized Trace Facility: The Generalized Trace Facility (GTF), is a standard feature in the OS/VS1 system operating on S/370 Processors of 144K bytes or more. It is a program service that assists users in performing problem determination and diagnosis by tracing system events, user events, or both. GTF consists of two major functions, the Generalized Trace function and the Trace Edit function.

The Generalized Trace function is a system service that can be optionally started from the master console. It executes as a system task in a partition. When the Generalized Trace function is started, the user also has the option of tracing internally in the GTF partition or externally to a data set on an auxiliary device. The Generalized Trace function supports a S/370 processor storage size of 144K bytes or more for internal tracing and 160K bytes or more for external tracing.

The Trace Edit function is a feature of the HMDPRDMP service aid and provides the user with a selective data reduction capability for the trace data set or formats GTF trace data contained within a storage dump produced by HMDSADMP or dumps in the SYS1.DUMP data set. It runs as a problem program and can be invoked via JCL. The Trace Edit function supports the minimum system support size.

Conversational Remote Job Entry - CRJE: Conversational Remote Job Entry (CRJE) allows remote access to OS/VS1 via low-cost printer-keyboard terminals. Terminal users share a central S/370 to submit jobs for execution, update and prepare programs and data, list job output, all concurrently with normal background OS/VS1 operations. An easy-to-use command language is provided to control entry, editing, inquiry and other control functions provided.

Among the features supported are: Supports 2740, 2741, 3767 (as a 2740-1 or 2741), and 1052 Printer-Keyboard terminals using BTAM ... Logon security ... Data set protection ... Library storage of remotely entered programs and data ... Administrative aids ... Data editing and minipulation capability ... Operator control of network ... Job status inquiry at terminal or console ... Routing of output data to central computer output devices or selectively to a remote terminal.

DASD space on a 2314, 2319 or 3330-1,-2/3333-1 Disk Storage Facility is required for CRJE tables, System Data Sets and Work Areas. Additional DASD space must be provided for user library data sets and directories, the exact amount must be established by the using installation. The 3350, 3344, 3330 mdl 11 and 3333 mdl 11 DASDs are not supported by CRJE.

A 2701, 2702, 2703, 3704 or 3705 (in emulation mode only) or mdl 135 ICA (#4640) with a Type I terminal control is required on the multiplexer channel with appropriate features for attachment of 1050 (1051 control unit mdl 1 or 2), 2740 mdl 1, 2741 or 3767 (as a 2740-1 or 2741) terminals over communication lines. All 2740 terminals must have the record checking feature and may not have the station control feature. If BTAM Online Test facilities are omitted from CRJE, full system resources must be made available to the Customer Engineer for terminal maintenance when required.

Note: Programming Support for CRJE was withdrawn effective December 15, 1978.

Program Products: There are a large number of program products which may be ordered to support OS/VS. The program product section of the sales manual pages should be referenced for more information and ordering instructions. For additional functional enhancements and device support for OS/VS1, see the the applicable sales manual pages for the following program products:

1. OS/VS1 Basic Programming Extensions (5662-257)
2. OS/VS1 Data Facility / Device Support (5740-AM6)

Current System Programs (CSP) Under OS/VS: Type I CSPs, such as Sort and the Language Compilers, are not distributed as part of the OS/VS SCP. Those wishing to continue using them may transfer them over from their OS Release 21.8 or later system. If the CSP is on a DASD device accessible to a VS system, then the VS system's SYS1.PROCLIB need only be updated to include the CSPs cataloged procedures. These procedures should contain a JOBLIB or STEPLIB DD card referencing the data set containing the CSP. If the CSPs reside on a DASD device not accessible to VS, then they should be copied to one with the Utility IEBCOPY. The VS system's SYS1.PROCLIB should be updated accordingly.

Those customers not on OS Release 21.8 must order this or a later release of the OS DLIBs. They would then perform a processor only sysgen as described in the *OS System Generation Guide* (GC28-6554). In so doing, the CSP target library and the procedural library should be one accessible by the VS system.

Ordering instructions for the Release 21.8 DLIBs are the same as for Release 21.7, which are available in the *Release 21.7 Guide* (GC-6730).

Type I Current System Programs (CSP) Under VS

Program Name	Program Number	Notes
COBOL F	360S-CB-524	1
COBOL F Library	360S-LM-525	1
COBOL LCP	360C-CV-713	2
Full ANS COBOL V2	360S-CB-545	
Full ANS COBOL V2 Library	360S-LM-546	
FORTRAN G	360S-FO-520	
FORTRAN H	360S-FO-500	
FORTRAN G & H Library	360S-LM-501	
FORTRAN Syntax Checker	360S-FO-550	
PL/I F	360S-NL-511	3
PL/I F Library	360S-LM-512	
PL/I Syntax Checker	360S-PL-552	
SORT/MERGE	360S-SM-023	

Notes:
1. Programs withdrawn, but will operate on OS/VS1 Release 1.
2. Orderable as an Independent Component Release.
3. Teleprocessing support is not available in this environment since QTAM is not supported by VS, and PL/I F does not support TCAM.

Minimum VS1 Configuration

The minimum configuration required for VS1 operation or SYSGEN is:

- S/370 mdl 135, 135-3, 138, 145, 145-3, 148, 155II, 158, 165II, 168, 3031, 3032 or 3033 Processor or 4300 Processor.
- 144K bytes of available real storage †
- A multiplexer channel.
- A selector or block multiplexer channel.
- For VS1 operation, two of the following DASD spindles are required, 2314/2319, 3330 mdls 1, 11 or 3333 mdls 1, 2, 11, 3340/3344, 3375 mdls A1, B1 or 3350. These spindles must be of the same type. Additional spindles may be required to meet customer needs.
- For SYSGEN and distribution library and installation, the following DASD spindles are required:
  Three 3330 mdls 1,11; or 3333 mdls 1,2,11; or Three 3340 spindles with 3348 mdl 70 Data Modules; or Five 3340 spindles with 3348 mdl 35 Data Modules; or Two 3350 spindles; or Two 3375 spindles; or Five 2314/2319s.

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The required number of 3330/3333 spindles may be the 3350 in 3330 mdl 1 or 11 compatibility mode, and the 3350 in native mode may be the new system residence device. The 3340 spindles may be provided by the appropriate logical 3340 volumes on the 3344.

- A SYSIN device (card reader, tape, or diskette).
- A SYSOUT Printer (printer or tape).
- A SYSOUT Punch (punch or tape).
- A console.
- A 9-track tape drive. *

† The OS/VS1 Release 7 starter systems require a minimum of 192K bytes of real storage. Previous starter systems still require a minimum of 160K.

* Distribution of the SCP, component releases, emulator SCPs and PTFs are made on 9-track; therefore, a 9-track tape on the system or access to another system meeting the minimum configuration requirements and having a 9-track tape at the customer installation is required for system generation and maintenance. Note, a tape drive is also recommended for the output from the high-speed stand-alone dump program (HMDSADMP). This may be the same drive used for generation and maintenance.

System Generation: This is the process of preparing a specially tailored operating system to match the machine configuration and operating system options selected by the user. This process uses the VS1 starter system or the user's current operational VS1 system, and requires the following programs: Control Program ... Data Management Data Set Control, BSAM, QSAM, BPAM ... Assembler ... Linkage Editor ... Utilities. PID distributes on tape for 2314/2319, 3330/3333, 3340 or 3350 residence the required libraries (Partitioned Data Sets) which contain the OS/VS1 system modules and the system macro instructions needed for the system generation process when OS/VS1 is ordered.

The same system requirements are required for maintenance as for generations since some changes may require a full or partial system generation.

Starter System: The standard starter system for OS/VS1 is a special VS1 system ordered separately.

The starter system has the basic elements necessary for system generation in a form that is directly usable by a majority of customers. The starter system functions with a variety of different I/O units at "standard" addresses. Customers may use the starter system to perform system generation if there are appropriate matching units and addresses in their own configuration.

Dedicated Data Set Support is used in SYSGEN for the utility data sets in assemblies, link edits, and data set copies.

The starter system runs on a S/370 or 4300 Processor which meets the minimum system requirements. RMS (Recovery Management System) routines for all S/370 or 4300 Processors are included in the system libraries thus allowing processor independence of the Starter System SCP. The OS/VS1 Release 7 starter systems require a minimum of 192K bytes of real storage. Previous starter systems still require a minimum of 160 K.

Customers should be encouraged to match unit addresses with those of the starter system to the greatest degree practical. Unit address are established as part of the normal physical planning and cable order process; therefore, physical installation plans should be reviewed where appropriate.

The following chart shows the devices supported by the starter system, the system functions for which they may be used, and the three character address assigned to each unit.

OS/VS1 (5652-VS1) (cont'd)

STARTER SYSTEM REQUIREMENTS CHART

Min. Reqd	Function	Device	MPX Channel	Device Address (Note 1) Selector Channel 1	Selector Channel 2	Selector Channel 3	Selector Channel 4
1	System Console	3066	019		219		
		3158 (Note 3)	010,014				
		3213 (Note 4)	011,015 025				
		3210/3215 (Note 5)	009,01F		209,21F		
		3278-2A (Note 8)	016				
1	System Input	2540 Reader	00C,02C		20C		
		3505 Reader	012,029				
		1442 Reader/Punch	00A,02A				
		2400/3400(7-Tr-DC)		180,181	280,281	380,381	480,481
		2400/3400(9-track)		182,183,184	282,283,284	382,383	482,483
1	Punch Output	2540 Punch	00D,02D		20D		
		1442 Reader/Punch	00A				
		2400/3400(7-Tr-DC)		180,181	280,281	380,381	480,481
		2400/3400(9-track)		182,183,184	282,283,284	382,383	482,483
		3525 Punch	013,026				
1	Print Output	3211	002,004, 024		202		
		1403	00E,00F 02E		20E		
		2400/3400(7-Tr-DC)		180,181	280,281	380,381	480,481
		2400/3400(9-track)		182,183	282,283	382,383	482,483
		3800	018,028	118	218		
		3203-4,5	016,017 027				
		3262-1,-11)(Note 10)	00B				
		3262-5	00B				
		4245-1	02F				
1	New system	2305-2		1D0			
		2314 (or 2319 on CHAN 1)		130,131,132 133,134	230,231,232, 233,234	330,331,332, 333,334	
		3330-1/3333-1		150,151,152 153	250,251,252, 253	350,351,352, 353	
		3330-1,-11/3333-11		158,159,15A 15B	258,259,25A, 25B	358,359,35A, 35B	
		3340/3344		1C0,1C1,1C2 1C3	2C0,2C1,2C2, 2C3	3C0,3C1,3C2, 3C3	
		3350		148,149,14A 14B	248,249,24A, 24B	348,349,34A 34B	
5	Starter	2314 (or 2319 on CHAN 1)		130,131,132 190,191,192 193,194,195	230,231,232,	330,331,332,	
3	System and Distribution Libraries (See Note 7)	3340 (M35)		133,134,135	233,234,235	333,334,335	
		3330-1/3333-1		150,151,152 153	Note 6	Note 6	Note 6
		3330-1,-11/3333-11		158,159,15A 1	Note 6	Note 6	Note 6
		3340/3344(M70)		1C0,1C1,1C2 1C3	Note 9 200,201 210,211	Note 6	Note 6
		3350		148,149,14A 14B	Note 6	Note 6	Note 6
	Three system generation utility data sets and the three object program data sets (Note 2)	2305-2		1D0			
		2314 (or 2319 on Chan 1)		130,131,132 133,134	230,231,232, 233,234	330,331,332, 333,334	
		3330-1/3333-1		150,151,152 153	Note 6	Note 6	Note 6
		3330-11/3333-11		158,159,15A 15B	Note 6	Note 6	Note 6
		3340/3344		1C0,1C1,1C2 1C3	Note 6	Note 6	Note 6
		3350		148,149,14A 14B	Note 6	Note 6	Note 6

Notes:

1. DASD 3330/3333 mdls 1 and 11, 3340 and 3350 are generated on channel 1 and accessed on channel 1, with channels 2 thru 4 as optional channels.
2. The three system generation utility data sets and the three object program data sets do not require additional direct access devices if sufficient space is available on the volumes that contain the new system and the starter system.
3. The 3138 and 3148 consoles use the 3158 console support (Display Mode).
4. 3286-2 optional printer for S/370 138/148.
5. 3138 and 3148 Console when IMPLed in Printer/Keyboard mode.

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6. See the addresses under channel 1; use only those addresses for sysgen.
7. The DLIB Installation and Build process requires space equal and additional to the distribution library space. The spindle(s) available after DLIB installation and build may be used for the new system being generated.
8. For 4300 Processors.
9. For all Processors, last two digits of address may be C0, C1, C2, or C3. In addition, addresses ending with 00, 01, 10 or 11 may be used for 4331.
10. For 4331 processors. Support for the 3262 Printer is provided by the OS/VS1 Basic Programming Extensions program product (5662-257).

Feature Support: The following features are supported by the Operating System/Virtual Storage 1. Other features, not listed, have no specific programming support; their existence is ignored by the control program. Attempts to use OS/VS1 with unsupported features may cause unpredictable results. For brevity this list does not include those basic features or control units which are required to connect a supported device.

PROCESSOR SPECIAL FEATURES

Feature	135	135-3	138	145	145-3	148
Advanced Control Program Support	N/A	**	**	1001	STD	STD
Conditional Swapping	1051	STD	STD	1051	***	***
Block Multiplexer Channel	1421	1425-6	STD	1421-4	1STD 1427-9	STD
Block Multiplexer Subchannels, Additional	N/A	N/A	N/A	N/A	1450	1450
Channel-to-channel	N/A	N/A	N/A	1850	1850	1850
Clock Comparator and CPU Timer	2001	STD	STD	2001	Pre-req	STD
Direct Control	3274	3274	3274	3274	3274	3274
Extended Control Program Support	N/A	STD	STD	N/A	STD	STD
Extended Precision Floating Point	3840	Pre-req	STD	3910	STD	STD
Floating Point Arithmetic	3900	STD	STD	3910	STD	STD
Multiplexer Subchannels, Additional	3905-7	3906-7	3906-7	4951-4	4953-4	4953-4
1401/1440/1460 Compatibility	4457	4457	4457	4457	4457	4457
1401, 1410/7010 Compatibility	N/A	N/A	N/A	4458	4458	4458
Integrated Communications Adapter	4640	4640	4640	N/A	N/A	N/A
2319 Integrated File Adapter	N/A	4650	N/A	N/A	N/A	N/A
3330/3340 File Adapter	4655	4655	4655	*	N/A	N/A
Integrated Storage Controls	N/A	N/A	N/A	4660*	4660	4660
Integrated Printer Adapter	4670, 2,7	4670, 2,7	4670, 2,7	N/A	N/A	N/A
OS/DOS Compatibility	STD	STD	STD	STD	STD	STD
Selector Channel	6981-2	N/A	N/A	6982-4	N/A	N/A
3210 Adapter	7844-5	7844	N/A	7844-5	7844-5	N/A
3215 Adapter	7855	7855	N/A	7855	7855	N/A
Integrated 3203-4 Printer Attachment	N/A	N/A	8075-6	N/A	N/A	8075-6
Two-Channel Switch for ISC	N/A	N/A	N/A	8100*	8100	8100
Word Buffer	N/A	N/A	N/A	8810	Pre-req	STD

* 3345 mdls 3, 4, 5, available on 145.

** Insert PSW Key and Set PSW Key From Address, which are part of Advanced Control Program Support, are standard on these machines, but are called PSW Key Handling.

*** These instructions are part of Advanced Control Program Support.

Feature	155II	158	165II	168	3031
Advanced Control Program Support	STD	STD	STD	STD	STD
Conditional Swapping	STD	STD	STD	STD	STD
Block Multiplexer Channel	1433-5	1433-5	N/A	N/A	N/A
Buffer Expansion	N/A	N/A	1432	1435	N/A
Channel-to-Channel	1850	1850	N/A	N/A	1850
Clock Comparator and CPU Timer	STD	STD	STD	STD	STD
Direct Control	3274	3274	N/A	N/A	3274
Extended Precision Floating Point	3700	3700	STD	STD	STD
Extended Channels	N/A	N/A	3850	3855	N/A
Floating Point Arithmetic	STD	STD	STD	STD	STD
1401/1440/1460 Compatibility	3950	3950	N/A	N/A	N/A
1401, 1410/7010 Compatibility	3950	3950	N/A	N/A	N/A
High Speed Multiply	N/A	N/A	4520	4525	N/A
Integrated Storage Controls	N/A	4650	N/A	4650	N/A
2nd Byte Multiplexer Channel	4990	4990	N/A	N/A	N/A
OS/DOS Compatibility	5450	5450	N/A	N/A	N/A
7070/7074 Compatibility	7117	7117	7117	7127	N/A
7080 Compatibility	N/A	N/A	7118	7128	N/A
709/7090/7094II Compat.	N/A	N/A	7119	7129	N/A
Staging Adapter for ISC	N/A	7220	N/A	7220	N/A
3213 Printer Attachment	N/A	7840	N/A	N/A	N/A
3210 Adapter	7844-5	N/A	N/A	N/A	N/A
3215 Adapter	7855	N/A	N/A	N/A	N/A
Two-Channel Switch for ISC	N/A	7905	N/A	7905	N/A
Extended Control Program Support	N/A	8750	N/A	N/A	STD

Feature	4331	4341
Advanced Control Program	STD	STD
Block Multiplexor Channel	1421	STD (2)
Additional	NA	1870
Byte Multiplexor Channel	5248	STD
Channel to Channel Adapter	NO	1850
Communications Adapter*	1601	NA
Conditional Swapping	STD	STD
Diskette Drive/3540 Mode	3401	NA
Display/Printer Adapter **	STD	NA
Extended Control Program Support	NA	NA
Extended Control Program Support: OS/VS1 Assist	NA	STD
Extended Precision Floating Point	STD	STD
Floating Point Arithmetic	STD	STD
Integrated Communications Adapter (See Communications Adapter)	NA	NA
3340/3344 Direct Attachment	7851	NA
Direct Access Storage Compatibility (2311 is not supported)	#7901	N/A
All other S/370 Processor Features Listed above	NA	NA

* Start/Stop and BSC line protocols.

** 3278 mdl 2 and 3287 mdl 2.

I/O Features

1052 Printer-Keyboard (see *VTAM, TCAM and BTAM Terminals Supported*)

1287 Optical Reader (mdls 1,2,3,4,5):
Supported: #3850 - Expanded Symbol Set
#3945 - Farrington 7B Font
#4470 - 1428 and ANSCS OCR Font
#5300 - NCR Optical Type Font
#5370 - Numeric Handwriting
#5479 - Optical Mark Reading

1288 Optical Page Reader (mdl 1):
Supported: #5370 - Numeric Handwriting
#5479 - Optical Mark Reading

1403 Printer (mdls 2,3,7,N1):
Supported: #8640 - Universal Character Set
#8641 - Universal Character Set

1419 Magnetic Character Reader (mdl 1):
Supported: #1445 - Batch Numbering
#5739,#5741 - Program Control for Pocket Lights

1442 Card Read Punch (mdl N1):
Supported: #1532 - Card Image (for problem program use only)

1442 Card Read Punch (mdl N2):
Supported: #1531 - Card Image

1443 Printer (mdl N1):
Supported: #5558 - 24 Additional Print Positions

2150 Console

2250 Display Unit (mdls 1,3)

2260 Display Station (see *VTAM, TCAM and BTAM Terminals Supported*)

2305 Fixed Head Storage (mdls 1,2):
Required: 2835 Storage Control
Not Supported: mdl 2 on S/370-135

2314 Direct Access Storage Facility (mdl A1):

OS/VS1 (5652-VS1) (cont'd)

Supported: #8170 - Two-Channel Switch

2319 Disk Storage

2401 Magnetic Tape Unit (mdls 1,2,3,4,5,6)

2402 Magnetic Tape Unit:
Supported: #3472 - Dual Density (800-1600 bpi)

2403 Magnetic Tape Unit and Control:
Supported: #3471 - Dual Density (800-1600 bpi)

2415 Magnetic Tape Unit:
Supported: #3471,#3472 - Dual Density (800-1600 bpi)

2420 Magnetic Tape Unit (mdls 5,7)

2495 Tape Cartridge Reader

2501 Card Reader (mdls B1,B2) :
Supported: #1531 - Card Image

2520 Card Read Punch (mdls A1,B1) :
Supported: #1531 - Card Image

2520 Card Punch (mdls A2,A3,B2,B3) :
Supported: #1531 - Card Image

2540 Card Read Punch (mdl 1) :
Supported: #1531 - Card Image

2596 Card Read Punch (mdl 1)

2671 Paper Tape Reader

2740 Communication Terminal (mdl 1) (see "VTAM, TCAM and BTAM Terminals Supported")

2741 Communication Terminal (see "VTAM, TCAM and BTAM Terminals Supported")

2780 Data Transmission Terminal (see "VTAM, TCAM and BTAM Terminals Supported"):
Supported: EBCDIC Transparency only

2803,2804 Tape Control (mdls 1,2,3) :
Required: #3228,#3236 - Data Conversion (for all 7-track tapes that record binary data such as variable length, format V records and abnormal end dumps. Inclusion of 7-track tapes without this feature is not recommended.)
Supported: #7125-#7127,#7135 - 7-track Compatibility
#7185 - 16 Drive Addressing
#7900 - 2420 Attachment

2816 Switching Unit (mdl 1) :
Supported: #1050-#1052,#1055,#2285, #2286,#4455, #6392,#6393 - Additional Switching

2821 Control Unit (mdls 1,2,3,5,6) :
Supported: #1990 - Column Binary (for problem program use only)
#8637-#8639 - Universal Character Set Adapter

2835 Storage Control (mdls 1,2) :
Supported: #8170,#8171 - Two-Channel Switch

2844 Auxiliary Storage Control:
Supported: #8171 - Two-Channel Switch

2860 Selector Channel (mdls 1,2,3) :
Supported: #1850 - Channel-to-Channel Adapter

2870 Multiplexer Channel:
Not Supported: Burst devices (including byte devices with burst mode options operating in burst mode) on a multiplexer subchannel. Magnetic tapes are supported on the selector subchannels.
Cross channel devices (2804 Tape Control, 2816 Switching Unit, 3803 Tape Control with communicator feature and either 2-control switch, 3-control switch or 4-control switch, 3803 Tape Control with #8100 Two-Channel Switch) attached between any 2870 selector subchannel and any other selector channel, or between any 2870 selector subchannel and a selector subchannel of a different 2870.

2880 Block Multiplexer Channel (mdls 1,2) :
Supported: #7850,#7851 - Two Byte Interface

3066 System Console (mdl 1)

3101 Display Terminal (see "VTAM, TCAM and BTAM Terminals Supported")

3158 Console Function

3203 Printer (mdls 4, 5) :
Required: (mdl 4): S/370 mdls 138, 148

3210 Console Printer-Keyboard

3211 Printer (mdl 1) :
Required: 3811 Printer Control Unit
Supported #5554 - 18 Additional Print Positions

3213 Console Printer

3215 Console Printer-Keyboard

3232 Keyboard Printer Terminal (mdl 1) (see "VTAM, TCAM and BTAM Terminals Supported") 3232 Keyboard Printer Terminal (mdl 51) (see "VTAM, TCAM and BTAM Terminals Supported")

3262 Printer (mdls 1,11). Requires the OS/VS1 Basic Programming Extensions program product (5662-257).

3262 Printer (mdl 5)

3268 Printer (mdl 2) [supported as a 3284/3286].

3275 Display Station (mdls 1,2) (see "VTAM, TCAM and BTAM Terminals Supported")

3277 Display Station (mdls 1,2) (see "VTAM, TCAM and BTAM Terminals Supported")

3278 mdl 2A Display Console
Required: 4331 and 4341 Processors

3284 Printer (mdls 1,2)

3286 Printer (mdls 1,2)

3287 Printer (mdls 1,2) [supported as a 3284/3286]

3288 Printer (mdl 2) (supported as a 3286-2)

3330 Disk Storage (mdls 1,2,11) :
Required: 3333 Disk Storage and Control, or
3830 Storage Control

3333 Disk Storage and Control (mdls 1,11) :
Supported: #8150 - String Switch

3340 Direct Access Storage (mdls A2,B1,B2) :
Required: 3340 mdl A2
Supported: #4301, 4302 Fixed Head Feature
#6201,#6202 - Rotational Position Sensing
#8150 - String Switch

3344 Direct Access Storage (mdls B2,B2F)

3350 Direct Access Storage Facility (mdls A2,A2F,B2,B2F,C2,C2F) :
Supported: #8150 - String Switch

3375 Direct Access Storage (mdls A1, B1)
Supported: #8150 - String Switch
Required: 3880 Storage Control mdls 1 or 2

3410 Magnetic Tape Unit (mdls 1,2,3) :
Supported: #3211 - Single Density
#3221 - Dual Density
#6550 - Seven-Track Tape Unit
#7360 - S/370 Attachment

3411 Magnetic Tape Unit and Control (mdls 1,2,3) :
Supported: #3211 - Single Density
#3221 - Dual Density
#6550 - Seven-Track Tape Unit
#7360 - S/370 Attachment

3420 Magnetic Tape Unit (mdls 3,5,7) :
Supported: #3550 - Dual Density
#6407 - 7-track
#6631 - Single Density

3420 Magnetic Tape Unit (mdls 4,6,8) :

OS/VS1 (5652-VS1) (cont'd)

Supported: #6420 - 6250 Density
#6425 - 6250/1600 Density

3430 Magnetic Tape Unit

3505 Card Reader (mdls B1,B2) :
Supported: #5450 - Optical Mark Read
#6555 - Selective Stacker

3525 Card Punch (mdls P1,P2,P3) :
Supported: #1533 - Card Read
#5272 - Multiple Card Print
#8338 - Two-Line Card Print

3540 Diskette Input/Output Unit (mdls B1,B2)
Diskette Drive (#3401) of the 4331 Processor is program compatible with the 3540

3741 Data Station (mdl 2) (see "VTAM, TCAM and BTAM Terminals Supported")

3741 Programmable Workstation (mdl 4) (see "VTAM, TCAM and BTAM Terminals Supported")

3767 Communication Terminal (supported as a 2740-1 or 2741) (see "VTAM, TCAM and BTAM Terminals Supported")

3770 Data Communication System (supported as a 2770; 3776/3777 also as a 3780) (see "VTAM, TCAM and BTAM Terminals Supported")

3780 Data Communications Terminal (mdl 1) (see "VTAM, TCAM and BTAM Terminals Supported")

3800 Printing Subsystem (mdl 1) :
Supported: #1490 - Burster-Trimmer-Stacker
#5401 - 127 Character Generation Storage Positions
#8170 - Two-Channel Switch

3848 Cryptographic Unit (mdl 1)

3803 Tape Control (mdl 1) :
Supported: #1792 - Two-Control Switch
#1793 - Three-Control Switch
#1794 - Four-Control Switch
#3551 - Dual Density
#6408 - Seven-Track
#9071 - Communicator 1-2
#9073 - Communicator 3-4

3803 Tape Control (mdl 2) :
Supported: #1792 - Two-Control Switch
#1793 - Three-Control Switch
#1794 - Four-Control Switch
#5310 - Nine-Track NRZI
#6320 - Seven-Track NRZI
#8100 - Two-Channel Switch
#9071 - Communicator 1-2
#9073 - Communicator 3-4

3811 Printer Control Unit (mdls 1,2) :
Supported: #5553 - Additional (18) Print Positions

3830 Storage Control (mdls 1,2,3) :
Supported: #8170 - Two-Channel Switch
#8171 - Two-Channel Switch, Additional

3851 Mass Storage Facility (mdls A1,A2,A3,A4,B1,B2,B3,B4)
Supported: #4901, 4902 MSC Twin Port
#8171 - Two-Channel Switch
#8172 - Two-Channel Switch, Additional

3880 Storage Control (mdls 1, 2, 3)
Supported: #8170 - Two-Channel Switch
#8171 - Two-Channel Switch Pair, Additional
#8172 - Eight-Channel Switch feature (Requires #8170 and #8171)
#6550 - Speed Matching Buffer for 3380
#6560 - Speed Matching Buffer for 3375

3886 Optical Character Reader (mdl 1) :
Supported: #3210 - Additional Data Storage
#4610 - Additional Instruction Storage
#4720 - Line Marking
#5360 - Numeric Handprinting
#6450 - Serial Numbering

3890 Document Processor (mdls A1,A2,A3,A4,A5,A6) :
Supported: #5111 - Microfilming
#4666 - Item Number/Endorsing

4245 Line Printer mdl 1

6670 Information Distributor

6733 Typewriter Communication Module as a CPT-TWX 33/35 (See ACF/VTAM, ACF/TCAM and BTAM Terminals Supported)

1130 Computing System (see "VTAM, TCAM and BTAM Terminals Supported")

5280 Distributed Data System (see "VTAM, TCAM and BTAM Terminals Supported")

System/3 (see "VTAM, TCAM and BTAM Terminals Supported")

System/32 (see "VTAM, TCAM, and BTAM Terminals Supported")

System/34 (see "VTAM, TCAM, and BTAM Terminals Supported")

System/36 (see "VTAM and BTAM Terminals Supported")

System/38 (see "VTAM, TCAM, and BTAM Terminals Supported")

S/360 (see "VTAM, TCAM and BTAM Terminals Supported")

S/370 (see "VTAM, TCAM and BTAM Terminals Supported")

4331 (see "VTAM, TCAM and BTAM Terminals Supported")

4341 (see "VTAM, TCAM and BTAM Terminals Supported")

4361 (see "VTAM, TCAM and BTAM Terminals Supported")

4381 (see "VTAM, TCAM and BTAM Terminals Supported")

DEVICE SUPPORT

The *Device Support Chart* shows all devices that are supported by OS/VS1 for system functions and/or non-TP access methods. (For other telecommunications devices see "VTAM, TCAM and BTAM Terminals Supported". The chart shows for each device the relevant functions supported.

Devices which are not shown in this chart have no specific programming support under OS/VS1 and their existence is not recognized by the control program.

Notes:

1) QSAM (device-dependent only) for journal tapes; BSAM (device-dependent only) for cut-form documents.
2) BSAM (device-dependent only).
3) The Selective Tape Listing Feature is not supported.
4) A console must consist of a printer-keyboard, or a card reader and printer to simulate the actions of a printer-keyboard (composite console).
5) Supported for read or punch, but not both simultaneously.
6) Mdl 1 only.
7) Multiple Requesting supported.
8) File Scan not supported.
9) Rotational Position Sensing supported (optional feature on 3340).
10) For message queues under TCAM.
11) A Data Set Utility (IEBTCRIN) is provided to read data from the 2495 and create a sequentially organized data set.
12) Punch Feed Read is not supported.
13) As a workstation for RES.
14) Space Compression/Expansion is not supported.
15) Support shown is for 3330s or 3333s as virtual device types. If real 3330/3333s are included as part of 3851, see the 3330/3333 lines above.
16) With 3330/3333 as staging device, Rotational Position Sensing supported.
17) User Program Libraries only.
18) QSAM (device-dependent only).

OS/VS1 (5652-VS1) (cont'd)

19) Supported on mdl 138.

20) Supported on mdl 148.

21) Supported as a 3213 on mdl 138 or 148.

22) Supported by the OS/VS1 Basic Programming Extensions program product.

23) Device recognition only: Supported by the OS/VS1 Basic Programming Extensions program product.

24) Supported by the OS/VS1 Data Facility Device Support program product.

Legend:

I/O Device Support Chart

The following units to a maximum of 768 devices are supported at the Release 7.0 level by OS/VS1, for the indicated functions.

C = Console
G = Graphic Programming Support
S = Sequential Access Methods
I = Indexed Sequential Access Methods
P = Basic Partitioned Access Method
D = Basic Direct Access Method
A = Virtual Storage Access Method
X = Function Supported

OS/VS1 (5652-VS1) (cont'd)

DEVICE SUPPORT CHART

Input/Output Units	Input Job Stream	In/Out Work Queue	System Output	Primary SYSRES	Program Libraries	C	G	S	I,P,D,A
1052 Printer-Keyboard	X		X			X			
1287 Optical Reader								X1	
1288 Optical Page Reader								X2	
1403 Printer			X3			X4		X3	
1419 Magnetic Character Reader								X2	
1442 Card Read Punch	X5		X5			X4		X	
1442 Card Punch			X					X	
1443 Printer			X			X4		X	
2150 Console						X			
2250 Display Unit						X6	X		
2260 Display Station						X	X		
2305 Fixed Head Storage (Notes 7,8)	X9	X9		X	X9			X9	X9
2314 Direct Access Storage Facility (Notes 8,10)	X	X		X	X			X	X
2319 Disk Storage (Notes 8,10)	X	X		X	X			X	X
2401 Magnetic Tape Unit	X		X					X	
2402 Magnetic Tape Unit	X		X					X	
2403 Magnetic Tape Unit and Control	X		X					X	
2415 Magnetic Tape Unit	X		X					X	
2420 Magnetic Tape Unit	X		X					X	
2495 Tape Cartridge Reader								X11	
2501 Card Reader	X		X			X4		X	
2520 Card Read Punch	X5		X5			X4		X5	
2520 Card Punch			X			X4		X	
2540 Card Read Punch	X12		X12			X4		X	
2596 Card Read Punch								X	
2671 Paper Tape Reader								X	
2740 Communication Terminal	X								
2741 Communication Terminal	X								
2770 Data Communication System	X13		X13						
2780 Data Transmission Terminal	X13		X13						
3066 System Console						X6			
3138 Console (Note 19)						X6			
3148 Console (Note 20)						X6			
3158 Console Function						X6			
3203 Printer			X			X4		X	
3210 Console Printer-Keyboard						X			
3211 Printer			X			X4		X	
3213 Console Printer						X			
3232-1 Keyboard Printer Terminal	X								
3232-51 Keyboard Printer	X								
3215 Console Printer-Keyboard						X			
3251 Display Station						X			
3262 Printer			X22					X22	
3268 Printer									
3275 Display Station						X			
3276 (supported as a 3277)						X3			
3277 Display Station						X			
3278 (supported as a 3277)						X3			
3278 mdl 2A Display Console						X4			
3284 Printer						X			
3286 Printer						X			
3286-2 Console Printer (Note 21)						X4			
3287-1, -2 Printer						X			
3288 Printer						X			
3330 Disk Storage (Notes 8,10)	X9	X9		X9	X			X9	X9
3333 Disk Storage and Control (Notes 8,10)	X9	X9		X9	X			X9	X9
3340 Direct Access Storage Facility (Notes 8,10)	X9	X9		X9	X9			X9	X9
3344 Direct Access Storage (Notes 8,10)	X9	X9		X9	X9			X9	X9
3350 DASF (Notes 8,10)	X9	X9		X9	X9			X9	X9
3375 Direct Access Storage (Notes 8, 10, 24)	X9	X9		X9	X9			X9	X9
3380 Direct Access Storage (Notes 8, 10, 24)	X9	X9		X9	X9			X9	X9
3410 Magnetic Tape Unit	X		X					X	
3411 Magnetic Tape Unit and Control	X		X					X	
3420 Magnetic Tape Unit			X					X	
3430 Magnetic Tape Unit			X					X	
3505 Card Reader	X					X4		X	
3525 Card Punch	X5		X5			X4		X	
3540 Diskette I/O Unit	X		X						
3741 Data Station	X		X						
3741 Programmable Workstation	X		X						
3767 Communication Terminal	X								
3770 Data Communication System	X		X						
3777-2 Communication Terminal (as a S/360-20 MULTI-LEAVING Workstation)	X		X						
3780 Data Communications Terminal	X14		X14						
3790 Communication System	X		X						
3800 Printing Subsystem			X					X	
3848 Cryptographic Unit									
3851 Mass Storage Facility (Note 15)	X16				X16,17			X16	X16
3886 Optical Character Reader								X2	
3890 Document Processor								X18	
4245 Printer			X			X4		X	
4331 Processor	X13		X13						
4341 Processor	X13		X13						
4361 Processor	X13		X13						
4381 Processor	X13		X13						
5285, 5288	X		X						
6670 (as a 2772)	X13		X13						
1130 Computing System	X13		X13						
System/3	X13		X13						
System/32	X13		X13						
System/34	X13		X13						

OS/VS1 (5652-VS1) (cont'd)

DEVICE SUPPORT CHART - Cont'd.

Input/Output Units	Input Job Stream	In/Out Work Queue	System Output	Primary SYSRES	Program Libraries	C	G	S	I,P,D,A
System/36	X13		X13						
System/38	X13		X13						
S/360	X13		X13						
S/370	X13		X13						
S/8100/DPCX Information System	X		X						
S/8100/DPPX RJE Workstation Facility	X		X						

VTAM, TCAM and BTAM TERMINALS SUPPORTED

VTAM, TCAM and BTAM telecommunications access methods support the following terminals, programmable features, transmission control units, and communications controllers. Programmable features which change the control or transmission characteristics and which are not shown are not supported. Attempts to use VTAM, TCAM or BTAM with unsupported features can cause unpredictable results. If the terminal/feature is not supported by all three access methods, the access method(s) which does (do) support the terminal/feature is (are) shown in parenthesis.

The user should be aware that many terminal and control unit special features are transparent to programming, and are therefore readily usable even though not specifically identified. Note that the appropriate line adapters and hardware attachment features must be included in the system configuration.

Terminals that are functionally equivalent to those specifically supported by VTAM, TCAM or BTAM may also function satisfactorily with VTAM, TCAM or BTAM; the customer is responsible for establishing equivalency. IBM assumes no responsibility for the impact that any changes to the IBM-supplied programs or products may have on such terminals.

REMOTE ATTACHMENT

Terminals and Terminal Features

SS LINES:

IBM TERMINALS

1030 Data Collection System on nonswitched lines: (TCAM,BTAM)
- 1031 Input Station (mdls A1,A2,A3,A4,A5,A6,A7) :
  - Supported: Attachment of 1031,1033,1034,1035
- 1031 Input Station (mdls B1,B2,B3,B4,B5,B6,B7) :
  - Supported: Attachment of 1035
- 1033 Printer
- 1034 Card Punch
- 1035 Badge Reader

1050 Data Communication System on switched or nonswitched lines:
- 1051 Control Unit (mdls 1,2) :
  - Supported: Attachment of 1052,1053,1054,1055,1056, 1057,1058,1092,1093
    #1313 - Automatic EOB
    #4795 - Line Correction
    #4796 - Line Correction Release
    #5465 - Open Line Detection
    #6100 - Receive Interrupt
    #9698 - Text Time-Out Suppression
    #9700 - Transmit Interrupt
- 1052 Printer-Keyboard (mdls 1,2) :
  - Supported: #1313 - Automatic EOB
    #9567,#9597 - PTTC/BCD Code
    #9571,#9591 - PTTC/EBCD Code
- 1053 Printer (mdl 1) :
  - Supported: **#9567,#9597** - PTTC/BCD Code
    #9571,#9591 - PTTC/EBCD Code
- 1054 Paper Tape Reader (mdl 1)
- 1055 Paper Tape Punch (mdl 1)
- 1056 Card Reader (mdls 1,3)
- 1057 Card Punch (mdl 1)
- 1058 Printing Card Punch (mdls 1,2)
- 1092 Programmed Keyboard (mdls 1,2)
- 1093 Programmed Keyboard (mdls 1,2)

2848 Display Control (mdls 1,2,3) on nonswitched lines: (TCAM,BTAM)
- Supported: Attachment of 2260,1053
  3901 - Extended Cursor Control
  #4787 - Line Addressing
  #5340 - Non-Destructive Cursor
  #5341 - Non-Destructive Cursor Adapter
- Not Supported: Attachment of 1053 (TCAM)
- 2260 Display Station (mdls 1,2) :
  - Supported: #3606 - Extended Cursor Control, Alphameric Keyboard
    #4766 - Alphameric Keyboard
  - Not Supported: Tab feature of #3606
- 1053 Printer (mdl 4) : (BTAM)
  - Supported: **#9567,#9597** - PTTC/BCD Code
    #9571,#9591 - PTTC/EBCD Code

2845 Display Control (mdl 1) on nonswitched lines: (TCAM,BTAM)
- Supported: Attachment of 2265,1053
  #3301 - Destructive Cursor
  #4801 - Line Addressing
- Not Supported: Attachment of 1053 (TCAM)
  #7801 - Tab
- 2265 Display Station (mdl 1) :
  - Supported: #4766 - Alphameric Keyboard
- 1053 Printer (mdl 4) : (BTAM)
  - Supported: **#9567,#9597** - PTTC/BCD Code
    #9571,#9591 - PTTC/EBCD Code

2740 Communication Terminal (mdl 1) on switched or nonswitched lines:
- Supported: #3255 - Dial Up
  #6114 - Record Checking
  #7479 - Station Control
  #8028 - Transmit Control
  8301 - 2760 Attachment (TCAM,BTAM)
  #9567,#9597 - PTTC/BCD Code
  #9571,#9591 - PTTC/EBCD Code
  Correspondence Code

2740 Communication Terminal (mdl 2) on nonswitched lines:
- Supported: #1495,#1496 - Buffer Expansion
  #1499 - Buffer Receive
  #6114 - Record Checking
  #9571,#9591 - PTTC/EBCD Code

2741 Communication Terminal (mdl 1) on switched or nonswitched lines:
- Supported: #3255 - Dial Up
  #4708 - Receive Interrupt
  #7900 - Transmit Interrupt
  #9567,#9597 - PTTC/BCD Code
  #9571,#9591 - PTTC/EBCD Code
  Correspondence Code

2760 Optical Image Unit (mdl 1) on switched or nonswitched lines (TCAM,BTAM)

3101 Display Terminal on switched lines: (BTAM, TCAM and VTAM)

3232 Keyboard Printer (mdl 51) on switched and nonswitched lines: (TCAM,VTAM) on switched lines supported as a CPT-TWX 33/35 (BTAM)

3767 Communication Terminal (mdls 1,2,3) (supported as a 2740-1) on switched or nonswitched lines:
- Required: #7111 - 2740-1 Start/Stop
- Supported: **#9560** - Station Control

3767 Communication Terminal (mdls 1,2,3) (supported as a 2740-2) on nonswitched lines:
- Required: #7112 - 2740-2 Start/Stop

3767 Communication Terminal (mdls 1,2,3) (supported as a 2741) on switched or nonswitched lines:
- Required: #7113 - 2741 Start/Stop

5100/5110 Computer Systems (supported as a 2741) on switched or nonswitched lines:
- Required: #1525 - Communications Adapter

6733 Typewriter Communication Module on switched and nonswitched lines as a CPT-TWX 33/35 (BTAM, ACF/TCAM and ACF/VTAM)

CMCST (Communicating Magnetic Card Selectric ® Typewriter) (supported as a 2741 with Correspondence Code) on switched lines:

OS/VS1 (5652-VS1) (cont'd)

Supported: The CMCST is functionally equivalent to a 2741 with Dial Up, Receive Interrupt and Transmit Interrupt

IBM PROCESSOR AS TERMINALS

(For details of programming support provided within the Processor when acting as a terminal, see appropriate programming sales manual pages)

S/7 (supported as a 2740-1 with checking) on switched or non-switched lines:
Required: #1610 - Asynchronous Communication Control

Non-IBM TERMINALS

AT&T 83B3 Line Control Type on nonswitched lines

CPT-TWX (mdl 33/35) Line Control Type on switched lines

World Trade Telegraph on nonswitched lines

WU 115A Line Control Type on nonswitched lines

BSC LINES:

IBM TERMINALS

2790 Data Communication System on switched or nonswitched lines: (TCAM,BTAM)
2715 Transmission Control Unit (mdl 2) :
Required: 2740
Supported: Attachment of 2798,1035,1053
#3801 - Expanded Capability
#4850 - Local 2740 Adapter
#9401 - Point-to-Point Nonswitched
#9402 - Point-to-point Switched
#9403 - Multipoint Nonswitched
2740 Communication Terminal (mdl 1)
2798 Guidance Display Unit (mdl 1)
1035 Badge Reader (mdl 1)
1053 Printer (mdl 1)

2770 Data Communication System on switched or nonswitched lines:
2772 Multipurpose Control Unit:
Required: #5010 - Multipoint Data Link Control (VTAM)
Supported: Attachment of 0050,0545,1017,1018,1053, 1255,2203,2213,2265,2502,5496
#1340 - Automatic Answering
#1490 - Buffer Expansion (256 bytes)
#1491 - Buffer Expansion Additional (512 bytes)
#1910 - Conversational Mode
#3250 - Display Format Control
#3650 - EBCDIC Transparency
#3860 - 144 Character Print Line
#4610 - Identification
#4690 - Keyboard Correction
#5010 - Multipoint Data Link Control (TCAM,BTAM)
#5890 - Horizontal Format Control
#6555 - Space Compression/Expansion
#7705 - Synchronous Clock
#7950 - Transmit-Receive-Monitor -Print
#9140 - Extended Re-Entry
#9402 - Line Termination - 2-wire
#9761 - Transmission Code EBCDIC
#9762 - Transmission Code ASCII
#9936 - Immediate WACK
0050 Magnetic Data Inscriber
0545 Output Punch (mdls 3,4)
1017 Paper Tape Reader (mdls 1,2)
1018 Paper Tape Punch (mdl 1)
1053 Printer (mdl 1)
1255 Magnetic Character Reader
2203 Printer (mdls A1,A2) :
Supported: #5558 - Print Positions, 24 Additional
2213 Printer (mdls 1,2)
2265 Display Station (mdl 2)
2502 Card Reader (mdls A1,A2)
5496 Data Recorder

2780 Data Transmission Terminal on switched or nonswitched lines:
Supported: #1340 - Automatic Answering
#1350 - Automatic Turnaround
#3401 - Dual Communication Interface
#5010 - Multiple Record Transmission
#5020 - Multipoint Line Control
#5820 - 120 Character Print Line
#5821 - 144 Character Print Line
#6400 - Selective Character Set
#7850 - Terminal Identification
#8030 - EBCDIC Transparency
#9150 - Extended Retry Transmission
#9761 - ASCII Transmission Code
#9762 - EBCDIC Transmission Code

2980 General Banking System on nonswitched lines:
2972 Station Control Unit (mdl 8 - RPQ 858160, mdl 11 - RPQ 858231) :
Supported: Attachment of 2980,2971
RPQ 835503 - Buffer Expansion
RPQ 858165,858182 - 96-Character Buffer
2980 Teller Station (mdl 1 - RPQ 835504, mdl 4 - RPQ 858147)
2980 Administrative Station (mdl 2 - RPQ 835505)
2971 Remote Control Unit (mdl 3 - RPQ 858144)

3270 Information Display System on nonswitched lines:
3262 Printer (mdls 3, 13) [supported as a 3286-2]
3271 Control Unit (mdls 1,2):
Supported: Attachment of 3262, 3277, 3284, 3286, 3287, 3288
#1550 - Copy
#9761 - EBCDIC Code
3274 Control Unit (model 1C) [supported as a 3271]:
Supported: Attachment of 3268, 3277, 3278, 3284, 3286, 3287, 3288, 3289
3276 Control Unit Display Station (mdls 1,2,3,4) [supported as a 3271]:
Supported: Attachment of 3268, 3278, 3287
#6350 - Selector Light-Pen
#9082 - EBCDIC Character Set
3277 Display Station (mdls 1,2) :
Supported: #6350 - Selector Light-Pen
#9089 - EBCDIC Character Set
3278 Display Station (mdls 1,2,3,4) [supported as 3277]:
Supported: #6350 - Selector Light-Pen
#9082 - EBCDIC Character Set
3268 Printer (mdl 2) [supported as a 3286-2]:
3284 Printer (mdls 1,2) :
Supported: **#9089** - EBCDIC Character Set
3286 Printer (mdls 1,2) :
Supported: **#9089** - EBCDIC Character Set
3287 Printer (mdls 1,2) [supported as a 3284 or 3286 attached to 3271-1 or -2]
Supported: **#9082** - EBCDIC Character Set
3288 Printer (mdl 2) (supported as a 3286-2) :
Supported: **#9089** - EBCDIC Character Set
3289 Printer (mdls 1,2) [supported as a 3286-2]

3270 Information Display System on switched lines (BTAM) or nonswitched lines: (VTAM,TCAM,BTAM)
3275 Display Station (mdls 1,2) :
Supported: Attachment of 3284
#6350 - Selector Light-Pen
#9089 - EBCDIC Character Set
#9761 - EBCDIC Code
3284 Printer (mdl 3) :
Supported: **#9089** - EBCDIC Character Set

3624 Consumer Transaction Facility (mdl 1, 2, 11, 12) (supported as a 2772): (BTAM)
Supported: Attached to a 3704/3705 via nonswitched lines only

3650 Programmable Store System (Supported as a S/3) on switched lines: (BTAM)
3651 Store Controller (mdls A25, B25, A75, B75, C75 D75)
Supported: Attachment of 3275, 3653, 3657, 3659, 3663, 3669, 3683, 3784
3653 Point of Sale Terminal (mdl 1 and 1P)
3683 Point of Sale Terminal
3663 Supermarket Terminal (mdl 1P, 2 and 3P)
3657 Ticket Unit (not available on 3651 mdls A25 and B25)
3275 Display Station (mdl 3)
Supported: Attachment of 3284
3284 Printer (mdl 3)
3659 Remote Communications Unit (mdl 1)
Required: 2400 BPS non-switched line
3784 Printer (mdl 1) not available on 3651 mdls A25 and B25.

OS/VS1 (5652-VS1) (cont'd)

3669 Remote Communications Unit. Not available on 3651 mdl A25 and B25.

3660 Supermarket Scanning System (supported as a S/3) on switched lines: (BTAM)
3651 Store Controller (mdls A60,B60) :
Supported: Attachment of 3663,3669
3663 Supermarket Terminal (mdls 1,2) :
Supported: Attachment of 3666
3666 Checkout Scanner (mdl 1)
3669 Store Communications Unit (mdl 1)

3660 Supermarket Key-Entry System (supported as a S/3) on switched lines: (BTAM) 3661 Store Controller:
Supported: Attachment of 3663
3663 Supermarket Terminal (mdls 1,2)

3670 Brokerage Communication System on nonswitched lines: (TCAM)
3671 Shared Terminal Control Unit (mdl 1) :
Supported: Attachment of 3672,3673,3674
#3250 - Display Expansion
3672 Executive Console (mdl 1)
3673 Data Display (mdl 1)
3674 Printer-Keyboard (mdl 1)

3680 Programmable Store System supported on switched and nonswitched lines: (VTAM)
3684 Point of Sale - Control Unit (mdls 1,-2):
Supported: Attachment of 3683 Point of Sale Terminal (mdl 2)

3735 Programmable Buffered Terminal (mdl 1) on switched or nonswitched lines:
Supported: Attachment of 5496,3286
5010 - Multipoint Data Link Control
#9761 - EBCDIC Code
#9762 - ASCII Code
3286 Printer (mdl 3)
5496 Data Recorder (mdl 1)

3741 Data Station (mdl 2) on switched or nonswitched lines:
Supported: Attachment of 0129,3713,3715,3717
#1680 - Expanded Communications
#1685 - Expanded Communications/ Multipoint Data Link Control
#5450 - Operator Identification Card Reader
#7850 - Terminal Identification
0129 Card Data Recorder (mdl 2)
3713 Printer (mdl 1)
3715 Printer (mdls 1,2)
3717 Printer (mdl 1)

3741 Programmable Workstation (mdl 4) on switched or nonswitched lines:
Supported: Attachment of 0129,3713,3715
#1680 - Expanded Communications
#1685 - Expanded Communications/ Multipoint Data Link Control
#5450 - Operator Identification Card Reader
#7850 - Terminal Identification
0129 Card Data Recorder (mdl 2)
3713 Printer (mdl 1)
3715 Printer (mdls 1,2)

3747 Data Converter (mdl 1) on switched or nonswitched lines:
Supported: #1660 - Communications Adapter

3770 Data Communication System (supported as a 2770) on switched or nonswitched lines:
3771 Communication Terminal (mdls 1,2,3) :
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point, or
#1462 - BSC Multipoint
Supported: #1201 - ASCII Code
3773 Communication Terminal (mdls 1,2,3,P1,P2,P3) :
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point, or
#1462 - BSC Multipoint
Supported: #1201 - ASCII Code
3774 Communication Terminal (mdls 1,2,P1,P2) :
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point, or
#1462 - BSC Multipoint
Supported: #1201 - ASCII Code
3775 Communication Terminal (mdls 1,P1) :
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point, or
#1462 - BSC Multipoint
Supported: #1201 - ASCII Code
3776 Communication Terminal (mdls 1,2) (supported as a 2772/3780) :
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point, or
#1462 - BSC Multipoint
Supported: #1201 - ASCII Code
3777 Communication Terminal (mdl 1) (supported as a 2772/3780) :
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point, or
#1462 - BSC Multipoint
Supported: #1201 - ASCII Code
3777 Communication Terminal (mdl 2) (supported as a S/360-20 MULTI-LEAVING Workstation) :
Required: #3701 - EIA Interface

3780 Data Communications Terminal (mdl 1) (supported as a 2772 without component select) on switched or nonswitched lines:
Supported: #3601 - EBCDIC Transparency
#5010 - Multipoint Data Link Control
#5701 - Print Positions, Additional
#9761 - EBCDIC Code

5110 Computer (supported as a 2770) on switched and nonswitched lines:
Required: #2074 BSCA
Supported: Attachment of a 5103, 5106, 5114
The 5110 emulates the following 2770 features:
Auto Answer
Buffer expansion additional (512)
EBCDIC Transparency
144 Character print line
Identification
Multipoint Data Link Control (TCAM, BTAM)
Horizontal Format Control
Space Compression/expansion
Synchronous Clock
Transmission Code EBCDIC

5265 Retail System Communication mdl (supported as 3741) point-to-point operation. (TCAM,BTAM)
Required: #5500 - 1200 BPS Integrated Nonswitched Modem or
#5501 - 1200 BPS Integrated Switched Modem or
#3701 - EIA/CCITT Interface

5275 Direct Numerical Control Station (mdl 1) [supported as a 3275 with EBCDIC Code and EBCDIC Character Set] on switched lines (BTAM) or nonswitched lines (VTAM, TCAM, BTAM).

6670 Information Distributor (by TCAM/BTAM) as a 2772

IBM PROCESSOR AS TERMINALS

(For details of programming support provided within the Processor when acting as a terminal, see appropriate programming sales manual pages)

1130 Computing System on switched or nonswitched lines: (TCAM,BTAM)
1131 Central Processing Unit:
Required: #7690 - Synchronous Communications Adapter

1800 Data Acquisition and Control System on switched or nonswitched lines: (TCAM,BTAM)
1826 Data Adapter Unit:
Required: #7550 - Communication Adapter

5280 Distributed Data System (supported as a 3271-2) on a non-switched line:
5285 and 5288 Controllers
Required: Refer to GSD Sales Manual for required features and related programming

5280 Distributed Data System (supported as a 3741 or S/3 MRJE) on switched or nonswitched lines:
5285 and 5288 Controllers
Required: #2500 - Communications Adapter

OS/VS1 (5652-VS1) (cont'd)

Series/1 (supported as a S/3) on switched or nonswitched lines: (BTAM)
4953 or 4955 Processor:
Required: #2074, #2075, or #2094 Binary Synchronous Communications Adapter

System/3 on switched or nonswitched lines:
5404, 5406, 5408, 5410, 5412, or 5414 Processing Unit:
Required: #2074 - Binary Synchronous Communications Adapter

System/7 (supported as a System/3) on switched or nonswitched lines:
5010 Processor Module:
Required: #2074 - Binary Synchronous Communications Adapter

System/32 (supported as a System/3) on switched or nonswitched lines:
5320 System Unit:
Required: #2074 - Binary Synchronous Communications Adapter

System/34 (supported as a System/3) on switched or nonswitched lines:
5340 System Unit:
Required: #2500, #3500 or #4500 - Communications Adapter feature

System/34 (supported as a 3271 mdl 2) on a nonswitched line:
5340 System Unit
Required: #2500, #3500 or #4500 Communications Adapter feature
#4900 or #4901 Workstation Control Expansion A or B

System/36 (supported as a System/3) on switched or nonswitched lines:
5360 System Unit:
Required: #2500 or #4500 - Communications Adapter feature

System/36 (supported as a S/360 mdls 25 and up) on switched or nonswitched lines:
5360 System Unit
Required: #2500 or #4500 Communications Adapter feature

System/36 (supported as a 3271 mdl 2) on nonswitched lines:
5360 System Unit:
Required: #2500 or #4500 - Communications Adapter feature
#4900 Workstation Control feature

System/38 (supported as a System/3) on switched or nonswitched line:
5381 System Unit:
Required: #1501 or #1502 Communications Attachment feature
#2001 or #2003 Communications Control feature
#3200 Line Base feature

System/38 (supported as a 3271 mdl 2) on a nonswitched line:
5381 System Unit
Required: #1501, #1502 Communications Attachment feature
#2001, #2003 Communications Control feature

S/360 mdl 20 on switched or nonswitched lines: (TCAM,BTAM)
2020 Processing Unit:
Required: #2074 - Binary Synchronous Communications Adapter

S/360 mdls 25, 30, 40, 50, 65, 65MP, 67(65 mode), 75, 85, 91, 195 on switched or nonswitched lines: (TCAM,BTAM)
Processing Unit:
Required: #4580 - Integrated Communications Attachment, or
2701 Data Adapter Unit, or
2703 Transmission Control, or
3704 Communications Controller in emulation mode, or
3705-I Communications Controller in emulation mode, or
3705-II Communications Controller in emulation mode

All virtual storage S/370 Processors or 4300 Processors on switched or nonswitched lines:
Processing Unit:
Required: #4640 - Integrated Communications Adapter (TCAM,BTAM), on S/370 mdls 135, 135-3, 138 or
#1601 - Communications Adapter (TCAM, BTAM) on 4331 or
2701 Data Adapter Unit (TCAM,BTAM), or
2703 Transmission Control (TCAM,BTAM), or
3704 Communications Controller in network control (VTAM,TCAM) or emulation mode (TCAM,BTAM), or
3705-I Communications Controller in network control (VTAM,TCAM) or emulation mode (TCAM,BTAM), or
3705-II Communications Controller in network control (VTAM,TCAM) or emulation mode (TCAM,BTAM)

8100 with DPPX on nonswitched lines: (BTAM, TCAM, VTAM)
Required: Refer to 8100 pages for required features and for licensed programs supported.

8100 with DPPX/SP on nonswitched lines: (BTAM, TCAM, VTAM)
Required: Refer to 8100 pages for required features and for licensed programs supported.

SDLC LINES:

COMMUNICATIONS CONTROLLERS

3704 Communications Controller in network control mode (VTAM,TCAM)

3705-I Communications Controller in network control mode (VTAM,TCAM)

IBM TERMINALS

3232-1 Keyboard Printer Terminal (Mdl 1) on switched and nonswitched lines (VTAM, TCAM)
3270 Information Display System on nonswitched lines: (VTAM,TCAM)
3271 Control Unit (mdls 11, 12) :
Supported: Attachment of 3277,3284,3286,3287, 3288
#1200 - ASCII Code
#1550 - Copy
#9761 - EBCDIC Code
3277 Display Station (mdls 1,2) :
Supported: #6350 - Selector Light-Pen
#9089 - EBCDIC Character Set
3284 Printer (mdls 1,2) :
Supported: **#9089** - EBCDIC Character Set
3286 Printer (mdls 1,2) :
Supported: **#9089** - EBCDIC Character Set
3287 Printer (mdls 1,2) [supported as a 3284 or 3286 attached to 3271-11 or -12]
Supported: **#9082** - EBCDIC Character Set
3288 Printer (mdl 2) (supported as a 3286-2) :
Supported: **#9089** - EBCDIC Character Set
3275 Display Station (mdls 11,12) :
Supported: Attachment of 3284
#1200 - ASCII Code
#6350 - Selector Light-Pen
#9089 - EBCDIC Character Set
#9761 - EBCDIC Code
3284 Printer (mdl 3) :
Supported: **#9089** - EBCDIC Character Set

3270 Information Display System on switched and nonswitched lines (VTAM) and on nonswitched lines only (TCAM/NCP Direct)
[Supported as a 3790 with Configuration Support #9165]:
3276 Control Unit Display Station (mdls 11,12,13,14) :
Supported: Attachment of 3268, 3278, 3287
#6350 - Selector Light-Pen
#9082 - EBCDIC Character Set
3278 Display Station (mdls 1,2,3,4) [Supported as 3277]:
Supported: #6350 - Selector Light-Pen
#9082 - EBCDIC Character Set
3287 Printer (mdls 1,2) [Supported as a 3284 or 3286]:
Supported: **#9082** - EBCDIC Character Set
3268 Printer (mdl 2) [Supported as a 3286-2]

OS/VS1 (5652-VS1) (cont'd)

3600 Finance Communication System on switched or nonswitched lines: (VTAM,TCAM) 3601 Controller (mdls 1,2A,2B,3A,3B):
Supported: Attachment of 3603,3604,3606, 3608,3610,-3611,3612,3614, 3615,3616,3618
3602 Controller (mdls 1A,1B) :
Supported: Attachment of 3603,3604,3606,3608,3610, 3611,3612,3614,3615,3616,3618
3603 Terminal Attachment Unit (mdl 1, 2) :
3604 Keyboard Display (mdls 1,2,3,4,5,6,7)
3606 Financial Services Terminal (mdls 1,2)
3608 Printing Financial Services Terminal (mdls 1,2)
3610 Document Printer (mdls 1,2,3,4,5,12,13)
3611 Passbook Printer (mdls 1,2)
3612 Passbook and Document Printer (mdls 1,2,3,12,13)
3618 Administrative Line Printer (mdl 1)
3614 Consumer Transaction Facility (mdls 1,2,11,12) :
Required: When attached to a 3601 or 3602 3601 or 3602 application programs
Supported: Attachment to a 3704/3705 (via non-switched lines only) or 3601,3602.
3615 Administrative Terminal Printer (mdls 1,2)
3616 Passbook and Document Printer (mdl 1)
3624 Consumer Transaction Facility (mdls 1,2,11,12) :
Required: When attached to a 3601 or 3602, 3601 or 3602 application programs
Supported: Attachment to a 3704/3705 (via non-switched lines only) or 3601, 3602.

3630 Plant Communication System on switched or non-switched lines (VTAM, TCAM)
3631 Controller (mdls 1A, 1B)
Supported: Attachment of 3604, 3641, 3642, 3643, 3644, 3646,3842, 7430 (RPQ)
3632 Controller (mdls 1A, 1B)
Supported: Attachment of 3604, 3641, 3642, 3643, 3644, 3646, 3842, 7430 (RPQ)
3604 Keyboard Display Terminal (mdl 6)
3641 Reporting Terminal (mdls 1,2)
3642 Encoder Printer (mdls 1, 2)
3643 Keyboard Display (mdls 2,3,4)
3644 Automatic Data Unit (mdl 1)
3646 Scanner Control Unit (mdl 1)
3647 Time and Attendance Terminal (mdl 1)
3842 Loop Control Unit (mdl 1)

7430 Document Printer (RPQ)

3650 Programmable Store System on switched or non-switched lines: (VTAM, ACF/VTAM)
3651 Store Controller (mdls A25, B25, A75, B75, C75, D75)
Supported: Attachment of 3653, 3683, 3663, 3657, 3275, 3659, 3669, 3784
3653 Point of Sale Terminal (mdl 1 and 1P)
3683 Point of Sale Terminal
3663 Supermarket Terminal (mdl 1P, 2 and 3P)
3657 Ticket Unit (Not available on 3651 mdls A25 and B25)
3275 Display Station (mdl 3)
Supported: Attachment of 3284
3284 Printer (mdl 3)
3659 Remote Communications Unit (mdl 1)
Required: 2400 bps nonswitched line
3784 Printer (mdl 1) not available on 3651 mdl A25 and B25
3669 Remote Communications Unit (mdl 1) not available on 3651 mdl A25 and B25

3650 Retail Store System on switched or nonswitched lines: (VTAM,TCAM) 3651 Store Controller (mdls A50,B50) :
Supported: Attachment of 3653,3657,3275, 3659,3784
3653 Point of Sale Terminal
3657 Ticket Unit
3275 Display Station (mdl 3) :
Supported: Attachment of 3284
3284 Printer (mdl 3)
3659 Remote Communications Unit (mdl 1)
3784 Printer (mdl 1)

3660 Supermarket Scanning System on switched lines: (VTAM)
3651 Store Controller (mdls A60,B60) :
Supported: Attachment of 3663,3669
3663 Supermarket Terminal (mdls 1,2) :
Supported: Attachment of 3666
3666 Checkout Scanner
3669 Store Communication Unit (mdl 1)

3660 Supermarket Key-Entry System on switched lines: (VTAM)
3661 Store Controller:
Supported: Attachment of 3663
3663 Supermarket Terminal (mdls 1,2)

3680 Programmable Store System supported on switched and nonswitched lines: (VTAM)
3684 Point of Sale - Control Unit (mdl 1,-2)
Supported: 3684 mdl 2: Attachment of 3683 Point of Sale Terminal
3683 Point of Sale Terminal

3730 Distributed Office Communication System on switched and nonswitched lines (VTAM and TCAM/NCP Direct).
3791 Controller, mdl 11C, 12A or 12B with: SDLC with clock (#6301) or SDLC without clock (#6302 or 6303), and required modem
3732 Text Display Station
3736 Printer

3767 Communication Terminal (mdls 1,2,3) on switched or non-switched lines: (VTAM,TCAM)
Supported: SDLC adapter provided unless one of the Start/Stop features are specified
#1201 - ASCII Code

3770 Data Communication System on switched or nonswitched lines: (VTAM,TCAM)
3771 Communication Terminal (mdls 1,2,3) :
Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
Supported: #1201 - ASCII Code
3773 Communication Terminal (mdls 1,2,3,P1,P2,P3) :
Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
Supported: #1201 - ASCII Code
3774 Communication Terminal (mdls 1,2,P1,P2) :
Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
Supported: #1201 - ASCII Code
3775 Communication Terminal (mdls 1,P1) :
Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
Supported: #1201 - ASCII Code
3776 Communication Terminal (mdls 1,2) :
Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
Supported: #1201 - ASCII Code
3776 Communication Terminal (mdls 3,4) [VTAM]:
Supported: #1201 - ASCII Code
3777 Communication Terminal (mdl 1) :
Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
Supported: #1201 - ASCII Code
3777 Communication Terminal (mdl 3) [VTAM]:
Supported: #1201 - ASCII Code

3790 Communication System on switched or nonswitched lines (VTAM,TCAM/NCP)

6670 Information Distributor

8100/DPCX Information System on switched or nonswitched lines (VTAM, TCAM/NCP)

IBM PROCESSOR AS TERMINALS

5280 Distributed Data System (supported as a 3274-1C) on switched and nonswitched lines: (VTAM)
5285 and 5288 Controllers
Required: Refer to appropriate pages for required features and programming

5280 Distributed Data System (supported as a 3770) on switched or nonswitched lines:
5285 and 5288 Controllers
Required: #2500 Communications Adapter

System/32 (supported as a 3770) on switched or nonswitched lines: (VTAM,TCAM)
5320 System Unit:
Required: #1005 - Additional Storage (minimum of one)
#6301 - Synchronous Data Link Control

OS/VS1 (5652-VS1) (cont'd)

System/34 (supported as a 3770 or 3791) on switched or nonswitched lines (VTAM, TCAM) :
5340 System Unit:
Required: #2500, #3500 or #4500 Communications Adapter feature

System/34 (supported as a 3274 mdl 1C) on a nonswitched line (VTAM):
5340 System Unit
Required: #2500, #3500 or #4500 Communications Adapter feature
#4900 or #4901 Workstation Control Expansion A or B

System/36 (supported as a 3770 or 3791) on switched or nonswitched lines:
5360 System Unit:
Required: #2500 or #4500 Communications Adapter feature

System/36 (supported as a 3274 mdl 1C) on switched or nonswitched lines:
5360 System Unit
Required: #2500 or #4500 Communications Adapter feature
#4900 Workstation Control feature

System/38 (supported as a 3770) on switched or nonswitched line (VTAM, TCAM):
5381 System Unit:
Required: #1501 or #1502 Communications Attachment feature
#2001, #2001, #2002 or #2003 Communications Control feature
#3200 Line Base feature

System/38 (supported as a 3774) on switched or nonswitched line (VTAM, TCAM):
5381 System Unit:
Required: #1501 or #1502 Communications Attachment feature
#2001, #2001, #2002 or #2003 Communications Control feature
#3200 Line Base feature

8100 with DPPX on switched or nonswitched lines (TCAM, VTAM)
Required: Refer to 8100 pages for required features and licensed programs supported.

8100 with DPPX/SP on switched or nonswitched lines (TCAM,VTAM)
Required: Refer to 8100 pages for required features and licensed programs supported.

LOCAL ATTACHMENT

Transmission Control Units and Communications Controllers

Integrated Communications Adapter of S/370 mdl 135: (TCAM,BTAM)
Required: #4640 - Integrated Communications Adapter
Supported: EBCDIC Code is a standard feature
#9763-#9780 - Transparency
#9681-#9688 - ASCII Code
#9689-#9696 - 6-bit Transcode

Communications Adapter on 4331/4361 (TCAM, BTAM)
Required: #1601 Communications Adapter

2701 Data Adapter Unit on local channel: (TCAM,BTAM)
Supported: #1302,#1303,#1314 - Autocall
#3455 - Dual Code
#3463-#3465 - Dual Communication Interface
#8029 - Transparency
#9060 - EBCDIC Code
#9061 - ASCII Code
#9062 - 6-bit Transcode

2702 Transmission Control Unit on local channel: (TCAM,BTAM)
Supported: #1290 - Autocall
#1319 - Autopoll
#8055 - 2741 Break

2703 Transmission Control Unit on local channel: (TCAM,BTAM)
Supported: #1340,#1341 - Autocall
#7715 - EBCDIC Code
#7716 - ASCII Code
#7717 - 6-bit Transcode
#8055 - 2741 Break
#9100 - Transparency for ASCII

2715 Transmission Control Unit (mdl 1) on local channel: (TCAM,BTAM)
Supported: See "2790" under *Local Terminals*

3704/3705-I/3705-II Communications Controller on local channel:
Supported: EBCDIC Code, ASCII Code, Autopoll and EBCDIC Transparency do not have special feature codes in the 3704/3705
EP/VS (TCAM,BTAM)
NCP/VS (VTAM,TCAM)
PEP
#8002 - Two-Channel Switch (VTAM,TCAM)

LOCAL TERMINALS

2848 Display Control (mdls 1,2,3) on local channel: (TCAM)
Supported: Attachment of 2260,1053
#3901 - Extended Cursor Control
#4787 - Line Addressing
#5340 - Non-Destructive Cursor
#5341 - Non-Destructive Cursor Adapter
Not Supported: Attachment of 1053
2260 Display Station (mdls 1,2) :
Supported: #3606 - Extended Cursor Control, Alphameric Keyboard
Not Supported: Tab feature of #3606

2790 Data Communication System on local channel: (TCAM,BTAM)
2715 Transmission Control Unit (mdl 1) :
Supported: Attachment of 2740,2791,2793
#3801 - Expanded Capability
#4850 - Local 2740 Adapter
Not Supported: #8110 - Two Processor Switch
2740 Communication Terminal (mdl 1)
2791 Area Station (mdls 1,2) :
Supported: Attachment of 1035,2795,2796,2797,2798, 1053
1035 Badge Reader (mdl 1)
2795 Data Entry Unit (mdl 1)
2796 Data Entry Unit (mdl 1)
2797 Data Entry Unit (mdl 1)
2798 Guidance Display Unit (mdl 1)
1053 Printer (mdl 1)
2793 Area Station (mdl 1) :
Supported: Attachment of 2795,2796,2797,2798, 1053
2795 Data Entry Unit (mdl 1)
2796 Data Entry Unit (mdl 1)
2797 Data Entry Unit (mdl 1)
2798 Guidance Display Unit (mdl 1)
1053 Printer (mdl 1)

3270 Information Display System on local channel:
3272 Control Unit (mdls 1,2) :
Supported: Attachment of 3277, 3284, 3286, 3287, 3288
3277 Display Station (mdls 1,2) :
Supported: #6350 - Selector Light-Pen
#9089 - EBCDIC Character Set
3284 Printer (mdls 1,2) :
Supported: **#9089** - EBCDIC Character Set
3286 Printer (mdls 1,2) :
Supported: **#9089** - EBCDIC Character Set
3287 Printer (mdls 1,2) [supported as a 3284 or 3286 attached to 3272-1 or -2]
Supported: **#9082** - EBCDIC Character Set
3288 Printer (mdl 2) (supported as a 3286-2) :
Supported: **#9089** - EBCDIC Character Set

3270 Information Display System on local channel: (Supported as a 3272)
3274 Control Unit (mdl 1B, 1D)
Supported: Attachment of 3268, 3277, 3278, 3284, 3286, 3287, 3288, 3289
3277 Display Station (mdls 1,2)
Supported: #6350 - Selector Light-Pen
#9089 - EBCDIC Character Set
3268 Printer (mdl 2) [Supported as a 3286-2]
3278 Display Station (mdls 1,2,3,4) [Supported as 3277]
Supported: #6350 - Selector Light-Pen
#9082 - EBCDIC Character Set
3284 Printer (mdls 1,2)
Supported: **#9089** - EBCDIC Character Set

OS/VS1 (5652-VS1) (cont'd)

3286 Printer (mdls 1,2)
Supported: **#9089** - EBCDIC Character Set
3287 Printer (mdls 1,2) [Supported as a 3284 or 3286]
Supported: **#9082** - EBCDIC Character Set
3288 Printer (mdl 2) [Supported as a 3286-2]
Supported: **#9089** - EBCDIC Character Set
3289 Printer (mdls 1,2) [Supported as a 3286-2]

3270 Information Display System on local channel: (VTAM, TCAM through VTAM) [Supported as 3790 with Configuration Support **#9165**]
3274 Control Unit (mdl 1A)
Supported: Attachment of 3268, 3277, 3278, 3284, 3286, 3287, 3288, 3289
3277 Display Station (mdls 1,2)
Supported: #6350 - Selector Light-Pen
#9089 - EBCDIC Character Set
3268 Printer (mdl 2) [Supported as a 3286-2]
3278 Display Station (mdls 1,2,3,4)
Supported: **#6350** Selector Light-Pen
#9082 EBCDIC Character Set
3284 Printer (mdls 1,2)
Supported: **#9089** - EBCDIC Character Set
3286 Printer (mdls 1,2)
Supported: **#9089** - EBCDIC Character Set
3287 Printer (mdls 1,2) [Supported as a 3284 or 3286]
Supported: **#9082** - EBCDIC Character Set
3288 Printer (mdl 2) [Supported as a 3286-2]
Supported: **#9089** - EBCDIC Character Set
3289 Printer (mdls 1,2) [Supported as a 3286-2]

3730 Distributed Office Communication System on local channel (VTAM)
3791 Controller, mdl 11C, 12A or 12B with: Local Channel Attachment (#1515)
3732 Text Display Station
3736 Printer

3790 Communication System on local channel (VTAM,TCAM)

7770 Audio Response Unit (mdl 3) on local channel (TCAM)

Legend:

(VTAM) = VTAM only
(TCAM) = TCAM only
(BTAM) = BTAM only

OS/VS1 (5652-VS1) (cont'd)

TERMINAL SUPPORT CHART 1

Remote Attach (a)	VTAM via NCP/VS (c)	TCAM via VTAM (c)	TCAM via NCP/VS (f)	TCAM or BTAM via EP/VS (g)	via 270X (h)	via 13X ICA or 4331 CA	RES RTAM
SS Lines:							
1031				X	1,2,3		
1051	X	X	X	X	1,2,3	X	
2260				X	1	X	
2265				X	1	X	
2740-1,-2	X	X	X	X	1,2,3	X	
2741	X	X	X	X	1,2,3	X	
2760				X	1,2,3	X	
3101	X	X		X			
3232-51	X	X	X	X		X	
3767-1,-2 (2740-1)	X	X	X	X		X	
3767-1,-2 (2740-2)	X	X	X	X	1	X	
3767-3 (2740-2)	X	X	X	X	1		X
3767-1,-2 (2741)	X	X	X	X		X	
5100 (2741)	X	X	X	X		X	
5110 (2741)	X	X	X	X		X	
CMCST (2741)	X	X	X	X	1,2,3	X	
System/7 (2740-1)	X	X	X	X	1,2,3	X	
AT&T 83B3 or WU 115A Line Control Type	X	X	X	X	1,2,3		
CPT-TWX (M33/35) Line Control Type	X	X	X	X	1,2,3	X	
WT Telegraph	X	X	X	X	1,2,3		
6733 (CPT-TWX 33/35)	X	X	X	X	-	X	-
BSC Lines:							
2715-2			X	X	1,3	X	
2772	X	X	X	X	1,3	X	X
2780	X	X	X	X	1,3	X	X
2972-8,-11	X	X	X	X (B)	1,3 (B)	X (B)	
3271-1,-2	X	X	X	X	1,3	X	
3274-1C (3271-1,-2)	X	X	X	X	1,3	X	X
3275-1,-2	X	X	X	X	1,3	X	
3276 (3276 (3271-1,-2)		X	X	X	1,3	X	X
3624-1,-2,-11,-12 (2772)				X (B)			
3651-A25,-B25,-A75 B75, C75, D75				X (B)		X (B)	
3651-A60,-B60 (S/3)				X (B)		X (B)	
3661 (S/3)				X (B)		X (B)	
3670				X (T)	1,3 (T)	X (T)	
3684				X (B)	1,3(B)	X (B)	
3735	X	X	X	X	1,3	X	
3741-2,-4	X	X	X	X	1,3	X	X
3747	X	X	X	X	1,3	X	
3771-1,-2,-3 (2772)	X	X	X	X	1	X	X
3773-1,-2,-3 (2772)	X	X	X	X	1	X	X
3773-P1,-P2,-P3 (2772)	X	X	X	X	1	X	
3774-1,-2 (2772)	X	X	X	X	1	X	X
3774-P1,-P2 (2772)	X	X	X	X	1	X	X (i)
3775-1 (2772)	X	X	X	X	1	X	X
3775-P1 (2772)	X	X	X	X	1	X	X (i)
3776-1,-2(2772/3780)	X	X	X	X	1	X	X
3777-1 (2772/3780)	X	X	X	X	1	X	X
3777-2 (S/360-20)							X
3780 (2772)	X	X	X	X	1,3	X	X
4331	X	X	X	X	1,3	X	X
4341	X	X	X	X	1,3	X	X
4361	X	X	X	X	1,3	X	X
5110 (2772)			X	X		X	X
5265 Communicating mdl (3741)			X	X		X	
5275 (3275-1,-2)	X	X	X	X	1		
5285/5288 (3741)	X	X	X	X (B)	1,3	X (B)	
5285/5288 (System/3)	X			X (B)	1,3		X
5285/5288 (3271-2)	X	X	X	X (B)	1,3	X	
6670 (2772)		X	X	X	1,3	X (M)	X
1131			X	X	1,3	X	X
1826			X	X (B)	1,3 (B)	X (B)	
Series/1 (System/3)				X (B)	1 (B)		
System/3	X	X	X	X	1,3	X	X
System/7 (System/3)	X	X	X	X	1,3	X	
System/32 (System/3)	X	X	X	X	1,3	X	X
System/34 (System/3)	X	X	X	X	1,3	X	X
System/34 (3271)	X			X (B)	1,3		
System/36 (System/3)	X	X	X	X	1,3	X	X
System/36 (3271)	X			X (B)	1,3		
System/38 (System/3)	X	X	X	X	1,3	X	X
System/38 (3271)	X		X		1,3	X	
System/38 (3274)	X		X		1,3	X	
S/360-20			X	X	1,3	X	X
S/360 (b)			X	X	1,3	X	X
S/370 (b)	X	X	X	X	1,3	X	X
S/8100	X		X	X	1,3	X	X

OS/VS1 (5652-VS1) (cont'd)

TERMINAL SUPPORT CHART 1 - cont'd

SDLC Lines:	VTAM via NCP/VS (c)	TCAM via VTAM (c)	TCAM via NCP/VS (T)		RES VTAM
3232-1	X	X	X		
3271-11,-12	X	X	X		
3274-1C (3791)	X	X	X		
3275-11,-12	X	X	X		
3276 (3791)	X	X			
3601	X	X	X (d)		
3602	X	X	X (d)		
3614	X	X	X		
3624	X (j)	X (j)			
3631	X				
3632	X				
3651-A25,B25,A75 B75,C75,D75	X	X			
3651-A50,-B50	X	X			
3651-A60,-B60	X				
3661	X				
3684	X				
3767-1,-2,-3	X	X	X		
3771-1,-2,-3	X	X	X		X
3773-1,-2,-3	X	X	X		X
3773-P1,-P2,-P3	X	X	X		
3774-1,-2	X	X	X		X
3774-P1,-P2	X	X	X		
3775-1	X	X	X		X
3775-P1	X	X	X		
3776-1,-2	X	X	X		X
3776-3,-4	X				X
3777-1	X	X	X		X
3777-3	X				X
3791	X	X	X		X
6670	X		X		X (l)
5285/5288 (3770)	X	X	X		X
5285/5288 (3274-1C)	X	X	X		
3791 (for 3730)	X		X		X (k)
8130/DPCX -A21,-A23	X	X	X		X
8140/DPCX-A31, A33,-A51,-A53	X	X	X		X
System/32 (3770)	X	X	X		X
System/34 (3770)	X	X	X		X
System/34 (3790)	X	X	X		
System/34 (3274-1C)	X	X	X		
System/36 (3770)	X	X	X		X
System/36 (3790)	X	X	X		
System/36 (3274-1C)	X	X	X		
System/38 (3770)	X	X	X		X
System/38 (3274)	X	-	X		-
S/8100/DPPX(j)	X	X	X		X
S/8100/DPPX(j)	X	X	X		X

Local Channel Attach	VTAM (c)	TCAM via VTAM (c)	TCAM	BTAM	RES VTAM
ICA, TCUs, Local Communications Controllers:					
ICA			X	X	
2701			X	X	
2702			X	X	
2703			X	X	
2715-1			X	X	
3704 (EP/VS)			X	X	
3704 (NCP/VS)	X	X	X		
3705-I (EP/VS)			X	X	
3705-I (NCP/VS)	X	X	X		
3705-II (EP/VS)			X	X	
3705-II (NCP/VS)	X	X	X		
Local Terminals:					
2260			X		
3272-1,-2	X	X	X	X	
3274-1A (3791)	X				
3274-1B (3272-2)	X	X	X	X	X
3791	X (e)	X			X
3791 (for 3730)	X	-	-	-	X (k)
7770-3			X		

Legend:

SS = Start/Stop
BSC = Binary Synchronous Communication
SDLC = Synchronous Data Link Control

X = supported now
(date) = date when support will be available.

Notes:

(B) BTAM only.
(T) TCAM only.

(a) If shown, the terminal type in parenthesis designates the programming support provided by SCPs. E.g., "S/7(2740-1)" means "the S/7 is supported as a 2740-1".

(b) S/360 mdls 25, 30, 40, 50, 65, 65MP, 67 (65 mode), 75, 85, 91, 195 with either BOS, BPS, DOS, or OS. S/370 mdls 115-168MP, 3031, 3032, and 3033 Processors or 4300 Processors with BOS, BPS, DOS, OS, DOS/VS, DOS/VSE, OS/VS1 or OS/VS2.

(c) OS/VS1 Release 3.1 or later.

(d) Available with TCAM NCP/VS Direct.

(e) The ICR for Special Programming Support for Key Entry (SPS/KE) supports only the local 3791 with Data Entry Configuration using 3760s, and precludes concurrent operation of 3704/3705 or 3272 controllers through VTAM or TCAM through VTAM.

(f) OS/VS1 Release 3.0 only, or the current OS/VS1 release when TCAM direct NCP/VS support becomes available in July, 1977.

(g) 3704/3705 EP/VS, or the Partitioned Emulation Programming (PEP) extension to 3704/3705 NCP/VS, can be used to emulate the 270X.

(h) 270X = 2701, 2702, 2703; column shows last digit of 270X support. All support without a date is available now.

(i) Support is for console printer and for data formatted as cards from diskette or keyboard (Logon).

(j) Nonswitched support only.

(k) Concurrent 3730-3790 systems only.

(l) SNA support for the 6670 requires the OS/VS1 Information Distribution Workstation Support Program Product. See the Program Product Sales Manual pages for additional information.

(m) The 6670 is not supported by the 4331 ICA.

OS/VS1 (5652-VS1) (cont'd)

TERMINAL SUPPORT CHART 2

Remote Attach (a)	Communications Code -- EBCDIC ----- norm	trans	ASCII ------ norm	trans	Communication Network --------- sw PTP	nonsw --- PTP	MP
SS Lines:							
1031	-	-	-	-	-	-	X
1051	-	-	-	-	X	-	X
2260	-	-	-	-	-	-	X
2265	-	-	-	-	-	-	X
2740-1	-	-	-	-	X	X	X
2740-2	-	-	-	-	-	-	X
2741	-	-	-	-	X	X	-
2760	-	-	-	-	X	X	-
3101	-	-	X	-	X	-	-
3232-51	-	-	X	-	X	X	-
3767-1,-2 (2740-1)	-	-	-	-	X	X	X
3767-1,-2,-3(2740-2)	-	-	-	-	-	-	X
3767-1,-2 (2741)	-	-	-	-	X	X	-
5100 (2741) (b)	-	-	-	-	X	X	-
CMCST (2741)	-	-	-	-	X	-	-
System/7 (2740-1)	-	-	-	-	X	X	X
AT&T 83B3, WU 115A	-	-	-	-	-	-	X
CPT-TWX (M33/35)	-	-	-	-	X	-	-
WT Telegraph	-	-	-	-	-	X	-
6733 (CPT-TWX 33/35)	-	-	X	-	X	X	-
BSC Lines:							
2715-2	-	X	-	-	S	X	M
2772	X	X	X	-	S	X	M
2780	X	X	X	-	S	X	M
2972-8,-11	X	-	-	-	-	-	M
3271-1,-2	X	-	X	-	-	-	M
3274-1C(3271-1,-2)	X	-	X	-	-	-	M
3275-1,-2	X	-	X	-	S	-	M
3276(3271-1,-2)	X	-	X	-	-	-	M
3624-1,-2,-11,-12 (2772)	-	X	-	-	-	-	M
3651-A50,-B50 (S/3)	-	X	-	-	X	X	M
3651-A60,-B60 (S/3)	-	X	-	-	X	-	-
3661 (S/3)	-	X	-	-	X	-	-
3670	X	-	-	-	-	-	M
3684		X			X		
3735	X	-	X	-	S	-	M
3741-2,-4	X	X	X	-	S (e)	X	-
3747	X	X	-	-	S (e)	X	-
3771,3773,3774, 3775 (2772)	X	X	X	-	S	X	M
3776-1,-2, 3777-1 (2772/3780)	X	X	X	-	S	X	M
3777-2 (S/360-20)	X	X			S	X	M
3780 (2772)	X	X	X	-	S	X	M
4331(c)	X	X	X	X	S	X	-
4341(c)	X	X	X	X	S	X	-
4361(c)	X	X	X	X	S	X	-
4381(c)	X	X	X	X	S	X	-
5110 (2772)	X	X	-	-	S	X	M
5265 Communicating mdl (3741)	X	-	-	-	X	X	-
5275 (3275-1,-2)	X	-	-	-	S (h)	-	M
5285/5288 (3271-2)	X	X	X	-	S	X	M
6670 (2772)	X	-	-	-	-	-	M
1131	X	X	X	-	S	X	-
1826	X	X	-	-	S	X	M
Series/1 (System/3)	X	X	X	-	S	X	M
System/3	X	X	X	-	S	X	
System/7 (System/3)	X	X	X	-	S	X	M
System/32 (System/3)	X	X	X	-	X	X (g)	M
System/34 (System/3)	X	X	X	-	S	X	M
System/34 (3271)	X	-	-	-	-	-	M
System/36 (System/3)	X	X	X	-	S	X	M
System/36 (S/360(c))	X	X	X	-	S	X	M
System/36 (3271)	X	-	-	-	-	-	M
System/38 (System/3)	X	X	X	-	S	X	-
System/38 (3271)	X	-	-	-	-	-	M
S/360-20	X	X	X	X	S	X	M
S/360 (c)	X	X	X	X	S	X	-
S/370 (c)	X	X	X	X	S	X	-
S/8100/DPPX DPPX/DSC	X	-	-	-	-	X	X
DPPX/RJE	X	X	-	-	-	X	-
S/8100/DPPX/SP DPPX/SP/DSC	X	-	-	-	-	X	X
DPPX/SP/RJE	X	X	X	-	S	X	M
SDLC Lines:							
3232-1						X	X	N
3271-11,-12	to data interchange					-	-	N
3274-1C (3791)						-	X	N
3275-11,-12	codes					-	-	N
3276 (3791)						D (f)	X	N
3601						X	X	N
3602						X	X	N
3614						-	X	N
3624						-	X	N
3631						X	X	N
3632						X	X	N
3651-A25,B25,A75 B75,C75,D75						D (f)	X	N
3651-A50,-B50						D (f)	X	N
3651-A60,-B60						D	-	-
3661						D	-	-
3684						D	X	N
3767-1,-2,-3						D	X	N
3771,3773,3774, 3775,3776,3777						D	X	N
5285/5288 (3274-1C)						D	X	N
5285/5288						D	X	N
6670						D	X	N
3791 (d)						D (f)	X	N
8130/DPCX-A21,-A23						D(f)	X	N
8140/DPCX-A31,-A33, -A51,-A53						D(f)	X	N
System/32 (3770)						D	X	N
System/34 (3770)						D	X	N
System/34 (3790)						D (f)	X	N
System/34 (3274)						-	X	N
System/36 (3770)						D	X	N
System/36 (3790)						D (f)	X	N
System/36 (3274)						D	X	N
System/38 (3770)						D	X	N
System/38 (3274)						D	X	N
S/8100/DPPX						D	X	N
S/8100/DPPX/SP						D	X	N
Local Channel Attach:								
2260	-	-	-	-				
2715-1	-	X	-	-				
3272-1,-2	X	-	-	-				
3274-1A (3791)	-	-	-	-				
3274-1B (3272)	X	-	-	-				
3791 (d)	3791 local attachment is code insensitive.							
7770-3	-	-	-	-				

Legend:

SS = Start/Stop
BSC = Binary Synchronous Communication
SDLC = Synchronous Data Link Control

X = supported
– = not supported

D = Group of terminals which can communicate over the public switched telephone network to the same SDLC line appearance on a 3704 or 3705 attached to a S/370. All DTEs so communicating must be operating with the same clocking source (either modem or business machine) and at the same transmission speed.

M = Group of terminals which can operate on same BSC MP line and same line speed.

N = Group of terminals which can operate on same SDLC MP line and same line speed.

S = Group of terminals which can share the same phone number(s).

Notes:

(a) If shown, the terminal type in parenthesis designates the programming support provided by SCPs. E.g., "System/7 (2740-1)" means "the System/7 is supported as a 2740-1".

(b) Supports EBCD communications code only.

OS/VS1 (5652-VS1) (cont'd)

(c) S/360 mdls 25, 30, 40, 50, 65, 65MP, 67 (65 mode), 75, 85, 91, 195 with either BOS, BPS, DOS or OS. S/370 mdls 115-168MP and 3031 Processor with either BOS, BPS, DOS, OS, DOS/VS, OS/VS1 or OS/VS2.

(d) The 3791 Controller, as part of the 3790 Communication System/Data Entry Configuration, does not support ASCII code.

(e) The 3741/3747 can use the same switched network hardware at the 3704/3705 as other BSC terminals. However, NCP/VS requires that the port be configured for 3741/3747 when the port is to be used for 3741/3747. Two separate versions of NCP/VS must be maintained for the two separate configurations of the port, and the proper version loaded into the 3704/3705 for the way the port is to be used at the time.

(f) Terminal operates on switched line using manual dial/manual and/or auto answer procedures and nonswitched VTAM-NCP/VS programming support. The 3651-A50,-B50 uses manual answer and the 3791 uses manual or auto answer procedures. These manual dial procedures will not be required when switched VTAM-NCP/VS support is available.

(g) IPL of System/7 is not supported in this network configuration.

(h) Switched network support by BTAM only.

SCP PROGRAMMING SERVICES

Class 2 SCP (Prior to Release 7); Class 1 SCP (Release 7)

VSE/ONLINE TEST EXECUTIVE PROGRAM VERSION 1.1.0 (VSE/OLTEP) 5656-092

PURPOSE

VSE/Online Test Executive Program (VSE/OLTEP) SCP Version 1 Release 1 Modification Level 0 is a Class 2 SCP program and is used by IBM Customer Engineers only.

The purpose of the new OLTEP Generation Program (OLTGEN) is to produce a VSE/OLTEP-LNKEDT-stream (CDS and OLTs), which is ready to be cataloged into the systems core image library in order to run online tests.

The CDS information can be specified manually or can be selected from the OLT master tape by specifying the physical device address or the symbolic name. All CDS records can be duplicated and/or their addresses/symbolic names can be modified. The OLT programs required for the installation will be selected by specifying the device types.

DESCRIPTION

Two new modules (IJZAGEN1 and IJZAGEN2) represent the new generation program. IJZAGEN1 will provide the processing routines and IJZAGEN2 supports all necessary I/O functions using logical IOCS. The system logical unit SYSPCH within a DTFDI is used to output the generated LNKEDT stream. Thus, according to the devices available in a specific installation, SYSPCH can be assigned to either a tape, a disk or a card punch device.

VSE/Online Test Executive Program (VSE/OLTEP) SCP 1.1.0 is a tool to service online, and provide preventive maintainance on the hardware. VSE/OLTEP enables the CE/FE to configurate and establish the installation-specific Configuration Data Sets and to run OLTEPS at any customer installation.

VSE/OLTEP is included in VSE System IPO/E 1.4.0. Customers not using the VSE System IPO/E 1.4.0 can order VSE/Online Test Executive Program (VSE/OLTEP) SCP separately. In any case, it is always shipped together with VSE/Advanced Functions 1.3.5.

The VSE/OLTEP Test system is composed of the Online Test Executive Program (OLTEP) and the Online Tests (OLTs). In order to execute the OLTs under OLTEP, a Configuration Data Set (CDS) has to be constructed, which combines installation-specific information such as device addresses, device types and codes, symbolic names, etc., with the required OLTs.

The enhancements in this new version of the OLTEP program is the OLTEP generation program (OLTGEN) which removes the mandatory use of a CKD disk device for the configuration run. It enables the FEs/CEs to configurate and establish the installation specific CDS at any customer installation with the following minimum I/O device equipment:

Operator console, a tape drive and a printer.

One more I/O device is required when OLTEP is used in a VSE system without VSE/POWER. This I/O device can either be:

A second tape drive or a CKD or FBA disk or a card punch device.

CUSTOMER RESPONSIBILITIES

If the customer wants to execute the OLTEPs, he must have VSE/AF 1.3.5 installed and have the proper Configuration Data Sets generated by Field Engineering or Customer Engineering.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

VSE/Online Test Executive Program (VSE/OLTEP) SCP is designed to execute on the same IBM processors S/370, 4300 and 303X processors which are supported by VSE/AF 1.3.5 or VSE/SYSTEM PACKAGE 1.1.0.

SOFTWARE REQUIREMENTS

VSE/Advanced Functions 1.3.5 or VSE/SYSTEM PACKAGE 1.1.0 is a prerequisite to execute VSE/OLTEP. VSE/OLTEP is always included in VSE SIPO/E 1.4.0 installations through VSE/SYSTEM PACKAGE 1.1.0, and it is separately orderable from PID. It is always shipped together with VSE/Advanced Functions 1.3.5.

The OLTEP Generation Program (OLTGEN) can run in any partition with a size of at least 24K and a partition-GETVIS-area-size of 96K.

If the operating system is SSX, the LNKEDT step of cataloging the CDS/OLTs into the library will execute automatically, because the punch device is spooled to the reader by default.

Using a VSE system without POWER, the user has to take care to correctly assign SYSPCH prior to start of OLTGEN, and to correctly assign SYSIN accordingly, in order to catalog the CDS.

MIGRATION/COEXISTENCE

Up to VSE Release 3.1, OLTEP was a VSE/AF component. Starting with VSE/AF Release 3.5, OLTEP is a Class 2 SCP and the first independent OLTEP release.

The extension of OLTEP, due to the OLTEP Generation Program (OLTGEN), does not have any impact or changes necessary to the already existing parts.

DOCUMENTATION

(available from Mechanicsburg)

VSE/Online Test Executive Program Installation and Operation (GC33-6156) ... *VSE/Online Test Executive Program Diagnosis Reference* (SY33-9105).

RPQs ACCEPTED: No

3694 INDEPENDENT RELEASE 1.0
5658-001

PURPOSE

The 3694 Independent Release 1.0 (IR1.0) is a System Control Program. This independently released System Control Programming contains the CPGEN macros which extend the 3600 Finance Communications System's CPGEN support to the 3694 Document Processing System. These macro definitions allow description of the 3694 devices in the same manner as 3600 devices are described, and allow description of unique 3694 macro parameters.

HIGHLIGHTS

- 3694 Controller Configuration.
  - Define the Document Processor model.
  - Define the Document Processor transport.
  - Define the Master List Printer/Keyboard.
  - Define the Distribution List Printers.
- Chain groups used for document/data processing.
  - Define document image storage area.
  - Define queued storage area.
- Document codeline definition table for MICR data analysis.
  - Describe document image fields to be processed.
  - Describe/edit special symbols and their functions.

CUSTOMER RESPONSIBILITIES

The customer is responsible for installing the 3694 IR1.0, and if required, implementing appropriate security procedures through programming and physical control methods.

SOFTWARE REQUIREMENTS

HOST PROGRAMMING REQUIREMENTS: The 3694 Independent Release 1.0 requires the same operating systems prerequisites and host programs which are required by the 3600 Independent Release 6.0 (IR/6.0).

In addition the following are also required:

3600 Independent Release 6.0:

5747-BR1 - DOS/VS (version 6)
5744-CA3 - OS/VS (version 5)

DOCUMENTATION
(available from Mechanicsburg)

3694 Independent Release 1.0 Specification (GC31-0013) ... *IBM 3600 FCS Host Services User's Guide* (GC22-9056) ... *IBM SNA Primary User's Guide.*

RPQs ACCEPTED: No.

SCP PROGRAMMING SERVICES

Independently released System Control Programming: Currently supported independently released SCP, used with Class 1 or Class 2 on an IBM processor, will be serviced as Class 1 or Class 2 SCP.

DISK ORIENTED SYSTEM/3 MODEL 10/MODEL 8 5702-SC1

PURPOSE

IBM System/3 Disk System Management Programs: The disk system management programs are designed to generate and maintain a disk resident system which facilitates the compilation, generation, and execution of programs. The disk resident system must reside on an IBM 5444 Disk Storage Drive.

HIGHLIGHTS

The management programs consist of a supervisor and a scheduler which provide the user with the advantages of:

- Reduced card handling.
- Automatic job-to-job transition.
- Selective retrieval of programs stored in object libraries on disk.
- Selective retrieval of programs and procedures stored in source libraries on disk.
- Functional ability of expanded core storage (program overlay).
- Support of ROLL IN/ROLL OUT capability - The ability to roll out a program during its execution, bring in an inquiry program to be executed and upon its completion, restart the original program. To use ROLL IN/ROLL OUT, a 5471 Printer-Keyboard is required.
- Support of Dual Programming feature - Through the use of operations control and dual program loading features, an expanded version of the supervisor controls program initiation, execution, and termination asynchronously in each of two partitions. Neither the printer, 3881, MFCU and/or 1442 can be used by both program levels. Disk Data files may be shared, but only one program level may write to a shared file. The 5471 Printer-Keyboard may be used by both program levels for either object program input/output or operations control information. Three programs which will not run in the Dual Program mode but can run in a dedicated mode with the Dual Program Supervisor are the Basic Assembler program (5702-AS1), the Utility program for the 1255 Magnetic Character Reader (5707-UT2), and the Library Maintenance program (5702-SC1).
- Data Management and I/O support for the control of Input/Output Services.
- Execution of programs from cataloged procedures - Operation Control Language Procedures can be cataloged in the Source Program Library and called by the scheduler at job execution time.

DESCRIPTION

Library Maintenance Program: Allows the user to produce, maintain, and service the system disk and the source and object program libraries. The libraries may reside on any 5444 Disk Storage Drive. The system residence must be on either the fixed or removable disk of Drive 1. The principle functions of the program are to add or delete the source programs, procedures, and object programs in the user's program libraries, to allocate or re-allocate disk space to the libraries, to display library contents, and to copy any or all of a library from one disk to another.

Disk Utility Programs: These programs are provided to allow the user to prepare and maintain his disks. They are:

- Disk Initialization - Performs surface analysis on the user's disk and formats the disk according to disk system management requirements.
- Alternate Track Assignment - Allows the user to assign an alternate track in place of a defective one and print the data content of the area in error.
- Alternate Track Rebuild - Permits the user to correct data on the assigned alternate track.
- File and Volume Display - Permits the user to display the entire contents of the volume table of contents on any disk or individually by file name.
- File Delete - Is one means for deleting temporary data files from a disk and the only means for the user to delete permanent data files from a disk.

Copy/Dump Program: This program supports both file-to-file copies (COPY) and volume-to-volume copies (DUMP).

The file copy routines provide the user with an easy to use method of creating a file backup on another disk, diskette, cards, tape, or printer. Additionally, it provides an easy method of moving files from one location to another, with both file limit modification and reorganization. The program supports one input and one output per execution. Disk input can be a sequential, indexed, or direct file.

A sequential file can be copied to an indexed file, and tape, card, and diskette files are supported for input and output. When copying a file, the printer may be specified in addition to other output. Records may be deleted from a file by specifying a deletion code and position within each record; these deleted records may be printed.

The volume copy function of the Copy/Dump Program copies an entire disk volume to another disk volume for backup.

The Copy/Dump Program allows for intermediate mountings of the output disk so that files and entire disk volumes may be copied on a one drive system. Intermediate mounting is only permitted for the 5444 Disk Storage Drive.

1255 and 1419 Data Management: SCP subroutines are supplied to perform device control and data management services for the 1255 and 1419 Magnetic Character Readers. The 1255 subroutine (SUBR08) and the 1419 subroutine (SUBR09) are used with a user-written RPG II or Assembler program, and are functionally equivalent to the mdls 12 and 15 1255 (SUBR08) and 1419 (SUBR09) SCP support.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Minimum System Requirement: The Disk System Control Programming operates on an IBM System/3 mdl 10 which includes as a minimum an IBM 5410 Processing Unit mdl A13 (12K bytes), an IBM 5424 MFCU mdl A1 or an IBM 1442 Card Read Punch mdl 6, an IBM 5203 Printer or 1403 Printer and an IBM 5444 Disk Storage Drive mdl 1.

A minimum System/3 mdl 8 includes an IBM 5408 Processing Unit mdl A14 (16K bytes), an IBM 5203 Printer, an IBM 5444 Disk Storage Drive mdl A1, and either an IBM 3741 Data Station directly attached or an IBM 5471 Printer-Keyboard.

Additional main storage and disk capacity will be utilized if available. The following configurations require at least 16K bytes of main storage:

- Dual Programming and IBM 5445/5448 Disk Storage Drive
- Dual Programming and IBM 3410/3411 Magnetic Tape Subsystem

Certain other configurations may require a minimum system of more than 12K: (1) when the supervisor requirement is greater than 4K (see "Supervisor Sizes" at the end of the SCP writeup for mdl 10); or (2) when program products require it.

SOFTWARE REQUIREMENTS (None)

DOCUMENTATION
(available from Mechanicsburg)

System/3 Model 8 Introduction (GC21-5114) ... *System/3 Disk System Introduction* (GC21-7510) ... *System/3 Models 8 and 10 System Control Programming Reference Manual* (GC21-7512) ... *System/3 Model 8 Operator's Guide* (GC21-7634) ... *System/3 Model 10 Disk System Operator's Guide* (GC21-7508) ... *System/3 Models 8 and 10 Halt Guide* (GC21-7540) ... *System/3 Models 4, 6, 8, 10, and 12 System Generation Reference Manual* (GC21-5126) ... *System/3 Disk Concepts and Planning Guide,* (GC21-7571) ... *System/3 Models 12 and 15 1255 and 1419 Magnetic Character Readers Reference and Program Logic Manual* (GC21-5132) ... *System/3 Bibliography* (GC20-8080).

REMOTE JOB ENTRY STATION (Feature #6004-#6006)

PURPOSE

The Disk version of the RJE Program provides the user with the same functional capabilities as the card version. Additional function to support the 5444 Disk Storage Drive as an RJE I/O device is included. The RJE support requires a logging device. Therefore, if the dual program feature is to be used and the non-RJE program requires use of the printer, an IBM 5471 printer-keyboard is required. This program is loaded and executed under control of Disk System Management programs.

PERFORMANCE

The RJE Work Station support requires a partition size of approximately 5,120 bytes of main storage.

DOCUMENTATION
(available from Mechanicsburg)

Remote Job Entry Workstation Reference Manual (GC21-7531) ... *System/3 Bibliography* (GC20-8080).

MACROS FEATURE (Feature #6020-#6021)

PURPOSE

This feature is applicable to System/3 model 8. The feature makes available to the user data management and input/output support for the control of input/output services through assembler languages. The I/O services are available to users of assembler languages through the system generation link processor (macro processor) in conjunction with the disk system input/output service macros. The keyword macro statements coded by the user are expanded by the macro process or using the macro prototype definitions. The expanded code is in a form that can be processed by an assembler. The macro processor is included in the user's system at the user's option.

Disk-oriented System/3 mdl 10/mdl 8 (cont'd)

The Macros feature (#6020-#6021) is made available to support the user who has requirements that are unsupported in other programming support and it is recommended that it be used only in that environment.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Minimum System Requirements: Same as for 5702-SC1.

SOFTWARE REQUIREMENTS: 5702-SC1.

DOCUMENTATION
(available from Mechanicsburg)

System/3 Models 8, 10, and 12 System Control Programming Macros Reference Manual (GC21-7562) ... *System/3 Bibliography* (GC20-8080).

5445 DISK STORAGE DRIVE FEATURE (Feature #6022-#6023)

PURPOSE

This feature is not applicable to System/3 model 8. The IBM 5445 Disk Storage Drive Feature provides support of the 5445 Disk Storage Drive as an input/output and data storage device. The 5445 Disk Storage Drive is not supported for either system or library residence.

DESCRIPTION

In addition to the disk system management functions, the following facilities are provided:

Disk Utility Programs: The Disk Utility Programs which are provided for the disk user to prepare and maintain his 5445 disks will include:

- Disk Initialization Utility
- Alternate Track Assignment Utility
- Alternate Track Rebuild
- Volume and File Display
- File Delete

Copy/Dump Program: This program provides the user with an easy-to-use method of copying a file or a complete disk backup on another disk. All features of the Copy/Dump Program for the 5445 are provided for the 5444 user with the exception that no intermediate mountings of the output pack on the 5445 are allowed for the COPYPACK function.

5445 Data Interchange Utility Program: This program is used prior to taking a 2316 Disk Pack from System/3 to System/360 or System/370 for processing, or prior to using the disk pack on System/3 after returning from System/360 or System/370. To use a 2316 Disk Pack in an interchange environment, it must have been initialized on System/3, and the interchange files must have been allocated on System/3. System/360 or System/370 OS or DOS may read, update, or in OS only, OUTPUT to these files, but may not create or extend them since OS and DOS do not create or update the System/3 Volume Table of Contents (VTOC).

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Minimum System Requirement: In addition to the requirement of 5702-SC1, this feature requires an IBM 5445 Disk Storage Drive.

SOFTWARE REQUIREMENTS: 5702-SC1.

MAGNETIC TAPE SUPPORT FEATURE (Feature #6024-#6025)

PURPOSE

This feature is applicable to System/3 model 8. The Disk SCP Magnetic Tape Support feature provides support for magnetic tape as a data storage device on System/3 model 10. The features provided are:

- Fixed and variable length records
- Blocked and unblocked records
- Physical block size from 18 bytes to 32K bytes
- Multi-volume files
- Support for unlabelled or labelled (ANSI or IBM Standard labels) tapes
- ASCII and EBCDIC data support
- Tape Error Statistics

DESCRIPTION

Tape Initialization Program: Allows the magnetic tape users to create and delete standard tape volume labels, check for unexpired labels and to display existing volume and data file labels.

Tape Error Summary Program: Prints tape error statistics that have been accumulated during processing.

Dump/Restore Program: Provides capability for model 10 tape-disk configurations to obtain backup of disk packs. It copies an entire 5444 or 5445 or 5448 disk volume to tape and restores a disk from a tape previously created by this program. Some of the options supported are 7- or 9-track, EBCDIC only, one pack per tape reel but multiple reel files are supported, and requires only minimum main storage.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Minimum System Requirements: In addition to the requirements of 5702-SC1, this feature requires the IBM 3410/3411 Magnetic Tape Subsystem. All available features of these tape drives are supported by this feature.

SOFTWARE REQUIREMENTS: 5702-SC1.

DOCUMENTATION
(available from Mechanicsburg)

IBM System/3 Magnetic Tape Program Planning Manual (GC21-5040) ... *System/3 Bibliography* (GC20-8080).

OVERLAY LINKAGE EDITOR AND CHECKPOINT/RESTART FEATURE (Feature #6026-6027)

PURPOSE

This feature is applicable to System/3 model 8. The Overlay Linkage Editor facility creates loadable programs from multiple relocatable modules. Output from the Overlay Linkage Editor may be cataloged in the Object Library and/or punched into cards. Overlay structures may be created automatically or as designated by the user from relocatable program modules.

The Checkpoint facility provides the user with the ability to write checkpoint records when using problem programs that have Checkpoint/Restart capabilities. Restart provides the facility to resume the execution of programs from the last checkpoint rather than from the beginning, if processing is terminated via a machine failure or an operator-initiated immediate cancel.

This feature is a prerequisite for the Basic Assembler program (5702-AS1), Subset ANS COBOL (5702-CB1), and Disk FORTRAN (5702-F01).

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Minimum System Requirements: Same as for 5702-SC1.

SOFTWARE REQUIREMENTS: 5702-SC1.

DOCUMENTATION
(available from Mechanicsburg)

Overlay Linkage Editor Reference Manual (GC21-7561) ... *System/3 Bibliography* (GC20-8080).

BSCA MULTILINE/MULTIPOINT FEATURE (Feature #6030 or #6031)

PURPOSE

The BSCA Multiline/Multipoint feature provides communications support when used in conjunction with the System/3 Macros feature #6020 or #6021. Configurations supported are point-to-point nonswitched, point-to-point switched and multipoint leased line with the System/3 as a multi-dropped terminal or control station. Also provided is the capability to operate two BSCA lines simultaneously on one System/3. The two BSCAs may have different configurations.

For a list of supported BSC devices and of the communications modes in which each device is supported (e.g., point-to-point, multipoint, etc.), see page M5408 or M5410. Support for the 3270 terminals via the Local Display Adapter (model 8 only) is also included.

Program counters will be maintained on the disk file to accumulate performance information per BSC line. Counters will be logged to the file at close time. A utility program will be provided to display the counters.

The BSCA IOS routines depend on the model 10 Disk System Control Programming (5702-SC1) for systems functions. Additional storage is required in the supervisor for support of BSCA. RPG II Telecommunications feature (5702-RG1) must not be used in the same RPG II generated program to which subroutines using the Multiline/Multipoint feature are linked.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Minimum System Requirements: The BSCA Multiline/Multipoint Feature requires for source program compilation the same minimum system as the IBM Disk model 10 System Control Programming (5702-SC1). For execution of an object program on the IBM 5410 Processing Unit using BSCA (#2074 or #2084) to control communication with multidropped terminals on a multipoint line, a minimum of 16K bytes of storage and a log device are required.

Disk-oriented System/3 mdl 10/mdl 8 (cont'd)

For execution of an object program on an IBM 5408 Processing Unit using either the ICA (#4645 with #6202 or #4801 or #4802) or the BSCA (#2074) to control communications with multi-dropped terminals on a multipoint line, a minimum model 8 System and a log device are required.

SOFTWARE REQUIREMENTS

5702-SC1, 5702-SC1 feature #6020/#6021; 5702-AS1 or its equivalent.

DOCUMENTATION
(available from Mechanicsburg)

System/3 Multiline/Multipoint Binary Synchronous Communications Reference Manual (GC21-7573) ... *System/3 Bibliography* (GC20-8080)

COMMUNICATIONS CONTROL PROGRAM (Feature #6033)

PURPOSE

The Communications Control Program (CCP) feature provides control program services needed for telecommunications systems. The services are:

- High Level language (RPG II, COBOL, FORTRAN) access to MLTA, BSCA (including the Integrated Communications Adapter) and Local Display Adapter attached terminals.
- Program Fetch as a result of terminal operator request.
- Resource Management to reduce contention between programs accessing the same files, provide access to terminals and manage storage available for application programs.
- Concurrent program execution allowing multiple application programs within the available storage.
- Terminal Monitoring to accept data and terminal commands.
- Display Format Facility (DFF) which permits the support of 3270 systems with a minimum of coding in high level languages.

DESCRIPTION

Terminals and Features Supported: The following terminals may be used with the Communications Control Program:

- **Through the Multiple Line Terminal Adapter (MLTA) (model 10 only):**
  - 1050 Data Communication System
    Multipoint switched
    Multipoint nonswitched
  - 2740 Communication Terminal model 1
    Basic
    Checking
    Dial
    Dial with checking
    Dial with transmit control
    Dial with transmit control and checking
    Station control
    Station control with checking
  - 2740 Communication Terminal model 2
    Station control
    Station control with checking
    Station control with buffer receive
    Station control with buffer receive and checking
  - 2741 Communication Terminal
    Basic
    Switched
  - 3767 Communications Terminal
    Treated as a 2740 Communication Terminal (model 1 or 2) or as a 2741 Communication Terminal
  - Communicating Magnetic Card SELECTRIC® Typewriter (appears identical to a 2741)
    Point-to-point switched
  - System/7 (appears identical to a 2740 model 1)
    Checking
    Dial with checking
    Station control with checking
  - 5100 Portable Computer
    (appears identical to a 2741)
- **With the Binary Synchronous Communications Adapter (BSCA):**
  - 3270 Information Display System
    Point-to-point nonswitched
    Multipoint nonswitched
    Point-to-point switched (3275 only)
  - 3735 Programmable Terminal
    Switched
    Multipoint nonswitched
  - 3741 Data Station model 2 and 3741 Programmable Workstation model 4
    Point-to-point (switched and nonswitched)
    Multipoint tributary
  - 5110 Computer (as a data mode CPU)
    Point-to-point (switched and nonswitched)
    Multipoint tributary
  - 5231 model 2 (appears as a 3741-2 or 4)
    Point-to-point (switched and nonswitched)
    Multipoint tributary
  - 5280 Distributed Data System
    Point-to-point (switched and nonswitched)
    Multipoint tributary
  - Series/1
    Switched
    Nonswitched point-to-point
  - System/3
    Switched
    Nonswitched point-to-point
    Multipoint control station
    Multipoint tributary
  - System/7
    Switched
    Nonswitched point-to-point
    Multipoint (System/3 is control station)
  - System/32
    Switched
    Nonswitched point-to-point
    Multipoint (System/3 is tributary)
  - System/34
    Switched
    Nonswitched point-to-point
    Multipoint (System/3 is control station)
  - System/360, System/370
    Switched
    Nonswitched point-to-point
    Multipoint (System/3 is tributary)
- **With the Local Display Adapter (model 8 only)**
  - 3270 terminals only
    3277 Display Station (model 1 or 2)
    3284 Printers (model 1 or 2)
    3286 Printers (model 1 or 2)
    3288 Printer (model 2)

In addition to controlling terminals, the System/3 can operate as a tributary terminal (BSCA only) to a host System/360 or System/370. In this configuration, the System/3 is a sub-host controlling terminals, and is itself a terminal to another system.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Hardware Requirements - IBM Model 10: The following is the minimum hardware necessary for a communications-based information system using the Communications Control Program:

- IBM 5410 model A15 Processing Unit (24,576 bytes of main storage)
- IBM 5410 model A16 Processing Unit (32,768 bytes of main storage) if DFF is used to support an IBM 3270 Information Display System
- One IBM 5444 model 2 Disk Storage Drive
- IBM 5471 Printer-Keyboard
- IBM 5424 Multi-Function Card Unit (MFCU) or IBM 1442 Card Read/Punch (required during CCP generation, but not required for operation)
- IBM 5203 or 1403 Printer (required during CCP generation, but not required for operation)
- Multiple Line Terminal Adapter RPQ (RPQs S40028 through S40033) or one Binary Synchronous Communications Adapter
- At least one communications terminal of a type listed under "Terminals and Features Supported".

With the above configuration, no more than one application program may be executing at a time. The minimum main storage size in which concurrent execution of more than one program is supported is 32,768

Disk-oriented System/3 mdl 10/mdl 8 (cont'd)

bytes (IBM 5410 model A16) and is 49,152 bytes (IBM 5410 model A17) if DFF is used to support the IBM 3270 Information Display System.

Additional Hardware Supported - Model 10: The following additional hardware facilities are supported by the Communications Control Program:

- Up to 49,152 bytes of main storage (65,536 bytes by RPQ)
- IBM 5444 Disk Storage Drive model 2, 3, A01, A02, A03
- One or two IBM 5445 Disk Storage Drives (for data files only)
- IBM 5448 Disk Storage Drive model A1 (for data files only)
- Both 5424 MFCU and 1442 Card Read/Punch (by RPQ)
- One directly attached 3741 Data Station/Programmable Workstation
- Two Binary Synchronous Communications Adapters and one Multiple-Line Terminal Adapter with up to eight lines
- Dual Program Feature (see Note)

Note: The Communications Control Program does not require the dual program feature to allow more than one program to be executed at a time. Use of the dual program feature is not prohibited during execution of the CCP, but any program executed in the other program level does not run under control of the CCP. The Communications Control Program cannot be run in both program levels concurrently.

Hardware Requirements - Model 8: The following is the minimum hardware necessary for a Model 8 CCP System.

- IBM 5408 model A16 (32K bytes)
- One IBM 5444 model A2 Disk Storage System
- IBM 5203 Printer (required during CCP generation, but not required for operation)
- IBM 5471 Printer-Keyboard
- Integrated Communications Adapter (#4645) and local/remote interface, or the Local Display Adapter
- At least one Communications terminal of a type listed under Terminals and Features Supported
- The minimum main storage size in which concurrent execution of more than one program is supported is 48K (IBM 5408 model A17) if DFF is used to support the IBM 3270 Information Display System.

Additional Hardware Supported - Model 8: The following additional facilities are supported by CCP on a model 8.

- Up to 64K bytes of Main Storage
- IBM 5444 Disk Storage Drive model A3 or a second model A2
- IBM 5448 Disk Storage Drive model A1 (for data files only)
- One Binary Synchronous Communications Adapter
- Dual Program feature (see note above under "Additional Hardware Supported - Model 10")
- One directly-attached IBM 3741 Data Station/Programmable Workstation

Note: MLTA and MLTA IOCS are not available for the model 8. Local Display Adapter is not available for the model 10.

SOFTWARE REQUIREMENTS

Execution of the Communications Control Program requires Disk System Management, including all modules for the appropriate IOCS.

A generation of the Communications Control Program requires Disk System Management, including:

- Macros feature (5702-SC1, feature #6020/#6021)
- Overlay Linkage Editor and Checkpoint/Restart feature (5702-SC1, feature #6026/#6027)
- The appropriate communications IOCS (program number 5799-WAU for MLTA and/or program number 5702-SC1, feature #6030/#6031, for the BSCA ML/MP feature)

No special programming systems requirements exist for the running of system assignments.

For the preparation of application programs, an applicable compiler or assembler is required.

Program Prerequisites: 5702-SC1; 5702-SC1, feature #6020/#6021; 5702-SC1, feature #6026/#6027; 5799-WAU and/or 5702-SC1, feature #6030/#6031.

DOCUMENTATION
(available from Mechanicsburg)

System/3 CCP Programmer's Reference Manual (GC21-7579) ... *System/3 CCP Terminal Operator's Guide* (GC21-7580) ... *System/3 Models 8, 10, and 12 CCP System Operator's Guide* (GC21-7581) ... *System/3 Models 8, 10, and 12 CCP System Reference,* (GC21-7588) ... *System/3 CCP Messages Manual* GC21-5170 ... *System/3 CCP General Information Manual* (GC21-7578) ... *System/3 Bibliography* (GC21-8080).

3881 OPTICAL MARK READER FEATURE (Feature #6034-#6035)

PURPOSE

Provides the user with system subroutines for data management and input control of the optical mark reader attached to System/3 model 10. These subroutines are used with the SPECIAL exit function of RPG II or with the Basic Assembler program.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Minimum System Requirements: In addition to the requirements for 5702-SC1, this feature requires an IBM 3881 Optical Mark Reader. This feature operates on a minimum IBM System/3 model 10 Disk System with 12K bytes of main storage and with the SIOC Feature. This feature is applicable to IBM System/3 model 8 and requires a minimum system and the SIOC.

SOFTWARE REQUIREMENTS

5702-SC1; 5702-RG1 or 5702-AS1.

DOCUMENTATION
(available from Mechanicsburg)

3881 Optical Mark Reader Model 1 Program Reference and Logic Manual (GC21-5103) ... *System/3 Bibliography* (GC20-8080).

MULTI-LEAVING REMOTE JOB ENTRY WORKSTATION PROGRAM (Feature #6036-#6037)

PURPOSE

Permits a System/3 Disk System equipped with a Binary Synchronous Communications Adapter with EBCDIC (Text Transparency optional) to function as a Multi-leaving Remote Job Entry Workstation communicating over a point-to-point (switched or nonswitched) line to a System/370 operating under control of one of the following:

- HASP II (Version 3.1 or 4.0)
- ASP (Version 2.6 or 3.0)
- Remote Entry Services (RES) of JES under OS/VS1 Release 2
- Multi-leaving Workstation facilities of JES2/JES3 under OS/VS2 Release 2
- RSCS of VM/370

DESCRIPTION

Any job which can be entered into the central system from locally-attached similarly-functioned I/O devices can be entered from the System/3 MRJE Workstation. Workstation input may be read from any of the devices indicated below. Operator messages and output data sets may be directed to any of the devices shown below. Output may be returned to the submitting workstation or routed to another workstation or directed to local central system I/O devices. (Not all of these devices are available for System/3-8.)

	Input*	Messages	Output
5424 MFCU	x		x
1442 Card Read Punch	x		x
3741 directly attached	x		x
5471 Printer-Keyboard	x	x	
5203 Printer		x	x
1403 Printer		x	x
5444 Disk Storage Drive	x		x
5445 Disk Storage	x		x
5448 Disk Storage	x		x
3410/3411 Mag. Tape	x		x

* Input may be from a combination of these devices.

All disk files created by the workstation program are standard System/3 consecutive files and may be accessed by any of the following programs: MRJE/WS

Print Utility, SCP Copy/Dump program, or user-written RPG II, COBOL, FORTRAN, or Assembler programs.

When using the Workstation program, the following restrictions apply:

- Column binary is not supported.
- Reading and punching OS object decks requires the BSCA Text Transparency feature and a 1442 Card Read Punch.
- For unit record devices (including the 3741), input record lengths can be 80 or 96 bytes; however, only the first 80 bytes of the input records will be processed by the Workstation program.
- Files processed with the READFILE command can contain records of other than 80 or 96 bytes. The file will be transmitted to the host central as 80-byte records. (Regrouping the data is the user's responsibility.)
- Print records which exceed the line length of the System/3 Printer will be truncated.

Disk-oriented System/3 mdl 10/mdl 8 (cont'd)

- The Workstation program requires a logging device.

The 5471 Printer-Keyboard is required only if MRJE is an 'Inquiry' program.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Minimum System Requirements: In addition to the minimum requirements for 5702-SC1, this feature requires the BSCA (#2074) with EBCDIC. A minimum program level size of 8.5K bytes is required for execution.

This feature is applicable to System/3 model 8 and can use the Integrated Communications Adapter (#4645 & #6202) or BSCA (#2074).

SOFTWARE REQUIREMENTS

5702-SC1; 5702-SC1 feature #6026/#6027.

DOCUMENTATION
(available from Mechanicsburg)

MRJE/WS Support Reference Manual (GC21-7621) ... *System/3 Bibliography* (GC20-8080).

IBM 3741 DATA STATION FEATURE (Feature #6066-#6067)

PURPOSE

This feature provides support for the 3741 Data Station (model 1 or 2) and Programmable Workstation (model 3 or 4) as an input/output device directly attached to a System/3. For 3741 models 3 and 4, System/3 does not support the Application Control Language (ACL).

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS>

Minimum System Requirements: In addition to the requirement for 5702-SC1, this feature requires a 3741 directly attached.

SOFTWARE REQUIREMENTS: 5702-SC1.

DOCUMENTATION
(available from Mechanicsburg)

System/3 3741 Reference Manual (GC21-5113) ... *System/3 Bibliography* (GC20-8080).

5448 DISK STORAGE DRIVE FEATURE (Feature #6074)

PURPOSE

The 5448 Disk Storage Drive on the System/3 models 8 and 10 is supported by the SCP as an input/output and data storage device. The 5448 is not supported for either system or library residence. Except for split cylinder files and offline multivolume files, the 5448 file organizations (sequential, indexed, and direct) and access methods are the same as for the 5445.

Note: To access files on the 5448, the RPG II compiler requires the Disk RPG II 5445 Disk Storage Drive feature (5702-RG1, feature #6014), and the Disk Sort program requires the Disk Sort 5445 Disk Storage feature (5702-SM1, feature #6010).

Disk Utility Programs: The Disk Utility Programs used to prepare and maintain the 5448 include the following:

	DESCRIPTION
$INIT	Disk Initialization
$ALT	Alternate Track Assignment
$BUILD	Alternate Track Rebuild
$LABEL	File and Volume Label Display
$DELET	File Delete Program
$COPY	Copy/Dump Program
$DCOPY	Dump/Restore Program
$PCOPY	Disk Pack Backup/Restore Program

Copy/Dump Programs: By using unit codes D1 and D2, $COPY can be used to copy files or entire volumes. For the COPYFILE function, all the features for 5444 and 5445 copies are supported. Using the COPYPACK function, a volume can be copied as follows: 5444 to 5444 ... 5448 to 5448.

Dump/Restore Program: By using the unit code D1 or D2, the $DCOPY program can be used to dump a 5448 volume to magnetic tape for backup, or to restore a 5448 volume from a tape created by this program. It is not possible to restore a 5444 or 5445 tape to a 5448, nor is it possible to restore a 5448 tape to a 5444 or 5445.

Disk Pack Backup/Restore Program: The Disk Pack Backup/Restore Program ($PCOPY) provides a method to backup a 5448 volume (D1 or D2) onto two 5440 disk cartridges and to restore a 5448 volume from two 5440 disk cartridges created by this program. When the 5440 disk cartridges contain a 5448 backup, they are protected and may only be accessed by $PCOPY or $INIT (using TYPE-CLEAR).

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Minimum System Requirements: An IBM System/3 model 8 includes: IBM 5408 Processing Unit model A14 (16K bytes) ... IBM 5444 Disk Storage Drive model A2 ... IBM 5448 Disk Storage Drive model A1 ... plus other devices required for a model 8.

A System/3 model 10 includes: IBM 5410 Processing Unit model A13 (12K bytes) ... IBM 5444 Disk Storage Drive model 2 or A2 ... IBM 5448 Disk Storage Drive model A1 ... plus other devices required for a model 10 Disk System.

SOFTWARE REQUIREMENTS: 5702-SC1.

DOCUMENTATION
(available from Mechanicsburg)

IBM System/3 5448 Disk Storage Drive Program Reference Manual (GC21-5168) ... *System/3 Bibliography* (GC20-8080).

SYSTEM/3 MODEL 10 DISK AND MODEL 8 SYSTEM SUPERVISOR SIZES

The size of the Disk System supervisor varies depending on the configuration. The following table can be used for planning purposes.

Disk Drives**	Dedicated System w/ console	Dedicated System w/o console	Dual Programming w/ console	Dual Programming w/o console
R1,F1	3.00K	2.75K	3.75K*	3.50K*
R1,F1,R2	3.25K	3.00K	4.00K	4.00K
R1,F1,R2,F2	3.25K	3.00K	4.00K	4.00K
R1,F1,D1 (5445)	3.75K	3.75K*	4.75K	4.50K
R1,F1,D1,D2 (5445)	4.00K	3.75K	4.75K	4.50K
R1,F1,D1,D2 (5448)	4.75K	4.50K	5.50K	5.50K
R1,F1,R2,F2,D1 (5445)	4.00K	3.75K	4.75K	4.50K
R1,F1,R2,F2,D1,D2 (5445)	4.00K	3.75K	4.75K	4.50K
R1,F1,R2,F2,D1,D2 (5448)	4.75K	4.50K	5.75K	5.50K

**Notes:

K = 1024 bytes (decimal)
R1,F1 = 5444 drive 1
R2/R2,F2 = 5444 drive 2
D1 = 5445 drive 1
D1,D2 = 5448/5445 drive 1 and drive2

For **tape support**, add 0.50K to the above numbers.

For configurations indicated with an asterisk, add 0.75K instead of 0.50K.

For **BSCA support** (with LINE 1 and LINE 2, ICA, local display adapter or ML/MP), add 0.25K to the above numbers. ICA and display adapter are supported on the model 8 only. BSCA support is not required if only running MRJE, since MRJE supplies its own BSCA support.

For **3741 directly attached**, add 0.75K to the above numbers.

Multiple Program Requests: System/3 Program Products and System Control Programming of program type 5702 which are ordered from PIDfor shipment at the same time may be shipped to the user stacked on a 5440 disk cartridge.

MODEL 4 and MODEL 6 BASE SCP 5703-SC1

PURPOSE

These programs perform the system control functions that are basic to a commercially-oriented IBM System/3 model 6 installation, or to an IBM System/3 model 4 installation. They are designed to run on either a model 4 or a model 6, except as noted in the program descriptions.

DESCRIPTION

Disk System Management Programs: The disk system management programs are designed to generate and maintain a disk resident system which facilitates the compilation, generation, and execution of programs.

The management programs consist of a supervisor and a scheduler which provide the user with the advantages of:

- Automatic job-to-job transition.
- Selective retrieval of programs stored in object libraries on disk.
- Selective retrieval of programs and procedures stored in libraries on disk.
- Functional ability of expanded core storage (program overlay).
- Support of ROLL IN/ROLL OUT capability - the ability to roll out a program during its execution, bring in an inquiry program to be executed and upon its completion, restart the original program at point of interruption.
- Data Management and I/O Support for the control of Input/Output Services.
- Execution of programs from cataloged procedures - Operation Control Language Procedures can be cataloged in the Source Program Library and called by the scheduler at job execution time.

Library Maintenance Program: Allows the user to create, maintain, and service the source and object program libraries. The libraries may reside on any drive. The system residence must be on either the fixed or removable disk of Drive 1. The principle functions of the program are to add or delete the source programs, procedures, and object programs in the user's program libraries, to allocate or re-allocate disk space to the libraries, to display library contents, and to copy any or all of the library from one disk to another.

Utility Programs: These programs are provided to allow the user to prepare and maintain his disks.

They are:

- Disk Initialization Utility - Performs surface analysis on the user's disk and formats the disk according to disk system management requirements.
- Alternate Track Assignment Utility - Allows the user to assign an alternate track in place of a defective one and print the data content of the area in error.
- Alternate Track Rebuild - Permits the user to correct data on the assigned alternate track.
- File and Volume Display - Permits the user to display the entire contents of the volume table of contents on any disk or individually by file name.
- File Delete - Is one means for deleting temporary files from a disk and the only means for the user to delete permanent data files from a disk.

Copy/Dump Program: This program supports both file-to-file copies (COPY) and volume-to-volume copies (DUMP).

The file copy routines provide the user with an easy-to-use method of creating a file backup on another disk, diskette, cards, or printer. Additionally, it provides an easy method of moving files from one location to another, with both file limit modification and reorganization. The program supports one input and one output per execution. Disk input can be sequential, indexed, or direct file.

A sequential file can be copied to an indexed file, and card and diskette files are supported for input and output. When copying a file, the printer may be specified in addition to other output. Records may be deleted from a file by specifying a deletion code and position within each record; these deleted records may be printed.

The volume copy function of the Copy/Dump program copies an entire disk volume to another disk volume for backup.

The program allows for intermediate mountings of the output disk so that files and entire volumes may be copied on a one-drive system.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

An IBM System/3 model 4 workstation system includes: IBM 5404 Processing Unit model A18 (64K bytes) ... IBM 5447 Disk Storage and Control ... IBM 5213 Printer ... IBM 3277 Display Station model 1 ... at least one locally attached terminal. (**Note:** The IBM 3277 is supported only by CCP; the Base SCP does not use the 3277.)

A minimum IBM System/3 model 6 configuration includes: IBM 5406 Processing Unit model B2 (8K bytes) ... IBM 5444 Disk Storage Drive ... IBM 5213 Printer or 2222 Printer.

Devices Supported:

Model 4	Model 6	Description
	X	129 Card Recorder model 1, 2 or 3
	X	2222 Printer model 1 or 2
	X	2265 Display Station model 2 (5406-B3 or B4 is required)
	X	5213 Printer model 1, 2 or 3
X		5213 Printer model 3
X		5404 Processing Unit model A18
	X	5406 Processing Unit model B2, B3 or B4
	X	5444 Disk Storage Drive model 1, 2 or 3
X		5447 Disk Storage and Control model A1 or A2
	X	5496 Data Recorder model 1

SOFTWARE REQUIREMENTS: None

DOCUMENTATION
(available from Mechanicsburg)

System/3 Model 4 Introduction (GC21-5146) ... *System/3 Models 4 and 6 Operation Control Language and Disk Utility Programs Reference Manual* (GC21-7516) ... *System/3 Model 4 Operator's Guide* (GC21-5149) .. *System/3 Model 6 Operator's Guide* (GC21-7501) ... *System/3 Models 4 and 6 Halt Guide* (GC21-7541) ... *System/3 Models 4, 6, 8, 10, and 12 System Generation Reference Manual* GC21-5126) ... *System/3 Disk Concepts and Planning Guide* GC21-7571 ... *System/3 Bibliography* (GC20-8080).

OVERLAY LINKAGE EDITOR FEATURE (Feature #6010-#6011)

PURPOSE

The Overlay Linkage Editor facility creates loadable programs from multiple relocatable modules. Output from the Overlay Linkage Editor may be cataloged in the Object Library and/or (model 6 only) punched into cards or written to diskette. Overlay structures may be created automatically or as designated by the user from relocatable program modules.

This feature is a prerequisite for Disk FORTRAN IV (5703-F01), for CCP/Disk Sort program (5703-SM2) and for the DFGR and PFGR functions of CCP (5703-SC1, feature #6033).

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Minimum System Requirements: Same as for 5703-SC1, except that for IBM System/3 model 6, an IBM 5406 Processing Unit model B3 or B4 is required.

SOFTWARE REQUIREMENTS: 5703-SC1.

DOCUMENTATION
(available from Mechanicsburg)

Overlay Linkage Editor Reference Manual (GC21-7561) ... *System/3 Bibliography* (GC20-8080).

MULTI-LEAVING REMOTE JOB ENTRY WORKSTATION PROGRAM Feature #6014-#6015

PURPOSE

Permits a System/3 Model 4 or Model 6 equipped with a Binary Synchronous Communications Adapter with EBCDIC (Text Transparency optional) to function as a MULTI-LEAVING Remote Job Remote Job Entry Workstation communicating over a point-to-point (switched or nonswitched) line to a System/370 operating under control of one of the following:

- HASP II (Version 3.1 or 4.0)
- ASP (Version 2.6 or 3.0)
- Remote Entry Services (RES) of JES under OS/VS1 Release 2
- Multi-leaving Workstation facilities of JES2/JES3 under OS/VS2 Release 2

DESCRIPTION

Any job which can be entered into the central system for locally-attached, similarly-functioned I/O devices can be entered from the System/3 RJE Workstation. Workstation input may be read from any of the devices indicated below. Operator messages and output data sets may be directed to any of the devices shown below. Output may be returned to the submitting workstation or routed to another workstation or directed to local central system I/O devices.

System/3 Mdl 4 and Mdl 6 Base SCP (cont'd)

	Input*	Messages	Output
Console Keyboard	x		
5496 Data Recorder	x		x
129 Card Data Recorder	x		x
3741 directly attached	x		x
5213 Printer		x	x
2222 Printer		x	x
5444 Disk Storage Drive	x		x
5447 Disk Storage & Control	x		x

* Input may be from a combination of these devices.

All disk files created by the workstation program are standard System/3 consecutive files and may be accessed by any of the following programs: MRJE/WS Print Utility, SCP Copy/Dump program, or a user-written RPG II or FORTRAN programs.

When using the MULTI-LEAVING Workstation program, the following restrictions apply: Column binary is not supported; OS object decks cannot be read or punched; only the first 80 bytes of input records will be processed by the Workstation program; input record lengths cannot exceed 96 bytes.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Same as for 5703-SC1, except that for System/3 model 6, an IBM 5406 Processing Unit model B3 or B4 is required. For either IBM System/3 model 4 or System/3 model 6, a BSCA (#2074) with EBCDIC is required.

SOFTWARE REQUIREMENTS

5703-SC1; 5703-SC1 feature #6010/#6011.

DOCUMENTATION
(available from Mechanicsburg)

MRJE/WS Support Reference Manual (GC21-7621) ... *System/3 Bibliography* (GC20-8080).

IBM 3741 DATA STATION FEATURE
Feature #6026-#6027)

PURPOSE

This feature provides support for the IBM 3741 Data Station (model 1 or 2) and Programmable Workstation (model 3 or 4) as an input/output device directly attached to the System/3. For IBM 3741 models 3 and 4, the IBM System/3 does not support the Application Control Language (ACL).

This feature is not supported for System/3 model 4.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Minimum System Requirements: In addition to the requirement for 5703-SC1, this feature requires at least 12K of main storage and a 3741 directly attached.

SOFTWARE REQUIREMENTS: (5703-SC1).

DOCUMENTATION
(available from Mechanicsburg)

System/3 3741 Reference Manual (GC21-5113) ... *System/3 Bibliography* (GC20-8080).

COMMUNICATIONS CONTROL PROGRAM
Feature #6033 (model 4 only)

PURPOSE

The IBM System/3 model 4 Communications Control Program (CCP) provides control program services needed for local or remote communication with workstations.

The services are:

- RPG II access to terminals attached to the CPU and to the Binary Synchronous Communications Adapter (BSCA).
- Program Fetch as a result of terminal operator request.
- Resource Management to reduce contention between programs accessing the same files, provide access to terminals and manage storage available for application programs.
- Concurrent program execution allowing multiple application programs within the available storage.
- Terminal Monitoring to accept data and terminal commands.
- Display Format Facility (DFF) which permits the support of 3270 systems with a minimum of coding in RPG II.

Terminals and Features Supported: The following terminals may be used with the Communications Control Program:

Directly To The CPU

- 3270 terminals only

  3277 Display Station (model 1 or 2)
  3284 Printer (model 1 or 2)
  3286 Printer (model 1 or 2)
  3288 Printer (model 2)

  Note: A maximum of 5 terminals may be attached to the CPU.

With the Binary Synchronous Communications Adapter (BSCA)

- 3270 Information Display System

  Point-to-point nonswitched
  Multipoint nonswitched
  Point-to-point switched (3275 only)

- 3735 Programmable Terminal

  Switched
  Multipoint

- 3741 Data Station model 2 and 3741 Programmable Workstation model 4

  Point-to-point (switched and nonswitched)
  Multipoint tributary

- IBM 5110 Computer System (as a data mode CPU)

  Point-to-point (switched and nonswitched)
  Multipoint tributary

- 5231 model 2 (appears identical to 3741 model 2 or 4)

  Point-to-point (switched or nonswitched)
  Multipoint tributary

- IBM 5280 Distributed Data System

  Point-to-point (switched and nonswitched)
  Multipoint Tributary

- Series/1

  Switched
  Nonswitched point-to-point

- System/3

  Switched
  Nonswitched point-to-point
  Multipoint control station
  Multipoint tributary

- System/7

  Switched
  Nonswitched point-to-point
  Multipoint (System/3 is control station)

- System/32

  Switched
  Nonswitched point-to-point
  Multipoint (System/3 is control station)

- System/34

  Switched
  Nonswitched point-to-point
  Multipoint (System/3 is control station)

- System/360, System/370

  Switched
  Nonswitched point-to-point
  Multipoint (System/3 is tributary)

In addition to controlling terminals, the System/3 can operate as a tributary terminal (BSCA only) to a host System/360 or System/370. In this configuration, the System/3 is a sub-host controlling terminals and is itself a terminal to another system.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Minimum System Requirements: The Communications Control Program requires an IBM System/3 model 4 which includes an IBM 5404 Processing Unit model A18 (64K bytes)... An IBM 5447 Disk Storage and Control... An IBM 5213 model 3 Printer... An IBM 3277 model 1 Display Station (for CCP messages)... and one of the devices listed under "Terminals and Features Supported".

SOFTWARE REQUIREMENTS

Since CCP is pre-generated by IBM, to install CCP the user simply copies one of two versions from the distribution disk cartridge.

System/3 Mdl 4 and Mdl 6 Base SCP (cont'd)

Execution of CCP requires the System Control Programming (5703-SC1).

No special programming systems requirement exists for the running of system assignments. The use of the Display Format Generator routines and the Printer Format Generator routines require the Overlay Linkage Editor (5703-SC1, feature #6011).

For the preparation of application programs, the RPG II Compiler (5703-RG1) is required. For the preparation of sort jobs to be run under control of CCP, the CCP/Disk Sort program (5703-SM2) is required.

SOFTWARE REQUIREMENTS

5703-SC1; 5703-SC1 feature #6011.

COMPATIBILITY

This Communications Control program is upward compatible with with the CCP for the model 8 and 10 (5702-SC1, feature #6033). The interface between the system and the operator is different from that of the model 8 or 10.

DOCUMENTATION

(available from Mechanicsburg)

Model 4 Introduction (GC21-5146) ... *Model 4 CCP Concepts and System Design Guide* (GC21-5148) ... *Model 4 CCP Programmer's Reference Manual* (GC21-5150) ... *Model 4 Operator's Guide* (GC21-5149) ... *Terminal Operator's Guide,* (GC21-7580) ... *CCP Messages Manual* (GC21-5170) ... *System/3 Bibliography* (GC20-8080).

SYSTEM/3 MODEL 15
SYSTEM CONTROL PROGRAMMING
5704-SC1, 5704-SC2

PURPOSE

These programs perform the system's control functions for the installation. They are supplied by IBM with the system at no additional charge.

System Control Programming (SCP) must be ordered from PID prior to Order Confirmation (OC) time.

DESCRIPTION

The SCP consists of Disk System Management, System Control Programs, and System Service Programs. Operation of the system is by means of Operator Control Commands (OCC) and Operation Control Language (OCL) statements. Libraries on disk store object programs, source programs and OCL procedures.

SCP 5704-SC1 is designed to support model 15A, 15B and 15C. Model 15A has 5444 Disk Storage Drives and, optionally, 5445 Disk Storage. Models 15B and 15C have the 3340 Direct Access Storage Facility. SCP 5704-SC2 is designed to support model 15D, which has the 3340 Direct Access Storage Facility and, optionally, the 3344 Direct Access Storage.

For 5704-SC1, the SCP and libraries must reside on a 5444 or 3340. System residence (pack or area from which Initial Program Load occurs and which contains the SCP library) must be on drive 1. The user libraries may reside on either of the 5444 drives or on drive 1 or 2 of a 3340.

On the 3340, programs are stored in special areas on a 3348 data module called 5444 simulation areas. Each 5444 simulation area is large enough to contain data from one 5440 disk cartridge. Two 5444 simulation areas on a data module mounted on 3340 drive 1 can be used by system programming and are referred to as R1 and F1. Two 5444 simulation areas on a data module mounted on drive 2 can be used by system programming and are referred to as R2 and F2. Use of these areas for program residence is the same as an actual 5444 disk storage drive.

For 5704-SC2, the SCP and libraries must reside on a 3340 or 3344. System residence can be on drive 1 (3340) or drive 3 (3344 only). The user libraries may reside on any drive.

On the 3340 or 3344, programs are stored in 5444 simulation areas. However, assignments of these areas can be made by the user.

On the 3344 (model 15D only) each drive contains four main data areas and eight 5444 simulation areas. The main data areas are supported in similar fashion to those on a 3348 data module. A simulation area on drive 1 (3340) or drive 3 (3344 only) is set by IPL as F1 (or R1) by the user and can be used for system programming by the three partitions. Then, from three to nine additional simulation areas can be referred to as R1 (or F1), F2 and R2 by the three partitions. The designation of units (except for IPL unit) as F1, R1, F2 and R2 is accomplished by partition OCL assignment.

Both data files and program libraries can reside on a 5444. Only data files can reside on a 5445; programs can be stored in data files on a 5445, but to use them, they must be cataloged into the 5444 library. On a 3340 or 3344, data files reside in the main data area, and libraries reside in 5444 simulation areas.

System/3 model 15 differs from other System/3 models in these ways:

- Support of different devices and features
- Multiprogramming
- Spooling of a unit record input and/or output
- Different Operator Interface

Disk System Management: The Disk System Management consists of a supervisor, scheduler and data management facilities for operation and support of the system and for execution of user programs. Highlights include:

- Automatic Job-to-Job transition in any partition.
- Selective retrieval of object programs, source programs, and procedures from libraries on disk.
- Execution of programs by using cataloged procedures - OCL procedures can be cataloged in the library and called by the scheduler at execution time.
- Support of ROLLOUT/ROLLIN capability - The ability to roll out a program during its execution, bring in an inquiry program to be executed and upon its completion, restart the original program. ROLLOUT/ROLLIN is supported by RPG II, COBOL, and FORTRAN, and is available to Assembler users; it is not supported for Sorts, Utilities and System Control and Service Programs. (ROLLOUT/ROLLIN is supported in Partition 1 only and is not supported by 5704-SC2.)
- Support of Checkpoint/Restart capability - The ability to write checkpoint records when using problem programs that have Checkpoint/Restart capabilities (such as COBOL). Restart provides the facility to resume the execution of programs from the last checkpoint rather than from the beginning, if processing is terminated via a machine failure or an operator initiated immediate cancel. (Checkpoint/Restart is supported in Partition 1 only and, using 5704-SC2, checkpointed programs must be 48K or less and must not be using file sharing or external buffers.)
- * The Tape Sort program supports Checkpoint/Restart but uses its own routines rather than the system routines.
- CRT/Keyboard simplifies operational control and speeds communications between the operator and the system.
- New halt approach - The need for operator intervention when system errors are encountered is reduced to a minimum through the use of system assigned automatic error defaults. The user has the flexibility of being able to specify the severity level of errors that he wishes his operator to control.
- Reduced system overhead—Improved transient handling, reduced interpartition interlock time and faster operator communication with the CRT should reduce system overhead (i.e., time required for such functions as initiate/terminate, open/close, allocate) as compared with the model 10.

The Interval timer - a standard feature on all 5415 Processing Units - is supported in one of the following levels:

- The time-of-day function is used by the system to time-stamp certain messages in the System History Area, and it can be used in application programs written in RPG II, COBOL, FORTRAN or Assembler.
- Full timer support, in addition to the time-of-day function, allows the user to time intervals.

Multiprogramming

- System/3 model 15 allows the concurrent execution of one user program in each of the two program partitions (5704-SC1) or three program partitions (5704-SC2). Programs share the CPU facilities, thus reducing the time that the system is in an unproductive waiting state.
- The supervisor controls priority for CPU processing, giving one partition priority over the other partition. All programs operate with interrupts enabled - when an interrupt occurs, the supervisor gains control, processes the interrupt, and gives control to the highest priority program that is in a ready state. Control is given up by a high priority program when it encounters a condition that prevents further processing. Control is taken away from a lower priority program at the completion of an event for which the higher priority program is waiting.

Spooling

- Spooling uses either a 5445 or a main data area on a 3340/3344 for intermediate storage of unit record input and output. It allows a single input or output device to serve all partitions.
- Spooling increases throughput by reducing the time the CPU waits for the completion of unit-record I/O operations. With spooling, the unit-record input and output is performed at disk I/O speed. A job's normal punched-card input (including operation control statements) is read from the card reader and stored on disk in an input queue before the start of the job. Similarly, a job's output is stored on disk in an output queue and printed and/or punched at a later time.
- One of the following levels of spooling support may be selected during system generation: Printing only ... printing and punching ... printing and input ... printing, punching and input. The selected level of support may be used in any or all partitions.
- The following devices are supported for spooling input and/or output: MFCU1, MFCU2, MFCM1, MFCM2, 1442, 2501, 1403. The 3741 directly attached is supported by spooling as an input device.

Data Management: Data Management routines provide an interface between the user program and the required data file(s). Data Management services are provided for disk files, tape files, card files, diskette files, printer files, and CRT files. In addition, a device-independent access method is supported.

Disk Data Management: Records may span physical disk boundaries (sectors, tracks, cylinders); the user need not be aware of the physical boundaries when he writes programs to access the data. Record sizes may range from 1 byte to 64K bytes, although a particular program (such as RPG II) may restrict the maximum size. The fixed length records may be blocked or unblocked for processing, and the blocking factor may vary from program to program.

System/3 Model 15 SCP (cont'd)

The following table shows the file organizations and maximum number of files for the 5444, 5445, 3340, and 3344.

File Organizations Supported

	Sequential	Indexed	Direct	Number of Files (Max)
5444 disk	X	X	X	50
5445 disk	X	X	X	50 or 1000
3340 data module				
Main data area	X	X	X	1000
Simulation area	X	--	X	50
3344 disk				
Main data area	X	X	X	1000
Simulation area	X	--	X	50

A file may be large enough to require more than one disk pack. Multivolume sequential or indexed files may be online (all volumes mounted during file allocation) or offline (all volumes not necessarily mounted during file allocation); multi-volume direct files must be online. Offline multi-volume files are not allowed on the IPL drive. Multi-volume files are not supported under CCP, and they cannot be shared.

External buffers (5704-SC2 only): An optional data management technique allows disk I/O buffers to be outside of the object program but within the partition.

File Sharing: Both SCPs allow the sharing of a disk file between partitions. However, 5704-SC2 has very few restrictions compared with 5704-SC1.

Standard System/3 disk labels are mandatory for all disk files. Data and labels are stored as 8-bit bytes on disk.

Tape Data Management: The 3410/3411 Magnetic Tape Subsystem is supported by data management. Magnetic tape is used as a data storage medium only; libraries and programs are not supported on tape, but they can be contained in data files on tape. The following features are supported by the SCP tape data management routines:

- Fixed or variable length records
- Blocked or unblocked records
- Physical block size from 18 bytes to 32K bytes
- Multi-volume files
- Multi-file volumes
- Unlabeled or labeled (ANSI or IBM Standard labels) tapes. (Non-standard labels on input will be bypassed.)
- Recording format: EBCDIC or ASCII
- Tape Error Statistics

Tape support is functionally equivalent to tape support on other System/3 models, except that only the model 15 supports multi-file tape volumes.

Card I/O Data Management

5424 MFCU - read 96 columns ... punch 96 columns ... print ... feed ... deferred punch or print ... stacker select ... single or double buffering ... combined file processing ... 64 EBCDIC characters for read, punch, or print ... same as model 10 support.

2560 MFCM - read 1-80 columns ... punch 1-80 columns ... print 1-64 positions on 1-6 lines ... feed ... stacker select ... single or double buffering ... deferred punch or print ... combined file processing ... 256 EBCDIC characters for read or punch; 64 characters for print.

1442 - read 80 columns ... punch 1-80 columns ... read card image (column binary) ... feed ... stacker select ... single or double buffering ... combined file processing ... 256 EBCDIC characters for read or punch (except for card image mode) ... same as model 10 support.

2501 - read 1-80 columns ... read card image (column binary) ... single or double buffering ... 256 EBCDIC characters (except for card image mode).

Diskette Data Management

3741 Directly attached - read 1-128 characters ... write 1-128 characters ... single or double buffering ... 256 EBCDIC characters ... support similar to card I/O support ... for 3741 models 3 and 4, does not support the Application Control Language (ACL).

Printer Data Management

1403 - print 132-character line ... skip to line number before or after print ... space 0, 1, 2, or 3 before or after print ... page overflow detection ... Universal Character Set ... same as model 10 support.

3284 - print 120-, 126-, or 132-character line ... skip to line number before or after print ... space 0, 1, 2, or 3 before print ... space 1, 2, or 3 after print ... page overflow detection ... 64 EBCDIC character set.

CRT/Keyboard Data Management: The 3277-1 Display Station is supported for output records, and in conjunction with the 78-key Operator Console Keyboard, for input and update records. The top 7 lines (each 40 characters) of the CRT screen are used, to a maximum area of 279 positions (the last position of this area is reserved for system use). Data can be displayed using any of the 64 EBCDIC characters allowed by the 3277. The program function keys 1-9 can be individually allocated by user programs.

Device Independent Data Management: A sequential file that uses Device Independent Data Management can be assigned at program execution time to one of the following devices: 1403, 3284, 5424, 2560, 1442, 2501, 3741 directly attached, 5444, 5445, 3340, 3344 or 3410/3411.

The following functions are supported: Double buffering, MFCU card printing, fixed length record processing, multi-volume tape file processing, and support of EBCDIC formats.

The following functions are not supported: stacker selection, forms control, record updating, record addition, combined file processing, multi-volume disk file processing, variable-length record processing, deferred opening of tape files, and support of ASCII formats.

Communications Management: Five communications interfaces are provided: RPG II Telecommunications (BSCA) support, RPG II 3270 Display Control Feature, BSCA Multiline/Multipoint (ML/MP) support, Multiple Line Terminal Adapter (MLTA) IOCS, and the Communications Control Program. The Terminal Support Chart shows the terminals supported by each interface. Refer to System/3 model 15 RPG pages for information on RPG II support. The MLTA IOCS is provided as a PSHRPQ and the Communications Control Program is an SCP feature.

BSCA Multiline/Multipoint Support: Configurations supported are point-to-point nonswitched, point-to-point switched and multipoint leased line with the System/3 as a multi-dropped terminal or a control station. Also provided is the capability to operate two BSCA lines simultaneously on one System/3. The two BSCAs may have different configurations. For a list of BSC devices and of the communications modes in which each device is supported (e.g., point-to-point, multipoint, etc.), see M5415 page. Support for 3270 terminals via the Display Adapter (#4601) is also included.

Program counters are maintained on disk to accumulate performance information per BSC line. Counters are logged at CLOSE time. A utility program allows the counters to be displayed.

RPG II Telecommunications Specifications must not be used in the same RPG II program to which subroutines using Multiline/Multipoint support are linked.

For compilation, ML/MP requires the SCP, including the macros, and requires an Assembler.

Other I/O Data Management: Two different SCP subroutines (SUBR07 and SUBR08) are supplied to perform device control and data management services for the 1255 Magnetic Character Reader. Each subroutine is used with a user-written RPG II or Assembler program.

An SCP subroutine (SUBR09) is supplied to perform device control and data management services for the 1419 Magnetic Character Reader. The subroutine is used with a user-written RPG II or Assembler program.

An SCP subroutine is supplied to perform device control and data management services for the 3881 Optical Mark Reader. The subroutine is used with a user-written RPG II or Assembler program and is functionally equivalent to the model 10 3881 feature.

System/3 Model 15 SCP (cont'd)

TERMINAL SUPPORT CHART FOR SYSTEM/3 MODEL 15

Terminals Operating with S/3-15	Type Comm (1)	Programming Support				Communication Code (2) EBCDIC		ASCII			Communication Network (3)			
		RPGII	MLMP	MLTA	CCP	Nor	Tran	Nor	Tran	PTTC	Point-to-Point Sw	Point-to-Point Nonsw	Multi-Point Trib	Ctrl Stat
1050	SS	-	-	X	X	-	-	-	-	X	X	X	-	X
2740 mdl 1	SS	-	-	X	X	-	-	-	-	X	X	X	-	X
2740 mdl 2	SS	-	-	X	X	-	-	-	-	X	-	X	-	X
2741	SS	-	-	X	X	-	-	-	-	X	X	X	-	-
3767 (as 274X)	SS	-	-	X	X	-	-	-	-	X	X	X	-	X
5100/5110 (as a 2741)	SS	-	-	X	X	-	-	-	-	X	X	X	-	-
CMCST	SS	-	-	X	X	-	-	-	-	X	X	-	-	-
S/7 ACC	SS	-	-	X	X	-	-	-	-	X	X	X	-	X
5100 (Note 7)	SS	-	-	X	X	-	-	-	-	X	X	X	-	-
S/360 & 370	BSC	X	X	-	X	X	X	X	-	-	X	X	X	-
S/360 mdl 20	BSC	X	X	-	X	X	X	X	-	-	X	X	-	-
1130 (Note 5)	BSC	X	-	-	-	X	X	-	-	-	X	X	-	-
2780	BSC	X	X	-	-	X	X	X	-	-	X	X	-	-
2770	BSC	X	X	-	-	X	X	X	-	-	X	X	-	-
S/7	BSC	X	X	-	X	X	X	X	-	-	X	X	-	X(4)
2972 mdls 8,11	BSC	-	X	-	-	X	-	-	-	-	-	-	-	X
3735	BSC	-	X	-	X	X	-	X	-	-	X	-	-	X
S/3	BSC	X	X	-	X	X	X	X	-	-	X	X	X	X(4)
3270	BSC	-	X	-	X	X	-	X	-	-	X(6)	-	-	X
3600 (Note 5)	BSC	-	X	-	X	X	X	-	-	-	-	-	-	X
3741 mdls 2, 4	BSC	X	X	-	X	X	X	-	-	-	X	X	-	X(4)
Series/1	BSC	X	X	-	X	X	X	X	-	-	X	X	-	-
S/32 & S/34	BSC	X	X	-	X	X	X	X	-	-	X	X	-	X(4)
5280 (as a 3741)	BSC	X	X	-	X	X	X	X	-	-	X	X	-	X(4)
5110	BSC	X	X	-	X	X	X	-	-	-	X	X	-	X(4)
5231 mdl 2 (as a 3741	BSC	X	X	-	X	X	-	-	-	-	X	X	-	X(4)
6670 (as a 2770)	BSC	X	X	-	-	X	X	X	-	-	X	X	-	X

Legend:

X = Supported
\- = Not Supported

Notes:

1. Type Comm - Type of Communication

   SS = Start/Stop
   BSC = Binary Synchronous Communication

2. Communication Code (as supported by System/3 model 15)

   Nor = Normal
   Tran = Transparency
   PTTC = Paper Tape Transmission Code

3. Communication Network

   Point-to-Point Switched (Sw)
   Point-to-Point Nonswitched (Nonsw)
   Multipoint, System/3 as a tributary station (Trib)
   Multipoint, System/3 as a control station (Ctrl Stat)

4. Not supported by RPG II.

5. Requires no-charge RPQ.

6. 3275 only.

7. The 5100 is supported by CCP as a 2741.

System Control and Service Programs: These programs allow the user to prepare and service his disks, and to perform basic functions necessary for the operation of the system. They are:

Library Maintenance Program: Allows the user to produce and service the source and object program libraries. The principal functions of the program are as follows:

- Add (or delete) source programs, procedures and object programs to (or from) the user's program libraries.
- Allocate or re-allocate disk space to the libraries or to the system history area.
- Display library contents.
- Copy any or all of a library from one disk to another.
- Copy a module into a library from a disk file.
- Copy a module from a library to a disk file.
- Modify entries in the source library.

Libraries may reside on either a 5444 or in a 5444 simulation area on a 3340/3344. Control statements may be entered from the system input device: MFCU, MFCM, 1442, 2501, 3741 directly attached, or 3277 keyboard. Library entries may be "punched" on the system punch device: MFCU, MFCM, 1442, or 3741 directly attached. Printed output may be on either the 1403 or 3284 Printer.

With 5704-SC2, the library entry retrieval subroutine (SUBR15) may be incorporated into a user-written RPG II or Assembler program in order to retrieve entries from any disk library (object, routine, source, procedure).

Copy/Dump Program: Used in the system generation process to provide the user with a system tailored for his installation. The program supports both file-to-file copies (COPY) and volume-to-volume copies (DUMP).

The file copy routines provide the user with an easy to use method of creating a file backup on another disk, tape, or printer. Additionally, it provides an easy method of moving files from one location to another, with both file limit modifications and reorganization. The program supports one input and one output per execution. Disk input can be a sequential, indexed, or direct file.

A sequential file can be copied to an indexed file, and tape, card and diskette files are supported for input and output. When copying a file, the printer may be specified in addition to other output. Records may be deleted from files by specifying a deletion code and position within each record. These deleted records may be printed. Using 5704-SC2, a direct file may be created from a sequential or direct file.

The volume copy allows the user to copy an entire volume to another volume for backup. The following combinations are supported:

5704-SC1: 5444 to 5444 ... 5445 to 5445 ... 3340 to 3340.

5704-SC2: 3340 to 3340 ... 3344 to 3344 ... 3340 to 3344 ... 3344 to 3340.

For the 3340 and 3344, either a main data area or simulation area can be copied. A simulation area can be copied only to another simulation area; a main data area can be copied only to another main data area.

Dump/Restore Program: Copies a disk volume to magnetic tape and restores a disk volume from a tape previously created by this program. For 5444 or 5444 simulation area, backup can be on diskettes.

Dump: 5444 to tape or diskettes ... 5445 to tape ... 3340/3344 main data area to tape ... 5444 simulation area to tape or diskettes.

Restore: 5444 on tape or diskettes to 5444 or 5444 simulation area ... 5445 on tape to 5445 ... 3340/3344 main data area on tape to 3340/3344 main data area ... 5444 simulation area on tape or diskettes to 5444 or 5444 simulation area.

System/3 Model 15 SCP (cont'd)

A tape created by this program can be used only by this program to restore the disk data at some future time, and cannot be accessed as a typical data file.

Other Disk Programs: The following programs are used for all disk units unless otherwise indicated.

Disk Initialization Program - Performs surface analysis on the user's disk and formats the disk according to disk system management requirements. (Not used for 5444 simulation areas.)

Alternate Track Assignment - Allows the user to assign an alternate track in place of a defective one and print the data content of the area in error.

Alternate Track Rebuild - Permits the user to correct data on the assigned alternate track.

File and Volume Label Display - Permits the user to display the entire Volume Table of Contents (VTOC) of a disk, or the information pertaining to a single file.

File Delete - is one means for deleting temporary data files from a disk and the only means for the user to delete permanent data files from a disk.

The following programs are used only for the disks indicated:

System History Area Display (5445, 3340 or 3344) - Permits the user to display or copy the contents of the system history area.

1000-File VTOC Conversion (5445, 3340 or 3344) - Permits the user to convert a 50-file VTOC on a 5445 to a 1000-file VTOC. For any disk with a 1000-file VTOC, this program can be used to compress the entries in the VTOC. For the 5704-SC2 user, only the compress function is supported.

Simulation Area Program (3340 or 3344) - This program is used to service the 5444 simulation areas on a 3340 or 3344. Copy, clear, rename, and display functions are provided.

Reassign Alternate Track (3340)—Permits the user to reassign the location of the alternate tracks on a data module so it can be used on a System/360 or System/370. The module is physically interchangeable, but the data is not.

Recover Index (3340 or 3344) - Permits the user to recover the index of an indexed file following abnormal program termination.

File Compress (3340 or 3344) - Permits the user to rearrange files to make one contiguous space out of the unused space between files. Using 5704-SC2, all of the files in a main data area may be copies to tape and be restored individually to disk.

Spool File Copy Program (5704-SC2 only) - Provides the user with access to the spool queues from a program partition—either a batch partition or a CCP partition. With this program, the user can: (1) copy the $SPOOL file to disk or tape; (2) copy jobs into the reader queue from a file or terminal; (3) copy print steps to a file; (4) copy punch steps to a file; and (5) copy spool queue status displays to a file or terminal.

5445 Data Interchange Utility (5445) (5704-SC1 only) - This program is used prior to taking a 2316 Disk Pack from System/3 to System/360 or System/370 for processing, or prior to using the disk pack on System/3 after returning from System/360 or System/370. To use a 2316 Disk Pack in an interchange environment, it must have been initialized on System/3 and the interchange files must have been allocated on System/3. System/360 or System/370 OS or DOS may read, update, or in OS only, OUTPUT to these files, but may not create or extend them since OS and DOS do not create or update the System/3 Volume Table of Contents (VTOC).

Other Tape Programs (3410/3411):

Tape Initialization Program - Allows the users of magnetic tape to create and delete standard tape volume labels, check for unexpired files and to display existing volume and data file labels.

Tape Error Summary Program - Prints magnetic tape error statistics that have been accumulated during processing.

Overlay Linkage Editor: The Overlay Linkage Editor creates loadable programs from multiple relocatable modules. Output from the Overlay Linkage Editor may be cataloged in the object library and/or punched into cards or written on a diskette. Overlay structures may be created automatically or as designated by the user from relocatable program modules. The Overlay Linkage Editor is used by the RPG II, COBOL, and FORTRAN Compilers, by the Basic Assembler Program, by the CCP/Disk Sort Program and by the System Generation procedures.

System Generation: When a user installs a system, he performs a "System Generation" (SYSGEN) to create a supervisor and data management support for his particular configuration, and to include the program products he has ordered. During system generation, the source library, object library, and system history area are established. The characteristics of the required spooling support are also defined.

Macros: Macros provide data management and input/output support for the control of input/output services through assembler languages. The I/O services are available to users of assembler languages through the macro processor in conjunction with the disk system input/output service macros. The keyword macro statements coded by the user are expanded by the macro processor using the macro prototype definitions. The expanded code is in a form that can be processed by an assembler.

Macros provide system services, general I/O support, unit record device support, disk device support, tape device support, and CRT/Keyboard support.

MRJE/WS: System/3 model 15 MULTI-LEAVING Remote Job Entry Workstation (MRJE/WS) Program permits a model 15 equipped with a BSCA with EBCDIC (Text Transparency optional) to function as a MULTI-LEAVING Remote Job Entry Work Station communicating over a point-to-point (switched or nonswitched) line to a 370.

This program, included with the base SCP 5704-SC2 (model 15D), is functionally identical to the MRJE/WS feature for System/3 models 15A, 15B, and 15C (see 5704-SC1 feature #6001/#6002 in the SCP section). In addition, the 3344 Direct Access Storage is supported for input and output.

Concurrent CE Diagnostics: CE diagnostics for selected devices and functions are distributed with SCP and generated as a user system. These diagnostic functions can be executed under SCP control in one partition while another program (such as CCP) is being executed in another partition.

SCP Main Storage Requirements: (These figures are provided for planning purposes only and are subject to change.)

Supervisor Requirements: The base supervisor supports multiprogramming and certain I/O devices. The size of the resident supervisor support depends on the options selected during system generation:

	5704-SC1 (Rel. 6)	5704-SC2 (Rel. 2)
Base Supervisor	17.45K	21.07K*
Options:		
3340 Support	0.94	N/A
3410/3411 Support	1.16	1.16
3741 Support	0.50	0.50
3284 Support	0.50	0.50
5424 MFCU Support	N/A	0.65
2560 MFCM Support	N/A	0.69
1442 Support	N/A	0.25
2501 Support	N/A	0.21
I/O Storage Protection	0.49	0.49
Unit Record Restart	0.34	0.25**
Memory Resident Overlays	0.50	0.50
Second 1403 Printer	N/A	2.02
BSCA/DA/LCA/MLTA/SIOC	1.41	--
Add for SIOC	0.40	--
BSCA/DA/LCA/MLTA/BSCC		
96K to 256 CPU	--	1.17
384K or 512K CPU	--	1.27
Add for BSCA/DA/LCA	--	0.16
Add for MLTA	--	0.09
Add for SIOC	--	0.41
Add for BSCC	--	0.35
Interval Timer		
Either Time of day only	0.45	0.47
Or full timer support	2.00	2.00
Spooling		
Minimum	7.11	7.11
Maximum	17.21	20.79
CCP		
Minimum	1.69	1.91
Maximum	6.32	6.65

* Includes 3340/3344 support.
**Includes extended restart as well as unit record restart.

The size of the supervisor is a multiple of 2K bytes.

The requirement for spooling depends on the devices and partitions selected for spooling. For example, with 7.11K spooling support, printer output from one partition can be spooled.

In addition to the resident supervisor requirements listed above, a resident file share common area is also required for SCP 5704-SC2. This area is a minimum of 2.00K and resides at the upper limit of main storage.

Depending on what modules are included during system generation, the size of the actual supervisor may not agree exactly with the size computed from the published tables.

Refer to *System Generation Reference Manual,* GC21-7616, for additional information regarding storage requirements.

System/3 Model 15 SCP (cont'd)

System Control and Service Programs

	Minimum Partition
Library Maintenance Program	10 K+
Copy/Dump Program	10 K+
Dump/Restore Program	8 K+
Disk Programs	
Disk Initialization	8 K+
Alternate Track Assignment	8 K+
Alternate Track Rebuild	8 K
File and Volume Label Display	
50-File VTOC	8 K
1000-File VTOC	10 K-18K
File Delete	8 K
System History Area Display	8 K
1000-File VTOC Conversion	8 K
3340 Simulation Area Program	10 K
Reassign Alternate Track	8 K
Recover Index	10 K
File Compress	10 K
Spool File Copy	10 K
5445 Data Interchange Utility	8 K
Tape Programs	
Tape Initialization	8 K
Tape Error Summary	8 K
Overlay Linkage Editor	10 K+
System Generation	30 K
Macro Processor	12 K+

+ These programs use additional storage, if available.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Minimum System Requirements: For an IBM System/3 model 15 with 5415 A Processing Unit:

- 5415 Processing Unit model A17 (48K bytes)
- 3277 Display Station model 1 with feature #4632 (Operator Console Keyboard)
- 5444 Disk Storage Drive
- 1403 Printer
- One of the following:
  - 5424 MFCU
  - 2560 MFCM
  - 1442 Card Read Punch

For a System/3 model 15 with 5415B or 5415C Processing Unit:

- 5415 Processing Unit model B17 (48K bytes) or model C21 (160K bytes)
- 3277 Display Station model 1 with #4632 (Operator Console Keyboard)
- 3340 Direct Access Storage Facility
- 1403 Printer
- One of the following:
  - 5424 MFCU
  - 2560 MFCM
  - 1442 Card Read Punch
  - 3741 Data Station, directly attached
  - 3741 Programmable Workstation, directly attached

For a System/3 model 15 with 5415D Processing Unit:

- 5415 Processing Unit model D19 (96K bytes)
- 3277 Display Station model 1 with #4632 (Operator Console Keyboard)
- 3340 Direct Access Storage Facility
- 1403 Printer
- One of the following:
  - 5424 MFCU
  - 2560 MFCM
  - 1442 Card Read Punch
  - 3741 Data Station, directly attached
  - 3741 Programmable Workstation, directly attached

The following devices are supported by SCP 5704-SC1 and its data management facilities:

- 5444 Disk Storage Drive models A2 and A3
- 5445 Disk Storage models 1, 2, and 3 (maximum 4)
- 3340 Direct Access Storage Facility models A2, B1 and B2 (3340 is mutually exclusive with 5444 and 5445)
- 3410/3411 Magnetic Tape Subsystem models 1, 2 and 3 (maximum 4 tape units)
- 1403 Printer models 2, 5 and N1
- 3277 Display Station model 1 (console)
- 5424 MFCU model A1 or A2
- 2560 MFCM model A1 or A2
- 1442 Card Read Punch model 6 or 7
- 2501 Card Reader model A1 or A2
- 3284 Printer model 1 (console)
- 1255 Magnetic Character Reader models 1, 2 and 3
- 1419 Magnetic Character Reader model 1
- 3881 Optical Mark Reader model 1
- 3741 Data Station models 1 and 2 (directly attached)
- 3741 Programmable Workstation models 3 and 4 (directly attached)

SCP 5704-SC2 and its data management facilities support the above devices with the following exceptions/additions:

- 5444 Disk Storage Drives are not supported.
- 5445 Disk Storage is not supported.
- 3344 Direct Access Storage model B2 is supported.

SOFTWARE REQUIREMENTS (None)

DOCUMENTATION
(available from Mechanicsburg)

Model 15 Introduction (GC21-5094) ... *SCP Reference Manual* (GC21-5077 for 5704-SC1) and (GC21-5162 for 5704-SC2) ... *Operator's Guide* (GC21-5075) ... *Messages* (GC21-5076) ... *System Generation* (GC21-7616) ... *3340 Reference Manual* (GC21-5111) ... *3741 Reference Manual,* GC21-5113 ... *User's Guide to Spooling,* GC21-7632 ... *Disk Concepts and Planning* (GC21-7571) ... *System/3 Bibliography* (GC20-8080).

SYSTEM/3 MODEL 15 MULTI-LEAVING REMOTE JOB ENTRY WORKSTATION PROGRAM 5704-SC1 FEATURE #6001-#6002

PURPOSE

5704-SC1 feature #6001-#6002 is used with SCP 5704-SC1, and uses 5444, 5445 or 3340 disks.

Permits an IBM System/3 model 15 equipped with a Binary Synchronous Communications Adapter with EBCDIC (Text Transparency optional) to function as a MULTI-LEAVING Remote Job Entry Work Station communicating over a point-to-point (switched or non-switched) line to a System/370 operating under control of one of the following:

- HASP II (Version 3.1 or 4.0)
- ASP (Version 2.6 or 3.1)
- Remote Entry Services (RES) of JES under OS/VS1
- MULTI-LEAVING Work Station facilities of JES2/JES3 under OS/VS2
- VM/370 Remote Spooling Communications Subsystem (RSCS)

Any job which can be entered into the central system from locally-attached, similarly-functioned I/O devices can be entered from the System/3 model 15 workstation.

Workstation input may be read from any of the devices indicated below. Operator messages and output data sets may be directed to any of the devices shown below. Output may be returned to the submitting work station or routed to another work station or directed to local central system I/O devices.

	Input*	Messages	Output
5424 MFCU	X		X
2560 MFCM	X		X
1442 Card Read Punch**	X		X
2501 Card Reader	X		
3741 directly attached**	X		X
1403 Printer		X	X
3284 Printer		X	
5444 Disk Storage Drive	X		X
5445 Disk Storage	X		X
3340 Direct Access Storage Facility	X		X
3410/3411 Magnetic Tape	X		X
3277 Display Station	X	X	

* Input may be from a combination of these devices.

** Cannot be used for both input and output simultaneously.

All disk files created by the work station program are standard System/3 consecutive files and may be accessed by any of the following programs: MRJE/WS Print Utility, SCP Copy/Dump Program, or user-written RPG II, COBOL, FORTRAN or Assembler programs.

When using the Workstation program, the following restrictions apply:

- Column binary is not supported.
- Reading and punching of OS object decks requires the BSCA Text Transparency Feature and either a 2560 MFCM or 1442 Card Read Punch; OS object decks can be read from the 2501 Card Reader.
- For unit record devices (including the 3741), input record length can be 80 or 96 bytes; however, only the first 80 bytes of the input records will be processed by the workstation program.

System/3 Model 15 SCP (cont'd)

- Files processed with the READFILE command can contain records of other than 80 or 96 bytes. The file will be transmitted to the host central as 80-byte records. (Regrouping the data is the user's responsibility.)
- Print records which exceed the line length of the System/3 printer will be truncated.

COMPATIBILITY

The model 15 MRJE/WS Program is functionally compatible with the MRJE/WS programs for model 6, 8, 10 or 12. Differences exist only in MRJE/WS messages, MRJE/WS commands and the MRJE/WS program generation, which are designed to be easier to use on the model 15.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Minimum System Requirements: In addition to the minimum requirements for SCP, this feature requires a Binary Synchronous Communications Adapter (#2074) with EBCDIC. A minimum partition size of 16K bytes is required for execution.

DOCUMENTATION
(available from Mechanicsburg)

Model 15 MRJE/WS Reference Manual (GC21-5115) ... *System/3 Bibliography* (GC20-8080).

SYSTEM/3 MODEL 15 COMMUNICATIONS CONTROL PROGRAM 5704-SC1, FEATURE #6033-#6070/#6071 5704-SC2, FEATURE #6011/#6012

PURPOSE

The Communications Control Program provides control program services needed for telecommunications systems.

5704-SC1 feature #6033 is resident on a 5444 Disk Storage Drive; 5704-SC1 feature 6070/6071 is resident on a 5444 simulation area on a 3340 Direct Access Storage Facility. Each feature requires the services of the supervisor and other SCP facilities of 5704-SC1.

5704-SC2 feature #6011/#6012 is resident on a 5444 simulation area on a 3340 Direct Access Storage Facility or 3344 Direct Access Storage, and it requires the services of the supervisor and other SCP facilities of 5704-SC2.

The services included in CCP are:

- High-Level language (COBOL, FORTRAN and RPG II) access to asynchronous start-stop) (MLTA) and binary synchronous (BSCA, BSCC, DA, LCA) terminals.
- Program Fetch as a result of terminal operator requests.
- Resource Management to reduce contention between programs accessing the same files, provide access to terminals and manage storage available for application programs.
- Concurrent program execution allowing multiple application programs within the available storage.
- Terminal Monitoring to accept data and terminal commands.
- Display Format Facility (DFF) which permits the support of 3270 systems with a minimum of coding in high-level languages.

The Communications Control Program is designed to be an integral part of the SCP. CCP will control program execution in one partition of a multi-partition system. The minimum partition size is 16K bytes, exclusive of user program areas; there is no limit on the maximum size of the partition. One to 15 programs can run concurrently under CCP; each program can range in size from 4K to 32K bytes. By contrast, under CCP on the model 4, 8, 10, or 12, 1 to 8 programs can run concurrently, and each program can range in size up to 48K bytes. In the minimum system configuration, more than one program may be executed under control of CCP.

Using model 15A or 15B the minimum system required to support CCP with DFF and multiple tasks is 64K. With a 48K system, DFF cannot be used, and the user may be limited to a single task.

CCP Device Support (System)

	Generation	Execution
5444 Disk Storage Drive mdl A2 or A3	Yes	Yes
5445 Disk Storage mdl 1, 2 or 3 (5704-SC1 only)	Opt	Opt
3340 Direct Access Storage Facility mdl A2, B1 or B2	Yes	Yes
3344 Direct Access Storage mdl B2 (5704-SC2 only)	Yes	Yes
3410/3411 Magnetic Tape Subsystem mdl 1, 2 or 3	No	No
1403 Printer mdl 2, 5 or N1	Req	Opt
3277 Display Station mdl 1 (console)	Req	Req
5424 MFCU mdl A1 or A2	Opt	Opt
2560 MFCM mdl A1 or A2	Opt	Opt
1442 Card Read Punch mdl 6 or 7	Opt	Opt
2501 Card Reader mdl A1 or A2	Opt	Opt
3284 Printer mdl 1 (console)	Opt	No
1255 MCR mdl 1, 2 or 3	No	No
3881 OMR mdl 1	No	No
3741 Data Station mdl 1, 2, 3 or 4 (directly attached)	Opt	Opt

Terminals and Features Supported: Table 1 lists the devices supported by CCP on System/3 model 15. Table 2 lists the devices of the 3270 Information Display System that are supported by model 15 CCP. Both tables show the communications interface used to attach each device.

Listed below are the particular features supported by CCP for each terminal, system, or device.

Asynchronous (start-stop) Terminals (via MLTA)

- 1050 Data Communication System
  - Multipoint switched
  - Multipoint nonswitched
- 2740 Communication Terminal Model 1
  - Basic
  - Checking
  - Dial
  - Dial with checking
  - Dial with transmit control
  - Dial with transmit control and checking
  - Station Control
  - Station Control with checking
- 2740 Communication Terminal Model 2
  - Station Control
  - Station Control with checking
  - Station Control with Buffer Receive
  - Station Control with Buffer Receive and checking
- 2741 Communication Terminal
  - Basic
  - Switched
- 3767 Communication Terminal
  - Treated as a 2740 Communication Terminal (model 1 or 2) or as a 2741 Communication Terminal
- System/7
  - Supported as a 2740-1
  - Checking
  - Dial with checking
  - Station Control with Checking
- Communicating Magnetic Card Selectric® Typewriter
  - Point-to-point switched (appears identical to 2741)

With Binary Synchronous Terminals

- 3270 Information Display System
  - Multipoint nonswitched
  - Point-to-point switched (3275 only)
- 3735 Programmable Terminal
  - Switched
  - Multipoint
- 5110 Computer (as a data mode CPU)
  - Point-to-point (switched or nonswitched)
  - Multipoint tributary
- 5231 model 2 (supported as a 3741 model 2 or 4)
  - Point-to-point switched or nonswitched

System/3 Model 15 SCP (cont'd)

- 3741 Data Station model 2 and 3741 Programmable Workstation model 4
  - Point-to-point (switched and nonswitched)
  - Multipoint tributary
- 5280 Distributed Data System
  - Point-to-point (switched and nonswitched)
  - Multipoint tributary
- Series/1
  - Point-to-point (switched or nonswitched)
- System/3
  - Point-to-point nonswitched or switched
  - Multipoint control station
  - Multipoint tributary
- System/7
  - Point-to-point nonswitched or switched
  - Multipoint tributary
- System/32
  - Point-to-point nonswitched or switched
  - Multipoint tributary
- System/34
  - Point-to-Point nonswitched or switched
  - Multipoint tributary
- System/360 and System/370
  - Point-to-point nonswitched or switched
  - Multipoint with System/3 as tributary

In addition to controlling the terminals previously listed, the System/3 operates as a tributary terminal (BSCA only) to a host System/360 or System/370. In this configuration, the System/3 is a sub-host controlling terminals and is itself a terminal to another system.

Refer to the "Terminal Support Chart" in the System/3 model 15 SCP programming pages for more information.

Terminals equivalent to those listed may also work, but the user must establish the equivalency, and IBM assumes no responsibility for impact of changes made to programming support.

COMPATIBILITY

The System/3 model 15 Communications Control Program is upward compatible with the Communications Control Program for the model 4 (5703-SC1, feature #6033), for the model 8 and 10 (5702-SC1, feature #6033) or for the model 12 (5705-SC1, feature #6070). The interface between the system and the operator is different than that of the model 4, 8, 10 or 12.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Minimum System Requirements: In addition to the minimum system requirements of the SCP, the Communications Control Program requires one of the following: MLTA (RPQ S40028) or BSCA or BSCC or LCA or Display Adapter (#4601). In addition, at least one communications terminal of a type listed under "Terminals and Features Supported" must be included.

SOFTWARE REQUIREMENTS

Generation and execution of the model 15 Communications Control Program requires System/3 model 15 System Control Programming. If the MLTA is to be supported, the MLTA IOCS must be available.

No special programming system requirements exist for the running system assignments. For the preparation of application programs, an applicable compiler or assembler is required.

DOCUMENTATION
(available from Mechanicsburg)

CCP System Reference Manual (GC21-7620) ... *CCP Programmers Reference* (GC21-7579) ... *CCP System Operator's Guide* (GC21-7619) ... *CCP Terminal Operator's Guide* (GC21-7580) ... *CCP General Information* (GC21-7578) ... *CCP System Design Guide* (GC21-5165) ... *System/3 Bibliography* (GC20-8080).

Table 1: Devices Supported by System/3 Model 15 CCP

	System/3-15 Communications Interface				
	Display Adapter	BSCA	BSCC (15D only)	LCA	MLTA
1050 Data Communication System					X
2740 Communication Terminal model 1					X
model 2					X
2741 Communication Terminal					X
3270 Information Display System (see Table 2)	X	X	X	X	
3600 Finance Communication System		X	X	X	
3735 Programmable Buffered Terminal		X	X		
3741 Data Station model 2		X	X		
3741 Programmable Workstation model 4		X	X		
3767 Communication Terminal					X
5100 Portable Computer					X
5230 Data Collection System (5231 Controller model 2)		X	X		
5280 Distributed Data System		X	X		
Communicating Magnetic Card Selectric Typewriter					X
System/3		X	X		
System/7		X	X		X
System/32		X	X		
System/34		X	X		
System/360		X			
System/370		X			

Notes:

MLTA is mutually exclusive with BSCC.
Display Adapter is mutually exclusive with BSCA-2.
LCA is mutually exclusive with BSCA-1.

Table 2: 3270 Devices Supported by System/3 Model 15 CCP

	System/3-15 Communications Interface						
	Display Adapter	BSCA	BSCC (15D only)	LCA	3270 Control Units 3271	3274	3276
3271 Control Unit mdl 1		X	X	X			
mdl 2		X	X	X			
3274 mdl 1C Control Unit		X	X	X			
3275 Display Station (nonsw) mdl 1		X	X	X			
mdl 2		X	X	X			
3275 Display Station (switched)		X					
3276-2 Control Unit		X	X	X			
3277 Display Station mdl 1		X			X	X	
mdl 2		X			X	X	
3278-2 Display Station						X	X
3284 Printer mdl 1	X				X	X	
mdl 2	X				X	X	
3286 Printer mdl 1	X				X	X	
mdl 2	X				X	X	
3287 Printer mdl 1	X				X	X	X
mdl 2	X				X	X	X
3288 Line Printer mdl 2	X				X	X	
3289 Printer mdl 1						X	X
mdl 2						X	X

SYSTEM/3 MODEL 12
SYSTEM CONTROL PROGRAMMING
5705-SC1

PURPOSE

The System/3 model 12 System Control Programming (SCP) consists of Disk System Management and System Utility Programs. These programs perform the system's control functions. They are supplied by IBM with the system at no additional charge.

DESCRIPTION

Program Residence: The SCP and libraries must reside on a 3340 Direct Access Storage Facility (DASF). These programs are stored in special areas on a 3340 data module called 5440 simulation areas. Each simulation area is large enough to contain data from one 5540 Disk Cartridge (2.45 million bytes). Two simulation areas on a data module mounted on 3340 Drive 1 can be used by system programming and are referred to as R1 and F1. Two simulation areas on a data module mounted on Drive 2 can be used by system programming and are referred to as R2 and F2. Use of these areas for program residence is the same as on an actual 5444 Disk Storage Drive.

System residence (pack from which Initial Program Load occurs and which contains the SCP library) must be on Drive 1 of a 3340 DASF. Libraries on the 3340 store object programs, source programs and Operation Control Language (OCL) procedures; the user libraries may reside on either Drive 1 or Drive 2 of a 3340 DASF. Data files reside in the main data area (40.8 million bytes per drive) of a 3340 data module.

Disk System Management: The Disk System Management consists of a supervisor, scheduler and data management facilities for operation and support of the system and for execution of user programs.

HIGHLIGHTS

- Automatic job-to-job transition.
- Selective retrieval of object programs, source programs, and procedures from libraries on disk.
- Execution of programs by using catalogued procedures - OCL procedures can be catalogued in the library and called by the scheduler at execution time.
- Support of ROLLOUT/ROLLIN capability - The ability to roll out a program during its execution, bring in an inquiry program to be executed and upon its completion, restart the original program. ROLLOUT/ROLLIN is supported by RPG II and FORTRAN, and is available to Assembler users; it is not supported for COBOL, Sorts, CCP, Utilities and System Control and Utility Programs. To use ROLLOUT/ROLLIN, a 5471 Printer-Keyboard is required. ROLLOUT/ROLLIN is supported in Program Level 1 only.
- Support of Checkpoint/Restart capability - The ability to write checkpoint records when using problem programs that have Checkpoint/Restart capabilities* (such as COBOL). Restart provides the facility to resume the execution of programs from the last checkpoint rather than from the beginning, if processing is terminated for any reason (except controlled cancel) before the normal end of job. Checkpoint/Restart is supported in Program Level 1 only.

  * The Tape Sort Program supports Checkpoint/Restart but uses its own routines rather than the system routines.
- Support of Dual Program Feature (DPF) - DPF allows two programs to reside in main storage at the same time. An expanded version of the supervisor controls program initiation, execution, and termination asynchronously in each of two main storage areas called program levels. Except for the 3340 DASF and the 5471 Printer-Keyboard, both program levels cannot use the same device at the same time. (Through the use of Print Spooling, the printer can serve both program levels.) Disk data files may be shared, but only one program level may write to a shared file. The 5471 Printer-Keyboard may be used by both program levels for either object program input/output of data, or operation control information. The Library Maintenance Program, the Macro Processor of the SCP (5705-SC1), the Basic Assembler (5705-AS1), and the Auto Report facility of RPG II (5705-RG1) will not run in the Dual Program mode but can run in a dedicated mode with the Dual Program Supervisor.
- Print Spooling - Print Spooling uses the 3340 DASF for intermediate storage of 5203 or 1403 Printer output. It allows a single printer to serve both program levels.

  Print Spooling increases throughput by reducing the time the CPU waits for the completion of printer operations. With spooling, the printer output is performed at disk I/O speed. A job's printed output is stored in a disk area called a print queue, and printed at a later time.

  Print Spooling requires as a prerequisite, either the 5471 Printer-Keyboard, or the Dual Program feature on the 5412 CPU.

Data Management: Data Management routines provide an interface between the user program and the required data file(s). Data Management services are provided for disk, card, printer, diskette, printer-keyboard, and tape files.

Disk Data Management: For data files on the 3340 DASF, the following file organizations are supported: Sequential, Indexed or Direct. Processing of these files can be consecutive, sequential, or random. Split cylinder files are not supported.

Records may span physical disk boundaries (sectors, tracks, cylinders); the user need not be aware of the physical boundaries when writing programs to access the data. The fixed length records may be blocked or unblocked for processing, and the blocking factor may vary from program to program.

The main data area of a 3340 data module may contain a maximum of 1,000 files. A file may be large enough to require more than one disk pack. Multivolume sequential or indexed files may be online or offline. Multivolume direct files must be online. Offline multivolume files are allowed on Drive 2 only.

A simulation area may contain up to 50 files. Indexed and multivolume files are not supported in the simulation areas.

Standard System/3 Disk Labels are mandatory for all disk files. Data and labels are stored as 8-bit bytes on disk.

Tape Data Management: The 3410/3411 Magnetic Tape Subsystem is supported by data management. Magnetic tape is used as a data storage medium only; libraries and programs are not supported on tape, but they can be contained in data files on tape.

The following features are supported by the SCP tape data management routines:

- Fixed- or variable-length records
- Blocked or unblocked records
- Physical block size from 18 bytes to 32K bytes
- Multivolume files
- Unlabeled or labeled (ANSI or IBM Standard labels) tapes (non-standard labels on input will be bypassed)
- Recording format: EBCDIC or ASCII
- Tape Error Statistics

Tape support is functionally equivalent to model 10 tape support.

Card I/O Data Management

5424 MFCU - read 1-96 columns ... punch 1-96 columns ... print ... feed ... deferred punch or print ... stacker select ... single or double buffering ... combined file processing ... 64 EBCDIC characters for read, punch, or print ... same as model 10 support.

1442 - read 80 columns ... punch 1-80 columns ... read card image (column binary) ... feed ... stacker select ... single or double buffering ... combined file processing ... 256 EBCDIC characters for read or punch (except for card image model) ... same as model 10 support.

Printer Data Management

1403 - print 132-character line ... skip to line number before or after print ... space 0, 1, 2 or 3 before or after print ... page overflow detection ... Universal Character Set ... same as model 10 support.

5203 - print 96-, 120- or 132-character line ... skip to line number before or after print ... space 0, 1, 2 or 3 before or after print ... page overflow detection ... Universal Character Set ... Dual Feed Carriage ... same as model 10 support.

Diskette Data Management

3741 directly attached - read 1-128 characters ... write 1-128 characters ... single or double buffering ... 256 EBCDIC characters ... support similar to card I/O support ... for 3741 models 3 and 4, the Application Control Language (ACL), is not supported by data management.

Printer-Keyboard Data Management

5471 Printer-Keyboard - read 1-125 characters ... print 1-125 characters ... 64 EBCDIC character set (except minus zero) ... same as model 10 support.

Communications Management: Four communications interfaces are provided: RPG II Telecommunications (BSCA) support, BSCA Multiline/Multipoint (ML/MP) support, Multiple Line Terminal Adapter (MLTA) IOCS, and the Communications Control Program. The Terminal Support Chart shows the terminals supported by each interface. Refer to System/3 model 12 RPG II in the Program Product section for information on RPG II support. The MLTA IOCS is provided as a PSHRPQ, (5799-WKH), and the Communications Control Program is an SCP feature (see 5705-SC1, feature #6070).

BSCA Multiline/Multipoint Support: Configurations supported are point-to-point nonswitched, point-to-point switched and multipoint leased line with the System/3 as a multi-dropped terminal or a control station. Also provided is the capability to operate two BSCA lines simultaneously on one System/3. The two BSCAs may have different

System/3 Mdl 12 SCP (cont'd)

configurations. For a list of BSC devices and of the communications modes in which each device is supported (e.g., point-to-point, multipoint, etc.), see page M5412. Support for the 3270 terminals via the Local Display Adapter is also included.

Program counters are maintained on disk to accumulate performance information per BSC line. Counters are logged at CLOSE time. A utility program allows the counters to be displayed.

RPG II Telecommunications Specifications must not be used in the same RPG II program to which subroutines using Multiline/Multipoint support are linked.

For compilation, ML/MP requires the SCP (5705-SC1), including the macros, and an assembler.

3881 Data Management: An SCP subroutine is supplied to perform device control and data management services for the 3881 Optical Mark Reader. The subroutine is used with a user-written RPG II or Assembler program and is functionally equivalent to the model 10 3881 feature.

1255 and 1419 Data Management: SCP subroutines are supplied to perform device control and data management services for the 1255 and 1419 Magnetic Character Readers.

The 1255 Subroutine (SUBR08) and the 1419 Subroutine (SUBR09) are used with a user-written RPG II or Assembler program and are functionally equivalent to the model 15 1255 (SUBR08) and 1419 (SUBR09) SCP support.

Concurrent CE Diagnostics: CE diagnostics for selected devices and functions are distributed with the SCP and generated as a user option. These diagnostic functions can be executed under SCP control in program level 1 while another program is being executed in program level 2.

System/3 Mdl 12 SCP (cont'd)

TERMINAL SUPPORT CHART FOR SYSTEM/3 MODEL 15

Terminals Operating with S/3-15	Type Comm (1)	Programming Support				Communication Code (2) EBCDIC		ASCII			Communication Network (3)			
		RPGII	MLMP	MLTA	CCP	Nor	Tran	Nor	Tran	PTTC	Point-to-Point Sw	Point-to-Point Nonsw	Multi-Point Trib	Ctrl Stat
1050	SS	-	-	X	X	-	-	-	-	X	X	X	-	X
2740 mdl 1	SS	-	-	X	X	-	-	-	-	X	X	X	-	X
2740 mdl 2	SS	-	-	X	X	-	-	-	-	X	-	X	-	X
2741	SS	-	-	X	X	-	-	-	-	X	X	X	-	-
3767 (Note 7)	SS	-	-	X	X	-	-	-	-	X	X	X	-	X
5100/5110 (Note 8)	SS	-	-	X	X	-	-	-	-	X	X	X	-	-
CMCST	SS	-	-	X	X	-	-	-	-	X	X	-	-	-
S/7 ACC	SS	-	-	X	X	-	-	-	-	X	X	X	-	X
S/360 & 370	BSC	X	X	-	X	X	X	X	-	-	X	X	X	-
S/360 mdl 20	BSC	X	X	-	X	X	X	X	-	-	X	X	-	-
1130 (Note 5)	BSC	X	-	-	-	X	X	-	-	-	X	X	-	-
2780	BSC	X	X	-	-	X	X	X	-	-	X	X	-	-
2770	BSC	X	X	-	-	X	X	X	-	-	X	X	-	-
S/7	BSC	X	X	-	X	X	X	X	-	-	X	X	-	X(4)
2972 mdls 8,11	BSC	-	X	-	-	X	-	-	-	-	-	-	-	X
3735	BSC	-	X	-	X	X	-	X	-	-	X	-	-	X
S/3 mdls 4,6,8, 10,12,15	BSC	X	X	-	X	X	X	X	-	-	X	X	X	X(4)
3270	BSC	-	X	-	X	X	-	X	-	-	X(6)	-	-	X
3741 mdls 2, 4	BSC	X	X	-	X	X	X	-	-	-	X	X	-	X(4)
Series/1	BSC	X	X	-	X	X	X	X	-	-	X	X	-	-
S/32 & S/34	BSC	X	X	-	X	X	X	X	-	-	X	X	-	X(4)
5110	BSC	X	X	-	X	X	X	-	-	-	X	X	-	X(4)
5280 (as a 3741)	BSC	X	X	-	X	X	X	X	-	-	X	X	-	X(4)
5231 mdl 2 (as a 3741	BSC	X	-	-	X	X	-	-	-	-	X	X	-	X(4)
6670 (as a 2770)	BSC	X	X	-	-	X	X	X	-	-	X	X	-	-

Legend:

X = Supported
\- = Not Supported

Notes:

1. Type Comm - Type of Communication

   SS = Start/Stop
   BSC = Binary Synchronous Communication

2. Communication Code (as supported by System/3-12)

   Nor = Normal
   Tran = Transparency
   PTTC = Paper Tape Transmission Code

3. Communication Network

   Point-to-Point Switched (Sw)
   Point-to-Point Nonswitched (Nonsw)
   Multipoint, System/3 as a tributary station (Trib)
   Multipoint, System/3 as a control station (Ctrl Stat)

4. Not supported by RPG II

5. Requires no-charge RPQ.

6. Only the 3275 (supported by ML/MP)

7. The 3767 is supported as a 2740 model 1 or 2 or a 2741 by CCP.

8. The 5100 is supported as a 2741 by CCP.

System Control and Utility Programs:

These programs allow the user to prepare and maintain modules, and to perform basic functions necessary for the operation of the system. They are:

Library Maintenance Program: Allows the user to produce, maintain, and service the source and object program libraries. The principal functions of the program are as follows:

- Add (or delete) source programs, procedures and object programs to (or from) the user's program libraries.
- Allocate or re-allocate disk space to the libraries.
- Print or punch library contents.
- Copy a part or all of a library from one simulation area to another.
- Copy a module into a library from a diskette (3741 directly attached), card, or disk file (either on the simulation area or main data area).
- Modify entries in the source library.
- Copy a module from a library to a disk file located on the simulation area or main data area.

The Library Maintenance program requires a dedicated system.

Copy/Dump Program: This program supports both file-to-file copies (COPY) and volume-to-volume copies (DUMP).

The 'file copy' routines provide the user with an easy-to-use method of creating a file backup on another disk, diskette, cards, tape, or printer. Additionally, it provides an easy method of moving files from one location to another, with both file limit modifications and reorganization. The program supports one input and one output per execution. Disk input can be a sequential, indexed, or direct file. A sequential file can be copied to an indexed file, and tape, card and diskette files are supported for input and output. When copying a file, the printer may be specified in addition to tape, card, diskette, or disk output. Records may be deleted from files by specifying a deletion code and position within each record. These deleted records may be printed.

The **volume copy** function of the Copy/Dump Program copies the main data area from one data module to another (the Simulation Area Program copies the simulation areas).

Simulation Area Program: This program is used to service the simulation areas of a 3340 data module. Copy, clear, move, rename, and display functions are provided.

Dump/Restore Program: Copies an entire main data area (D1, D2) to magnetic tape and restores a main data area from a tape previously created by this program. Copies an entire simulation area (R1, F1, R2, F2) to magnetic tape or diskettes and restores a simulation area from tape or diskettes previously created by this program.

A tape or diskettes created by this program can be used only by this program to restore the disk data at some future time, and can't be accessed as a typical data file.

Spool Writer Program: This program controls the printing of the spooled output and handles Operator Control Command (OCC) requests. The program operates in a program level (or on a dedicated system) and is executed like any other program. The Spool Writer requires, as a prerequisite, either the 5471 Printer-Keyboard, or the Dual Program Feature on the 5412 CPU.

Execution of the program is controlled by the operator, using OCC commands. On a dedicated system (without the Dual Program Feature), commands are entered via the 5471 Printer-Keyboard. On a DPF system, commands are entered via the system input device or the 5471 Printer-Keyboard (optional on a DPF system).

Other Disk Utilities (3340)

Disk Initialization Program - Formats the data module according to disk system management requirements.

Alternate Track Assignment Program - Allows the user to assign an alternate track in place of a defective one and print the data content of the area in error.

Alternate Track Rebuild Program - Permits the user to correct data on the assigned alternate track.

File and Volume Label Display Program - Permits the user to display the entire Volume Table of Contents (VTOC) of either a simulation

System/3 Mdl 12 SCP (cont'd)

area or main data area or the VTOC information pertaining to a single file.

File Delete Program - Is one means for deleting temporary data files from a simulation area or main data area and the only means for the user to delete permanent data files from either a simulation area or main data area.

Re-assign Alternate Track Program - Permits the user to re-assign the location of the alternate tracks on a data module so it can be used on a System/360 or System/370. The module is physically interchangeable, but the data is not.

Recovery Index Program - Permits the user to recover the index of an indexed file following abnormal program termination.

Tape Utilities (3410/3411)

Tape Initialization Program - Allows the users of magnetic tape to create and delete standard tape volume labels, check for unexpired files and to display existing volume and data file labels.

Tape Error Summary Program - Prints magnetic tape error statisticsthat have been accumulated during processing.

Overlay Linkage Editor: The Overlay Linkage Editor creates loadable programs from multiple relocatable modules. Output from the Overlay Linkage Editor may be cataloged in the object library and/or punched into cards or written on a diskette. Overlay structures may be created automatically or as designated by the user from relocatable program modules. The Overlay Linkage Editor is used by the COBOL and FORTRAN Compilers, by the Basic Assembler Program, and by the System Generation procedures. (RPG II uses its own Linkage Editor.)

System Generation: When a user installs a system, System Generation (SYSGEN) is performed to create a supervisor and data management support for the particular configuration, and to include the program products the user has ordered. During system generation, the source library and object library are established. The characteristics of the required spooling support are also defined.

Macros: Macros provide data management and input/output support for the control of input/output services through an assembler language. The I/O services are available to users of an assembler language through the macro processor in conjunction with the disk system input/output service macros. The keyword macro statements coded by the user are expanded by the macro process or using the macro prototype definitions. The expanded code is in a form that can be processed by an assembler.

Macros provide system services, general I/O support, unit record device support, disk device support, tape device support, and communications support.

SCP Main Storage Requirements

Supervisor Requirements: The minimum main storage requirement for the supervisor on the model B16 (32K), B17 (48K), and B18 (64K), is 7.2K bytes. For the C19 (80K) and C20 (96K), the minimum main storage requirement is 8.8K bytes. The minimum supervisor on both the B-models and the C-models supports the following configuration:

- 3340 DASF model C2
- 5203 or 1403 Printer
- 5424 MFCU or 1442 Card Read Punch

For the Dual Program Feature, on the B-models, add 0.9K bytes; on the C-models, the minimum supervisor supports the Dual Program feature.

For print spooling support on the B-models, add 4.8K bytes for one program level, or 6.1K bytes for two program levels; on the C-models, add 5.1K bytes for one program level, or 6.4K bytes for two program levels.

Additional supervisor main storage is required, on any model, to support:

BSCA-2 or ICA or LDA and/or MLMP:	0.3K bytes
3410/3411 Magnetic Tape Subsystem:	0.7K bytes
5471 Printer-Keyboard:	0.3K bytes
3741 Data/Programmable Workstation, directly attached:	0.6K bytes

Additional supervisor main storage is required, on C-models using CCP, for a CCP intercept routine: 0.5K bytes.

When calculating the main storage requirements for program level 1 on any model or for program level 2 on B-models, the supervisor size (including optional print spooling) must be rounded up to the nearest multiple of 0.25K bytes.

When calculating the main storage requirements for program level 2 on the C-models, the supervisor size (excluding any spooling support) must be rounded up to the nearest multiple of 2.0K bytes.

System Control and Utility Programs

	Minimum Program Level
Library Maintenance Program	8K*
Copy/Dump Program	8K*
Simulation Area Program	8K*
Dump/Restore Program	8K
Spool Writer Program	8K
Disk Programs	
Disk Initialization	8K
Alternate Track Assignment	8K
Alternate Track Rebuild	8K
File and Volume Label Display	8K**
File Delete	8K
Recover Index	10K*
Reassign Alternate Track	8K
File Compress	10K*
Recover Index	10K
Tape Programs	
Tape Initialization	8K
Tape Error Summary	8K
Overlay Linkage Editor	8K
Macro Processor	12K*

* These programs use additional storage, if available.

** 8K for simulation areas; 10-18K for main data areas. Total memory required is a function of the number of files and the use of the SORT function.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Minimum System Requirements: As a minimum, the System Control and Utility Programs require a configuration of the IBM System/3 model 12 which includes an IBM 5412 Processing Unit model B16 (32K) ... an IBM 3340 DASF ... an IBM 5203 or 1403 Printer ... and an IBM 5424 MFCU or an IBM 1442 Card Read Punch or a directly-attached IBM 3741 Data Station/Programmable Workstation. Additionally, a C19 or C20 Processing Unit requires the Dual Program feature (#3500) for IBM Programming Systems Support.

SCP services are also provided for the IBM 3410/3411 Magnetic Tape Subsystem ... the IBM 5471 Printer-Keyboard ... and the IBM 3881 Optical Mark Reader model 1... the IBM 1255 Magnetic Character Reader model 1, 2 and 3... and the IBM 1419 Magnetic Character Reader model 1 (requires an RPQ on the 1419).

SOFTWARE REQUIREMENTS (None)

DOCUMENTATION
(available from Mechanicsburg)

System/3 Model 12 Introduction (GC21-5116) ... *System/3 Model 12 System Control Programming Reference Manual* (GC21-5130) ... *System/3 Model 12 User's Guide* (GC21-5142) ... *System/3 Multiline/Multipoint BSC Reference Manual* (GC21-7573) ... *3881 Optical Mark Reader Model 1 Program Reference and Logic Manual* (GC21-5103) ... *Tape Program Planning Manual* (GC21-5040) ... *System/3 Models 12 and 15 1255 and 1419 Magnetic Character Readers Reference and Program Logic Manual* (GC21-5132) ... *System/3 Bibliography* (GC20-8080).

MULTI-LEAVING REMOTE JOB ENTRY WORKSTATION PROGRAM
Feature #6001

PURPOSE

Permits a System/3 Disk System equipped with an Integrated Communications Adapter (remote only) or a Binary Synchronous Communications Adapter with EBCDIC (Text Transparency optional) to function as a MULTI-LEAVING Remote Job Entry Work Station communicating over a point-to-point (switched or non-switched) line to a S/360 or S/370. MRJE/WS operates with one of the following:

- HASP II (Version 3.1 or 4.0)
- ASP (Version 2.6 or 3.1)
- Remote Entry Services (RES) of JES under OS/VS1
- MULTI-LEAVING Workstation facilities of JES2/JES3 under OS/VS2
- Remote spooling capability of VM/370 (RSCS)

DESCRIPTION

Any job which can be entered into the central system from locally attached, similarly-functioned I/O devices can be entered from the System/3 MRJE Workstation. Workstation input may be read from the 5424 MFCU, the 1442 Card Read Punch, the directly-attached 3741 Data Station/Programmable Workstation, the 3340 Direct Access Storage Facility, the 5471 Printer-Keyboard, the 3410/3411 Magnetic Tape Subsystem or from a combination of these devices. Operator

System/3 Mdl 12 SCP (cont'd)

messages may be directed to either the System/3 printer or the 5471 Printer-Keyboard.

Output data sets may be directed to the System/3 printer (5203 or 1403 both of which can be spooled), the 5424 MFCU, the 1442 Card Read Punch, the directly attached 3741 Data Station/Programmable Workstation, or written to disk or magnetic tape. Output may be returned to the submitting work station or routed to another workstation or directed to local central system I/O devices.

All files created by the MRJE/WS program are standard System/3 consecutive files and may be accessed by user-written RPG II, COBOL, FORTRAN and Assembler Programs, or by the Copy/Dump program. Also, the MRJE/WS Print Utility can be used to print data which was directed to disk or tape data sets during an MRJE/WS session.

When using the MRJE/WS Program, the following restrictions apply:

- Column binary is not supported.
- Reading or punching of OS object decks requires the BSCA Text Transparency feature and a 1442 Card Read Punch.
- Input record lengths may be greater than 96 bytes; however, the input file will be transmitted to the host central as 80-byte records, and it will be the users' responsibility to regroup the data.
- Print records which exceed the print positions of the System/3 printer will be truncated.
- The Workstation Program requires a logging device.

The 5471 Printer-Keyboard is required only if the MRJE/WS is an Inquiry program, or if the MRJE/WS output is being spooled.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Minimum System Requirements: In addition to the minimum requirements of 5705-SC1, this feature requires a Binary Synchronous Communications Adapter (#2074 or #2084) with EBCDIC or the Integrated Communications Adapter (#4645 and #6202). A minimum program level size of 14K bytes is required for execution.

SOFTWARE REQUIREMENTS (5705-SC1)

COMPATIBILITY

The model 12 MRJE/WS program is functionally compatible with the MRJE/WS programs for System/3 model 6, 8 or 10.

DOCUMENTATION
(available from Mechanicsburg)

System/3 MRJE/WS Reference Manual (GC21-7621) ... *System/3 Bibliography* (GC20-8080).

SYSTEM/3 MODEL 12 COMMUNICATIONS CONTROL PROGRAM
Feature #6070

PURPOSE

The Communication Control Program (CCP) provides control program services needed for telecommunications systems. This SCP feature is resident on a 3340 Direct Access Storage Facility and requires the services of the Supervisor and other SCP facilities (5705-SC1).

The services included are:

- High-Level language (COBOL, FORTRAN, and RPG II) access to MLTA, BSCA (including the Integrated Communications Adapter), and Local Display Adapter attached terminals.
- Program Fetch as a result of terminal operator requests.
- Resource Management to reduce contention between programs accessing the same files, provide access to terminals and manage storage available for application programs.
- Concurrent program execution allowing multiple application programs within the available storage.
- Terminal Monitoring to accept data and terminal commands.
- Display Format Facility (DFF) which permits the support of 3270 systems with a minimum of coding in high-level languages.

The Communications Control Program is designed to be an integral part of the SCP. CCP will control program execution in one program level on a system with the Dual Program feature. The minimum main memory requirements for CCP (exclusive of Supervisor requirements) are: 18K, plus 4K for DFF, plus a user program (5K minimum). One to eight programs can run concurrently.

Terminals and Features Supported: The following terminals may be used with the Communications Control Program:

Through the Multiple Line Terminal Adapter (MLTA):

- 1050 Data Communication System
  - Multipoint switched
  - Multipoint nonswitched
- 2740 Communication Terminal model 1
  - Basic
  - Checking
  - Dial
  - Dial with checking
  - Dial with transmit control
  - Dial with transmit control and checking
  - Station Control
  - Station Control with checking
- 2740 Communication Terminal model 2
  - Station Control
  - Station Control with checking
  - Station Control with buffer receive
  - Station Control with buffer receive and checking
- 2741 Communication Terminal
  - Basic
  - Switched
- 3767 Terminal
  - Supported by CCP as a 2740 model 1 or 2 or a 2741.
  - Transparent to MLTA.
- Communicating Magnetic Card Selectric® Typewriter (appears identical to 2741)
  - Point-to-point switched
- System/7 (appears identical to a 2740 model 1)
  - Checking
  - Dial with checking
  - Station control with checking

With the Binary Synchronous Communications Adapter (BSCA), or the Integrated Communications Adapter (ICA):

- 3270 Information Display System
  - Point-to-Point nonswitched
  - Multipoint nonswitched
  - Switched - 3275 only
- 3735 Programmable Terminal
  - Switched
  - Multipoint
- 5231 model 2 (appears identical to a 3741-2, 4)
  - Point-to-point switched or nonswitched
- 3741 Data Station model 2 and 3741 Programmable Workstation Station model 4
  - Point-to-Point (switched and nonswitched)
  - Multipoint tributary
- 5110 Computer (as a data mode CPU)
  - Point-to-point (switched and nonswitched)
  - Multipoint tributary
- 5280 Distributed Data System
  - Switched
  - Nonswitched point-to-point
  - Multipoint tributary
- Series/1
  - Switched
  - Nonswitched point-to-point
- System/3
  - Switched
  - Nonswitched point-to-point
  - Multipoint control station
  - Multipoint tributary
- System/7
  - Switched
  - Nonswitched Point-to-point
  - Multipoint (System/3 is control station)
- System/32
  - Switched
  - Nonswitched point-to-point
  - Multipoint (System/3 is control station)
- System/34
  - Switched
  - Nonswitched point-to-point
  - Multipoint (System/3 is control station)

System/3 Mdl 12 SCP (cont'd)

- System/360 and System/370
  - Switched
  - Nonswitched point-to-point
  - Multipoint (System/3 is tributary)

With the Local Display Adapter:

- 3277 Display Station
- 3284 Printer, model 1 or 2
- 3286 Printer, model 1 or 2
- 3288 Printer, model 2

In addition to controlling the terminals previously listed, the System/3 operates as a multipoint tributary (BSCA only) to a host S/360 or S/370. In this configuration, the System/3 is a sub-host controlling terminals and is itself a terminal to another system.

Refer to the "Terminal Support Chart" in the model 12 SCP section for more information.

Terminals equivalent to those listed may also work, but the user must establish the equivalency, and IBM assumes no responsibility for impact of changes made to programming support.

COMPATIBILITY

The System/3 model 12 Communications Control Program is upward compatible with the Communications Control Program for the System/3 model 4 (feature #6033) and for the System/3 model 8 and 10 (5702-SC1, feature #6033). The interface between the system and the operator is different than that of the model 4, 8, or 10.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Minimum System Requirements: CCP requires an IBM System/3 model 12 which includes as a minimum, an IBM 5412 Processing Unit model B17 (48K bytes) ... an IBM 3340 DASF ... an IBM 5203 or 1403 Printer ... an IBM 5424 MFCU or an IBM 1442 Card Read Punch or a directly-attached IBM 3741 Data Station/Programmable Workstation ... an IBM 5471 Printer-Keyboard ... a Binary Synchronous Communications Adapter or the Multiple Line Terminal Adapter (MLTA) RPQ (RPQs S40028 through S40033) or the Integrated Communications Adapter (#4645) or the Local Display Adapter (#4702) ... and at least one communications terminal of a type listed under "Terminals and Features Supported". Additionally, if CCP is to run on a C-model CPU, that model requires the Dual Program feature (#3500) for IBM Programming Systems Support.

CCP will operate with the Dual Program feature (DPF), however, CCP does not require the DPF to allow more than one program to be executed at a time. Use of the DPF is not prohibited during execution of the CCP, but any program executed in the other program level does not run under control of the CCP. CCP cannot be run in both program levels concurrently.

CCP Device Support (System)

	Generation	Execution
3340 Direct Access Storage Facility model C2	Req	Req
3410/3411 Magnetic Tape Unit model 1, 2 or 3	No	No
5203 Printer, model 1, 2 or 3	Req*	Opt
1403 Printer, model 2, 5 or N1	Req*	Opt
5424 MFCU, model A1 or A2	Opt	Opt
1442 Card Read Punch, model 6 or 7	Opt	Opt
5471 Printer-Keyboard, model 1	Opt	Req
3741 Data Station/Programmable Workstation model 1, 2, 3 or 4 (directly attached)	Opt	Opt
1255 MCR model 1, 2 or 3	No	No
3881 OMR model 1	No	No

* Either a 5203 or 1403 Printer is required during CCP generation.

SOFTWARE REQUIREMENTS

Generation and execution of the model 12 Communications Control Program requires IBM System/3 model 12 System Control Programming (5705-SC1). If the MLTA is to be supported, the MLTA IOCS (5799-WKH) must also be available.

No special programming system requirements exist for the running of system assignments. For the preparation of application programs, an applicable compiler or assembler is required.

Note: While MLTA can run in either program level on the B-model CPU, it can run in only program level one on the C-models.

DOCUMENTATION
(available from Mechanicsburg)

System/3 CCP General Information Manual (GC21-7578) ... *System/3 CCP Program Reference Manual* (GC21-7579) ... *System/3 CCP Terminal Operator's Guide* GC21-7580) ... *System/3 Models 10 and 12 CCP System Operator's Guide* (GC21-7581) ... *System/3 Models 10 and 12 CCP System Reference Manual* (GC21-7588) ... *System/3 Bibliography* (GC20-8080).

SYSTEM/ 7 PROGRAM PREPARATION FACILITIES 5707-AA1

PURPOSE

System/7 Program Preparation Facilities provides stand-alone program preparation capability for the System/7. This capability is complementary to the MSP/7 Host Program Preparation Facility II and allows the user to select which of the two methods most suitably meets the user's requirements for System/7 program preparation.

System/7 Program Preparation Facilities provides the following System/7 stand-alone components:

- Disk Support System/7 (5707-AG1)
- Source Library Editor (5707-AE1)
- System/7 Macro Library/Relocatable (MACLIB/R) (5707-AC1)
- System/7 Macro Assembler (ASM/7) (5707-AD1)
- System/7 Linkage Editor (LINK/7) (5707-AF1)
- System/7 Procedure Library (5707-AB1)

System/7 program preparation can also be provided concurrently with an application via the online batch facility (EXECUTIVE/7).

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Minimum System Requirements for the System/7 Program Preparation Facilities include:

- IBM 5010 Processor Module with a minimum of 12K words of storage for program preparation offline and a minimum of 20K words of storage for program preparation online. (Cycle Steal Disk is strongly recommended when using online program preparation facilities.)
- IBM 5022 Disk Storage Module model 1 or 2 (2 platter).
- 5028 Operator Station.

Support is also included for the IBM 129 Card Data Recorder, 7431 Serial Printer, 2502 model A2 Card Reader and the Line Printer available with the IBM 5024 I/O Attachment Enclosure. These devices should be considered for ease of use and performance improvements. The nucleus provided must be reassembled if support for the IBM 5496 Data Recorder is desired. The 5496 is supported only as an input/output source device.

Emulated 5022s on an IBM 3348 Data Module are supported: However, the minimum system configuration when using the IBM 3340 Direct Access Storage Facility (DASF) is 28K words of storage.

SOFTWARE REQUIREMENTS (None)

The group order number, 5707-AA1, provides all modules of the System/7 Program Preparations Facilities.

System/7 Program Preparation Facilities (5707-AA1)
System/7 Procedure Library** (5707-AB1)*
System/7 Macro Library/Relocatable*** (5707-AC1)*
System/7 Macro Assembler (5707-AD1)*
System/7 Source Library Editor (5707-AE1)*
System/7 Linkage Editor (5707-AF1)*
System/7 Disk Support for System/7 (8-12K) (5707-AG1)

* Orderable only under group order 5707-AA1, not orderable separately.
** Contains cataloged procedures.
*** Contains both source and object libraries ($SYSCODE).

The Disk Support System/7 (5707-AG1) can be ordered separately. The 8K version excludes stand-alone program preparations and is available on tape cassette. The 12K version with stand-alone program preparation is available on 5440 only.

SYSTEM/7 PROCEDURE LIBRARY 5707-AB1

PURPOSE

The Procedure Library contains predefined catalog procedures to support stand-alone program preparation via the System/7 Program Preparation Facilities. The procedures are shipped as part of 5707-AA1. The user may add procedures to this library as required.

SYSTEM/7 MACRO LIBRARY/RELOCATABLE 5707-AC1

PURPOSE

Macro Library/Relocatable provides MSP/7 support macros to operate in the Linkage Editor and TASKING environment. Functions include:

DESCRIPTION

Specification Macros

- Environmental characteristics.
- Physical and operational characteristics of the system.

System Macros

- System Initialization.
- Start timers, prepare feature modules for operation, etc.
- Timer control functions that provide for program timers, time-of-day clocks, and scheduling of periodic program execution.
- Two-way communication between operator and system through the Operator Station printer-keyboard.
- Program checkout and debugging facilities providing storage dump, snapshot dump, and storage patch via printer/keyboard or paper tape.
- Error recovery to handle machine check, power failure, and program check interrupts.

Access Macros: Macros to control the functions of Digital, Analog and Operator Station input/output. These include interrupt handling and error recovery routines.

- 2790 Control Support
  - Macros allowing use of the System/7, with 2790 control, as the system controller for 2790 system units. (Supports one to four 2790 Controls per System/7.)
  - Macros for area station and attached device definition, building Transaction Control List, and Data Entry Unit List.
  - Units supported include: 2791 Area Stations ... 2792 Remote Communications Controller ... 2793 Area Stations ... 2795 Data Entry Unit ... 2796 Data Entry Unit ... 2797 Data Entry Unit ... 2798 Guidance Display Unit ... 1053 Output Typewriter ... 1035 Badge Reader.
  - Online Diagnostics for both area stations and 2792. Invokable from any local or remote area station or from 5028 or 2792. Prerequisite for systems with 2792, more than 16 area stations, or when system availability is critical. The 2790 online diagnostics may reside either on disk or in storage. If disk resident is specified, the 2790 diagnostics will be loaded into a partition when required. The disk-resident version requires the partition queuing facilities.
- Asynchronous Communication Control Support
  - Macros to initiate and control data transfer via the asynchronous communication adapter.
  - A transparent data scheme to permit the transfer of load modules to the System/7 for execution or punching to paper tape.
  - Macros to simulate 2740 model 1 terminal with error checking, which allows System/7 to send and receive data under control of DOS/VS BTAM, QTAM, and VSAM; OS/VS BTAM, TCAM, and VTAM.
- Binary Synchronous Communications Adapter Support via the Communications Access Method.

  The BSCA feature allows remote connection of a System/7 as a processor terminal to:

  - S/370 models 115, 125, and 135 (via the Integrated Communications Adapter).
  - S/370 models 115 or larger (via a 2701, 2703, 3704, or 3705).
  - System/3 model 6, 10 or 15 (via the System/3 BSCA).
  - Another System/7 (via the BSCA).
  - System/32 (via the System/32 BSCA).

  Both EBCDIC and ASCII transmission codes are supported under software control. Transparent mode is standard but allowed only with EBCDIC. **Note:** S/370 model 135 ICA will not allow transparent and non-transparent code support on the same line.)

  Communication may be over any 2- or 4-wire links on point-to-point (switched or nonswitched) or multipoint configurations. In point-to-point configurations, the System/7 is supported as a processor terminal. In a multipoint configuration, System/7 is supported as a tributary station only with no multipoint central capability available. Transmission is half duplex, and data transfers in and out of System/7 storage are by means of a direct storage access mechanism on a cycle stealing basis.

  The System/7 BSCA provides the capability of remote initial program load (IPL) from another system. Initiation of the IPL is controlled by the remote system. A System/7 can be IPL'd from a remote system when it is configured as a processor terminal on a point-to-point switched line or as a tributary station in a multipoint

System/7 Program Preparation Facilities (cont'd)

configuration. The IPL message is transmitted in transparent EBCDIC only.

The System/7 BSCA is supported as a BSC terminal by: BTAM under DOS/VS; BTAM and TCAM under OS/VS1 and OS/VS2; 3704/3705 emulation mode; System/3 Multiline/Multipoint (ML/MP), RPG II and Communication Control Program (CCP).

Other Function Macros

- Data conversion macros
- Multiply-Divide
- Square Root
- Simultaneous Disk Services
- Dynamic Buffer Management
- Variable-Length Character Manipulation
- Double-Word Integer Arithmetic

Basic Disk Support Macros

- Seek, Read, Write, and Write-Verify functions.
- Multiple sector operations, including cylinder overflow support.
- Multiple 5022 Modules are supported. (Seeks may be overlapped.)
- Error handling routines.

Symbolic File Support Macros

5022 Disk Module

- System/3 compatible, Volume Table of Contents (VTOC).
- Directorized data sets with sub-allocation of data set space into subdata sets called members.
- Programs stored to disk as members of a directorized data set.
- Data sets comprised of one or more tracks, members comprised of one or more sectors.

3340 Direct Access Storage Facility (DASF)

- S/370-Compatible Volume Table of Contents (VTOC)
- Each 3348 data module can emulate multiple 5022 disk modules (emulation by programming)
- Emulated 5022s support all functions provided by Symbolic File Support (SFS) for 5022 Disk Modules.
- New Direct Access Method for 3340 on System/7 (NDAM/7) compatible with OS/VS and DOS/VS, and S/370 DOS/VS. Can be created, written into, and read from by System/7, S/370 OS/VS, and S/370 DOS/VS.
- All models of the 3348 Data Module are supported, including the fixed head data area.

Support provides:

- Storage Resident (non-disk support) and Disk Resident Versions (full support).
- Access routines to load data sets or members
- OPEN routine to locate data sets or members and make available for access.
- Access routines to SEEK, READ, WRITE, GET, PUT data sets or member records.
- CLOSE routines to make data sets or members unavailable for access.
- Retrieval and execution of program members via @FETCH macro.
- Programs which are FETCHed into storage may contain a single overlay area defined at link-edit time by Link/7 for loading called routines.

Access routines support:

- Basic Access Method - Access to data sets or members by relative sector number. One request allows read and write of multiple sectors across track and cylinder boundaries.
- Direct Access Method - Access to fixed-length records of data sets or members randomly by relative record number. GET and PUT of records also provides for sequential input/output of records (record number is incremented by one after each access).
- Program Access Method - Supports the loading and retrieval of a program to a program member already defined under the Disk Support System.
- Variable Segment Access Method - Access to variable-length records as if they were on a sequential device. Provides for backspace of records, rewind of data set,etc.
- Sequential Access Method - Provides sequential device independent I/O for 5022 disk, 129 and 5496 data recorders. 7431 serial printer, 5028 operator station, and the 2502 Card Reader and Line Printer available with the 5024 I/O Attachment Enclosure.
- New Direct Access Method - (NDAM/7). Access to data sets organized in a 370-compatible format. Method used is direct, fixed length (within a data set), unblocked, relative record access.
- Communications Access Method - Supports BSCA at the logical (GET/PUT) record level and the physical record (READ/WRITE) level.

The allocation of disk space and the use of the OPEN facility allows the user to reference a data area on disk by symbolic name rather than disk address. OPEN logically connects a disk data area to the symbolic name referenced in the application program and can be either within the program at assembly time or in conjunction with the Disk Support System at the time the program is loaded for execution.

Note: System/3 - System/7 data interchange

- System/3 to System/7: System/3 files (data sets) marked as Direct Indexed and Consecutive may be read on the System/7 using the Basic Access Method or the Direct Access Method.
- System/3 files (data sets) marked as Variable-Length Spanned Unblocked Sequential may be accessed on the System/7 using Basic Access Method or the Variable Segment Access Method. System/7 FORTRAN uses VSAM and DAM.
- System/7 to System/3: System/7 data sets marked as Direct (built by the Direct Access Method) may be opened by System/3 data management and accessed as a consecutive or direct file. System/7 data sets marked as variable sequential (loaded by the Variable Segment Access Method) may be accessed by System/3 data management as a variable consecutive file. System/3 FORTRAN uses both direct and variable sequential files. The System/7 directorized data sets and members of directorized data sets are not available to System/3 Support Facilities.

Message Buffering Facility: A facility which provides for routing of text messages to symbolic devices with independent disk buffering of messages, and on line operator and program control of the devices. Data sets on a 5022 Disk Module or in an emulated 5022 on a 3348 Data Module can be used for disk buffering.

Output devices supported include 1053 Printer (on 2790 only), 7431 Matrix Printer, 129 Card Data Recorder, 5496 Data Recorder, 5028 Operator Station, Binary Synchronous Communications Control (feature #2074 on 5010), the Asynchronous Communications Control (feature #1610 on 5010), and the line printer available with the 5024 I/O Attachment Enclosure.

Data Interchange Facility: A program for data transmission, via BSCA, between a System/7 and a System/3, System/32, S/370 or another System/7. The program runs in a partition of a user-generated MSP/7 Release 9 system and will operate in the following manner.

- Single Partition - Data Interchange Facility is the only job running.
- Multiple Partition - Data Interchange is running with other realtime jobs and/or a batch job.
- Data Interchange Facility must be loaded into a realtime partition.
- Data is transferred to/from a System/7 disk file. Data sets on a 5022 Disk Module or in an emulated 5022 on a 3348 Data Module can be used for disk buffering.
- The user is required to write a communication program for the host system (System/3, System/32, S/370 or another System/7).

The programming interface information that is required by the user to write a host program is documented in the System/7 publication *MSP/7 Macro Library/Relocatable: Coding the I/O Macros* (GC34-0020). In addition, sample RPG II T/P programs for the System/3 and the System/32 are included in this manual. These sample programs illustrate the host program requirements for the System/3 or the System/32 to communicate with a System/7 that is using the Data Interchange Facility.

Online Batch Facility (EXECUTIVE/7)

- Concurrent execution of batch programs including program preparation with realtime operations.
- Storage protection of realtime programs from online batch processing.
- Interactive or unattended mode for online batch processing.
- Automatic clearing of online batch programs from the card reader when errors occur (unattended mode).
- Priority queuing by hardware level of 5022 Disk I/O requests.
- @RELEV macro which releases current level for execution of other programs on the same level.
- Establishment and processing of a permanent system REFER library supporting both realtime and batch programs.

Partition Queuing Facilities

- Facility for a generated storage load to be subdivided into separate areas called partitions to effectively utilize storage.
- Ability to operate online batch in a partition.
- Batch Save/Restore facility to preempt and utilize the batch partition.

System/7 Program Preparation Facilities (cont'd)

- Automatic recovery capability that allows the user to specify the program that will be executed after a power failure as well as the partition in which it will be executed. Power Failure Detect (#5731) is required on the 5026 Enclosure in order to use this facility.

TASKING

MSP/7 Support Macros provide facility:

- To ensure serial use of a non-reentrant program.
- To maintain registers and work area after program suspension and reactivation.

WAIT/POST Macros: The program WAITING for the completion of an event can relinquish control and free its interrupt level for other use. The WAIT/POST Macros:

- Save registers in dynamically allocated storage.
- Automatically restore register contents and reactivate the supported program when completion of the event is POSTED.
- Facilitate overlap of processing with input/output operations.

SYSTEM/7 MACRO ASSEMBLER (ASM/7) 5707-AD1

PURPOSE

ASM/7 is a System/7 Language Translator that translates symbolic instructions into machine language instruction, assigns storage locations, and performs auxiliary functions necessary to produce executable machine language programs. In addition, ASM/7:

- Produces object modules suitable for input to the storage load formatting utility or the Linkage Editor.
- Allows user macros.
- Provides conditional assembly instructions.

Minimum system requirements in the minimum configuration required by the stand-alone System/7 Program Preparation Facilities.

SYSTEM/7 SOURCE LIBRARY EDITOR 5707-AE1

PURPOSE

The Source Library Editor service program is provided to facilitate entry and manipulation of source data such as FORTRAN and Assembler source, catalog procedures, source PTF application, etc.

SYSTEM/7 LINKAGE EDITOR (LINK/7) 5707-AF1

PURPOSE

The Linkage Editor combines separately assembled or compiled object modules into a load module suitable for input to the storage load formatting utility of DSS/7 and subsequent execution. It also combines previously edited load modules with each other or with object modules.

HIGHLIGHTS

In addition to its primary function of linking or combining of program modules, the Linkage Editor:

- Incorporates program segments from a library into load modules, either automatically or upon request.
- Aids in construction of overlay program segments.
- Aids program modification by replacing program segments.
- Allows the user to define a single overlay area in each partition for subroutines to be loaded-on-call.

Minimum system requirements is the minimum configuration required by the stand-alone System/7 Program Preparation Facilities.

DISK SUPPORT SYSTEM/7 5707-AG1

PURPOSE

This version of DSS/7 is an extended version of the 4K DSS/7. In the 8-12K environment, support is provided for the 5022 Disk, the 129 Data Recorder, the 7431 Serial Printer and the 5028 Operator Station via the Sequential Access Method. This provides device independence and permits the user to alter device assignments at execution time. In an 8K System/7 the user can execute service programs which do not require devICE support beyond the 5022, 129, 7431, or 5028. In addition to these devices DSS/7 also supports the 2502 model A2 Card Reader and the Line Printer available with the 5024 I/O Attachment Enclosure. This DSS/7 support requires a 5010 E processor.

DSS/7 utilizes an enhanced command language which permits the:

- Loading and execution of the System/7 Program Preparation Facilities
- Loading and execution of user programs (non-real time)
- Loading and execution of a complete storage load (realtime)
- Loading and execution of disk resident service programs
- Accessing and execution of predefined catalog procedures
- Association of symbolic file names with physical devices
- Establishment and processing of a permanent system REFER library supporting both realtime and batch programs
- Passing of parameter information
- Selection of alternate command language input streams

The MSP/7 service programs provided include:

- Device Independent Copy
- Disk to Print
- Disk Delete, Rename Data Set or Member
- Define Data Set or Members
- Disk Initialize
- Disk Patch
- Define Auto Restart
- Service Program Monitor
- Load Module Formatting

Also, the stand-alone program preparation components execute as service programs in the 12K DSS/7 environment. With additional storage, program preparation, service programs, and user batch programs can be supported online concurrently with realtime programs. The user is responsible for generating a storage load supporting online batch operations.

DOCUMENTATION
(available from Mechanicsburg)

Understanding MSP/7 (GC34-0027) ... *MSP/7 Binary Synchronous Communications: Program Logic Manual* (GY34-0012) ... *IBM System/7 Macro Assembler: Program Logic Manual* (GY34-0013) ... *IBM System/7 Linkage Editor: Program Logic Manual* (GY34-0014) ... *IBM System/7 Source Library Editor: Program Logic Manual* (GY34-0015) ... *IBM System/7 Disk Support System (DSS/7): Program Logic Manual* (GY34-0011) ... *IBM System/7 Macro Library/Relocatable: Program Logic Manual* (GY34-0010) ... *IBM System/7 Symbolic File Support (SFS): Program Logic Manual* (GY34-0018) ... *MSP/7 Subject Guide* (GC34-0035).

MSP/7 DISK SUPPORT SYSTEM (DSS/7) 5707-SC2

PURPOSE

The MSP/7 Disk Support System is a group of IBM-supplied programs which reside on the 5022 Disk Storage Module and provide program initiation capability using the 5028 Operator Station, and service programs to support disk organization and maintenance. The Disk Support System supports both Direct Program Control and Cycle Steal 5022s.

DESCRIPTION

This version of DSS/7 (5707-SC2) requires a 4K System/7 and does not support System/7 Program Preparation Facilities. The 8-12K version of DSS/7 (5707-AG1) is required for program preparation.

Operator Station commands allow:

- Load and execution of IBM-supplied disk-resident support service programs.
- Load and execution of disk-resident user programs.
- Association of symbolic file names to disk data sets or members at IPL time (requires symbolic file support macros).

Disk Support Service Programs:

- The Disk Initialization Service Program ($UDINT) Formats the Disk Volume ... Performs Surface Analysis ... Performs alternate track assignment or deassignment ... Verifies Disk Data.
- The Designate Restart Service Program ($UDARP) provides support of the Auto-Restart Facility on disk. The restart program is linked to the Automatic IPL Function of the Auto-Restart feature (#5731). The restart program information can also be printed to the Operator Console Printer.
- The Define Disk File Service Program ($UDDEF) provides allocation of disk space into data sets through a System/3 compatible Volume Table of Contents (VTOC) and provides for suballocation of directorized data set space into subsets called members. The utility determines if sufficient space is available and allocates a data set or member. An entry is made in the directory and/or VTOC.
- The Delete Data Set Utility ($UDDLT) deletes or re-names existing data sets or members. The VTOC directory entry is changed optionally, the area formerly occupied by the data set or member may be set to zero.
- The Program Load to Disk Service Program ($UDLDR) loads programs from paper tape to a disk volume. Output of FORMAT/7 or the 1130 or 1800 Edit program is loaded to a previously defined program member of a Directorized Data Set.
- The Disk Dump Service Program ($UDDMP) dumps data in hexadecimal representation from the disk to the Operator Station printer. An edited dump of VTOC or the directory of a directorized data set may be requested.
- The Disk Copy Service Program ($UDCPY) copies data from one disk volume to another disk volume or to another location of the same disk volume. The data copies may be designated by data set name, member name, or absolute disk addresses.
- The Disk Patch Utility ($UDPAT) allows data stored on disk to be modified by input from paper tape or the keyboard of the 5028 Operator Station.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Minimum Storage Requirements: To execute the Disk Support System, an IBM System/7 with 4,096 words of storage, an IBM 5022 Disk Module (mdls 1, 2, 3, or 4) and an IBM 5028 Operator Station. The 5022 may be either a Direct Program Control or Cycle Steal (#2664). The IBM 5010 Processor Module must have Cycle Steal Basic (#2662) installed to operate with a Cycle Steal 5022.

DOCUMENTATION
(available from Mechanicsburg)

IBM System/7 Disk Support System (DSS/7): Program Logic Manual (GY34-0011).

SYSTEM/7 HOST MACRO ASSEMBLER (ASM/7)

OS-VS (5744-AB1)
DOS-VS (5747-AB1)

PURPOSE

ASM/7 is a System/7 Language Translator that translates symbolic instructions into machine language instructions, assigns storage locations, and performs auxiliary functions necessary to produce executable machine-language programs. ASM/7 is language compatible with the stand-alone ASM/7.

In addition, ASM/7:

- Produces object modules suitable for input to the storage load formatting utility or the Linkage Editor.
- Allows user macros.
- Provides conditional assembly instructions.
- Supports new instructions for System/7 mdl E processor.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Minimum System Requirements for Execution on an IBM S/370 Operating Under:

Disk Operating System - Virtual Storage (DOS-VS)

- 14K bytes of storage exclusive of System Control and Basic IOCS.

In addition, ASM/7 requires auxiliary storage as follows:

- Three IBM 2311, 2314/2319, or 3330 disk storage extents as work files, or
- Three IBM 2400- or 3400-series magnetic tape units (either 7-track or 9 -track) as work files. The data conversion feature is required for 7-track operation.
- Must be link-edited using the NOREL option and executed in Virtual=Real Mode.

Operating System - Virtual Storage (OS-VS)

- 44K bytes of storage exclusive of data management and supervisor services.

In addition, ASM/7 requires space in auxiliary storage for the following data sets:

- System Input.
- Three Intermediate (work storage).
- Macro Instruction Library (this requirement may be satisfied by DASD system residence or private library).
- Print Output (selectable through JCL).
- Object Module (selectable through JCL).
- Punch Output (selectable through JCL).

SYSTEM/7 HOST LINKAGE EDITOR (LINK/7)

OS-VS (5744-AC1)
DOS-VS (5747-AC1)

PURPOSE

The Linkage Editor combines separately assembled or compiled object modules into a load module suitable for input to FORMAT/7 and subsequent execution. It also combines previously edited load modules with each other or with object modules.

HIGHLIGHTS

In addition to its primary function of linking or combining of host or stand-alone program modules, the Linkage Editor:

- Incorporates program segments from a library into load modules, either automatically or upon request.
- Aids in construction of overlay program segments.
- Aids program modification by replacing program segments.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Minimum System Requirements for Execution on an IBM S/370 Operating Under:

Disk Operating System - Virtual Storage (DOS/VS)

- 24K bytes of storage exclusive of system control and Basic IOCS.
- Auxiliary storage for at least two intermediate work areas (DASD).

Operating System - Virtual Storage (OS/VS)

- 44K bytes of storage exclusive of data management and supervisory services.

In addition to the standard system residence, the Linkage Editor requires space in auxiliary storage for at least the following data sets:

- System Input.
- One Intermediate (requires DASD).

System/7 DSS/7 (cont'd)

- Print Output (selectable through JCL).
- Output Load Modules (requires DASD).

SYSTEM/7 HOST STORAGE LOAD FORMATTING PROGRAM (FORMAT/7)
OS-VS (5744-AD1)
DOS-VS (5747-AD1)

PURPOSE

FORMAT/7 allows the user to generate loadable System/7 storage loads from ASM/7 output. The output storage load can be directed to disk for transmission via the ACCA connection or to cards for later conversion. For the DOS user with a 1018 Paper Tape Punch, the storage load can go directly to paper tape.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Minimum System Requirements for Execution on an IBM S/370 Operating Under:

Disk Operating System - Virtual Storage (DOS/VS)

- 14K bytes of storage exclusive of System Control and Basic IOCS.

Operating System - Virtual Storage (OS/VS)

- 44K bytes of storage exclusive of data management and supervisory services.

5708-SC1 - 5280 SYSTEM CONTROL PROGRAMMING

PURPOSE

5280 System Control Programming (SCP) provides the capability to perform basic functions necessary for the operation of the system. The SCP has been designed for ease of installation and is provided by IBM at no additional charge.

DESCRIPTION

Included in the SCP are:

System Configuration Program: Allows the user to describe the physical and logical configuration of a 5280 system to be used in a specific operating environment. Output of this program is an IPL data set, which contains user-specified system characteristics.

Execution of the System Configuration Program is an interactive process of responding to displayed prompts to describe the system configuration (for example, keyboard types, number of disk and diskette drives and the number and size of partitions). This procedure is typically performed during initial installation of the SCP on the user's system, but may be repeated as required, to reflect a change in the system configuration or to change the number and/or size of partitions required for a specific operating environment.

Initial Program Loader: A unique IPL, providing a single partition 'starter' system for any 5280 system. The Initial Program Loader initializes the system for program execution by loading a storage map, tables and common subroutines into main storage.

PTF Application Program: Provides the capability to make program patches, formal changes to IBM programs, replace program modules and display the PTF log number of changes made to a module or the whole system.

Close Failure Recovery Program: Provides the capability for the user to scan a data set and specify an EOD (end of data) record. The program is designed for circumstances, such as power failure, that prevent the normal closing of a data set, which may result in data loss.

SPECIFIED OPERATING ENVIRONMENT

Support will be provided for this licensed program when it is operated in the following specified operating environment:

HARDWARE REQUIREMENTS

The IBM 5280 System Control Programming runs on any IBM 5280 system. Minimum main storage partition size requirements are as follows: For the System Configuration Program - 16K; for the PTF Application Program and the Close Failure Recovery Program - 9K.

SOFTWARE REQUIREMENTS (None)

DOCUMENTATION
(available from Mechanicsburg)

IBM 5280 System Control Programming Specifications (GC21-7797) ... *IBM 5280 System Control Programming Reference/Operation Manual* (GC21-7824).

RPQs ACCEPTED: No

SYSTEM/32 SYSTEM CONTROL PROGRAMMING 5725-SC1

PURPOSE

System/32 System Control Programming provides these major capabilities:

- Operation Control Language
- System Utilities
- Data Management
- System History Area
- 2K SCP Main Storage Requirement
- Rollout/Rollin Inquiry
- Overlay Linkage Editor
- System/32 Macros
- Job Stream Support
- 1255 MICR Device Support
- Synchronous Data Link Control (SDLC) as a part of the Systems Network Architecture (SNA)
- Binary Synchronous Communications (BSC)
- Word Processing Feature

DESCRIPTION

Operation Control Language (OCL): System/32 OCL is highly compatible with System/3 OCL with the following exceptions:

- A command statement which has the capability to pass parameters to the indicated procedure is used in place of the System/3 CALL.
- Capability for specifying default values for missing OCL parameters.
- Logical IF statement provides for intelligence within procedures. It is possible to execute different jobs based on tests performed in OCL.
- Other differences brought about by devices and system function.

System Utilities: In addition to the function provided by System/3 SCP Utilities, System/32 also provides a complete set of utilities to copy data, programs and procedures for transferring data from the diskettes and to the disk and vice versa. Procedures, distributed as part of the SCP, allow easier execution of the most frequently desired utility functions by entering a one-statement command. The SCP utilities support the diskette in both 128 bytes per sector and 512 bytes per sector formats.

Data Management: System/32 provides data management support for the disk, the display screen, the keyboard and printing, all of which are functionally equivalent to that provided on System/3 mdl 6. In addition, a new combined buffered data management is provided for the display and the keyboard, which makes the programming of interactive data entry easier. The diskette drive is supported only by Load/Dump utilities.

System History Area: System/32 provides a history area on disk which contains all recently executed OCL statements and all messages issued to SYSLOG. The messages and data may be retrieved and redisplayed on the display or printed. Either all the OCL statements or only those originally displayed may be printed as a hard copy log of the activity of the system.

2K SCP Main Storage Requirement: Only 2K bytes of main storage are required for the supervisor. The remainder is available for user programming.

Rollout/Rollin Inquiry: The user may interrupt a processing program, inquire into a file and return to the processing program. The processing program will be rolled out to disk; the inquiry program will be executed and the processing program will be rolled back into main storage and processing resumed.

Overlay Linkage Editor: The Overlay Linkage Editor Facility converts relocatable object modules, produced by the Basic Assembler and FORTRAN, to executable programs. Overlay structures may be created automatically or as designated by the user.

This facility is not required for Assembler subroutines included in RPG II programs that have been previously assembled.

System/32 Macros: System/32 Macros will provide support to the Assembler user through the Macro Processor for the following System Control Program facilities: Disk functions, printer operation, keyboard and display screen access, Scientific Macros, and binary synchronous communications. The macros themselves provide no capability that is not available elsewhere in the system (for example, RPG II, FORTRAN IV, and System Utilities).

The macros are supplied to provide an interface to existing SCP support for the user who desires to use the Assembler for some purpose, and it is recommended that they be used only to meet those requirements.

Job Stream Support: An SCP command statement reads a prepared job stream, consisting of OCL, source code and data from either cards or diskette into the System/32 library as a procedure. This procedure can then be executed with OCL, source and data being read from the procedure.

1255 MICR Device Support: An SCP subroutine, similar to that provided on System/3 mdls 12 and 15, performs device control and data management services for the 1255 Magnetic Character Reader. The subroutine can be used with user-written RPG II or Basic Assembler programs.

Synchronous Data Link Control (SDLC) as a part of the Systems Network Architecture (SNA): System/32 batch workstation system utility program (SCP) provides data communications capability with a S/370 (mdls 115 through 168) operating under DOS/VS, OS/VS1, OS/VS2, or any of these operating systems when running under VM/370. Attachment of System/32 is with a 3704 or 3705 operating under the Network Control Program/VS (NCP/VS).

These SNA/SDLC utility programs provide communications with the following subsystems:

- POWER/VS
- Remote Entry Services (RES)
- Job Entry Subsystem 2 (JES2)
- CICS/DOS/VS
- CICS/OS/VS
- IMS/OS/VS

Highlights of the batch workstation programs are:

- Batch input (JCL and/or data) from disk storage
- Batch output to either the print facility or disk storage
- Individual printer and 'punch' data sets can be directed to disk storage for creation of permanent individual files.
- Keyboard/display screen combination functions as a console for operator communication.
- Utility program statements may be entered through the keyboard or from a file on disk storage.
- All utility program statements and central system commands and all messages are logged in the System/32 History File.
- Compression and expansion of blanks and duplicate characters (POWER/VS, RES and JES2 only)
- Multiple buffers provided to enhance data transmission.
- Utility program will utilize more than 22K if available.
- Central system programming support is generated specifying 3770 as the supported terminal.

  Note: Card I/O, the Mag Card Unit, the 1255 Magnetic Character Reader or the diskette drive cannot be operated within the same program as the Batch Workstation system utility program.

Binary Synchronous Communications: The SCP provides the Binary Synchronous Communications (BSC) data management for System/32 RPG II. For the devices supported, this BSC data management appears the same as the program support provided by the System/3 RPG II Telecommunications feature. A system utility is also provided to select certain communications characteristics at program execution time such as: Line type, terminal address, line speed, error retry count, etc.

Multi-leaving Remote Job Entry Workstation Program (MRJE/WS): The MRJE/WS System Utility program permits a System/32 to function as a remote job entry (RJE) workstation for submission of jobs to a central S/370. The central OS processing is performed under control of one of the following: HASP II, ASP, RES or OS/VS1, JES2, or JES3 of OS/VS2. The System/32 MRJE/WS program will also operate with VM/370 Remote Spooling Communications Subsystem (RSCS) as a HASP Workstation. The workstation program operates under control of the System/32 SCP and communicates with the central system over a point-to-point (switched or nonswitched) communication line via the Binary Synchronous Communications Adapter. Central system RJE programming support should be generated specifying System/3 as the supported terminal.

Highlights of the MRJE/WS Program are:

- Full multi-leaving support permits concurrent System/32 device operation.
- Card I/O operation is simulated by disk storage.

System/32 SCP (cont'd)

- Compression and expansion of blanks and duplicate characters is performed for increased line utilization.
- At user option, the program automatically selects a default for any message requiring an operator response.
- Disk storage is supported for jobstream input and output and for individual data set output.
- A Print Utility program is provided for transferring 'punch' and printer data streams to the print facility which were directed to disk storage during the RJE session.
- MRJE/WS program statements may be entered through the keyboard or from a file on disk storage.
- Keyboard/display screen combination functions as a console for operator communication.
- All MRJE/WS program statements and central system commands and all messages are logged in the System/32 History File.
- MRJE/WS program will utilize more than 14K if available.

Note: Card I/O, the 5321 Mag Card Unit, the 1255 Magnetic Character Reader or the diskette drive cannot be operated within the same program as the MRJE/WS Program.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

The IBM System Control Programming (SCP) runs on all models of IBM System/32 and supports all features. The system configuration required to support SDLC (#6301) via System/32 SCP requires a minimum of 24K bytes of main storage. A minimum of one Additional Storage feature (#1005) must be installed.

SOFTWARE REQUIREMENTS

All IBM licensed programs for IBM System/32 are designed to operate in an environment that includes IBM System/32 SCP (5725-SC1) or its equivalent.

DOCUMENTATION
(available from Mechanicsburg)

System/32 System Data Areas and Diagnostic Aids (SY21-0532) ...*System/32 Control Storage Logic Manual* (SY21-0533) ... *System/32 Word Processing Logic Manual* (SY34-0069).

WORD PROCESSING FEATURE (#6002)

PURPOSE

System Control Programming Word Processing feature (#6002) provides these additional capabilities:

- Extended printing support
- Character set extensions for upper/lowercase keyboard/display
- Job-to-Job Transition without operator intervention
- Mag Card Unit access method
- Linked Direct Access Method (LDAM) for document libraries
- System utilities for document library maintenance
- Word Processing Communications Utility

DESCRIPTION

Extended Printing Support: The System/32 printing function is extended to support superscript and subscript printing and to provide additional translate tables and code required to permit printing upper/lowercase data using the 48- and 64-character monocase (EBCDIC) belts.

Character Set Extensions for the Keyboard/Display: The System/32 Console Keyboard/Display capability is extended to include user-controlled definition. The SCP feature (#6002) supports user-redefinition of the keyboard both in character set and in character arrangement. A predefined set of character/graphics and arrangements can be selected by the operator through OCL statements at job initiation time. The various offerings of characters and the arrangements were selected to support word/text processing applications with nine magnetic keyboard arrangements. Two System/32 arrangements are provided. Support of the new code key functions is via application programming. See Type Catalog for details. (Does not support ASCII arrangements.)

Job-to-Job Transition: Job-to-Job Transition is provided to support the word processing user transition between jobs without operator intervention.

Magnetic Card Unit Access Method: The access method provides data transfer between System/32 and the 5321 Magnetic Card Unit at application program request. I/O control commands are supported by Basic Assembler. The File Conversion utility provides stand-alone access to magnetic card data.

Linked Direct Access Method (LDAM): Feature #6002 provides additional fixed disk data management support for System/32. It supports (a) storing variable length data such as text and (b) the dynamic reuse of file space without reorganization. In brief, this is accomplished through the use of two files; (1) an indexed sequential file which contains the data IDs, starting addresses, etc. and also a dynamic table of available space; (2) the 'member' file of user data consisting of linked direct sectors with embedded chained addresses. File organization, definition, load, dump and application use is supported at the user level through provided utilities and System/32 Basic Assembler licensed program.

System Utilities: Feature #6002 provides a complete set of utilities initiated via System/32 console input to initialize, reorganize and/or dump LDAM members to and from diskette; document deletion is supported from System/32 console or application program.

The Word Processing Communications Utility (WPCU) is provided as a System/32 Word Processing feature (#6002) enhancement to support the transfer of documents or data files between a Word Processing System/32 and another word processing system:

Office Systems 6/430, 6/440 or 6/450
6640 Document Printer
System/32 (with feature (#6002 WPCU)
Magnetic Card II Typewriter - Communicating

WPCU is invoked at the System/32 using a procedure statement and prompts via the System/32 console display, or through standard System/32 OCL and utility control statements to define the remote device, mode of operation (transmit/receive), line speed, transparency option, and other information. This utility can transmit or receive multiple LDAM document library members (document or tabular data files) or a single System/32 data file (records accessed consecutively).

Data Transmission is accomplished using the existing Binary Synchronous Communications Adapter (BSCA) #2074 on the System/32 over point-to-point switched or nonswitched lines. Communications with an Office System/6, Magnetic Card II Typewriter - Communicating or a 6640 Document Printer are at speeds of up to 2400 bps in EBCDIC nontransparent mode only. System/32-to-System/32 communications are at speeds of up to 4800 bps (switched) or up to 7200 bps (nonswitched) in EBCDIC transparent or nontransparent mode. Character set translation is supported for all valid magnetic card keyboard character sets supported by the SCP.

System/32 SCP (cont'd)

Release 2 of the Word Processor/32 licensed program will support the writing of systems formattted data (documents) to the LDAM Document Library.

Prerequisites: BSCA feature #2074 on the 5320.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

IBM SCP Word Processing feature (#6002) requires 4.6K of high-end user storage when LDAM or Job-to-Job transition functions are used. Otherwise, regular SCP main storage requirements apply. SCP Word Processing feature (#6002) supports all IBM 5320 'B' and 'C' mdls and the following Special Features: #4530 Half Line Space Printing, #4900 5321 Magnetic Card Unit Attachment, #3400 Dual Case Keyboard and Display, and #1005 Additional Storage. 96-character print belts do not require #6002 for support.

SOFTWARE REQUIREMENTS

IBM System/32 SCP Word Processing Feature (#6002) requires the current version of IBM System/32 System Control Programming (5725-SC1) for support.

DOCUMENTATION
(available from Mechanicsburg)

Word Processing SCP Reference Manual (GC34-0078) ... *Word Processing SCP PLM* (SY34-0069).

TERMS and CONDITIONS: See PP Index

SYSTEM/7 HOST MACRO ASSEMBLER (ASM/7)
OS-VS: 5744-AB1
DOS-VS: 5747-AB1

PURPOSE

ASM/7 is a System/7 Language Translator that translates symbolic instructions into machine language instructions, assigns storage locations, and performs auxiliary functions necessary to produce executable machine language programs. ASM/7 is language compatible with the stand-alone ASM/7.

In addition, ASM/7:

- Produces object modules suitable for input to the storage load formatting utility or the Linkage Editor.
- Allows user macros.
- Provides conditional assembly instructions.
- Supports new instructions for System/7 model E processor.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Minimum System Requirements for Execution on a System/370 Operating Under:

Disk Operating System - Virtual Storage DOS-VS

- 14K bytes of storage exclusive of System Control and Basic IOCS.

In addition, ASM/7 requires auxiliary storage as follows:

- Three 2311, 2314/2319, or 3330 disk storage extents as work files, or
- Three 2400- or 3400-series magnetic tape units (either 7-track or 9-track) as work files. The data conversion feature is required for 7-track operation.
- Must be link-edited using the NOREL option and executed in Virtual=Real Mode.

Operating System - Virtual Storage (OS-VS)

- 44K bytes of storage exclusive of data management and supervisor services.

In addition, ASM/7 requires space in auxiliary storage for the following data sets:

- System Input.
- Three Intermediate (work storage).
- Macro Instruction Library (this requirement may be satisfied by DASD system residence or private library).
- Print Output (selectable through JCL).
- Object Module (selectable through JCL).
- Punch Output (selectable through JCL).

SYSTEM/7 HOST LINKAGE EDITOR (LINK/7)
OS-VS: 5744-AC1
DOS: 5747-AC1

PURPOSE

The Linkage Editor combines separately assembled or compiled object modules into a load module suitable for input to FORMAT/7 and subsequent execution. It also combines previously edited load modules with each other or with object modules.

HIGHLIGHTS

In addition to its primary function of linking or combining of host or stand-alone program modules, the Linkage Editor:

- Incorporates program segments from a library into load modules, either automatically or upon request.
- Aids in construction of overlay program segments.
- Aids program modification by replacing program segments.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Minimum System Requirements for Execution on a System/370 Operating Under:

Disk Operating System - Virtual Storage (DOS/VS)

- 24K bytes of storage exclusive of system control and Basic IOCS.
- Auxiliary storage for at least two intermediate work areas (DASD).

Operating System - Virtual storage (OS/VS)

- 44K bytes of storage exclusive of data management and supervisory services.

In addition to the standard system residence, the Linkage Editor requires space in auxiliary storage for at least the following data sets:

- System Input.
- One Intermediate (requires DASD).
- Print Output (selectable through JCL).
- Output Load Modules (requires DASD).

SYSTEM/7 HOST STORAGE LOAD FORMATTING PROGRAM (FORMAT/7)
OS-VS: 5744-AD1
DOS-VS: 5747-AD1

PURPOSE

FORMAT/7 allows the user to generate loadable System/7 storage loads from ASM/7 output. The output storage load can be directed to disk for transmission via the ACCA connection or to cards for later conversion. For the DOS user with a 1018 Paper Tape Punch, the storage load can go directly to paper tape.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Minimum System Requirements for Execution on a System/370 Operating Under:

Disk Operating System/Virtual Storage (DOS/VS)

- 14K bytes of storage exclusive of System Control and Basic IOCS.

Operating System/Virtual Storage (OS/VS)

- 44K bytes of storage exclusive of data management and supervisory services.

IBM ISG

SYSTEM CONTROL PROGRAMMING
SYSTEM/370 PROGRAMMING
CONVERSION SERVICE

1410/7010 EMULATOR PROGRAM for the SYSTEM/370 MODELS 145, 155II and 158 Under OS/VS (5744-AG1)

PURPOSE

The 1410/7010 Emulator Program executes as a problem program under the Operating System Virtual Storage using the IBM 1401/1440/1460, 1410/7010 Compatibility Feature (#4458). The combination of the program and the compatibility feature enables programs written for the 1410 or 7010 Data Processing Systems to be executed on the Model 145. Most 1410/7010 programs require no changes for execution under the emulator, although certain special and custom features are not emulated. Emulation is provided for 1410/7010 systems with main storage sizes from 10,000 to 100,000 positions of core storage.

DESCRIPTION

All basic features are emulated, along with the following optional features: Processing Overlap ... Priority Processing ... Two Channels on 1410 ... Inverted Print Edit ... 7010 Second, Third, and Fourth Data Channels ... 7010 Storage and Restore Status ... 7010 Floating Point Arithmetic Feature.

The following features and operations are not emulated: 1401/1410 Compatibility Mode ... Column Binary ... 51-Column Card ... Selective Stacker ... 1410/7010 Diagnostic Instruction Branch on Tape Indicate J (I) K ... 7010 Diagnostic Instruction Branch on C Bit ... 7010 Program Relocation and Storage Protection ... 7010 Interval Timer ... Disk CE Track Operations (i.e., operation with CE switch on).

The following input/output devices are not emulated: 1311 Disk Storage Drive ... 1405 Disk Storage ... 7340 Hypertape Drive ... 1011 Paper Tape Reader ... 1012 Paper Tape Punch ... Magnetic Character Readers ... Teleprocessing Devices ... Optical Readers, 1442 Card Reader*, Model 3.

Throughput under emulation is not determined as much by the emulator as it is by the 1410/7010 program being executed. Throughput of 1410/7010 jobs is affected by the mix of processor operations (executed by the compatibility feature), input/output operations (executed by the emulator program), and the amount of interference from higher-priority regions and paging rates. A precise performance estimate cannot be given.

Unlike stand-alone emulators, integrated emulators must share the processor and input/output devices with the operating system. In a system with multiprogramming capability, however, the time lost waiting for a shared resource is much less on the average than the time lost by a stand-alone emulator waiting for its input/output operations to complete. This reduction in system wait time should increase total system throughput.

The emulator program takes advantage of the multiprogramming facilities of the System/370 Operating System Virtual Storage. Other problem programs, such as utility programs, user jobs, compilers, and more than one "integrated" emulator program can be executed concurrently.

The emulator program uses the data management services of the operating system, and takes advantage of the automatic allocation of resources and the device independence achieved by these services. The operating system error recovery procedures are also used. Both emulator program jobs and System/370 jobs can be placed in a single input job stream for processing. The emulator program allows the user to apply most of his programming resources toward developing new applications and redesigning existing applications to take full advantage of available Model 145 facilities.

Card, tape, and disk programs are emulated. Cards and tapes, used and produced by the 1410/7010 system or by other emulator programs, and mixed parity tapes, are emulated. Disk files must be converted before they can be used by the emulator program. Two tape formatting programs are provided with the emulator program: (1) to assist the user in converting his tape files before emulation so they can be used more efficiently by the emulator program, and (2) to convert tape files produced during emulation back to the 1410/7010 format so they can be used on the original system. In addition, a disk formatting program is provided to assist the user in converting his disk files.

Disk files created by the 1410/7010 system or a stand-alone emulator program must be dumped onto tape using a 1410/7010 utility program, and then restored to disks that have been formatted by the disk formatting program. Both the disk formatting program and the tape formatting programs run as problem programs under the operating system.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS:

The emulator program requires the Compatibility Feature (4458); enough real storage for the operating system; the emulator functions required for the system being emulated (emulator program and buffers); the 1410/7010 program; and enough Model 145 devices to correspond to the emulated 1410/7010 devices, in addition to the devices required for the operating system.

Input/Output Device Correspondence is as follows:

1410/7010 I/O Device**	System/370 I/O Device
1402 Card Read Punch	Any card reader or card read punch supported by the queued sequential access method of of the operating system
1403 Printer	Any printer supported by the queued sequential access method of the operating system.
729 II, IV, V, VI Tape Unit, or 7330 Magnetic Tape Unit	Any tape unit or direct access storage device supported by the basic sequential access method of the operating system.
1415 Console Printer	Any operator's console supported by the operating system.
1301 Disk Storage Model 1 or 2, 1302 Disk Storage, Model 1 or 2, 2302 Disk Storage, Model 1 or 2	Any direct access storage device supported by the basic direct access method of the operating system***.

Notes

* Can be emulated if running on 1402 mode.

** Programmed reading on more than one reader, printing on more than one printer, or punching on more than one punch is not supported.

*** If more than one System/370 direct access storage device is required to correspond to the 1410/7010 disk storage device being emulated, all corresponding System/370 devices must be the same type of direct access storage device.

IBM ISG

SYSTEM CONTROL PROGRAMMING
SYSTEM/370 PROGRAMMING
CONVERSION SERVICE

1401/1440/1460 EMULATOR PROGRAM for the S/370 under OS/VS 5744-AH1

PURPOSE

The 1401/1440/1460 Emulator Program executes as a problem program under the Operating System/VS using the IBM Compatibility Feature (#4457 or 4458). The combination of the program and the compatibility feature enables programs written for the IBM 1401, 1440, or 1460 Data Processing Systems to be executed on the Models 135, 145 or 158. Most 1401/1440/1460 programs require no changes for execution under the emulator, although certain special and custom features are not emulated. Programs written for the 1401 Model G are not emulated. Emulation is provided for 1401/1440/1460 systems with main storage sizes from 2,000 to 16,000 positions of main storage.

DESCRIPTION

All basic features are emulated, along with the following optional features: Expanded Print Edit ... Inverted Print Edit ... High-Low-Equal Compare ... Multiply-Divide ... Processing Overlap ... Sense Switches ... Advanced Programming/Indexing ... Bit Test ... Print Storage ... Additional Print Control ... Space Suppression ... Selective Stacker.

The following features and operations are not emulated: Column Binary ... Binary Transfer ... 51-column Card ... Punch-Feed Read ... Read-Punch Release ... Card Image (on 1442) ... Selective Tape Listing (on 1403) ... Compressed Tapes.

The following input/output devices are not emulated: 1404 Printer ... 1444 Card Punch ... 1445 Printer ... 7340 Hypertape Drive ... 1011 Paper Tape Reader ... 1012 Paper Tape Punch ... Optical Readers ... Magnetic Character Readers ... Teleprocessing Devices.

Throughput under emulation is not determined as much by the emulator as it is by the 1400 program being executed. Throughput of 1400 jobs is affected by the mix of processor operations (executed by the compatibility feature), input/output operations (executed by the emulator program), and the amount of interference from higher-priority regions and paging rates. A precise performance estimate cannot be given.

Unlike stand-alone emulators, integrated emulators must share the processor and input/output devices with the operating system. In a system with multiprogramming capability, however, the time lost waiting for a shared resource is much less on the average than the time lost by a stand-alone emulator waiting for its input/output operations to complete. This reduction in system wait time should increase total system throughput.

The emulator program takes advantage of the multiprogramming facilities of OS/VS compilers, and more than one "integrated" emulator program can be executed concurrently. The emulator program uses the data management services of the operating system, and takes advantage of the automatic allocation of resources and the device independence achieved by these services. The operating system error recovery procedures are also used. Both emulator program jobs and System/370 jobs can be placed in a single input job stream for processing.

The emulator program allows the user to apply most of his programming resources toward developing new applications and redesigning existing applications to take full advantage of available Model 145 facilities.

Card, tape, and disk programs are emulated. Cards and tapes, used and produced by the 1401/1440/1460 system or by other emulator programs, and mixed parity tapes, are emulated. Disk files must be converted before they can be used by the emulator program. Two tape formatting programs are provided with the emulator program: (1) to assist the user in converting his tape files before emulation so they can be used more efficiently by the emulator program, and (2) to convert tape files produced during emulation back to the 1401/1440/1460 format so they can be used on the original system. In addition, a disk formatting program is provided to assist the user in converting his disk files.

Disk files created by the 1401/1440/1460 system or an stand-alone emulator program must be dumped onto tape using a 1401/1440/1460 utility program, and then restored to disks that have been formatted by the disk formatting program. Both the disk formatting program and the tape formatting programs run as problem programs under the operating system.

SPECIFIED OPERATING ENVIRONMENT

MACHINE REQUIREMENTS

The emulator program requires the Models 135, 145 or 158, the Compatibility Feature (#4457 or 4458), enough real storage for the operating system, the emulator functions required for the system being emulated (emulator program and buffers), the 1401/1440/1460 program and enough Models 135, 145 or 158 devices to correspond to the emulated 1401/1440/1460 devices, in addition to the devices required for the operating system.

Input/output device correspondence is as follows:

1401/1440/1460 I/O DEVICE*	SYSTEM/370 I/O DEVICE
1401 Card Read Punch 1442 Card Read Punch	Any card reader or card read punch supported by the queued sequential access method of the Operating System Virtual Storage
1403 Printer 1443 Printer	Any printer supported by the queued sequential access method of OS/VS
729 II, IV, V, VI Tape Unit or 7330 Magnetic Tape Unit, or 7335 Magnetic Tape Unit	Any tape unit or direct access storage device supported by the basic sequential access method of OS/VS
1407 Console Inquiry Station, or 1447 Console	Any operator's console supported by OS/VS.
1301 Disk Storage, or 1311 Disk Storage Drive, or 1405 Disk Storage, Model 1 or 2	Any direct access storage device supported by the basic direct access method of OS/VS**.

DOCUMENTATION: (available from Mechanicsburg)

IBM Operating System: 1401/1440/1460 OS Emulator on Models 135/145/155, Reference (GC33-2008).

Notes:

* Programmed reading on more than one reader, printing on more than one printer, or punching on more than one punch is not supported.

** If more than one System/370 direct access storage device is required to correspond to the emulated 1401/1440/1460 disk storage device, all corresponding System/370 devices must be the same type of direct access storage device.

5744-AN1 - 3704/3705 EP/VS (OS)
5747-AG1 - 3704/3705 EP/VS (DOS)
5744-BA2 - 3704/3705 NCP/VS (OS/VS)
5747-AJ2 - 3705/3705 NCP/VS (DOS/VS)
3704/3705 SYSTEM SUPPORT PROGRAMS

PURPOSE

3704/3705 System Support Programs for OS/VS and DOS/VS consist of a Generation Procedure which allows generation of the Network Control Program/Virtual Storage (NCP/VS), and its Partitioned Emulation Programming (PEP) Extension, the Emulation Program/Virtual Storage (EP/VS), the Load Program, the Dump Program, and the 3704/3705 Assembler for use in conjunction with OS/VS and DOS/VS systems.

See the PP section for the System Support Programs (SSP) for Advanced Communications Function NCP/VS, 5734-XX3

NCP/VS GENERATION PROCEDURE

In OS/VS, the 3704/3705 NCP/VS Generation Procedure is a two-stage process using the 3704/3705 Assembler and the Linkage Editor to generate a 3704/3705 NCP/VS.

Stage 1 is an assembly of system generation macros. The output from Stage 1 is a job stream containing the JCL and the control information necessary to generate and link edit an NCP/VS. Stage 2 is the execution of the job stream.

In DOS/VS, the 3704/3705 NCP/VS Generation Procedure is a three-stage process using the 3704/3705 Assembler and the Linkage Editor to generate a 3704/3705 NCP/VS.

Stage 1 is an assembly of System Generation macros. Stage 2 processes the conditionally assembled NCP/VS modules and builds a job stream containing the JCL necessary to catalog the conditionally assembled modules and link edit an NCP/VS. Stage 3 is the execution of the job stream.

System generation macros are divided into three groups: System Macros ... Configuration Definition Macros ... Block Handling Macros.

The System Macros provide information pertaining to the entire communications controller. The macros specify facilities such as:

Storage Size ... Channel Type ... Buffer size and number ... Recommended serviceability aids (online terminal test; address interrupt trace) ... Dynamic network alteration and interrogation facilities.

The Configuration Definition Macros describe the characteristics of:

Line Group ... Terminals ... Terminal Components ... Service Order Tables for nonswitched lines ... Terminal ID sequence for BSC devices.

Block Handling Macros define processing to be done on data blocks and when the processing is to be performed. Processing functions include: Editing out backspaced text ... Date/Time stamping.

Processing may be performed: After receipt from a terminal ... After receipt from the processor, but before the line is available ... After receipt from the processor, but after the line is available.

The Partitioned Emulation Programming (PEP) Extension may be generated in a similar manner. In addition, NCP/VS-only or EP/VS-only systems may be generated by use of the Generation Procedure.

LOAD PROGRAM

The 3704/3705 Load Program retrieves a specified load module from direct access on the host system. This load module is then transferred across the channel to the Communications Controller. Upon successful completion of this transfer, control is passed to the program just loaded.

DUMP PROGRAM

The Dump Program dumps the storage and register contents of the Communications Controller to a host system data set and provides for the printing of the contents. Formatting of critical control blocks of the NCP/VS is provided as an option. The dump may be a full or partial dump.

3704/3705 ASSEMBLER

The 3704/3705 Assembler assembles programs written in 3704/ 3705 Assembler language. The instructions are similar to those processed by the OS/VS and DOS/VS assemblers. The assembler operates on three kinds of instructions: 3704/3705 machine instructions (written in 3704/3705 Assembler language notation) ... Macro instructions ... Assembler instructions.

The machine instructions are represented to the 3704/3705 Assembler by mnemonic operation codes, usually followed by one or more operands.

The macro language provides a convenient method of generating a desired sequence of assembler language statements many times in one or more programs. Macro definitions can be coded inline in assembler language programs or stored in a host library and called in when needed by means of a macro instruction coded in the program.

The assembler instructions direct the assembler to perform certain operations during the assembly process, but are not converted into executable code.

EP/VS GENERATION PROCEDURE

The EP/VS Generation Procedure is a two-stage process which uses the 3704/3705 Assembler and the OS/VS or DOS/VS Linkage Editor to generate a 3704/3705 EP/VS.

Stage 1 is an assembly of the System Generation Macros. The output of Stage 1 is a job stream containing the JCL and control information necessary to generate and link edit an EP/VS. Stage 2 is the execution of the job stream.

SSP SYSTEM REQUIREMENTS

The OS/VS SSP operates in a minimum 192K virtual region. The DOS/VS SSP operates in a minimum 64K virtual partition.

3704/3705 EP/VS
DOS 5747-AG1
OS 5744-AN1

A set of program modules provided to the customer to generate (by use of the EP/VS Generation Procedure) his customized 3704/3705 EP/VS. The EP/VS, when generated and loaded, executes in the 3704/3705 and provides the functional capabilities of the 2701 Data Adapter Unit and/or 2702/2703 Transmission Control Units through the physical medium of the 3704/3705-I/3705-II.

Programs which operate with an IBM 2701, 2702, or 2703 will operate with a 3704/3705-I/3705-II in emulation mode, provided the programs: use only the 2701, 2702 or 2703 features supported by EP/VS ... use only terminals and processor attachments supported by EP/VS ... require only RPQs supported by EP/VS ... are not time-dependent.

2701, 2702, and 2703 features not supported by EP/VS are: Synchronous Data Adapter Type I ... Parallel Data Adapter ... Programmable Two-Processor Switch ... 6-Bit Transcode ... Attachment to other than a byte multiplexer channel ... 230, 400 bps Synchronous Speed ... 1032 Digital Time Unit Attachment. ASCII Transparency is only supported by the emulation mode of operation when the 3705 has a Communication Scanner, Type 3 (FC 1643). A second channel is only supported when two Channel Adapters, Type 4 (FC 1544) are installed in the 3705.

Intermixing of 2701, 2702, and 2703 line and function is permitted; however, subchannel address assignment must be contiguous. Replacement of multiple 2701s, 2702s, or 2703s with a 3704/3705-I/3705-II may require device address reassignment.

The following RPQs for 2701s, 2702s, and 2703s will be provided as standard features with EP/VS:

2701	M44307	Attach 2711
	F26072	Autopoll IBM III
	M53193	Break Command IBM I
	858492	Break Command IBM I
	E60987	IBM Type III at 4800 bps
	E56160	Dataphone 50 on SDA II
2702	F13308	50 bps Speed
	E46765	Break Command IBM I
	E54838	Immediate End
	E62920	Carriage Return on TTY
	EA3120	TTY X Off
2703	E53715	Break Command IBM I
	F17897	50 bps Speed
	Z71949	1200 bps Speed
	Z16087	Immediate End
	E49633	28 Second Timeout - no data
	E62376	TTY II Character Recognition
	858126	Timeout Change
	E61947	TTY II with Telegraph Line Set
	W21061	Timeout Change
	W23396	IBM I - no LRC
	Y24344	EOT or EOB Four Character Sequence

Although operation of EP/VS is mutually exclusive with operation of NCP/VS, EP/VS and NCP/VS operation may be alternated provided the customer has sufficient storage to support NCP/VS operation. This procedure will necessitate a re-IPL of the 3704/3705-I/3705-II. EP/VS and NCP/VS may co-reside using PEP as described in *Network Control Program/Virtual Storage - NCP/VS.*

EP/VS & NCP/VS (cont'd)

Throughput rates of the 3705-I with EP/VS are, in most cases, comparable to those attained with a similarly configured 2701, 2702, or 2703.

The following terminals and processor remote attachments are supported by EP/VS:

EP/VS TERMINAL SUPPORT CHART

SS Terminals	BSC Terminals
1031	2715-2
1051	2772
	2780
2848/2260	2972-8,-11
2845/2265	3271-1,-2
	3274-1C (3271-1,2)
2740-1 (a)	3275-1,-2
	3276 (3271-1,2)
	3624-1,-2,-11,-12 (as a 2772)
2740-2	3651-A25,-B25,-A75,-B75 C75,-D75 (S/3)
2741	3651-A60,-B60 (as a System/3)
3101-10,-12,-13, -20,-22,-23	
3232-51	
3767-1,-2 (as a 2740-1,-2, 2741)	3661 (as a System/3)
	3670
	3684-1,-2
3767-3 (as a 2740-2)	3735
5100 (as a 2741)	3741-2,-4
5110 (as a 2741)	
CMCST	3747
6733 (as a CPT-TWX 33/35)	
S/7 (as a 2740-1)	3771-1,-2,-3 (as a 2772)
AT&T 83B2/B3 Line Control Type	3773-1,-2,-3,-P1,-P2,-P3 (as a 2772)
CPT-TWX (M33/35) Line Control Type	3774-1,-2,-P1,-P2 (as a 2772)
WU 115A Line Control Type	3775-1,-P1 (as a 2772)
WT Telegraph	3776-1,-2 (as a 2772/3780)
	3777-1 (as a 2772/3780)
	3777-2 (as a S/360-20)
	3780
	5110 (as a 2772)
	5265 (as a 3741-2, 4)
	1131 w/ SCA
	1826 w/ CA
	5285 and 5288 (as a 3791)
	5285 and 5288 (as a System/3)
	System/3
	System/7 (as a System/3)
	System/32 (as a System/3)
	System/34 (as a System/3)
	System/34 (as a 3271)
	System/36 (as a System/3)
	System/36 (as a 3271)
	System/36 (as a S/360 mdls 25 and up multi-leaving workstation)
	System/38 (as a System/3)
(a) 2760 attached to a 2740-1 is supported.	S/360-20 w/BSCA
	S/360-25 w/ICA
	S/370-115,-125,-135, -135-3,-138 w/ICA
	S/360, S/370 w/2701,2703
	S/360, S/370 w/Local 3704/3705-I/3705-II
	8100/DPPX (as a S/360 mdl 25 multi-leaving workstation)
	8100/DPPX/SP (as a S/360 mdl 25 multi-leaving workstation)
	8100/DPPX (as a 3271)
	8100/DPPX/SP (as a 3271)

EP/VS MINIMUM MACHINE REQUIREMENTS

The minimum 3704/3705-I configuration for program execution is a mdl A1 with Channel Adapter Type 1, Communications Scanner Type 1 or Type 2, and appropriate line attachment features. The minimum 3705-II configuration is a mdl E1 with a Channel Adapter Type 1, Communication Scanner Type 2, and the appropriate line attachment features.

SCP PROGRAMMING SERVICES: Class 2 SCP

NCP/VS
OS/VS (5744-BA2)
DOS/VS (5747-AJ2)

[NO LONGER AVAILABLE]

(Also refer to the Program Products section for licensed options provided for NCP/VS.)

DESCRIPTION

NCP/VS is a set of program modules provided to the customer to generate (by use of the NCP/VS Generation Procedure) his customized NCP/VS. NCP/VS, when generated and loaded, executes in the 3704/3705-I/3705-II and is supported by OS/VS VTAM, OS/VS TCAM, DOS/VS VTAM and by DOS/VS EXTM (a Program Product).

NCP/VS performs such transmission control unit functions as line control, character recognition, line timeout, character assembly/disassembly and checking. In addition, some functions typically performed by a telecommunications access method are provided by NCP/VS. Polling, addressing, code translation, data link control and first level error recovery procedures are performed by NCP/VS.

The basic element of communication between the host access method and the 3704/3705 is the block. A transfer between the Processor and 3704/3705 may consist of one or more blocks. A block consists of control information and any text that may accompany it. The text is generally a transmission block destined to or received from a terminal.

A block is sent by the host to the Communications Controller to request that an operation be performed. When the operation is complete, NCP/VS may send a block to the host indicating the results of the requested operation. NCP/VS will also send unsolicited blocks to the host to provide it with such information as error statistics.

Within the Controller, the installation can optionally select functions to make certain changes in transmission block data. These functions are essentially data editing functions which can be performed on a transmission block before transmission to a terminal on output or before transmission to the Processor on input.

At any time, the NCP/VS may have several transactions in process at various points in the subsystem. The supervisory functions provide the capability for scheduling NCP/VS activity optimally by resolving contention for processing time within NCP/VS.

In addition, there are functions in NCP/VS to accomplish the logical and physical elements of input/output on the communication lines and the channel to the host Processor. These functions are dependent upon the network configuration, specifically line and terminal types.

SDLC/BSC Path: The SDLC/BSC Path is an enhancement to NCP/VS. It provides an SNA application-driven two-way path for data flow between the Host Positive Credit Session of a 3651 Retail Store Controller and a specific BSC device via a 3705-I/3705-II Communications Controller.

The 3651 and the BSC device must be attached to the same 3705-I/3705-II: the 3651 via a nonswitched SDLC line and the BSC device via a point-to-point nonswitched BSC line operating in EBCDIC transparent mode. The 3705-II must be local.

When using the SDLC/BSC Path, the following are supported as terminals on the BSC line: S/360 and S/370, and the 1130, 1800, S/3, and S/7 when specified as a S/3. Any device or application code required is the user's responsibility.

Definition of the path is accomplished at NCP system generation time. Data flowing over the SDLC/BSC Path does not enter the host processor. First level error recovery is performed by NCP/VS. Other errors must be handled by the user-written application program interacting with VTAM in the host. Application dependent logic can be added by way of the BSC User Block Handling Routines (UBHRs) in NCP/VS.

PARTITIONED EMULATION PROGRAMMING (PEP)

PEP is an extension of NCP/VS and EP/VS to co-reside within a single 3704/3705-I/3705-II. Through PEP, a contiguous range of subchannel addresses may be assigned to emulation mode operation for the execution through the 3704/3705 of programs written for the IBM 2701 Data Adapter Unit, the IBM 2702 Transmission Control Unit and the IBM 2703 Transmission Control Unit, concurrently with network control mode operation. A line may be assigned to either network control mode or emulation mode operation at one time. Assignments may be changed between network control mode and emulation mode through use of a Control Command issued to the NCP/VS by the host Processor Operator Control Facility.

Support of features, attachment of remote terminals and Processor attachments for the NCP/VS partition when PEP is generated is the same as described for NCP/VS, and for the EP/VS partition is the same as described for EP/VS, except that: (1) Two channel NCP/VS support for MP systems is available when PEP is used provided both a Type 1 and a Type 3 channel adapter are employed; (2) NCP/VS support is for virtual storage operating systems only.

EP/VS & NCP/VS (cont'd)

PEP is available for S/370 Processors using OS/VS with VTAM or TCAM or using DOS/VS with VTAM. The EP/VS partition does not operate with VTAM.

Problem determination aids such as machine and program check recording, permanent line error recording, 3704/3705 panel display, online terminal test, abend condition check and debugging aids are provided by NCP/VS.

Remote attachment via the NCP/VS is shown in the following chart:

NCP/VS TERMINAL SUPPORT CHART

	Communications Code						Communications Network		
	BCD	EBCD	Correspondence	EBCDIC norm	EBCDIC trans	ASCII norm	sw PTP	nonsw PTP	nonsw MP
SS Terminals:									
1051	X	X	-	-	-	-	X	X	X
2740-1	X	X	X	-	-	-	X	X	X
2740-2	X	X	-	-	-	-	-	-	X
2741	X	X	X	-	-	-	X	X	-
3101-10,-12,-13, -20,-22,-23	-	-	-	-	-	X	-	X	-
3232-51	-	-	-	-	-	X	X	X	-
3767-1,-2 (2740-1)	-	X	X	-	-	-	X	X	X
3767-1,-2,-3 (2740-2)	-	X	-	-	-	-	-	-	X
3767-1,-2 (2741)	-	X	X	-	-	-	X	X	-
5100 (2741)	-	X	X	-	-	-	X	X	-
5110 (2741)	-	X	X	-	-	-	X	X	-
6733 (as CPT-TWX 33/35)	-	-	-	-	-	X	X	X	-
CMCST (2741)	-	-	X	-	-	-	X	-	-
System/7 (2740-1)	-	X	-	-	-	-	X	X	X
AT&T 83B3 (b)	-	-	-	-	-	-	-	-	X
CPT-TWX (M33/35)	-	-	-	-	-	-	X	-	-
WT Telegraph	-	-	-	-	-	-	-	X	-
WU 115A (b)	-	-	-	-	-	-	-	-	X
BSC Terminals:									
3101 Mdls 10, 12, 13 20, 22, 23									
2715-2	-	-	-	-	X	-	X	X	X
2772	-	-	-	X	X	X	X	X	X
2780	-	-	-	X	X	X	X	X	X
2972-8,-11	-	-	-	X	-	-	-	-	X
3271-1,-2	-	-	-	X	-	X	-	-	X
3274-1C (3271-1,-2)	-	-	-	X	-	X	-	-	X
3275-1,2	-	-	-	X	-	X	-	-	X
3276 (3271-1,2)	-	-	-	X	-	X	-	-	X
3684	-	-	-	-	X	-	X		
3735	-	-	-	X	-	X	X	-	X
3741-2,-4	-	-	-	X	X	-	X	X	-
3747	-	-	-	X	X	-	X	X	-
3771-1,-2,-3 (2772)	-	-	-	X	X	X	X	X	X
3773-1,-2,-3,-P1, -P2,-P3(2772)	-	-	-	X	X	X	X	X	X
3774-1,-2,-P1, -P2 (2772)	-	-	-	X	X	X	X	X	X
3775-1,-P1 (2772)	-	-	-	X	X	X	X	X	X
3776-1,-2 (2772/3780)	-	-	-	X	X	X	X	X	X
3777-1 (2772/3780)	-	-	-	X	X	X	X	X	X
3777-2 (S/360-20)	-	-	-	X	X	X	X	X	X
3780 (2772)	-	-	-	X	X	X	X	X	X
5110 (as a 2772)	-	-	-	X	X	-	X	X	X
5265 (3741-2,4)	-	-	-	X	-	-	X	X	-
5275 (3275-1,-2)	-	-	-	X	-	-	-	-	X
5285/5288 (3271-2)	-	-	-	-	-	-	-	X	X
5285/5288 (System/3)	-	-	-	X	X	X	X	X	-
1131	-	-	-	X	X	-	X	X	X
1826	-	-	-	X	X	X	X	X	X
System/3	-	-	-	X	X	X	X	X	X
System/7 (System/3)	-	-	-	X	X	X	X(c)	X	X
System/32 (System/3)	-	-	-	X	X	X	X	X	X
System/34 (System/3)	-	-	-	X	X	X	X	X	X
System/34 (3271)	-	-	-	X	-	-	-	-	X
System/36 (System/3)	-	-	-	X	X	X	X	X	X
System/36 (3271)	-	-	-	X	-	-	-	-	X
System/36 (S/360) mdls 25 up	-	-	-	X	X	-	X	X	X
System/38 (System/3)	-	-	-	X	X	X	X	X	-
S/360-20	-	-	-	X	X	X	X	X	X
S/360	-	-	-	X	X	X	X	X	-
S/370	-	-	-	X	X	X	X	X	-
8100/DPPX DPPX/DSC	-	-	-	X	-	-	-	X	X
DPPX/RJE	-	-	-	X	X	-	-	X	-
8100/DPPX/SP DPPX/SP/DSC	-	-	-	X	-	-	-	X	X
DPPX/SP/RJE	-	-	-	X	X	-	-	X	-
SDLC Terminals:									
3232-1							X	X	X
3271-11,-12	SDLC is communication						-	-	X
3274-1C (3791)							-	X	X
3275-11,-12	code insensitive						-	-	X
3276 (3791)							X	X	X
3601							X	X	X
3602							X	X	X
3614							-	X	X
3624							-	X	X
3631							X	X	X
3632							X	X	X
3651-A50,-B50							X	X	X
3651-A60,-B60							X	-	-
3661							X	-	-
3684							X	X	X
3694							X	X	X
3767-1,-2,-3							X	X	X
3771-1,-2,-3							X	X	X
3773-1,-2,-3,-P1,-P2,-P3							X	X	X
3774-1,-2,-P1,-P2							X	X	X
3775-1,-P1							X	X	X
3776-1,-2,-3,-4							X	X	X
3777-1,-3							X	X	X
3791							X	X	X
5285/5288 (3274-1C)							X	X	X
5285/5288 (3770)							X	X	X
8130/DPCX-A21,-A23							X	X	N
8140/DPCX-A31,-A33,-A51.-A53							X	X	N
System/32 (3770)							X	X	X
System/34 (3770, 3791)							X	X	X
System/34 (3274)							-	X	X
System/36 (3770, 3791)							X	X	X
System/36 (3274)							X	X	X
System/38 (3770)							X	X	X
System/38 (3274)							X	X	X
8100/DPPX							X	X	X
8100/DPPX/SP							X	X	X
8775-11,12							X	X	X

Legend:

X = Supported now or will be supported. See *Terminal Support Chart 1* for specifics.

- = Not supported.

Notes:

(a) All terminals shown are supported by a Local 3704/3705-I/3705-II. Consult the 3705 Configurator for storage sizing and performance capabilities of the 3704 and 3705 in terms of the number of lines and terminal mix. If shown, the terminal type in parenthesis designates the programming support provided. E.g., "System/7 (2740-1)" means "that System/7 is supported as a 2740-1".

(b) Attachment of non-IBM terminals is under the provisions of the IBM Multiple Supplier Systems Policy.

(c) IPL of System/7 is not supported in this network configuration.

EP/VS & NCP/VS (cont'd)

NCP/VS Support with IBM 3872, 3874, 3875 Modems of BSC, SDLC Lines

Attachment BSC	Attachment SDLC	IBM Modem 3872	IBM Modem 3874	IBM Modem 3875	Multiplexer's Modem Configuration	Remote Modem Configuration
X		X	X	X	Nonswitched	Nonswitched
	X	X	X	X	Nonswitched	Nonswitched
X		X	X	X	Nonswitched with SNBU*	Nonswitched with SNBU
						Nonswitched with SNBU & fan out only when NCP/VS originates the call to the remote modem
X		X	X		Switched Network	Switched Network

* Switched Network Back Up

NCP/VS MINIMUM MACHINE CONFIGURATION

For program execution -- a 3705-I mdl A2 with Channel Adapter Type 1 or Type 2, Communication Scanner Type 1 or Type 2, and appropriate line attachment features ... a 3704 mdl A3 with Channel Adapter Type 1, Communication Scanner Type 1 or Type 2, and appropriate line attachment features ... a 3705-II mdl A3 with Channel Adapter Type 1, Communication Scanner Type 2, and appropriate line attachment features.

CF 3705, the IBM aid available via the HONE system, should be used to determine hardware feature configurations and storage estimates for specific traffic requirements.

DOCUMENTATION
(order from Mechanicsburg)

Title	Order Number
IBM 3704 and 3705 Communications Controllers Assembler Language	GC30-3003
IBM 3704 and 3705 Communications Controllers Principles of Operations	GC30-3004
Introduction to the 3704/3705 Communications Controllers	GA27-3051
IBM3704/3705 Communications Controllers Network Control Program/VS Program Logic Manual	SY30-3007
IBM 3704/3705 Communications Controllers Network Control Program Storage Estimates for OS/TCAM and OS/VS TCAM Users	GC30-3006
IBM3704/3705 Program Reference Handbook	GY30-3012
Network Control Program/TCAM Network User's Guide	GC30-3009
EP Storage and Performance Guide	GC30-3005
EP Program Logic Manual	SY30-3001

SCP PROGRAMMING SERVICES: Class 2 SCP

IBM ISG

SYSTEM CONTROL PROGRAMMING
SYSTEM/370
CONVERSION SERVICE

DOS EMULATOR UNDER OS/VS VERSION 3 (5744-AS1)

PURPOSE

The DOS Emulator eases the transition for DOS (Releases 25, 26 27, 28, 29, 30, 31, 32 and 33) user migration to OS/VS and the System/370 Models 135 (OS/VS1), 145, 155 II, or 158. The Emulator program integrates the facilities of the DOS system into the operating environment of OS/VS. It receives DOS jobs as input and produces output in the same format as found in DOS.

Throughput under emulation is not determined as much by the emulator as it is by the DOS program being executed. Throughput of DOS jobs is affected by the amount of interference from higher priority virtual or real regions/address spaces, and the paging rate of the system.

HIGHLIGHTS of VERSION 3 MODIFICATION 3

- DOS programs can be processed under OS/VS without conversion.
- No re-linkage edit, re-compile, or re-assembly is required for DOS programs.
- Other OS/VS programs can run concurrently.
- DOS/VS functions supported are:
  - Extended Control Mode
  - Virtual Storage Support
  - Relocating Loader
  - Five partitions
  - Shared Virtual Area
  - Generic assignment
  - Block Multiplexer Channel and Rotational Position Sensing
- OS/VS Sysin/Sysout facilities are available to the DOS user.
- DOS BTAM is supported; includes 2260 and 3270 local and remote.
- DASD Device Sharing support allows both OS/VS and DOS programs to concurrently share DASD volumes.
- 3340 in restricted, non restricted (sharable) and substituted modes.
- 3330 Model 11 in non restricted (sharable) and substituted modes.
- Device substitution allows programs written for a given type of DASD to run on another type of DASD.
- Volume sharing and device substitution facilities are extended to the 3850 Mass Storage System, using the virtual 3330 device.
- The 3540 Diskette is supported via the OS/VS Reader and Writer facilities.
- The 3344 and 3350 Direct Access Storage devices are accepted by the Emulator in Compatibility Mode only. This support allows the user to operate a 3344 as if it were four 70MB 3340's, or a 3350 as if it were two Model 1 3330's.
- ISAM mapping function allows unmodified DOS programs to access OS/VS formatted ISAM data sets. This function, together with a degree of existing SAM and DAM compatibility, allows individual program conversion where a group of programs access common data sets.
- An automatic DOS IPL procedure eliminates the need for ADD, SET CAT, and DPD commands.
- Operator communications substantially improved compared with Version 2.

RESTRICTIONS

The following IBM units and features supported by DOS are not supported by the emulator:

Virtual Storage Support: DOS/VS programs should not rely on the DOS/VS paging mechanism.
Other DOS/VS functions: Emulator does not support SDAID, OLTEP, Machine Emulators, QTAM, VTAM.
Programs using VSAM run only on restricted DOS volumes.
2260 and 3270: 2260 local and 3270 local and remote are supported only if accessed through DOS BTAM.
Device substitution: supported for non restricted DASD volumes only. Emulated DOS programs must not contain any device dependent coding other than DTF's. Emulated DOS systems and OS/VS systems must support explicitly the substituted (new) device.
1270, 1275 optical reader, sorter.
1259, 1412, and 1419 magnetic character readers.
1287, 1288 optical character reader in document mode, when: response times are required for pocket selection, (1287 only); PIC bit in the CCW is used, or the CCW string is modified between the READ and WAITF macros.
Model-dependent functions such as CS30, CS40, and the DIAGNOSE instruction.
7770 and 7772 Audio Response Units under DOS BTAM.
Use of data chaining for staged devices.
Device Sharing.
DOS files accessed on a device shared volume cannot:
- have more than 16 extents.
- be a DOS ISAM file.
- be a multivolume file.
- have both split and unsplit cylinder.

DOS programs accessing files on a device shared volume must:
- issue a DOS OPEN or OPENR for each file accessed.
- not and cannot rely on the information in the DBDL and EXTENT cards other than the logical unit (SYSXXX, file name, and file-ID fields).
- not use embedded SEEKS in the channel program accessing the files on the shared volume.
- use absolute track specifications on the DD when accessing files using absolute track address.

ISAM Mapping.
The use of the ISAM Mapping Feature is subject to the following limitations:
- DOS program may read and write only fixed-length records.
- The use of incore indexes or prime data will be ignored.
- The ISAM DTF may not be modified.
- Fields other than filename C, P, O, I, A, R, T, and H are not supported and may be invalid.
- The Emulator does not take any steps to provide or prevent concurrent use of an ISAM file with other jobs.

3540 Diskette.
DOS/VS programs using the 3540 Diskette will not run under the Emulator if they:
... attempt to use a file without issuing an OPENR Macro
... use EXCP's or non-standard access method
... attempt to use a file created in the same Emulator job

The following programming items, permissable in the DOS environment, cannot be handled by the emulator:

The emulator program for 1401/40/60, 1410/7010 and Model 20 under DOS.
Modification, use, or storing of information in user CCW's between EXCP and WAIT.
Storage protection under DOS may be specified but is not effective.

QTAM, AUTOTEST and VTAM.
HIO is not a restriction for DOS BTAM.
Programs that:
Depend upon the HIO, RDD, WDD, and DIAGNOSE instructions for their operation.
Rely on known timing relationships of DOS.
Use PCI bit.

SPECIFIED OPERATING REQUIREMENTS

HARDWARE REQUIREMENTS

The Emulator requires the OS/DOS Compatibility Feature. The basic Emulator program requires 48K bytes of Virtual Storage. Additional virtual storage is required for the DOS System being emulated including allowances for its associated partitions.

- 48K bytes: Emulator program
- 6K bytes: Control blocks for up to 10 I/O devices in job step
- Add 300 bytes for each additional device
- Add 20K bytes for the emulator's service aids

SOFTWARE REQUIREMENTS

Version 3 Modification 3 of the DOS/OS Emulator supports DOS Releases 25-27 plus DOS/VS Releases 28, 29, 30, 31, 32 and 33 on all releases of OS/VS1 and OS/VS2 current at the time of availability of Version 3.

DOS Emulator support in no way changes the currency of a DOS or DOS/VS release.

Device Requirements: There must be enough devices available to support both DOS and OS/VS. When using staged I/O, and device sharing facilities the need for devices dedicated dedicated to DOS can be minimized.

Generally, the Emulator supports devices which are concurrently supported by the System/370, OS/VS system and DOS system being utilized. The Emulator support of devices may not be concurrent with the various releases of OS/VS or DOS.

In addition, allowable mapping of command code compatible devices between OS/VS and DOS are as follows:

DOS	OS/VS
1403	3211
2400	3420
2540 (Reader)	3505 (Reader)
2540 (Punch)	3525 (Punch)

DOS EMULATOR UNDER OS/VS (cont'd)

Note that OS/VS does not support 2311 Disk Units and 2321 Data Cells.

The System/370 Model 155 requires logic EC level 260-448 and DOS Compatibility Feature (5450) EC level 260-715.

DOCUMENTATION (available from Mechanicsburg)

Title	Order Number
Program Logic Manual	SY33-7015

DISTRIBUTED INTELLIGENCE SYSTEM HIGH-LEVEL HOST SUPPORT OF SYSTEM/7 ATTACHMENT TO SYSTEM/370 5744-BK1

PURPOSE

The Distributed Intelligence System System Control Programming provides the means for operating a host S/370 connected to one or more System/7s.

Each System/7 is attached to the S/370 using the high-speed S-Based Control Unit/Sensor-Based Control Adapter (SBCU/SBCA) attachments. Distributed Intelligence System supports the S/370 and each System/7 as a single system with distributed facilities. The System/7 applications programmer using Distributed Intelligence System has available for use, through the high-level Distributed Intelligence System functions, the power of a S/370 for data analysis and storage.

Distributed Intelligence System provides System Control Programming code on the S/370 under OS/VS1 and on the System/7 under MSP/7.

The Distributed Intelligence System functions provide the user with the ability to move data between the S/370 system and each satellite System/7, and the ability to load and execute application programs in a given system in the network.

In general, almost all Distributed Intelligence System functions are symmetrical; i.e., each processor may invoke any command.

HIGHLIGHTS

- Distributed Intelligence System supports S/370 mdls 135, 145, 155 II, 158, 165 II and 168 with the SBCU custom product (RPQ D08116) and System/7 with the SBCA custom product (RPQ D08119).
- Requests for Distributed Intelligence System functions may be initiated by either the S/370 system or any System/7.
- Distributed Intelligence System provides inter-partition data handling and transaction synchronization functions which provide a high-level interface between Distributed Intelligence System and CICS or IMS.
- High-level language support is available through PL/I and FORTRAN in the S/370; and FORTRAN and APG/7 (5734-XC3) in the System/7.

Program Movement and Execution:

- System/7 application programs are on S/370 disk in a partitioned data set. The user may also specify programs to be loaded into pageable or page-fixed S/370 storage for high-speed access.
- System/7 application programs may be loaded and executed by a command from the S/370 or System/7.
- System/7 application programs may be executed in either IPL or program segment mode.
- S/370 programs must reside on S/370 disk in one of a number of partitioned data sets. These programs may be loaded and executed, in the Distributed Intelligence System partition or in a background partition, by a command from the S/370 program, System/7, or S/370 console operator dynamically or at initialization time. The operating system facilities for program retention will be used.

Data Definition and Movement:

- A given program can move data to itself or to any other program in the network with a single command. These programs may reside in any VS1 partition or the Distributed Intelligence System partition of the S/370 or on the System/7.
- A System/7 application program either in the Distributed Intelligence System partition or another partition may move data to a System/7 program, a storage area obtained within Distributed Intelligence System, or a S/370 disk file.
- A System/7 application program may move data to or from a System/370 program (either in the Distributed Intelligence System partition or another partition), a storage area on the S/370 obtained within Distributed Intelligence System, or a S/370 disk file.
- User's standard S/370 disk data sets can be processed by Distributed Intelligence System access commands (providing VSAM, BDAM or BSAM support).
- S/370 work data files may be dynamically selected from a pool of VSAM disk data files according to user's processing and performance requirements. The files are accessed via Distributed Intelligence System commands and may be returned to the pool dynamically.

Control Services:

- Program synchronization commands may be invoked from S/370 or System/7.
- Dumps of System/7 storage on S/370 may be invoked by S/370 or System/7 programs, or System/370 console operator.
- Initiation and termination of logging and tracing functions may be invoked by the S/370 console operator. User logging functions may be invoked by S/370 or System/7.
- Communication with the S/370 console operator with option to receive a reply may be invoked by S/370 or System/7.

Use: Distributed Intelligence System consists of control software which resides on both the S/370 and System/7. To use the S/370-System/7 multisystem configuration, application programs must use Distributed Intelligence System in the following manner:

- The Distributed Intelligence System partition is initiated as an OS/VS1 job by using OS/VS1 Job Control Language (JCL).
- The S/370 or System/7 user programs can invoke the Distributed Intelligence System subroutines, from a high level language (FORTRAN or PL/I from the System/370; and a FORTRAN or APG/7 from the System/7).
- The System/7 or S/370 assembler language programs invoke Distributed Intelligence System macros.

CUSTOMER RESPONSIBILITIES

The customer:

- Is responsible for providing the necessary cabling between the SBCU/SBCA.
- Is responsible for proper generation of Distributed Intelligence System to match the system configuration.
- Must ensure that the macros provided with S/370 Distributed Intelligence System are installed in the OS/VS1 macro library or another S/370 library, and that the FORTRAN subroutines, PL/I and APG/7 subroutines have been installed in the FORTRAN, APG/7 and PL/I libraries, if Distributed Intelligence System functions are to be invoked through these high-level languages.
- Must have knowledge of Distributed Intelligence System, MSP/7, and S/370 Assembler, FORTRAN, APG/7 or PL/I languages in order to code the Distributed System Application.
- Must provide sufficient S/370 direct access storage to contain any System/7 programs and data sets desired as resident on the S/370.
- Is responsible for providing protection against accidental loss or misuse of their data.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

Minimum Machine Configurations: The Distributed Intelligence System minimum IBM S/370 configuration is:

Supported on mdls 135, 145, 155II, 158 165II and 168 CPU, the minimum configuration is that required for the OS/VS1 operating system used plus a minimum of 6K page-fixed for Distributed Intelligence System. However, 30K is recommended. Additionally, a minimum of 64K of real storage for paging is recommended in S/370 for Distributed Intelligence System and other VS1 applications. Mdl 135 must have the Conditional Swapping feature (#1051). Mdl 145 must have either Conditional Swapping feature (#1051) or Advanced Control Program Support feature (#1001). Sensor-Based Control Unit (SBCU) custom product (RPQ D08116) attached to a selector/block multiplexer channel.

The minimum IBM System/7 configuration is:

- IBM 5010 Processor Module mdl A06 (minimum 6K storage of which Distributed Intelligence System requires 2K words) ...
- Sensor-Based Control Adapter custom product (RPQ D08119) ...
- IBM 5028 Operator Station.

SOFTWARE REQUIREMENTS

IBM S/370 Programs: The Distributed Intelligence System S/370-resident programs operate under OS/VS1 (5741-031). Distributed Intelligence System runs in a Virtual (V=V) environment, but requires a minimum of 6K of page-fixed storage; however, 30K is recommended to support its functions. In addition, 64K of real pageable storage will be required by Distributed Intelligence System. The Distributed Intelligence System partition size in virtual storage will depend on user routines included in these partitions. To this partition size must be added space for buffered queues, storage files, and user programs, which are to be executed in the Distributed Intelligence System partition. Any other access method the user wishes to support may be included as part of the supervisor. For example, if the Virtual Storage Access Method (VSAM) is to be supported, it should be included as part of the pageable System Queue Area.

Distributed Intelligence System High-Level Host Support of System/7 Attach to S/370 (cont'd)

Distributed Intelligence System adds SVC routines and a resident attention handling routine to the OS/VS1 Nucleus and a minimum of six modules (appendages, error routines, SVCs) to SYS1.SVCLIB

IBM System/7 Programs: MSP/7 supports Distributed Intelligence System. IBM System/7 Host Program Preparation Facilities II programs (OS/VS1) are required for System/7 program generation.

DOCUMENTATION
(available from Mechanicsburg)

SBCU General Information Manual (GA34-1511) ... *SBCA General Information Manual* (GA34-1512) ... *General Information Manual* (GC34-0056) ... *OS/VS1: Program Logic Manual* (GY34-0019) ... Program Listings (Microfiche) (GJD1-1795).

RPQs ACCEPTED: Yes

PROGRAMMABLE STORE SYSTEM HOST SUPPORT DOS (5747-D16) - OS (5744-D16)

PURPOSE

3650 PSS and 3680 PSS Programming Support consists of SPPS II and Host Support.

DESCRIPTION

PROGRAMMABLE STORE SYSTEM HOST SUPPORT

In support of the 3650 Programmable Store System and 3680 Programmable Store System residing in a Host S/370 or 4300 is the PSS Host Support which consists of the following basic components: Controller Configuration Facility, Terminal Configuration Facility, Data Base Facility and Data Communication Facility. They supply the support to maintain system libraries, tailor and transmit controller and terminal programs from a Host S/370 to a 3651 or 3684, generate tables for use in a 3651 or 3684, create format controls and space allocation for files and provide problem determination aids. Either BTAM for BSC or VTAM for SDLC provides transmission to and from the store controller.

PSS provides the capability for user-written programs executing in the 3651 controller to interact with user written programs executing in the Host, another 3651 mdl 75, 3653 mdl 1P, 3663 mdl 1P or 3P, and 3683 mdl 1.

The 3650 PSS also supports the 3653 mdl 1 functions and the Subsystem Programming Preparation Support (SPPS) language.

The 3680 PSS provides the capability for user-written programs executing in the 3684 to interact with user written programs executing in the Host and 3683 Point of Sale Terminal.

SUBSYSTEM PROGRAM PREPARATION SUPPORT II

The Subsystem Programming Preparation Support II (SPPS II) provides the capability of writing programs for execution in the 3651 mdls A25, B25, A75, B75, C75 and D75 Store Controller or 3684 Point of Sale Control Unit mdls 1 and 2. Devices supported by the Subsystem Programming Preparation Support II are the 3651, 3683, 3684, host communications, 3275-3 Display Station and 3284 in Screen image mode, and 3653 mdl 1 for basic input and output operations only.

Refer to the *PP-Systems section* of the sales manual for information on Subsystem Programming Preparation Support II (SPPS II).

SPECIFIED OPERATING ENVIRONMENT

A minimum 3650 or 3680 Programmable Store System requires support from:

(1) One S/370 with the following minimum storage entry:

	BTAM	VTAM
DOS/VS	128K	160K
OS/VS1	240K	256K
OS/VS2	768K	768K

Additional storage will be required based on application requirements and performance considerations.

(2) An IBM 3704 or 3705 Communications Controller in emulation mode using BTAM or network control mode using VTAM, or a S/370 ICA using BTAM.

(3) A telecommunications access method (BTAM for BSC, VTAM for SDLC).

(4) The Virtual Storage Access Method (VSAM).

(5) The IBM 3651 mdl A25, B25, A75, B75, C75 or D75 Store Controller or 3684 Point of Sale Control Unit mdl 1 and 2.

(6) An IBM 3653 mdl 1 or 1P, an IBM 3663 mdl 1P or 3P, an IBM 3275 mdl 3 display station, or a 3683 Point of Sale Terminal.

Additional terminal devices may be added. (See appropriate "machines" pages.)

5745-010 - DISK OPERATING SYSTEM/VS

PURPOSE

The Disk Operating System/Virtual Storage (DOS/VS), 5745-010, is a disk-resident system designed to provide operating system capabilities for any virtual storage S/370 Processor and attachable input/output devices. Note: Mdl 155II does not have EREP support in DOS/VS.

OVERVIEW

DOS/VS is an operating system optimized to the function and performance needed by the small and intermediate users of the S/370. It gives the user the ability to multiprogram five jobstreams concurrently which generally include the POWER/VS spooling component, a real time subsystem, such as CICS/VS, one or two batch jobstreams, and an unscheduled work partition for quick turn-around jobs. The operating system supports most large DASD and most terminals and devices supported by the larger Operating System. This gives the DOS/VS user the capability to start out on a mdl 115 or 125 and grow his system and workload up through the S/370 line, as his DP business needs increase.

DOS/VS is classified as IBM System Control Programming (SCP) for distribution, installation, and programming support purposes.

The system operates in extended control (EC) mode only and uses the BC mode format of the program status word (PSW) and low-order storage locations from 0 to 511. Dynamic Address Translation (DAT) is used to provide virtual storage support. The Program Event Recording (PER) Facility and Monitor Calling Facility are used to provide system debugging facilities (SDAIDS).

This section describes the individual components from which the DOS/VS Operating System is built. For a description of basic concepts and facilities of DOS/VS see the *Introduction to DOS/VS*, GN33-8800. To obtain more detailed information the reader should consult the appropriate IBM reference manuals.

SYSTEM CONCEPTS AND ORGANIZATION

Virtual Storage Support: Virtual storage is the address space available to the DOS/VS system. It starts at storage address 0, and its total size is determined by user specification at supervisor assembly time.

SYSTEM COMPONENTS

The Disk Operating System/Virtual Storage System Control Programming consists of the following components:

- Control and Service Programs:
  - Initial Program Load and Buffer Load
  - Supervisor
  - Job Control
  - Attention routines, Initiators, Terminators
  - Checkpoint/Restart
  - Linkage Editor
  - Librarian - Maintenance and Service
  - Display Operator Console Support
- The POWER/VS Program (Priority Output Writers, Execution Processors and Input Readers)
- The Assembler
- Data Management:
  - **Sequential Access Methods:**
  - IOCS and Device Independent I/O
  - Magnetic Tape IOCS
  - Sequential Disk IOCS
  - Paper Tape IOCS
  - Diskette IOCS
  - Magnetic Character Recognition IOCS
  - Optical Character Recognition IOCS
  - **Direct Access Methods:**
  - Direct Access Method
  - Indexed Sequential Access Method
  - Virtual Storage Access Method
- Telecommunications Support:
  - Virtual Telecommunications Access Method
  - Basic Telecommunications Access Method
  - Queued Telecommunications Access Method
- Utility Programs:
  - System Utility Programs
  - Utility Services
  - Access Method Services
- Error Recovery:
  - Recovery Management Support and Recording
  - Environmental Recording and Editing Program
  - Tape Error Recovery Procedures
  - Disk Error Recovery Procedures
- Diagnostic Aids:
  - Online Test Executive Program
  - Problem Determination and System Debugging Aids
- Emulator Program:
  - S/360 mdl 20 Emulator Program

The following sections describe each of these components in more detail.

Control and Service Programs: The control and service programs form the central part of the IBM Disk Operating System/Virtual Storage. The three control programs are initial program load, the supervisor, and job control; the two service programs are the linkage editor and the librarian. The functions of these five programs are outlined in the following paragraphs; details are in the *System Management Guide.*

Initial Program Load (IPL) initializes the system for execution by loading the supervisor into the real address area. At this time, the system operator has the option to alter the contents of the supervisor device address tables and to create the page data file. Job Control is then loaded into the virtual address area associated with the background partition, and control is passed to it.

The Supervisor provides resident and transient control functions for use by all other system and user programs. Supervisor assembly macro instructions allow the user to create an individual supervisor tailored to the needs of his own system. The assembly options he may select include:

- The size of the real address area to be supported.
- The size of the virtual address area to be supported.
- The size of the Shared Virtual Area.
- The number of partitions to be supported.
- The number of physical devices to be supported.
- The number of symbolic logical units to be supported.
- Page fixing support.
- Asynchronous processing (multitasking) support.
- Telecommunications support.
- Relocating loader support.
- Extended cataloged procedure support.
- Multiple timer support.
- POWER/VS support (see *The POWER/VS Program* described later).
- Virtual Storage Access Method support.
- Block Multiplex Channel support.
- Rotational Position Sensing support.
- Fast Channel Command Word Translation.
- Cross Partition Event Control.

This list is not exhaustive.

Specification of any of these or of any of the other available options will increase the processor storage requirement of the supervisor above the minimum requirements tabled below. Details of storage requirements of each individual option are in the *System Generation Manual.*

Minimum Supervisor:

Mdl 115	30K
Mdl 125	30K
Mdl 135, 135-3	30K
Mdl 138	34K
Mdl 145, 145-3	30K
Mdl 148	34K
Mdl 155II	30K
Mdl 158	30K
3031 Processor	34K

Installation improvement facilities are provided in DOS/VS to ease:

- System generation.
- DOS/VS installation.
- Transition to production system.

Support Capabilities include:

- Pre-compiled supervisors.
- Pre-compiled I/O modules.
- Pre-linked system components for immediate use.
- New backup/restore library utilities.
- System generation in a virtual partition.
- Coded samples.
- PTFs pre-applied.
- Default supervisor with RELLDR=YES.
- Automated merge of libraries.
- New delete procedure to aid in tailoring the system.
- UCS-buffer load modules for 1403-N1.
- New, easy to follow documentation for systems generation.

HIGHLIGHTS

- Pre-compiled supervisors.

  Seven supervisors (all RELLDR=YES) are provided in the Core Image Library. Their source code (including JCL) is contained in the A sublibrary of the Source Statement Library.

  Pre-assembled versions of all I/O modules required for RPG II and PL/I Optimizer are provided in the Relocatable Library.

- Pre-Compiled I/O modules.
- IBM components pre-linked for immediate use.

  System components have been link-edited relocatable. This eliminates the effort previously required to link system compo-

DOS/VS (cont'd)

nents at each individual customer location. As a result, the elapsed time required for installing DOS/VS has been significantly reduced.

- New system utilities which allow for backup/restore of system and private libraries.

  Two new programs are included which provide for backup of system and/or private libraries to tape with subsequent restore to disk. When the libraries are restored to disk, they are automatically condensed and may be reallocated to different sizes or to different DASD types. The restore program will accept the PID tape as input and allocate the libraries within a DOS/VS partition.

- Complete system generation in a virtual partition.

  Included are the necessary programs and documentation to completely sysgen in a partition of an existing release of DOS/VS (including restore and allocation of libraries). Since no stand-alone time is required to do the SYSGEN, production may continue during the generation of the new system subject to DASD and partition availability.

- Coded samples.

  Coded samples in the Procedure Library for:

  - Procedures to delete and link system components.
  - Standard labels.
  - Private library creation.
  - VSAM file definition.

- PTFs pre-applied.

  The DOS/VS package will be periodically updated with the latest PTFs.

- Default supervisor with RELLDR=YES.

  The default supervisor $$A$SUP1 has been generated with relocating loader feature. This allows the pre-linked IBM system components to be linked using the relocating loader. Since most DOS/VS users use this feature, this eliminates the need to relink the components that were previously linked without the relocating loader.

- Automatic merge of libraries.

  A program is included that will compare the directories of the old system with the directories of the newly created system and produce the necessary copy cards for use with the copy and reorganize program CORGZ. This program supports private libraries as well as the system libraries and eliminates the manual effort of comparing sorted directory listings and punching the required copy cards. As a result, the human error or missing a module in the directory comparison is eliminated. In addition, the accidental merge of an undesired module cannot occur.

- New delete procedures to aid in tailoring the system.

  Since all IBM system components are pre-linked into the system core-image library, new delete procedures are included to allow the DOS/VS user to delete any unwanted IBM components. These procedures are included in the DOS/VS procedure library.

- UCS-buffer load modules for 1403-N1.

  Pre-assembled versions of buffer load modules for several train arrangements for the 1403-N1 with universal character set feature are contained in the relocatable library.

Job Control provides job initiation and job-to-job transition facilities for all partitions on the basis of control statements read from the system console (SYSLOG) or from the system reader (SYSRDR) for the partition in question. The supervisor loads job control into a virtual partition whenever the previous job in that partition comes to an end, or, if the partition is not in active use, on request from the system operator. Job control is always executed in virtual mode; it may initiate execution of jobs in either virtual or real mode dependent on user specification.

The control statements that make up the job control language allow the user to: name the program phase or phases to be executed ... select either virtual or real mode for their execution ... specify the quantity of virtual or real storage required ... specify the physical devices to be used ... specify the file labels of program files ... call a catalogued procedure from the procedure library ... overwrite statements within a catalogued procedure ... exercise general control functions over program execution.

Operator commands allow the system operator to intervene in the process if it is necessary to modify control statements to meet abnormal conditions in the operating environment.

Attention Routines, Initiators, Terminators - The Initiators allow the operator to communicate with the system through the Attention Routines. Terminator routines provide the support for program termination: under program control; through operator action; a program error; or certain I/O failures.

Checkpoint/Restart - The progress of a program that performs considerable processing in one job step can be protected against destruction in case the program is canceled. The checkpoint facility makes it possible to preserve information at regular intervals and in sufficient quantity to allow restarting a program at an intermediate point.

The Linkage Editor links and relocates separate program sections (relocatable modules) read from the system link device (SYSLNK) or from system or private relocatable libraries or from any combination of these three, creating executable object program phases which are then stored in the core image library selected by the user. If action REL has been specified, the linkage editor will form object program phases which can later be loaded for execution from any set of real or virtual storage locations. If action NOREL has been specified, object program phases will be absolute and must be executed from the storage locations to which they have been link-edited unless they have been written in such a way as to make them self-relocating. If neither has been specified, the linkage editor will make a decision based upon specifications of relocating loader support. A program may be link-edited for execution in the virtual or real part of any partition regardless of the partition in which the linkage editor itself is executed.

The Librarian provides maintenance and service functions for all system and private libraries. The librarian is a collection of programs which allow the user to catalog, delete, rename, display, output, copy, condense, and reallocate the contents of libraries and to create and use new private libraries. Certain functions are restricted so that system libraries may only be modified by programs executed in the background partition. Details of these restrictions are given in the *System Management Guide.*

The control and service programs use the system logical units shown in the following lists. The types of physical device that may be assigned to each specific logical unit are shown individually, and summarized in the table at the end of this section.

The 3344 Disk Storage may be used where the 3340 is specified. Consideration should be given to the effect of locating multiple logical volumes on one physical spindle.

The system as a whole requires one of each of the following system logical units:

- **SYSRES** - The System Residence is the direct access storage device on which the operator has mounted the volume containing the system residence extent. The following physical devices may be used: 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1, 2 and 11/3333-1 and 11/3340/3350 Disk Storage.

- **SYSVIS** - The System Virtual Storage is the direct access storage device on which the operator has mounted the volume containing the page set extent. The following physical devices may be used: 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330/3333/3340/3350 Disk Storage.

- **SYSLOG** - The System Log is the system console used for system and operator communication. It is normally assigned to one of the following physical devices: 3210 Console Printer-Keyboard ... 3215 Console Printer-Keyboard ... the Display Console for the mdl 138 with or without the 3286 Printer mdl 2 ... the Display Console for the mdl 148 with or without the 3286 Printer mdl 2 ... the Display Console for the mdl 158 together with the 3213 Console Printer (supported in 3215 compatibility mode only) ... the display operator console for the mdl 115 or 125 with or without the 5213 mdl 1 Console Printer ... the 3277 Display Station (locally attached via 3272 control Unit). To obtain more detailed information, consult the appropriate IBM reference manuals.

  Should the console printer-keyboard become inoperable, SYSLOG may be assigned to one of the following printers: 1403 Printer ... 1443 Printer ... 3203 Printer ... 3211 Printer ... 3800 Printing Subsystem ... 5203-3 Printer.

  Such a printer assignment allows system operation to continue though with restricted operator-to-system communication.

- **SYSREC** - The System Recorder is the direct access storage device on which the operator has mounted the volume which is to contain records output by the Recovery Management Support Recorder. The following physical devices may be used: 2311 Disk Storage Drive ... 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11/3333-1/3340/3344/3350 Disk Storage.

- **SYSCAT** - The System Catalog is the direct access storage device on which the operator has mounted the volume containing the VSAM file catalog. The following physical devices may be used: 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11/3333-1/3340/3344/3350 Disk Storage ... 3540 Diskette I/O Unit.

  Note: Assignment of the System Catalog is not required if the Virtual Storage Access Method is not used.

Each partition requires one of each of the following logical units:

DOS/VS (cont'd)

- **SYSRDR** - The System Reader is the source of control statement input for the job control program. Each partition requires the assignment of a separate physical device as System Reader except when the assignment is made to a direct access storage device; in this case, separate System Reader extents may occupy the same direct access storage volume. System Readers may be assigned to any of the following devices: 1442 Card Read Punch ... 2501 Card Reader ... 2520 Card Read Punch ... 2540 Card Read Punch ... 2560 Multifunction Card Machine ... 3504 Card Reader ... 3505 Card Reader ... 3525 Card Punch (with Read Feature) ... 3540 Diskette Input/Output Unit (mdl 2 can be assigned to two partitions) ... 5425 Multifunction Card Unit ... 2400-Series Magnetic Tape Units ... 3400-Series Magnetic Tape Units ... 2311 Disk Storage Drive ... 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11/3333-1/3340/3344/3350 Disk Storage.

- **SYSIPT** - The System Input Device is the source of all system input other than that for the job control program. Each partition requires the assignment of a separate physical device as the System Input Device except when the assignment is made to a direct access storage device; in this case, separate System Input extents may occupy the same direct access storage volume. System Input Devices may be assigned to any of the physical devices listed under SYSRDR above.

  Within any one partition SYSRDR and SYSIPT may be assigned to the same physical device or to separate physical devices in accordance with user requirements.

- **SYSLST** - The System List Device is the destination of print lines or print line images output by the system. Each partition requires the assignment of a separate physical device as the System List Device except when the assignment is made to a direct access storage device; in this case, separate System List extents may occupy the same direct access storage volume. System List Devices may be assigned to any of the following physical devices: 1403 Printer ... 1443 Printer ... 3203 Printer ... 3211 Printer ... 3800 Printing Subsystem ... 5203 Printer ...2400-Series Magnetic Tape Units ... 3400-Series Magnetic Tape Units ... 2311 Disk Storage Drive ... 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11/3333-1/3340/3344/3350 Disk Storage ... 3540 Diskette I/O Unit.

- **SYSPCH** - The System Punch Device is the destination of all cards or card images output by the system. Each partition requires the assignment of a separate physical device as the System Punch Device except when the assignment is made to a direct access storage device; in this case, separate System Punch extents may occupy the same direct access storage volume. System Punch Devices may be assigned to any of the following physical devices: 1442 Card Read Punch ... 2520 Card Read Punch ... 2540 Card Read Punch ... 2560 Multifunction Card Machine ... 3525 Card Punch ... 5425 Multifunction Card Unit ... 2400-Series Magnetic Tape Units ... 3400-Series Magnetic Tape Units ... 2311 Disk Storage Drive ... 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11/3333-1/3340/3344/3350 Disk Storage ... 3540 Diskette I/O Unit.

  Within any one partition SYSLST and SYSPCH may be assigned to the same physical magnetic tape unit.

The number of unit record devices required to operate the system in the multiprogramming environment can be greatly reduced by use of the POWER/VS program described later in these pages.

Each partition may also require one or more of the following system logical units in order to perform particular control and service functions:

- **SYSLNK** - A System Link Device is a direct access storage device used to store input for the linkage editor program. It may be assigned to any of the following physical devices: 2311 Disk Storage Drive ... 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11/3333-1/3340/3344/3350 Disk Storage.

- **SYSCLB** - A Core Image Library Device is a direct access storage device on which the operator has mounted a volume containing a private core image library.

- **SYSRLB** - A Relocatable Library Device is a direct access storage device on which the operator has mounted a volume containing a private relocatable library. It must be assigned to the same type of direct access storage device as SYSRES.

- **SYSSLB** - A Source Statement Library Device is a direct access storage device on which the operator has mounted a volume containing a private source statement library. It must be assigned to the same type of direct access storage device as SYSRES.

Display Operator Console Support provides the functions to operate and control the mdls 115, 125, 138, and 148. Operator input entered through the alphameric keyboard and messages from system and problem programs are displayed on the screen of the cathode ray tube. System messages requiring operator reply or action will stay on the screen until the reply is received by the system. A hard copy record of the sequential activity on the video display is available and may be printed on the optional Console Printer via a utility.

Permissible Device Assignments for the System Logical Units

Logical Unit	SYSRDR SYSIPT	SYSLST	SYSPCH	SYSLOG	SYSRES SYSCLB SYSRLB SYSSLB SYSVIS SYSCAT	SYSREC SYSLNK
Model 115 DOC				X		
Model 125 DOC				X		
Device Type						
1403		X		X		
1442	X		X			
1443		X		X		
2501	X					
2520	X		X			
2560	X		X			
3203		X		X		
3262-5		X		X		
2540	X		X			
3210				X		
3211		X		X		
3213				X		
3215				X		
3800		X		X		
3504/3505	X					
3525	X		X			
3540	X	X	X			
2400-series	X	X	X			
3400-series	X	X	X			
2311	X	X	X			X
2314	X	X	X		X	X
2319	X	X	X		X	X
3330-1,-2,-11 3333-1,-11	X	X	X		X	X
3340/3344/3350	X	X	X		X	X
5203		X		X		
5425	X		X			

THE POWER/VS PROGRAM

The POWER/VS program is a spooling system which provides the user with automatic staging of unit record input and output and priority scheduling for all programs executed under its control. The POWER/VS program resides in one partition and is able to control all remaining partitions, provided these have a lower system dispatching priority than that of the POWER/VS partition.

The POWER/VS program runs on any model of S/370 that is supported by DOS/VS and has a minimum of 96K of real storage, and is executed in virtual mode in order to take advantage of the virtual storage environment provided by DOS/VS. POWER/VS makes extremely dynamic use of the address space and acquires real processor storage on an as-needed basis. Page frames released by POWER/VS tasks are freed and returned to the Page Pool. Programs executed under POWER/VS control may be executed not only in virtual mode but also in real mode.

The DOS/VS system contains a POWER/VS Reader/Writer version catalogued in the System Core Image Library, generated with default values for all POWER/VS generation parameters.

If these options are appropriate to the system environment of the user, no POWER/VS System Generation is necessary.

POWER/VS is generated by assembly of the POWER/VS macros, which allows the user to specify the options appropriate to his own system environment, and creates the POWER/VS generation table. The resultant object deck contains the code necessary to invoke the POWER/VS program.

The POWER/VS program maintains input and output queues on direct access storage for the card readers, Diskette I/O Units (input only), card punches, and printers associated with the partitions under its control. These queues are filled or emptied by the appropriate physical devices. When a program under POWER/VS control makes an input or output request to one of these devices, POWER/VS presents it with the next record from the appropriate input queue or collects the record and places it in the appropriate output queue. These operations take place at main storage or direct access storage speeds; hence, programs execute quicker and take better advantage of the system environment. POWER/VS is transparent to the programs executed under its control; these do not require modification to take advantage of POWER/VS.

Since the queues are under optional operator control, the system operator can modify the order in which programs are executed by manipulating the queues with POWER/VS operator commands. The effective substitution of direct access storage devices for unit record

DOS/VS (cont'd)

devices reduces the number of the latter needed to operate the system efficiently in a multiprogramming environment.

The use of partition-independent input classes simplifies the operational characteristics of the POWER/VS system. This dynamic partition scheduling provides automatic balancing of the input between the various partitions controlled by POWER/VS.

The POWER/VS program supports the following unit record devices for peripheral input and output: 1442 Card Read Punch ... 2501 Card Reader ... 2520 Card Read Punch ... 2540 Card Read Punch ... 2560 Multifunction Card Machine ... 3504/3505 Card Reader ... 3525 Card Punch ... 5425 Multifunction Card Unit ... 1403 Printer ... 1443 Printer ... 3203 Printer ... 3211 Printer ... 3800 Printing Subsystem ... 5203 Printer ... 3540 Diskette I/O Unit (input only). 51 column Interchangeable Read Feed features #4151 and #3921 are not supported in POWER/VS.

The following combinations are supported on the 3540: Job control statements from a card reader, data from one or more 3540 files ... Job control statements and data from a single 3540 file (multi-volume files are supported).

In addition the POWER/VS program requires direct access storage for its work files. Different POWER/VS direct access files may be on different direct access storage devices, which may be any of the following: 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330/3333 Disk Storage ... 3340 Disk Storage ... 3344 Disk Storage ... 3350 Disk Storage.

The POWER/VS program supports the following magnetic tape devices for output spooling only: 2400-series Magnetic Tape Units (2495 is not supported by POWER/VS) ... 3400-series Magnetic Tape Units.

POWER/VS MAJOR FEATURES

- Easy POWER/VS generation and start up procedures include automatic start up of a POWER/VS system via control cards.
- As many partitions as provided with the individual DOS/VS installation, minus one partition each for POWER/VS and VTAM (optionally), may be controlled by POWER/VS. The user need not specify this number during the DOS/VS POWER/VS generation.
- Jobs entered into the system are grouped into user-assigned input classes. Any class may be either partition-dependent or partition-independent. Within each class, jobs may be assigned different priorities for execution. The operator may call for execution of jobs of an individual class or of a group of up to four classes.
- Job input may be retained after job execution to allow for repeated execution of the same job.
- List and punch output is grouped into output classes. The list or punch class output of a job may be the same as or different from the input class assigned to the job. The operator may call for list or punch output of an individual output class or of a group of up to four classes.
- Job output may be retained after printing or punching has been performed to allow production of further output copies at a later time.
- A segmented output capability is provided. Physical output for a job can be started before all list or punch output for that job has been accumulated.
- Output processing may be stopped, and later restarted from the point at which it was stopped, or from any other point. A large punch job on a card read punch can be stopped in this way to allow read operations to be started using the same physical device.
- Multiple copies of printed or punched output may be requested at output time.
- List or punch output from successive jobs may be separated by internally generated list separator pages or punch separation cards.

  Up to 8 printers and 8 punches may be associated with each POWER/VS controlled partition at the time the partition is started. Hence, concurrent multiple printer and punch output can be handled.
- POWER/VS job accounting records include the job accounting information provided through the DOS/VS job accounting interface.
- The internal Reader/Writer interface allows any DOS/VS partition
  - To put a jobstream into the POWER/VS reader queue.
  - To retrieve spooled output from the POWER/VS list queue and
  - To submit POWER/VS commands.
- RJE support for ASCII as transmission code.

DOS/VS POWER/VS REMOTE JOB ENTRY (RJE)

The DOS/VS POWER/VS Remote Job Entry feature provides an efficient method to enter jobs from terminals into the system for execution and to obtain output either centrally or at a work station.

POWER/VS supports the following BSC terminals:

2770 Data Communication System
2780 Data Transmission Terminal
3741 Data Station (mdl 2) in 2780 emulation mode
3741 Programmable Work station (mdl 4) as a 2780
3770 Data Communication System (non-programmable models only)
3780 Data Communications Terminal

Only BSC point-to-point connections are supported.

DOS/VS POWER/VS supports the non-programmable models of the 3770 Data Communication System, the 3790 Communication System, the System/32 (as a 3770), the System/34 (as a 3770) and the System/36 (as a 3770). Transmission to the terminals is via Synchronous Data Link Control (SDLC). This provides DOS/VS POWER/VS remote entry support for SDLC terminals in a terminal-sharing environment where several applications may establish logical connections with the terminal on a per-session basis. To achieve this flexibility of terminal-sharing, POWER/VS uses the VTAM application program interface for the support of the SDLC terminals which are attached to a 3704 or 3705 in network control mode.

SDLC terminals supported by POWER/VS are:

3771 Communication Terminal*
3773 Communication Terminal*
3774 Communication Terminal*
3775 Communication Terminal*
3776 Communication Terminal*
3777 Communication Terminal*
3790 Communication System
8100/DPCX Information System
8100/DPPX Information System
8100/DPPX/SP Information System
System/32 (as a 3770)
System/34 (as a 3770)
System/36 (as a 3770)

*Non-programmable models only.

The functional characteristics of the DOS/VS POWER/VS support for SDLC terminals are as follows:

- Half duplex flow for single logical unit work stations.
- Full duplex flows for multiple logical unit work stations.
- Multipoint operation.
- Serial data transmission operation for single logical unit work stations, that is, no concurrent operation of printer and punch on the outbound flow from POWER/VS to the SDLC terminals.
- Concurrent data transmission operation for multiple logical unit work stations, that is, concurrent inbound and outbound data flows between POWER/VS and SDLC terminals.
- Transparent 3770 and 3790 disk operation.
- Compression of repeated characters in data stream for printer output for 3770 and 3790 terminals. Compaction for printer output data streams for 3790 terminals.

Multiple Logical Unit (MLU) 3776 mdls 3,4 and 3777 mdl 3 with up to six independent and concurrent sessions are supported.

Up to 25 BSC terminals or up to 200 SDLC and BSC terminals can communicate concurrently with the central system via switched or nonswitched lines. Through the use of switched lines many more terminals may be in the POWER/VS network non-concurrently.

POWER/VS TERMINALS SUPPORTED

BSC Lines

2770 Data Communication System
2772 Multipurpose Control Unit:

Required:	#3650 - EBCDIC Transparency (see note below) **#9140** - Extended Re-try **#9402** - Line Termination - 2-Wire **#9761** - Transmission Code EBCDIC, or **#9762** - Transmission Code ASCII **#9936** - Immediate WACK
Supported:	Attachment of 0545, 2213, 2502, 2203 #1340 - Automatic Answering #1490 - Buffer Expansion (256 bytes) #1491 - Buffer Expansion Additional (512 bytes) #3860 - 144 Character Print Line #5890 - Horizontal Format Control #6555 - Space Compression/Expansion
Not Supported:	Attachment of 0050,1017,1018,1255,2265

DOS/VS (cont'd)

#4610 - Identification
#5010 - Multipoint Data Link Control

0545 Output Punch (mdls 3,4)

2213 Printer (mdls 1,2)

2502 Card Reader (mdls A1,A2):
- Supported: The standard keyboard provided with the 2772 may be used as a 2502 reader for text which is compatible with card input. Such input is limited to entry of commands and extremely short job-streams (the complete stream must fit entirely into the 2772 buffer).

2203 Printer (mdls A1,A2)
- Supported: #5558 - Print Positions, 24 Additional

2780 Data Transmission Terminal:
- Required: #8030 - EBCDIC Transparency (see note below)
  #9150 - Extended Retry Transmission
  #9402 - Line Termination
  #9761 - ASCII Transmission Code, or
  #9762 - EBCDIC Transmission Code
- Supported: #1340 - Automatic Answering
  #1350 - Automatic Turnaround
  #5010 - Multiple Record Transmission
  #5800 - Printer Horizontal Format Control
  #5820 - 120 Character Print Line
  #5821 - 144 Character Print Line
  #6400 - Selective Character Set
- Not Supported: #5020 - Multipoint Line Control
  #7850 - Terminal Identification

3741 Data Station (mdl 2) on switched or nonswitched line (supported as 2780):
- Required: The 3741 must be strapped for nonswitched line operation even though a switched line facility will be used. The Data Terminal Ready (DTR) pins must remain set for a switched line facility.
- Supported: Attachment of 0129, 3713, 3715, 3717
  #1680 - Expanded Communications
  #1685 - Expanded Communications/Multipoint Data Link Control
- Not Supported: #5450 - Operator Identification Card Reader
  #7850 - Terminal Identification

0129 Card Data Recorder (mdl 2)

3713 Printer (mdl 1)

3715 Printer (mdls 1, 2)

3717 Printer (mdl 1)

3741 Programmable Workstation (mdl 4) on switched or nonswitched line (supported as a 2780):
- Required: The 3741 must be strapped for nonswitched line operation even though a switched line facility will be used. The Data Terminal Ready (DTR) pins must remain set for a switched line facility.
- Supported: Attachment of 0129, 3713, 3715
  #1680 - Expanded Communications
  #1685 - Expanded Communications/Multipoint Data Link Control
- Not Supported: #5450 - Operator Identification Card Reader
  #7850 - Terminal Identification

0129 Card Data Recorder (mdl 2)

3713 Printer (mdl 1)

3715 Printer (mdls 1, 2)

3770 Data Communication System:

3771 Communication Terminal (mdls 1,2,3) [supported as a 2772]:
- Required: #1460 - SDLC/BSC, Switch Control, or
  #1461 - BSC Point-to-Point

3773 Communication Terminal (mdls 1,2,3) [supported as a 2772]:
- Required: #1460 - SDLC/BSC, Switch Control, or
  #1461 - BSC Point-to-Point

3774 Communication Terminal (mdls 1,2,P1,P2) [supported as a 2772]:
- Required: #1460 - SDLC/BSC, Switch Control, or
  #1461 - BSC Point-to-Point

3775 Communication Terminal (mdl 1,P1) [supported as a 2772]:
- Required: #1460 - SDLC/BSC, Switch Control, or
  #1461 - BSC Point-to-Point

3776/3777 Communication Terminal (mdls 1,2) [supported as a 2772/3780]:
- Required: #1460 - SDLC/BSC, Switch Control, or
  #1461 - BSC Point-to-Point

3780 Data Communications Terminal [supported as a 2772]:
- Required: #3601 - EBCDIC Transparency (see note below)
  #9150 - Extended Retry Transmission
  #9761 - EBCDIC Transmission Code, or
  #9762 - ASCII Transmission Code
  #9936 - WACK Response
- Supported: Attachment of 3781
  #1601 - Component Selection
  #5701 - Print Positions, Additional
  #7651 - Switched Network Control
- Not Supported: #5010 - Multipoint Data Link Control
  #9350 - Terminal and Security Identification

3781 Punch:
- Required: #1601 - Component Selection

6670 Information Distributor and 6670 mdl II (supported as 2770) on switched, nonswitched or local attach lines:
- Supported: The 6670 emulates the following 2770 features: (all items listed are standard on the 6670)
  Automatic Answering
  Buffer Expansion (256 bytes)
  Buffer Expansion (512 bytes)
  EBCDIC Transparency
  Identification (Terminal only)
  Space Expansion
  Synchronous Clock
  Extended Retry (Transmission)
  Transmission Code EBCDIC
  Transmission Code ASCII

SDLC Lines

3770 Data Communication System:

3771 Communication Terminal (mdls 1,2,3):
- Required: #1460 - SDLC/BSC, Switch Control, or
  #1470 - SDLC

3773 Communication Terminal (mdls 1,2,3,P1,P2,P3):
- Required: #1460 - SDLC/BSC, Switch Control, or
  #1470 - SDLC

3774 Communication Terminal (mdls 1,2,P1,P2):
- Required: #1460 - SDLC/BSC, Switch Control, or
  #1470 - SDLC

3775 Communication Terminal (mdl 1, P1):
- Required: #1460 - SDLC/BSC, Switch Control, or
  #1470 - SDLC

3776 Communication Terminal (mdls 1,2,3,4):
- Required: #1460 - SDLC/BSC, Switch Control, or
  #1470 - SDLC

3777 Communication Terminal (mdl 1,3):
- Required: #1460 - SDLC/BSC, Switch Control, or
  #1470 - SDLC

3790 Communication System

3791 Communication Controller
- Required: Configuration Feature **#9165** or **#9169**

6670 and 6670 mdl II (as Logical Unit Type 4)

8100/DPCX Information System

8100/DPPX Information System

8100/DPPX/SP Information System

System/32 (supported as a 3770):

5320 System Unit:
- Required: #1005 - Additional Storage (minimum of one)
  #6301 - Synchronous Data Line Control

System/34 (supported as a 3770):

5340 System Unit
- Required: #2500, #3500 or #4500 Communications Adapter Feature

System/36 (supported as a 3770 or 3791):

5360 System Unit
- Required: #2500 or #4500 Communications Adapter Feature

System/38 (supported as a 3770) on switched or nonswitched line:

5381 System Unit
- Required: #1501 or #1502 Communications Attachment Feature
  #2000, #2001, #2002, or #2003 Communications Control Feature
  #3200 Line Base Feature

Host System Terminal Attachment Requirements: Attachment of terminals to the host system requires one of the following minimum configurations:

S/370 mdl 115 with:
- #4640 - Integrated Communications Adapter
- #7100 - Synchronous Line Group
- #7141 - Synchronous Line Medium Speed with Clock, or
- #7151 - Synchronous Line Medium Speed

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Up to 4 lines can be attached with the additional features: #7142, #7143, #7144 or #7152, #7153, #7154.

S/370 mdl 125, with:

#4640 - Integrated Communications Adapter
#7100 - Synchronous Line Group, with
#7141 - Synchronous Line Medium Speed with Clock, or
#7151 - Synchronous Line Medium Speed or
#4640 - Integrated Communications Adapter
#7131 - Synchronous Line Low Load

Up to 6 lines can be attached with the additional features: #7142, 7143, 7144 or #7152, 7153, 7154 or #7132

S/370 mdl 135, 135-3, 138 with:

#4640 - Integrated Communications Adapter
#9649 - Synchronous Data Adapter Type II
#9673 - Transparency (see note below)

Up to 8 lines can be attached with the additional features: #4722-4728 or #9650-9656

Any System/370 supported by DOS/VS with BSC capability through one of the following attached devices:

2701 Data Adapter Unit with the following features:

#7698 - Synchronous Data Adapters Type II
#8029 - Transparency (see note below)
#9060 - EBCDIC code, or
#9061 - ASCII code

2703 Transmission Control Unit with the following features:

#7702 - Synchronous Attachment
#7703 - Synchronous Base, or
#7704 - Synchronous Base, or
#7706 - Synchronous Base
#7710 - Synchronous Line Set
#7715 - Synchronous Terminal Control EBCDIC or,
#7716 - Synchronous Terminal Control ASCII

3704/3705-I/3705-II Communications Controller in emulation mode (BSC), or 3704/3705-I/3705-II Communications Controller in network control mode (SDLC), or 3705-I/3705-II Communications Controller in emulation mode (BSC) with the following line features:

#4714 - Line Set 1D
#4716 - Line Set 1F

#4714 and #4716 are line attachment features only; for full configuration, see M3704/3705 pages.

Note: Print output to a terminal is always sent in non-transparent mode. If the full range of data characters from X'00' to X'FF' (e.g., needed in case of sending an object deck to the punch) is not needed and the user is transmitting in non-transparent mode only, the EBCDIC Transparency Feature (#8030, #3650 or #3601) and Transparency (#8029 or **#9673**) may be omitted from the requirements. Transparent mode is provided as a standard option with the mdl 138 ICA feature.

THE ASSEMBLER

The Assembler is a programming tool for the implementation of programs written in S/370 Assembler Language. Assembler language gives the user access to machine and operating system functions and permits obtaining the best balance between storage utilization and speed of program execution. However, a problem solution expressed in Assembler language normally requires more coding effort than a solution to the same problem expressed in a higher level language.

The major features of the Assembler include:

Macro instructions, which provide the programmer with a powerful programming tool. Use of the system macro instructions provides access to all of the capabilities of DOS/VS. Use of programmer-defined macro instructions can simplify the programming of particular applications and makes possible the definition of special-purpose languages.

Performance has been improved by the introduction of a pre-edited macro library. Conditional assembly statements are used to alter the sequence in which statements are processed or to specify the selective assembly of sets of instructions. The conditional assembly feature is a key element of the macro feature.

Private libraries, which may be used to contain both Assembler language statements to be inserted into programs by means of COPY statements, and macro instruction definitions for use by the macro processor.

The Assembler uses the S/370 Standard Instruction Set, and requires for execution a minimum partition size of 20K; it may be executed either in virtual or in real mode.

The Assembler reads source program input from SYSIPT and directs its output to SYSLST, SYSPCH, and SYSLNK, dependent on the user options in force. Library input may also be read from SYSSLB. All of these logical units may be assigned to any of the physical devices already indicated for the control and service programs. The Assembler further requires direct access storage space for three work files; any of the following physical devices may be used for this purpose:

2311 Disk Storage Drive

2314 Direct Access Storage Facility

2319 Disk Storage

3330-1,-2,-11/3333-1,-11 Disk Storage

3340 Disk Storage

3344 Disk Storage

3350 Disk Storage

DATA MANAGEMENT

The data management facilities of DOS/VS are divided into two parts: The physical input/output control system (physical IOCS); and the logical input/output control system (logical IOCS). The user invokes the services of the IOCS routines by use of macro instructions.

The EXCP (execute channel program) and WAIT macro instructions of physical IOCS allow the user to handle input and output devices in a direct way by writing his own channel programs; it is usually more convenient for him however to use the macro instructions of logical IOCS, either using GET and PUT macro instructions to handle logical data records or using READ and WRITE macro instructions to handle physical data blocks. OPEN and CLOSE macro instructions perform the functions of creating, checking, and updating file labels for input and output files; the CNTRL macro instruction performs specific device-dependent control functions such as stacker selection, printer carriage movement, and magnetic tape positioning.

The individual component routines of logical IOCS are classified under four headings: the Sequential Access Method (SAM), the Direct Access Method (DAM), the Indexed Sequential Access Method (ISAM), and the Virtual Storage Access Method (VSAM).

When RPS is specified during System generation

- SAM, DAM and VSAM will automatically include Rotational Position Sensing for 3330-1,-2,-11, 3333-1,-11, 3340, 3344 and 3350 Disk Storage.
- ISAM will automatically include Rotational Position Sensing for 3330-1, 2, 3333-1, 3340, 3344, and 3350 (in 3330-1 Compatibility Mode) Disk Storage.

Sequential Access Method - SAM: The Sequential Access Method (SAM) enables files to be defined and accessed in a sequential manner beginning with the first logical record of the file and continuing in sequence till the last logical record of the file is reached. The components of the Sequential Access Method are described in the following paragraphs.

Basic Sequential IOCS provides support for definition, creation and processing of files associated with unit record devices and the system console. The DTFCD macro instruction is used to define a punched card file; the DTFPR macro instruction is used to define a printer file; the DTFCN macro instruction is used to define a system console file.

By means of GET or PUT macro instructions, records are obtained or created starting with the first record of the logical file and continuing to the last record. Logical records are considered to be unblocked and may be of either fixed or variable length within the limits of the unit record medium to which they relate. Input and output operations may be overlapped with instruction processing by specification of two data areas for use by IOCS. Either the CNTRL macro instruction or first data character control may be used to effect any stacker selection or printer forms carriage movement required.

Basic Sequential IOCS supports the following devices:

1442 Card Read Punch
2501 Card Reader
2520 Card Read Punch
2540 Card Read Punch
2560 Multifunction Card Machine
2596 Card Read Punch
3504/3505 Card Reader
3525 Card Punch
5425 Multifunction Card Unit
1403 Printer
1443 Printer
3211 Printer
3262 Printer
3800 Printing Subsystem
3881 Optical Mark Reader
3210 Console Printer-Keyboard
3215 Console Printer-Keyboard

The display operator console for the mdl 115 or 125 with or without the 5213 Console Printer mdl 1.

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The display console for the mdls 138 or 148 with or without the 3286 printer mdl 2.
The display console for the mdl 158 together with the 3213 Console Printer (supported only in 3215 compatibility mode).

Device-Independent IOCS provides support for definition, creation and processing of files associated with the system input and output logical units. The IOCS is used with the card readers, card punches, and printers that act as system input and output units, and enables magnetic tape or direct access storage to be substituted for such devices at execution time without the need for program modification. The DTFDI macro instruction is used to define a device-independent file.

By means of GET or PUT macro instructions records are obtained or created starting with the first logical record of the file and continuing to the last record. Logical records are unblocked and of fixed length within the constraints of the unit record medium to which they may relate. First data character control must be used to specify any stacker selection or printer forms carriage movement required.

Device-Independent IOCS supports the following physical devices:

1442 Card Read Punch
2501 Card Reader
2520 Card Read Punch
2540 Card Read Punch
2560 Multifunction Card Machine
3504/3505 Card Reader
3525 Card Punch
5425 Multifunction Card Unit
1403 Printer
1443 Printer
3203 Printer
3211 Printer
3262 Printer
3800 Printing Subsystem
3540 Diskette I/O Unit
5203 Printer

Any of the following physical devices may be substituted for these devices at execution time:

2400-series Magnetic Tape Units
3400-series Magnetic Tape Units
2311 Disk Storage Drive
2314 Direct Access Storage Facility
2319 Disk Storage
3330-1,-2,-11/3333-1,-11 Disk Storage
3340 Disk Storage
3344 Disk Storage
3350 Disk Storage

Sequential Tape IOCS provides support for definition, creation and processing of input and output files recorded on magnetic tape. The DTFMT macro instruction is used to define a magnetic tape file.

By means of GET or PUT macro instructions magnetic tape records are obtained or created starting with the first logical record of the file and continuing to the last record. Logical records may be either blocked or unblocked and may be of either fixed or variable length. Necessary blocking and deblocking of logical records is performed by the IOCS. Logical records, blocked or unblocked, may span multiple physical records. Input and output operations may be overlapped with instruction processing by the specification of two data areas for use by IOCS. The data within a file may be encoded either in EBCDIC or in ASCII. The CNTRL macro instruction enables the user to specify such control operations as forward space, backspace, rewind, and unload; the user may position magnetic tapes in accordance with the needs of the program.

Sequential Tape IOCS also provides support for definition, creation and processing of magnetic tape work files; that is, files which serve as output and as input within the same program. In this case READ or WRITE macro instructions are used to obtain or create physical blocks; any necessary blocking or deblocking of logical records within physical blocks is the responsibility of the user. He may also issue the NOTE and the various POINT macro instructions to reposition magnetic tapes in accordance with the needs of his program.

Sequential Tape IOCS supports the following physical devices:

2400-series Magnetic Tape Units
3400-series Magnetic Tape Units

Sequential Disk IOCS provides support for definition, creation, and processing of input and output files recorded on direct access storage devices. The DTFSD macro instruction is used to define a direct access storage file.

By means of GET or PUT macro instructions direct access records are obtained or created starting with the first logical record of the file and continuing to the last record. Logical records may be either blocked or unblocked and may be of either fixed or variable length. Necessary blocking and deblocking of logical records is performed by the IOCS. Logical records, blocked or unblocked, may span multiple physical records. Input and output operations may be overlapped with instruction processing by the specification of two data areas for use by IOCS.

Sequential Disk IOCS also provides support for definition, creation and processing of direct access storage work files; that is, files which serve as output and as input within the same program. In this case READ or WRITE macro instructions are used to obtain or create physical blocks; any necessary blocking or deblocking of logical records within physical blocks is the responsibility of the user. Users may also issue the NOTE and the various POINT macro instructions to logically reposition the file in accordance with the needs of their program.

Sequential Disk IOCS supports the following physical devices:

2311 Disk Storage Drive
2314 Direct Access Storage Facility
2319 Disk Storage
2321 Data Cell Drive
3330-1,-2,-11/3333-1,-11 Disk Storage
3340 Disk Storage
3344 Disk Storage
3350 Disk Storage

Sequential Diskette IOCS provides support for definition, creation and processing of input and output files recorded on IBM diskettes. The DTFDU macro instruction is used to define a diskette file.

By means of GET or PUT macro instructions, diskette records are obtained or created starting with the first logical record of the file and continuing to the last record. Logical records are fixed length and unblocked, but may be grouped together in the user's I/O AREA(s) for performance reasons through IOCS use of command chaining.

Sequential Diskette IOCS supports the following physical device:

3540 Diskette Input/Output Unit

Sequential Paper Tape IOCS provides support for definition, creation, and processing of input and output files recorded in punched paper tape. The DTFPT macro instruction is used to define a paper tape file.

By means of GET or PUT macro instructions paper tape records are obtained or created starting with the first logical record of the file and continuing to the last record. Logical records may be either of undefined format, in which case they must be terminated by the end-of-record character, or of fixed length and unblocked, in which case the end-of-record character must not be present. Input and output operations may be overlapped with instruction processing by the specification of two data areas for use by IOCS. Any necessary translation of codes may be performed under the control of user-specified translation tables.

Sequential Paper Tape IOCS supports the following physical devices:

1017 Paper Tape Reader
1018 Paper Tape Punch
2671 Paper Tape Reader

Magnetic Character Recognition IOCS provides support for definition and processing of the input files associated with the IBM magnetic character recognition readers and certain optical character readers. The DTFMR macro instruction is used to define such a file.

The external interrupt feature is used to provide automatic entry to a user-written stacker selection routine on a first priority basis regardless of the priority of the partition in which the routine resides. Following stacker selection, the IOCS enables the user to access documents sequentially, process the data, and exercise control of non-MCR and non-OCR input and output devices. This normal processing (as opposed to stacker selection processing) takes the dispatching priority of the partition in which the problem program is executed.

Engage, disengage, stacker selection and document reading functions are invoked by the use of macro instructions. A buffer is maintained for each MCR device to provide the problem program with continuous input data. GET macro instructions are used when a single reader is attached to the system; READ CHECK, and WAIT F macro instructions are used when the system is servicing a number of readers.

The supervisor and logical IOCS can support a maximum of six character readers which may operate in any combination in any or all partitions. The maximum number that may be effectively operated is application and configuration dependent. Pertinent timing information is provided in the *Supervisor and I/O Macros* manual.

Magnetic Character Recognition IOCS supports the following physical devices:

1255 Magnetic Character Reader
1259 Magnetic Character Reader
1419 Magnetic Character Reader

Note: Programs utilizing the Magnetic Character Recognition IOCS are highly time-dependent and should be executed in real mode only.

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Optical Character Recognition IOCS provides support for definition and processing of input files associated with certain IBM optical character readers. The DTFOR macro instruction is used to define such a file for the 1287, 1288 and the 3886.

The 3886 is supported with special document definition macros used in a separate assembly to create a format record. Format records are stored in the Core Image Library for access by user 3886 processing programs.

The IOCS is used to read printed paper tapes or journal rolls such as those produced on cash registers and accounting machines. The IOCS is also used to read printed and hand-printed data and optical mark-read data from cut-form documents such as sales checks, utility stubs and customer orders.

Optical Character Recognition support can be used in a multiprogramming environment. Factors affecting performance include the following:

Processor model.
Number of readers (a maximum of eight are supported).
Characteristics of tapes and documents.
Batch or multiprogramming environment.
Blocking of input data on printed paper tapes.
User programming.

In addition throughput is dependent on operator loading and unloading time. This handling time is significant when processing short printed paper tape rolls.

Optical Character Recognition IOCS supports operations on the following physical devices:

1287 Optical Reader
1288 Optical Page Reader
3886 Optical Character Reader (Model 1)

Direct Access Method - DAM: The Direct Access Method (DAM) enables files to be defined on direct access storage volumes with any form of organization and access that the user may require. The records making up the file may be of fixed or variable length and may or may not contain key fields. All records are regarded as being unblocked; any necessary blocking or deblocking of logical records within physical records is the responsibility of the user. The DTFDA macro instruction is used to define a direct access file.

READ and WRITE macro instructions are used to retrieve and store physical records on the basis of information supplied by the user; such information may be either actual disk addresses or relative addresses within the file. Furthermore the address may be that of the actual record required or may indicate the point within the file at which a search for the required record is to begin.

The Direct Access Method allows the use of spanned records such that each record retrieved or stored spans multiple physical records. When this is the case, the physical segments making up the record are stored contiguously within the file.

The Direct Access Method supports the following physical devices:

2311 Disk Storage Drive
2314 Direct Access Storage Facility
2319 Disk Storage
2321 Data Cell Drive
3330-1,-2,-11/3333-1,-11 Disk Storage
3340 Disk Storage
3344 Disk Storage
3350 Disk Storage

Indexed Sequential Access Method - ISAM: The Indexed Sequential Access Method (ISAM) enables files to be defined on direct access storage volumes in such a way that records making up the file may be processed either in sequential order or in random order according to the needs of the accessing program. Logical records must be of fixed length, but may be blocked or unblocked; necessary blocking and deblocking of logical records is performed by the IOCS. Records can be added within the file without the necessity for sorting, recopying or merging. Records may also be updated as required. The DTFIS macro instruction is used to define an indexed sequential file.

GET and PUT macro instructions are used to process the file in sequential order, the user supplying control information for the *first record* to be processed. READ and WRITE macro instructions are used to process the file in random order, the user supplying control information for *each* record to be processed.

Optional features of the Indexed Sequential Access Method allow the user to speed up program execution in exchange for increased main storage requirements.

The Indexed Sequential Access Method supports the following physical devices:

2311 Disk Storage Drive
2314 Direct Access Storage Facility
2319 Disk Storage
2321 Data Cell Drive
3330-1,-2/3333-1 Disk Storage
3340 Disk Storage
3344 Disk Storage
3350 Disk Storage in 3330 Model 1 Compatibility Mode.

Note: 3330-11, 3333-11 and 3350 in native mode are not supported.

Virtual Storage Access Method - VSAM: VSAM is an access method designed to operate with direct access devices and to support both direct and sequential processing by means of either an index key (keyed accessing) or by means of relative byte address (addressed accessing). (Relative byte address refers to the displacement of a stored record, or control interval, from the beginning of the storage space allocated to the file to which it belongs.)

Three types of data sets are provided: key-sequenced data sets, which are ordered by a key field in the data record, entry-sequenced data sets, which are ordered by the sequence in which the records were loaded, and relative record data sets which are ordered by record number. Keyed accessing is used to access key-sequenced or relative record data sets, and addressed accessing is used to access both key-sequenced and entry-sequenced data sets. Key-sequenced and entry-sequenced data sets may be either fixed or variable length records; relative record data sets are fixed length records only.

VSAM is composed of two major elements: a data organization which minimizes data movement and which is suitable for data base applications; and routines for creating files in the VSAM organization, adding and deleting records and performing other data management functions. See also *Access Method Services* under System Utility Programs. Because the VSAM data organization and the access method routines are supported for both OS/VS and DOS/VS, VSAM provides full file portability.

VSAM Highlights

- Access to data via VSAM is controlled by macro instructions written under the conventions of the Assembler language. Access to files may be either direct or sequential, and may either be keyed (controlled by index key) or addressed (controlled by relative byte address).
- With VSAM, certain device-dependent calculations such as the optimum block size for a given device type will be carried out automatically. All data accessing is by relative byte within the storage space allocated to the file. These features minimize programmer effort when he wants to change device types.
- VSAM offers the DOS/VS user the facility of a catalog (which will simplify JCL preparation), variable-length record support, and password protection.
- Most existing COBOL, PL/I, RPG II and Assembler language programs written for use with ISAM data sets may be used with VSAM data sets by means of the VSAM ISAM Interface Program. The ISAM Interface Program maps ISAM macro instructions into the corresponding VSAM requests. Refer to the Program Product pages for details regarding COBOL and PL/I support of VSAM.
- VSAM offers a multifunction service program to facilitate overall management of data. Such services as defining files initially, deleting VSAM files from the VSAM catalog, printing and copying data, listing the VSAM catalog and providing backup and portability features are controlled by this multifunction program. Converting files from the ISAM and SAM format to the VSAM format is another important function of this program.
- The VSAM user can expect to see performance improvements relative to DOS/VS ISAM. Performance gains with VSAM become increasingly significant as the number of insertions to the file rises. This is due to the elimination of the "chained record overflow" concept employed by ISAM. VSAM will effectively maintain its sequential, non-inserted file performance as records are added to the file. While maintaining equivalent or better performance on direct retrieve and update, VSAM requires significantly less time to perform a record insert than does ISAM. These factors, coupled with the efficient VSAM index structure and with the VSAM performance options offer the potential of significant performance improvements relative to ISAM.

  The functional enhancements inherent to DOS/VS VSAM (e.g., variable length records, device independence, etc.), and the relative performance improvements over ISAM may require additional pages of main storage.

  Some of VSAM's performance improvements over DOS/VS ISAM are due to adaptations made to provide DOS/VS relocate support. These adaptations include dynamically allocating input/output areas and modules, having the index in main storage, and reducing the usage of transient areas.
- A significant feature of VSAM is that of file and volume portability. Because the VSAM file organization and the access method

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routines are supported for both DOS/VS and OS/VS, VSAM provides full file portability.

- VSAM offers multiple levels of password protection to enhance file security.

Additional features are available to VSAM users. The primary objective of these features is to provide functions which will reduce the need to schedule redundant work, and improve compatibility with OS/VS by providing the following options:

Alternate Indexes: This feature permits application programs to access the records of a VSAM entry or key sequenced data set on the basis of keys other than the prime key. These alternate keys may be non-unique and must be contained in the base data record. Once an Alternate Index has been constructed by using Access Method Services, it may optionally be automatically updated whenever a data record is changed in the base data set to which it relates.

Relative Record Data Set: With this feature the data set is viewed as a numbered sequence of fixed length slots. Records may be inserted, updated, read or erased in these slots using VSAM keyed processing, with the slot (i.e., record) number as the key. No index is used since each record's physical location is calculated directly by VSAM from its record number and the characteristics of the data set.

Get Previous: This feature permits retrieval and update processing on the basis of descending key values, relative record numbers, or relative byte addresses. Processing may begin either within or at the end of the data set.

Reusable Data Set: This capability allows a data set to be reused (i.e., reset to empty when opened and reloaded) many times without being deleted and redefined. A reusable data set may be any key sequenced, entry sequenced or relative record data set that does not have an alternate index associated with it and that does not reside on unique space. However, an alternate index may be a reusable data set.

Spanned Record: Originally VSAM did not permit a record to exceed a control interval in size. The Spanned Record feature removes the restriction, allowing a record to occupy multiple control intervals within a control area. If indexed, the keys must be in the first control interval.

Recovery: Extensions to the facilities within VSAM Catalog Management and Access Method Services permits limited access, via Access Method Services, to data that is not addressable by the catalog (due to the loss of, or damage to the catalog). Further, the user can restore addressability of the data and reconstruct the associated catalog entries.

User Catalogs: This facility is compatible with the one provided to OS/VS users in the original release of VSAM. It can increase volume portability by allowing user catalogs to control VSAM data sets. A user catalog and its associated data can be moved from one system to another without reading or writing data sets.

Automatic Close at End of Job: This facility is similar to one provided to OS/VS users in the original release of VSAM. It is designed to update the catalog entry and closes all open VSAM data sets within a partition. This helps to ensure that the data sets have been closed properly, whether the end of job was normal or abnormal.

VSAM Supported Input/Output Devices: Direct access devices supported by VSAM under DOS/VS are the 2314, 2319, and 3330-1,-2,-11,/3333-1,-11,/3340, 3344, and 3350. VSAM under DOS/VS does not support the 2301, 2303, 2305, 2311, or 2321.

Device Support: The Device Support Chart shows all devices that are supported by DOS/VS. (For other telecommunications devices see VTAM, QTAM and BTAM Terminals Supported). See also *The POWER/VS Program.* The chart shows for each device the relevant models of System/370 to which it may be attached and the type of channel or control unit necessary to perform the attachment.

Devices which are not shown in this table have no specific programming support under DOS/VS and their existence is not recognized by the control program.

DOS/VS (cont'd)

DEVICE SUPPORT CHART

Device	S/370 Model 115	125	135, 135-3, 138	145, 145-3, 148	155II 158	3031
1017 Paper Tape Reader mdls 1, 2	2826	2826	2826	2826	2826	2826
1018 Paper Tape Punch	2826	2826	2826	2826	2826	2826
1255 Magnetic Character Reader mdls 1, 2, 3	m	m	X	X	X	X
1259 Magnetic Character Reader mdl 2	m	m	X	X	-	-
1270 Optical Character Reader mdls 1, 2, 3, 4	m	m	m	m	m	m
1275 Optical Character Reader mdls 2, 4	m	m	m	m	m	m
1287 Optical Reader mdls 1, 2, 3, 4	-	-	X	X	X	X
1287 Optical Reader mdl 5	m	m	X	X	X	X
1288 Optical Page Reader	-	-	X	X	X	X
1403 Printer mdls 2, 7, N1	n	n	2821	2821	2821	2821
mdl 3	-	-	2821	2821	2821	2821
1419 Magnetic Character Reader mdl 1	m	m	X	X	X	X
1442 Card Read Punch mdl N1	m	m	X	X	X	X
1442 Card Punch mdl N2	m	m	X	X	X	X
1443 Printer mdl N1	m	m	X	X	X	X
2311 Disk Storage Drive mdl 1	-	-	2841	2841	2841	2841
2314 Disk Storage - A Series						
2312 Disk Storage mdl A1	-	-	2314-A1	2314-A1	2314-A1	2314-A1
2313 Disk Storage mdl A1	-	-	2314-A1	2314-A1	2314-A1	2314-A1
2314 Storage Control mdl A1	-	-	X	X	X	X
2318 Disk Storage mdl A1	-	-	2314-A1	2314-A1	2314-A1	2314-A1
2314 Disk Storage - B Series						
2314 Storage Control mdl B1	-	-	X	X	X	X
2319 Disk Storage mdl B1	-	-	2314-B1	2314-B1	2314-B1	2314-B1
2319 Disk Storage mdl B2	-	-	2319-B1	2319-B1	2319-B1	2319-B1
2319 Disk Storage - A Series						
2319 Disk Storage mdl A1	-	-	IFA	IFA	-	-
2319 Disk Storage mdl A2	-	-	-	2319-A1	-	-
2319 Disk Storage mdl A3	-	-	2319-A1	-	-	-
2321 Data Cell Drive	-	-	2841	2841	-	-
2401 Magnetic Tape Unit mdls 1 to 6, 8	-	-	2803/4	2803/4	2803/4	2803/4
2415 Magnetic Tape Unit and Control mdls 1 to 6	-	-	X	X	X	X
2420 Magnetic Tape Unit mdls 5, 7	-	-	2803	2803	2803	2803
2501 Card Reader mdls B1, B2	m	m	X	X	X	X
2520 Card Read Punch mdl B1	m	m	X	X	X	X
2520 Card Punch mdls B2, B3	m	m	X	X	X	X
2540 Card Read Punch	2821	2821	2821	2821	2821	2821
2560 Multifunction Card Machine	n	n	-	-	-	-
2596 Card Read Punch	m	m	X	X	X	X
2671 Paper Tape Reader	2822	2822	2822	2822	2822	2822
2803 Tape Control mdls 1, 2, 3	-	-	X	X	X	X
2804 Tape Control mdls 1, 2, 3	-	-	X	X	X	X
2816 Switching Unit	-	-	X	X	X	X
2821 Control Unit mdls 1, 2, 3, 5, 6	m	m	X	X	X	X
2822 Paper Tape Reader Control	m	m	X	X	X	X
2826 Paper Tape Control	m	m	m	m	m	m
2841 Storage Control	-	-	X	X	X	X
3203 Printer mdls 1, 2	n	n	-	-	-	-
3203 Printer mdl 4	-	-	n***	n***	-	-
3203 Printer mdl 5	m	m	X	X	X	X
3210 Console Printer-Keyboard mdl 1****	-	-	n	n	n**	n**
3210 Console Printer-Keyboard mdl 2****	-	-	n	n**	n**	
3211 Printer	-	-	3811	3811	3811	3811
3213 Console Printer mdl 1	-	-	-	-	n*	n*
3215 Console Printer-Keyboard	-	-	n	n	n**	n**
3262 Printer mdl 5	-	-	X	X	X*	X
3330 Disk Storage mdls 1, 2 and 11	-	3333	3333, 3830-1	3333, 3830-1	3333, 3830-1	3333, 3830-1
3333 Disk Storage and Control mdl 1 and 11	-	n	3830-2, IFA	3830-2, 3345-3, -4,-5, ISC	3830-2, ISC	3830-2, ISC
3340 Direct Access Storage Facility mdl A2	n	n	3830-2# IFA	3830-2 3345-3, -4,-5, ISC	3830-2 ISC*	3830-2 ISC*
3340 Direct Access Storage Facility mdls B1, B2	3340-A2	3340-A2	3340-A2	3340-A2	3340-A2	3340-A2
3344 Disk Storage	3340-A2+	3340-A2+	3340-A2	3340-A2	3340-A2	3340-A2
3345 Storage and Control Frame mdls 3, 4, 5	-	-	-	n	-	-
3350 Disk Storage and Control mdls A2, A2F	-	-	3830-2	3830-2, ISC	3830-2, ISC*	3830-2, ISC*
3350 Disk Storage mdls B2, B2F (in 3330 mdl 1 Compatibility Mode only)	-	-	3350-A2, -A2F	3350-A2 -A2F	3350-A2, -A2F	3350-A2, -A2F
3410 Magnetic Tape Unit mdls 1, 2, 3	3411	3411	3411	3411	3411	3411
3411 Magnetic Tape Unit and Control mdls 1, 2, 3	n	n	X	X	X	X
3420 Magnetic Tape Unit mdls 3, 5	3803-3	3803-3	-	-	-	-
3420 Magnetic Tape Unit mdls 3, 5, 7	-	-	3803-1	3803-1	3803-1	3803-1
3420 Magnetic Tape Unit mdls 4, 6, 8	-	-	3803-2	3803-2	3803-2	3803-2
3504 Card Reader mdls A1, A2	-	n	-	-	-	-
3505 Card Reader mdls B1, B2	m	m	X	X	X	X
3525 Card Punch mdls P1, P2, P3	3505-B1, -B2	n or 3505 -B1,-B2	3505-B1, -B2	3505-B1 ,-B2	3505-B1, -B2	3505-B1, -B2
3540 Diskette I/O Unit mdls B1, B2	m	m	X	X	X	X
3800 Printing Subsystem	-	-	-	X	X	X
3803 Tape Control mdl 1	-	-	X	X	X	X
3803 Tape Control mdl 2	-	-	S	S	S	S
3803 Tape Control mdl 3	n	n	-	-	-	-
3811 Printer Control Unit	-	-	X	X	X	X

DOS/VS (cont'd)

Device	S/370 Model 115	125	135, 135-3, 138	145, 145-3, 148	155II 158	3031
3830 Storage Control mdl 2	-	-	X	X	X	X
3881 Optical Mark Reader	m	m	m	m	m	m
3886 Optical Character Reader mdl 1	m	m	X	X	X	X
5203 Printer mdl 3	n	-	-	-	-	-
5213 Printer mdl 1	n	n	-	-	-	-
5425 Multifunction Card Unit mdls A1, A2	n	n	-	-	-	-

Notes:

-	Not attachable.
X	Attachable to any available channel.
m	Attachable to a multiplexer channel only.
f	Natively attachable.
*	Attachable to mdl 158 only.
**	Attachable to mdl 155II only.
***	Mdl 138 and 148 only.
****	Does not attach to the S/370 mdls 138 or 148.
#	Not attachable if string contains 3344
+	On 3115-2/3125-2 only.
S	Attachable to selector channel only.
IFA	Integrated File Adapter.
ISC	Integrated Storage Control.

TELECOMMUNICATIONS SUPPORT

Support for telecommunications devices is provided under the IBM Disk Operating System/Virtual Storage by three access methods: the Virtual Telecommunications Access Method (VTAM), the Basic Telecommunications Access Method (BTAM) and the Queued Telecommunications Access Method (QTAM).

Virtual Telecommunications Access Method - VTAM: (Also refer to the Program Products section for licensed options provided for VTAM).

The Virtual Telecommunications Access Method (VTAM) is a functionally superior alternative to BTAM and provides telecommunications support for the 3704/3705 in network control mode and for locally attached 3270s, 3730s and 3790s. In addition, VTAM controls the sharing of telecommunication resources between application programs and supports the concurrent execution of multiple teleprocessing applications.

VTAM provides for the direct transmission of messages between application programs and terminals. Using the network control mode, it makes the lines and communications controllers transparent to the application program; thus, the application program need only be responsible for device control characters in data streams.

The expanded interface for application programs allows the user to control connections between application programs and terminals, as well as to request data transfer. A single request for connection or input can be directed simultaneously to more than one terminal.

For SS and BSC terminals, VTAM supports switched networks as point-to-point, manual dial, automatic dial and automatic answer. Nonswitched networks are supported as point-to-point or multipoint, as appropriate for the device.

For SDLC terminals, VTAM supports switched and nonswitched lines. Nonswitched networks are supported as point-to-point or multipoint, as appropriate for the device. Switched networks are supported as point-to-point, manual dial, automatic dial and automatic answer. Each station has a unique transmission identification within the network, as defined by the installation.

The VTAM application program interface is upwards compatible for the three virtual storage operating systems (DOS/VS, OS/VS1 and OS/VS2). It is designed for long-term stability and to aid user teleprocessing growth.

VTAM and VSAM are companion access methods on which to build customer data base/data communications systems.

Network operator-control facilities are provided, enabling the user to monitor and reconfigure his network to meet fluctuating requirements.

The program operator facility allows an authorized user-written application program to enter VTAM Network operator commands and receive VTAM Network operator messages.

Configuration Restart Facilities allow the VTAM Network to be reinstated after a failure or a normal deactivation occurs. Manual switching support to a backup Processor or 3704/3705 is provided.

VTAM's modular design and use of tailored DOS/VS RAS facilities provide a reliable telecommunications system and assist in maintenance.

A 3790-SNA System Installation Package, consisting of a 3790 Sample Installation test program with appropriate supporting code and control statements, and a *3790 Installation Guide* is provided to facilitate installation of VTAM2-3790 Communication Systems and the host communications subsystem. The 3790 - SNA System Installation Package supports the 8100/DPCX Information System.

To aid in installing the 8100 Information System with DPPX or DPPX/SP, the Host Command Facility licensed program, with a 3270 display station running under VTAM, can be used to:

- Remotely operate an 8100/DPPX or DPPX/SP System from a 3270 display station.
- Run 8100/DPPX or DPPX/SP checkout routines remotely.
- Verify the operation of a connection between S/370 and 8100/DPPX or DPPX/SP.
- Modify DPPX or DPPX/SP network profiles.

Maintaining Telecommunications Integrity: VTAM provides the capability for an installation to establish and maintain the integrity of the telecommunications system. These capabilities involve the control of connections between application programs and terminals and of the access and use of data within the system.

Specifically, VTAM enables the installation (via macro instructions and user-coded exit routines):

- To control which terminals can logon to which application programs.
- To specify and check authorization for a terminal user's connection to a specified application program.
- To request that VTAM buffers and NCP/VS buffers be cleared before being returned to the buffer pool.

In addition, VTAM validates requests from application programs when the request is received and before the response is returned.

Teleprocessing Online Test Executive Program (TOLTEP) is a component of VTAM and is designed to control the selection, loading, and execution of teleprocessing online terminal tests (OLTTs) for all control units and terminals in a VTAM network. It uses VTAM capabilities for line sharing, remote reporting and remote test requests. TOLTEP performs control services, device accessing and configuration-update functions for teleprocessing OLTTs of devices supported by VTAM.

TOLTEP allows the operator or IBM representative to run teleprocessing OLTTs concurrently with other processing programs, with VTAM, and with the operating system. TOLTEP is automatically included in a system when VTAM is generated. It is initiated when VTAM is initiated and stopped when VTAM is stopped.

TOLTEP does not support the dedicated testing of a locally attached 3704/3705 Communications Controller. Dedicated testing of the local 3704/3705 is handled by OLTEP.

Although TOLTEP provides testing facilities for the VTAM network, OLTEP is still required for testing appropriate non-VTAM networks.

TOLTEP requires the configuration data set (CDS) and the OLTT data set.

VTAM System Requirements: VTAM operates in DOS/VS and requires the Compare and Swap and the Compare Double and Swap instructions. These instructions are provided via the Conditional Swapping Feature (#1051) for the mdl 135, and via the Advanced Control Program Support Feature (#1001) or the Conditional Swapping Feature (#1051) for the mdl 145. The minimum DOS/VS system under which VTAM operates is 128K of real storage.

Note: Conditional Swapping is standard on the mdls 135-3 and 138. Advanced Control Program Support is standard on the mdls 145-3 and 148. Insert PSW Key and Set PSW Key from Address, which are part of Advanced Control Program Support, are standard on the S/370 mdls 135-3 and 138, but are called PSW Key Handling.

See VTAM, QTAM and BTAM Terminals Supported for a list of the devices supported by VTAM with DOS/VS.

Basic Telecommunications Access Method (BTAM) provides basic support for telecommunications systems. The BTAM facilities of DOS/VS may be used in all or any of the system partitions in either virtual or real mode, or may be used to design a dedicated telecommunications system in a system with a single partition.

BTAM provides facilities for performing the following operations: Initiating and answering calls to and from terminals on switched networks ... Polling and addressing terminals on nonswitched multipoint lines ... Changing the status of terminal lists ... Transmitting and receiving messages ... Posting completion status of messages ... Managing buffer pools ... Code translation ... Retransmitting messages

DOS/VS (cont'd)

received with detected errors ... Providing online terminal test facilities ... Keeping error statistics.

In a multiple partition environment the teleprocessing program will normally operate in a high priority foreground partition that will include the BTAM module combined with the user's message processing routines. The user may employ any of the IOCS macro instructions provided by the system in the design of his telecommunications application.

BTAM provides a multiple WAIT macro instruction for use by telecommunications line operations *only*. This macro instruction enables the telecommunications program to release control of the central processing unit until one or more of a series of events has occurred (such as the completion of a BTAM READ or WRITE operation). Thus it provides for the efficient concurrent operation of lower priority programs. The support of Binary Synchronous Communications and a variety of start-stop devices gives BTAM considerable flexibility and a wide range of applications. This support covers both low and high speed devices in a single access method.

Queued Telecommunications Access Method (QTAM): Provides a generalized IOCS that extends the techniques of logical IOCS to the telecommunications environment. QTAM provides a macro definition language to generate a high-level and flexible message control program in addition to the standard GET and PUT macro instruction support for message processing programs. Functions provided by QTAM macro instructions include: automatic control of switched networks ... polling of terminals ... receiving and editing messages from terminals ... addressing terminals ... sending and editing messages to terminals ... dynamic buffer management ... queuing of messages on a direct access storage device ... dequeuing messages and passing them to separate processing programs ... collecting output messages passed from processing programs onto a queue.

Telecommunications systems built from QTAM facilities consist of:

- A message control program which resides in real storage allocated to a high priority partition and controls the flow of message traffic from one remote terminal to another (message switching applications) and between remote terminals and any message processing programs (message processing applications).
- One or more message processing programs which reside in real storage allocated to partitions of lower priority and perform the message processing functions required by the user's application.

QTAM allows asynchronous operation of all processing programs.

QTAM requires direct access storage for intermediate storage of message queues. The following physical devices may be used for this purpose: 2311 Disk Storage Drive ... 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2/3333-1 Disk Storage ... 3344 Disk Storage ... 3350 Disk Storage in 3330 mdl 1 Compatibility Mode.

Note: Programs built from QTAM facilities may be executed in real mode only.

Communication Serviceability Facilities: Communication Serviceability Facilities are provided by VTAM, QTAM and, on an optional basis, by BTAM. The user is strongly advised to include these facilities with BTAM since they increase system availability by providing statistics and diagnostic aids for system repair and preventive maintenance. The devices supported by each facility are shown in *VTAM, QTAM and BTAM Terminals Supported* at the end of this section.

The following facilities are provided for VTAM:

Error Recovery Procedures are provided for the 3704, 3705-I and 3705-II Communications Controllers as well as the local 3270 Information Display System. The 3704 and 3705 in network control mode provides error recovery on a line basis. If the ERP fails, VTAM is informed of the error and the error is recorded.

Error Counts are maintained on a line basis by the 3704 and 3705 Communications Controllers. Error counts are maintained for the 3704, 3705, and local 3270 by VTAM.

Online Terminal Tests, are available via the Teleprocessing Online Test Executive Program (TOLTEP) concurrently with user programs and do not impact user operations apart from the time required to perform their functions. Online tests requested from a terminal supported by VTAM can be returned to that terminal or to any other terminal on the same system supported by VTAM. Normal operation is maintained for terminals in the system not under test.

The following facilities are provided by both BTAM and QTAM:

Error Recovery Procedures are provided on a line basis. The operation in error is retried, twice on non-BSC devices. If the error persists a descriptive message is output to the system console. Certain non-recoverable errors result in termination of the job and a storage dump. Diagnostic Write and Read commands (2701 only) are performed to isolate non-recoverable errors to either the control unit or an external source.

Error Counts are maintained on a line basis and output to the system console if the error rate becomes excessive. The user program can request error statistics from the cumulative counters to be output to the system console.

Online Terminal Test Procedures operate concurrently with user programs and do not impact user operations apart from the time taken to perform their functions. (When tests use the 2760, the film should be reloaded before continuing the job.) Tests requested from a terminal can be returned to that terminal or to any other terminal on the same system. Normal operation is maintained for unaffected terminals within the system.

The following facilities are provided by QTAM only:

Operator Control is an option to allow the operator to examine and modify QTAM control information and to respond to errors and other unusual conditions. A 1050 System or a 2740 Communication Terminal with station control and checking is required for use as an operator control terminal. When the facility is used operator awareness messages may be routed to this terminal instead of the system console.

Checkpoint/Restart of the QTAM message control program is optional. The terminal table queue control blocks and the polling lists are checkpointed on disk at user-specified intervals. Two checkpoint records are maintained, with a pointer to the most current record. Restart is accomplished by reloading the message control program and using the latest checkpoint record to overlay the initial queue control blocks and polling lists.

Telecommunications Design Considerations: The following configuration and design considerations apply to the DOS/VS telecommunications environment:

All telecommunications devices with the exception of the 2701 SDA-II, the Integrated Communications Adapters of S/370 mdl 135/138, the 2848-2260 (local), the 3270 (local), and the 3704/3705-I/3705-II must be attached to the multiplexer channel, and no burst mode device may co-exist on the channel with telecommunications devices. Support for the 2701 SDA-II attached to a selector channel is limited to nonswitched (leased or private line connection) networks.

All start/stop terminals on a multipoint nonswitched line must be of the same type. Different types of terminals may be mixed within the same problem program.

BSC terminals and remote Processors are supported by BTAM and VTAM.

Different types of BSC terminals may be mixed on the same multipoint line in a nonswitched network or on the same computer phone number in a switched network. The BSC terminal mix capability is shown in the *Terminal Support Chart 2* at the end of this section.

SDLC terminals are supported by VTAM and NCP/VS. The data transmission link may be nonswitched or switched facilities, connected in half-duplex or full-duplex configuration. *Terminal Support Chart 2,* later on in this section, shows the support available for dialing and answering, as well as the terminal mix capability.

For application programs using BTAM or QTAM, storage requirements depend on the BTAM or QTAM modules themselves and also on the extent of the following user-specified areas and functions: I/O buffer areas ... terminal lists ... message processing routines ... number of macro instructions issued ... number of lines supported ... number of terminals per line ... line procedure specifications.

For application programs using VTAM, storage requirements are largely dependent upon how efficiently the application programs manage their VTAM control blocks. In addition, storage requirements depend upon the following user-specified areas and functions: I/O buffer areas ... number and organization of terminals ... number and type of macro instructions used.

VTAM, QTAM and BTAM TERMINALS SUPPORTED

VTAM, QTAM and BTAM telecommunications access methods support the following terminals, programmable features, transmission control units, and communications controllers. Programmable features which change the control or transmission characteristics and which are not shown are not supported. Attempts to use VTAM, QTAM or BTAM with unsupported features can cause unpredictable results. If the terminal/feature is not supported by all three access methods, the access method(s) which does(do) support the terminal/feature is(are) shown in parenthesis.

The user should be aware that many terminal and control unit special features are transparent to programming, and are therefore readily usable even though not specifically identified. Note that the appropriate line adapters and hardware attachment features must be included in the system configuration.

DOS/VS (cont'd)

Terminals that are functionally equivalent to those specifically supported by VTAM, QTAM or BTAM may also function satisfactorily with VTAM, QTAM or BTAM; the customer is responsible for establishing equivalency. IBM assumes no responsibility for the impact that any changes to the IBM-supplied programs or products may have on such terminals.

REMOTE ATTACHMENT

Terminals and Terminal Features

SS Lines:

IBM Terminals

1030 Data Collection System on nonswitched lines: (QTAM,BTAM)
- 1031 Input Station (mdls A1, A2, A3, A4, A5, A6, A7):
  - Supported: Attachment of 1031, 1033, 1034, 1035
- 1031 Input Station (mdls B1, B2, B3, B4, B5, B6, B7):
  - Supported: Attachment of 1035
- 1033 Printer
- 1034 Card Punch
- 1035 Badge Reader

1050 Data Communication System on switched or nonswitched lines:
- 1051 Control Unit (mdls 1,2):
  - Supported: Attachment of 1052, 1053, 1054, 1055, 1056, 1057, 1058, 1092, 1093
  - #1313 - Automatic EOB
  - #4795 - Line Correction
  - #4796 - Line Correction Release
  - #5465 - Open Line Detection
  - #6100 - Receive Interrupt
  - **#9698** - Text Time-Out Suppression
  - **#9700** - Transmit Interrupt
- 1052 Printer-Keyboard (mdls 1, 2):
  - Supported: #1313 - Automatic EOB
  - **#9567,#9597** - PTTC/BCD Code
  - **#9571,#9591** - PTTC/EBCD Code
- 1053 Printer (mdl 1):
  - Supported: **#9567,#9597** - PTTC/BCD Code
  - **#9571,#9591** - PTTC/EBCD Code
- 1054 Paper Tape Reader (mdl 1)
- 1055 Paper Tape Punch (mdl 1)
- 1056 Card Reader (mdls 1, 3)
- 1057 Card Punch (mdl 1)
- 1058 Printing Card Punch (mdls 1, 2)
- 1092 Programmed Keyboard (mdls 1, 2)
- 1093 Programmed Keyboard (mdls 1, 2)

2848 Display Control (mdls 1,2,3) on nonswitched lines: (QTAM,BTAM)
- Supported: Attachment of 2260,1053
- #3901 - Extended Cursor Control
- #4787 - Line Addressing
- #5340 - Non-Destructive Cursor
- #5341 - Non-Destructive Cursor Adapter
- Not Supported: Attachment of 1053 (QTAM)
- 2260 Display Station (mdls 1, 2):
  - Supported: #3606 - Extended Cursor Control, Alphameric Keyboard
  - #4766 - Alphameric Keyboard
  - Not Supported: Tab feature of #3606
- 1053 Printer (mdl 4): (BTAM)
  - Supported: **#9567,#9597** - PTTC/BCD Code
  - **#9571,#9591** - PTTC/EBCD Code

2845 Display Control (mdl 1) on nonswitched lines: (QTAM,BTAM)
- Supported: Attachment of 2265,1053
- #3301 - Destructive Cursor
- #4801 - Line Addressing
- Not Supported: Attachment of 1053 (QTAM)
- #7801 - Tab
- 2265 Display Station (mdl 1):
  - Supported: #4766 - Alphameric Keyboard
- 1053 Printer (mdl 4): (BTAM)
  - Supported: **#9567,#9597** - PTTC/BCD Code
  - **#9571,#9591** - PTTC/EBCD Code

2740 Communication Terminal (mdl 1) on switched or nonswitched lines:
- Supported: #3255 - Dial Up (Switched only)
- #6114 - Record Checking
- #7479 - Station Control (non switched only
- #8028 - Transmit Control (Switched only)
- #8301 - 2760 Attachment (QTAM,BTAM)
- **#9567,#9597** - PTTC/BCD Code
- **#9571,#9591** - PTTC/EBCD Code
- Correspondence Code

2740 Communication Terminal (mdl 2) on nonswitched lines:
- Supported: #1495,#1496 - Buffer Expansion
- #1499 - Buffer Receive
- #6114 - Record Checking
- **#9571,#9591** - PTTC/EBCD Code

2741 Communication Terminal (mdl 1) on switched or nonswitched lines: (VTAM)
- Supported: #3255 - Dial Up
- #4708 - Receive Interrupt
- #7900 - Transmit Interrupt
- **#9567,#9597** - PTTC/BCD Code
- **#9571,#9591** - PTTC/EBCD Code
- Correspondence Code

2760 Optical Image Unit (mdl 1) on switched or nonswitched lines: (QTAM,BTAM)

3101 Display Terminal (mdls 10, 12, 13, 20, 22, 23) on switched lines 110-1200 bps (BTAM and VTAM)

3232 Keyboard Printer (mdl 51) on switched or nonswitched lines 300-1200 bps (BTAM and VTAM). BTAM-ES supports the 3232 mdl 51 on switched lines as a CPT-TWX 33/35.

3767 Communication Terminal (mdls 1,2) (supported as a 2740-1) on switched or nonswitched lines:
- Required: #7111 - 2740-1 Start/Stop
- Supported: #9560 - Station Control

3767 Communication Terminal (mdls 1,2,3) (supported as a 2740-2) on nonswitched lines:
- Required: #7112 - 2740-2 Start/Stop

3767 Communication Terminal (mdls 1,2) (supported as a 2741) on switched or nonswitched lines: (VTAM)
- Required: #7113 - 2741 Start/Stop

5100/5110 Portable Computer (supported as a 2741) on switched or nonswitched lines:
- Required: #1525 - Communications Adapter

CMCST (Communicating Magnetic Card Selectric ® Typewriter) (supported as a 2741 with Correspondence Code) on switched lines:
- Supported: The CMCST is functionally equivalent to a 2741 with Dial Up, Receive Interrupt and Transmit Interrupt

IBM Processors As Terminals

(For details of programming support provided within the Processor when acting as a terminal, see appropriate programming sales manual pages)

S/7 (supported as a 2740-1 with checking) on switched or nonswitched lines:
- Required: #1610 - Asynchronous Communication Control

Non-IBM Terminals

AT&T 83B3 Line Control Type on nonswitched lines

CPT-TWX (mdl 33/35) Line Control Type on switched lines

World Trade Telegraph on nonswitched lines

WU 115A Line Control Type on nonswitched lines

BSC LINES:

IBM Terminals

2790 Data Communication System on switched or nonswitched lines: (BTAM)
- 2715 Transmission Control Unit (mdl 1, 2):
  - Required: 2740
  - Supported: Attachment of 2798,1035,1053
  - #3801 - Expanded Capability
  - #4850 - Local 2740 Adapter
  - **#9401** - Point-to-Point Nonswitched
  - **#9402** - Point-to-point Switched
  - **#9403** - Multipoint Nonswitched
- 2740 Communication Terminal (mdl 1)
- 2798 Guidance Unit (mdl 1)
- 1035 Badge Reader (mdl 1)
- 1053 Printer (mdl 1)

2770 Data Communication System on switched or nonswitched lines: (VTAM,BTAM)
- 2772 Multipurpose Control Unit:
  - Required: #5010 - Multipoint Data Link Control (VTAM)
  - Supported: Attachment of 0050,0545,1017,1018,1053, 1255,2203,2213,2265,2502,5496
  - #1340 - Automatic Answering
  - #1490 - Buffer Expansion (256 bytes)
  - #1491 - Buffer Expansion Additional (512 bytes)
  - #1910 - Conversational Mode
  - #3250 - Display Format Control
  - #3650 - EBCDIC Transparency
  - #3860 - 144 Character Print Line
  - #4610 - Identification
  - #4690 - Keyboard Correction

DOS/VS (cont'd)

#5010 - Multipoint Data Link Control (BTAM)
#5890 - Horizontal Format Control
#6555 - Space Compression/Expansion
#7705 - Synchronous Clock
#7950 - Transmit-Receive-Monitor -Print
#9140 - Extended Re-Entry
#9402 - Line Termination - 2-wire
#9761 - Transmission Code EBCDIC
#9762 - Transmission Code ASCII
#9936 - Immediate WACK

0050 Magnetic Data Inscriber
0545 Output Punch (mdls 3,4)
1017 Paper Tape Reader (mdls 1,2)
1018 Paper Tape Punch (mdl 1)
1053 Printer (mdl 1)
1255 Magnetic Character Reader
2203 Printer (mdls A1,A2):
Supported: #5558 - Print Positions, 24 Additional
2213 Printer (mdls 1,2)
2265 Display Station (mdl 2)
2502 Card Reader (mdls A1,A2)
5496 Data Recorder

2780 Data Transmission Terminal on switched or nonswitched lines: (VTAM,BTAM)
Supported: #1340 - Automatic Answering
#1350 - Automatic Turnaround
#3401 - Dual Communication Interface
#5010 - Multiple Record Transmission
#5020 - Multipoint Line Control
#5820 - 120 Character Print Line
#5821 - 144 Character Print Line
#6400 - Selective Character Set
#7850 - Terminal Identification
#8030 - EBCDIC Transparency
#9150 - Extended Retry Transmission
#9761 - ASCII Transmission Code
#9762 - EBCDIC Transmission Code

2980 General Banking System on nonswitched lines: (VTAM,BTAM)
2972 Station Control Unit (mdl 8 - RPQ 858160, mdl 11 - RPQ 858231):
Supported: Attachment of 2980,2971
RPQ 835503 - Buffer Expansion
RPQ 858165,858182 - 96-Character Buffer
2980 Teller Station (mdl 1 - RPQ 835504, mdl 4 - RPQ 858147)
2980 Administrative Station (mdl 2 - RPQ 835505)
2971 Remote Control Unit (mdl 3 - RPQ 858144)

3270 Information Display System on nonswitched lines: (VTAM,BTAM)
3271 Control Unit (mdls 1,2):
Supported: Attachment of 3277,3284,3286, 3287,3288
#1550 - Copy
#9761 - EBCDIC Code
3274 Control Unit (mdl 1C) [supported as a 3271]:
Supported: Attachment of 3230, 3268, 3277, 3278, 3284, 3286, 3287, 3288, 3289
3276 Control Unit Display Station (mdls 1,2,3,4) [supported as a 3271]:
Supported: Attachment of 3268, 3278,3287
#6350 - Selector Light-Pen
#9082 - EBCDIC Character Set
3277 Display Station (mdls 1,2):
Supported: #6350 - Selector Light-Pen
#9082 - EBCDIC Character Set
3278 Display Station (mdls 1,2,3,4) [supported as a 3277]:
Supported: #6350 Selector Light Pen
#9082 - EBCDIC Character Set
3230 Printer (mdl 2) [supported as 3286-2]
3268 Printer (mdl 2) [supported as 3286-2]
3284 Printer (mdls 1,2):
Supported: **#9089** - EBCDIC Character Set
3286 Printer (mdls 1,2):
Supported: **#9089** - EBCDIC Character Set
3287 Printer (mdls 1,2) [supported as a 3284 or 3286]:
Supported: **#9082** - EBCDIC Character Set
3288 Printer (mdl 2) [supported as a 3286-2]:
Supported: #9089 - EBCDIC Character Set
3289 Printer (mdls 1,2) [supported as a 3286-2]

3270 Information Display System on switched lines (BTAM) or nonswitched lines: (VTAM,BTAM)
3275 Display Station (mdls 1,2):
Supported: Attachment of 3284
#6350 - Selector Light Pen
#9089 - EBCDIC Character Set
#9761 - EBCDIC Code
3284 Printer (mdl 3):
Supported: **#9089** - EBCDIC Character Set

3624 Consumer Transaction Facility (mdl 1, 2,11, 12) (supported as a 2772) (BTAM)
Supported: Attachment to a 3704/3705 via nonswitched lines only

3650 Programmable Store System (Supported as a S/3) on switched lines: (BTAM)
3651 Store Controller (mdls A25, B25, A75, B75, C75, D75
Supported: Attachment of 3653, 3683, 3663, 3657, 3275, 3659, 3669, 3784
3653 Point of Sale Terminal (mdl 1 and 1P)
3683 Point of Sale Terminal (all models)
3663 Supermarket Terminal (mdl 1P, 2 and 3P)
3657 Ticket Unit (not available on 3651 mdls A25 and B25)
3275 Display Station (mdl 3)
Supported: Attachment of 3284
3284 Printer (mdl 3)
3659 Remote Communication Unit (mdl 1)
Required: 2400 BPS non-switched line
3784 Printer (mdl 1) not available on 3651 models A25 and B25
3669 Remote Communications Unit (not available on 3651 mdl A25 and B25)

3660 Supermarket Scanning System (supported as a S/3) on switched lines: (BTAM) 3651 Store Controller (mdls A60,B60):
Supported: Attachment of 3663,3669
3663 Supermarket Terminal (mdls 1,2):
Supported: Attachment of 3666
3666 Checkout Scanner (mdl 1)
3669 Store Communications Unit (mdl 1)

3660 Supermarket Key-Entry System (supported as a S/3) on switched lines: (BTAM) 3661 Store Controller:
Supported: Attachment of 3663
3663 Supermarket Terminal (mdls 1,2)

3680 Programmable Store System supported on switched or non-switched lines: (BTAM)
3684 Point of Sale - Control Unit (mdls 1, 2)
Supported: 3684 mdl 2: Attachment of 3683 Point of Sale Terminal
3683 Point of Sale Terminal

3735 Programmable Buffered Terminal (mdl 1) on switched or nonswitched lines: (VTAM,BTAM)
Supported: Attachment of 5496,3286
#5010 - Multipoint Data Link Control
#9761 - EBCDIC Code
#9762 - ASCII Code
5496 Data Recorder (mdl 1)
3286 Printer (mdl 3)

3741 Data Station (mdl 2) on switched or nonswitched lines: (VTAM,BTAM)
Supported: Attachment of 0129,3713,3715, 3717
#1680 - Expanded Communications
#1685 - Expanded Communications/ Multipoint Data Link Control
#5450 - Operator Identification Card Reader
#7850 - Terminal Identification
0129 Card Data Recorder (mdl 2)
3713 Printer (mdl 1)
3715 Printer (mdls 1,2)
3717 Printer (mdl 1)

3741 Programmable Workstation (mdl 4) on switched or nonswitched lines: (VTAM,BTAM)
Supported: Attachment of 0129,3713,3715
#1680 - Expanded Communications
#1685 - Expanded Communications/ Multipoint Data Link Control
#5450 - Operator Identification Card Reader
#7850 - Terminal Identification
0129 Card Data Recorder (mdl 2)
3713 Printer (mdl 1)
3715 Printer (mdls 1,2)

3747 Data Converter (mdl 1) on switched or nonswitched lines: (VTAM,BTAM)
Supported: #1660 - Communications Adapter

3770 Data Communication System (supported as a 2770) on switched or nonswitched lines: (VTAM,BTAM)
3771 Communication Terminal (mdls 1,2,3):
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point, or
#1462 - BSC Multipoint
Supported: #1201 - ASCII Code
3773 Communication Terminal (mdls 1,2,3,P1,P2,P3):
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point, or
#1462 - BSC Multipoint
Supported: #1201 - ASCII Code
3774 Communication Terminal (mdls 1,2,P1,P2):
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point, or

DOS/VS (cont'd)

#1462 - BSC Multipoint
Supported: #1201 - ASCII Code

3775 Communication Terminal (mdls 1,P1):
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point, or
#1462 - BSC Multipoint
Supported: #1201 - ASCII Code

3776 Communication Terminal (mdls 1,2) [supported as a 2772/3780]:
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point, or
#1462 - BSC Multipoint
Supported: #1201 - ASCII Code

3777 Communication Terminal (mdl 1) [supported as a 2772/3780]:
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point, or
#1462 - BSC Multipoint
Supported: #1201 - ASCII Code

3780 Data Communications Terminal (mdl 1) [supported as a 2772 without component select] on switched or nonswitched lines: (VTAM,BTAM)
Supported: #3601 - EBCDIC Transparency
#5010 - Multipoint Data Link Control
#5701 - Print Positions, Additional
#9761 - EBCDIC Code
#9762 - ASCII Code

5110 Computer (supported as a 2772) on switched and nonswitched lines:
Required: #2074 BSCA
Supported: Attachment of a 5103 Printer, 5106 Tape Cartridge and 5114 Diskette Unit
The 5110 emulates the following 2772 features:
Auto Answer
Buffer Expansion Additional
144 Character Print Line
Identification
Multipoint Data Link Control (TCAM, BTAM)
Horizontal Format Control
Space Compression/Expansion
Synchronous Clock
Transmission Code EBCDIC

5230 Data Collection System (supported as a 3741-2,-4) on switched or nonswitched point-to-point lines: (BTAM)
5231 Controller (mdl 2):
Required: #2074 - BSCA

5275 Direct Numerical Control Station (Model 1) (supported as a 3275 with EBCDIC Code and EBCDIC Character Set) on switched lines (BTAM) or nonswitched lines (VTAM,BTAM)

5260 Retail System (supported as a 3741) on switched or nonswitched point-to-point lines: (BTAM)
5265 Communicating mdl

6670 Information Distributor and 6670 Model II (supported as 2770) on switched, nonswitched or local attach lines: (VTAM, BTAM)
Supported: The 6670 emulates the following 2770 features: (All items listed are standard on the 6670)
Automatic Answering
Buffer Expansion (256 bytes)
Buffer Expansion (512 bytes)
EBCDIC Transparency
Identification (Terminal only)
Space Expansion
Synchronous Clock
Extended Retry (Transmission)
Transmission Code EBCDIC
Transmission Code ASCII

IBM Processors As Terminals

(For details of programming support provided within the Processor when acting as a terminal, see appropriate programming sales manual pages)

1130 Computing System on switched or nonswitched lines: (BTAM)
1131 Central Processing Unit:
Required: #7690 - Synchronous Communications Adapter

1800 Data Acquisition and Control System on switched or nonswitched lines: (BTAM)
1826 Data Adapter Unit:
Required: #7550 - Communication Adapter

Series/1 (supported as a System/3) on switched or nonswitched lines: (BTAM)
4953 or 4955 Processor
Required: 2074, 2075, 2094 Binary Synchronous Communications Adapter

System/3 on switched or nonswitched lines (VTAM,BTAM):
5404, 5406, 5408, 5410, 5412, or 5415 Processing Unit
Required: #2074 - Binary Synchronous Communications Adapter

System/7 (supported as a System/3) on switched or nonswitched lines (VTAM,BTAM):
5010 Processor Module
Required: #2074 - Binary Synchronous Communications Adapter

System/32 (supported as a System/3) on switched or nonswitched lines (VTAM,BTAM):
5320 System Unit
Required: #2074 - Binary Synchronous Communications Adapter

System/34 (supported as a System/3) on switched or nonswitched lines (VTAM, BTAM):
5340 System Unit
Required: #2500, #3500 or #4500 Communications Adapter Feature

System/34 (supported as a 3271) on a nonswitched line (BTAM, VTAM):
5340 System Unit
Required: #2500, #3500 or #4500 Communications Adapter Feature
#4900 or #4901 Work Station Control Expansion A or B

System/36 (supported as a System/3) on switched or nonswitched lines (VTAM, BTAM):
5360 System Unit
Required: #2500 or #4500 Communications Adapter Feature

System/36 (supported as a S/360 mdls 25 and up) on switched or nonswitched lines (VTAM, BTAM):
5360 System Unit
Required: #2500 or #4500 Communications Adapter Feature

System/36 (supported as a 3271 mdl 2) on nonswitched lines (VTAM, BTAM):
5360 System Unit
Required: #2500 or #4500 Communications Adapter Feature
#4900 Work Station Control Feature

System/38 (supported as a System/3) on switched or nonswitched lines (BTAM, VTAM):
5381 System Unit
Required: #1501 or #1502 Communications Attachment Feature
#2001 or #2003 Communications Control Feature
#3200 Line Base Feature

System/38 (supported as a 3271 mdl 2) on a nonswitched line (BTAM, VTAM):
5381 System Unit
Required: #1501, #1502 Communications Attachment Feature
#2001, #2003 Communications Control Feature

S/360 mdl 20 on switched or nonswitched lines (BTAM):
2020 Processing Unit
Required: #2074 - Binary Synchronous Communications Adapter

S/360 mdls 25,30,40,50,65,65MP,67(65mode),75,85,91, 195 on switched or nonswitched lines (BTAM):
Processing Unit:
Required: #4580 - Integrated Communications Attachment
2701 Data Adapter Unit, or
2703 Transmission Control, or
3704 Communications Controller in emulation mode, or
3705-I Communications Controller in emulation mode, or
3705-II Communications Controller in emulation mode

All virtual storage S/370 Processors on switched or nonswitched lines: (VTAM,BTAM)
Processing Unit:
Required: #4640 - Integrated Communications Adapter
2701 Data Adapter Unit (BTAM), or
2703 Transmission Control (BTAM), or
3704 Communications Controller in network control (VTAM) or emulation mode (BTAM), or

DOS/VS (cont'd)

3705-I Communications Controller in network control (VTAM) or emulation mode (BTAM), or
3705-II Communications Controller in network control (VTAM) or emulation mode (BTAM)

5280 Distributed Data System (supported as a 3271-2) on a non-switched line (BTAM, VTAM)
5285 and 5288 Controllers
Required: See M5285, M5288 pages required features and related programming

S/8100 with DPPX on nonswitched lines (Supported as a 3271) (VTAM, BTAM)

S/8100 with DPPX/SP on nonswitched lines (Supported as a 3271) (VTAM, BTAM)

SDLC Lines:

Communications Controllers

3704 Communications Controller in network control mode (VTAM)

3705-I Communications Controller in network control mode (VTAM)

IBM Terminals

3270 Information Display System on nonswitched lines: (VTAM)
3271 Control Unit (mdls 11,12):
Supported: Attachment of 3277,3284,3286, 3287,3288
#1200 - ASCII Code
#1550 - Copy
#9761 - EBCDIC Code
3277 Display Station (mdls 1,2):
Supported: #6350 - Selector Light Pen
#9089 - EBCDIC Character Set
3284 Printer (mdls 1,2,3):
Supported: **#9089** - EBCDIC Character Set
3286 Printer (mdls 1,2):
Supported: **#9089** - EBCDIC Character Set
3287 Printer (mdls 1,2) [supported as a 3284 or a 3286]:
Supported: **#9089** - EBCDIC Character Set
3288 Printer (mdl 2) (supported as a 3286-2):
Supported: **#9089** - EBCDIC Character Set
3275 Display Station (mdls 11,12):
Supported: Attachment of 3284
#1200 - ASCII Code
#6350 - Selector Light Pen
#9089 - EBCDIC Character Set
#9761 - EBCDIC Code

3270 Information Display System on switched and nonswitched lines: (VTAM) (supported as a 3790 with Configuration Support **9165**)
3276 Control Unit Display Station (mdls 11,12,13,14)
Supported: Attachment of 3230, 3268, 3278, 3287
#6350 - Selector Light Pen
#9082 - EBCDIC Character Set
3278 Display Station (mdls 1,2,3,4) [supported as a 3277]
Supported: 6350 - Selector Light Pen
#9082 EBCDIC Character Set
3230 Printer (mdl 2) [supported as 3286-2]
3268 Printer (mdl 2) [supported as 3286-2]
3287 Printer (mdls 1,2) [supported as a 3284 or 3286]
Supported: **#9082** - EBCDIC Character Set

3600 Finance Communication System on switched or nonswitched lines: (VTAM)
3601 Controller (mdls 1,2A,2B,3A,3B):
Supported: Attachment of 3603, 3604, 3606, 3608, 3610, 3611, 3612, 3615, 3614, 3616, 3618, 3624
3602 Controller (mdls 1A,1B):
Supported: Attachment of 3603, 3604, 3606, 3608, 3610 3611, 3612, 3615, 3614, 3616, 3618, 3624, 3694 (on 3602 only)
3603 Terminal Attachment Unit (mdl 1,2):
3604 Keyboard Display (mdls 1,2,3,4,5,6,7)
3606 Financial Services Terminal (mdls 1,2)
3608 Printing Financial Services Terminal (mdls 1,2)
3610 Document Printer (mdls 1,2,3,4,5)
3611 Passbook Printer (mdls 1,2)
3612 Passbook and Document Printer mdls (1,2,3)
3614 Consumer Transaction Facility (mdls 1,2,11,12
Required: When attached to a 3601 or 3602, 3602 or 3602 application programs
3615 Administrative Terminal Printer mdls (1,2)
3616 Passbook and Document Printer (mdl 1)
3618 Administrative Line Printer (mdl 1)
3624 Consumer Transaction Facility (mdls' 12,11,12):
Required: When attached to a 3601 or 3602, 3601 or 3602 application programs
Supported: Attachment to a 3704/3705 (via nonswitched lines only) or 3601, 3602
3694 Document Processing System

3630 Plant Communication System on switched or nonswitched lines (VTAM, TCAM)
3631 Controller (mdls 1A, 1B)
Supported: Attachment of 3604, 3641, 3642, 3643, 3644, 3646, 3842, , 7430 (RPQ)
3632 Controller (mdls 1A, 1B)
Supported: Attachment of 3604, 3641, 3642, 3643, 3644, 3646, 3842, , 7430 (RPQ)
3604 Keyboard Display (mdl 6)
3641 Reporting Terminal (mdls 1, 2)
3642 Encoder Printer (mdls 1, 2)
3643 Keyboard Display mdls 2, 3,4
3644 Automatic Data Unit (mdl 1)
3646 Scanner Control Unit (mdl 1
3647 Time and Attendance Terminal (mdl 1)
3842 Loop Control Unit (mdl 1)
7430 Document Printer (RPQ)

3650 Programmable Store System on switched or nonswitched lines: (VTAM, TCAM via VTAM)
3651 Store Controller (mdls A25, B25, A75, B75, C75, D75)
Supported: Attachment of 3653, 3683, 3663, 3657, 3275, 3659, 3669, 3784
3653 Point of Sale Terminal (mdl 1 and 1P)
3683 Point of Sale Terminal (all models)
3663 Supermarket Terminal (mdl 1P, 2 and 3P)
3657 Ticket Unit (not available on 3651 mdls A25 and B25)
3275 Display Station (mdl 3)
Supported: Attachment of 3284
3284 Printer (mdl 3)
3659 Remote Communications Unit (mdl 1)
Required: 2400 BPS non-switched line
3784 Printer (mdl 1) not available on 3651 mdl A25 and B25
3669 Remote Communications Unit (mdl 1) not available on 3651 mdl A25 and B25

3650 Retail Store System on switched or nonswitched lines: (VTAM)
3651 Store Controller (mdls A50,B50):
Supported: Attachment of 3653,3657,3275,3659,3784
3653 Point of Sale Terminal
3657 Ticket Unit
3275 Display Station (mdl 3):
Supported: Attachment of 3284
3284 Printer (mdl 3)
3659 Remote Communications Unit (mdl 1):
3784 Printer (mdl 1)

3660 Supermarket Scanning System on switched lines: (VTAM)
3651 Store Controller (mdls A60,B60):
Supported: Attachment of 3663,3669
3663 Supermarket Terminal (mdls 1,2):
Supported: Attachment of 3666
3666 Checkout Scanner
3669 Store Communication Unit (mdl 1)

3660 Supermarket Key-Entry System on switched lines: (VTAM)
3661 Store Controller:
Supported: Attachment of 3663
3663 Supermarket Terminal (mdls 1,2)

3680 Programmable Store System supported on switched or non-switched lines: (VTAM)
3684 Point of Sale - Control Unit (mdls 1, 2)
Supported: 3684 mdl 2: Attachment of 3683 Point of Sale Terminal
3683 Point of Sale Terminal

3730 Distributed Office Communication System on switched or nonswitched lines: (VTAM)
3791 Controller (mdl 11C, 12A, or 12 B with: SDLC with Clock (#6301) or SDLC without Clock (#6302 or 6303) and required modem
3732 Text Display Station
3736 Printer

3767 Communication Terminal (mdls 1,2,3) on switched or nonswitched lines: (VTAM)
Supported: SDLC adapter provided unless one of the Start/Stop features are specified
#1201 - ASCII Code

3770 Data Communication System on switched or nonswitched lines: (VTAM)
3771 Communication Terminal (mdls 1,2,3):
Required: #1460 - SDLC/BSC, Switch Control, or
#1470 - SDLC
Supported: #1201 - ASCII Code
3773 Communication Terminal (mdls 1,2,3,P1,P2,P3):
Required: #1460 - SDLC/BSC, Switch Control, or
#1470 - SDLC
Supported: #1201 - ASCII Code
3774 Communication Terminal (mdls 1,2,P1,P2):

DOS/VS (cont'd)

Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
Supported: #1201 - ASCII Code

3775 Communication Terminal (mdls 1,P1):
Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
Supported: #1201 - ASCII Code

3776 Communication Terminal (mdls 1,2):
Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
Supported: #1201 - ASCII Code

3776 Communication Terminal (mdls 3,4):
Supported: 1201 ASCII Code

3777 Communication Terminal (mdl 1):
Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
Supported: #1201 - ASCII Code

3777 Communication Terminal (mdl 3):
Supported: #1201 ASCII Code

3790 Communication System on switched or nonswitched lines (VTAM)

6670 and 6670 Model II (as Logical Unit Type 4)

8100/DPCX Information System on switched or nonswitched lines: (VTAM)

IBM Processors As Terminals

System/32 (supported as a 3770) on switched or nonswitched lines (VTAM):
5320 System Unit
Required: #1005 - Additional Storage (minimum of one)
#6301 - Synchronous Data Link Control

System/34 (supported as a 3770) on switched or nonswitched lines (VTAM):
5340 System Unit
Required: #2500, 3500 or 4500 Communications Adapter Feature

System/34 (supported as a 3274) on nonswitched lines (VTAM):
5340 System Unit
Required: #2500, 3500 or 4500 Communication Adapter Feature
#4900 or 4901 Work Station Control Expansion A or B

System/36 (supported as a 3770) on switched or nonswitched lines (VTAM):
5360 System Unit
Required: #2500 or 4500 Communications Adapter Feature

System/36 (supported as a 3274 mdl 1C) on switched or nonswitched lines (VTAM):
5360 System Unit
Required: #2500 or 4500 Communications Adapter Feature
#4900 Work Station Control Feature

System/38 (supported as a 3770 on switched or nonswitched line (VTAM):
5381 System Unit
Required: #1501 or #1502 Communications Attachment Feature
#2000, #2001, #2002, or #2003 Communications Control Feature
#3200 Line Base Feature

System/38 (supported as a 3274 on switched or nonswitched line (VTAM, TCAM):
5381 System Unit
Required: #1501 or #1502 Communications Attachment feature
#2000, #2001, #2002, or #2003 Communications Control feature
#3200 Line Base feature

5280 Distributed Data System (supported as a 3274-1C) on switched and nonswitched lines (VTAM)
5285 and 5288 Controllers
Required: See M5285, M5288 pages for required features and related programming

S/8100 with DPPX on switched or nonswitched lines (VTAM):

S/8100 with DPPX/SP on switched or nonswitched lines (VTAM):

Local Attachment

Transmission Control Units and Communications Controllers

Integrated Communications Adapter of S/370 mdl 115 (QTAM,BTAM):
Required: #4640 - Integrated Communications Adapter
Supported: #1291-#1296 - Autocall

Integrated Communications Adapter of S/370 mdl 125 (QTAM,BTAM):
Required: #4640 - Integrated Communications Adapter
Supported: #1291-#1296 - Autocall

Integrated Communications Adapter of S/370 mdl 135, 135-3, 138 (QTAM,BTAM):
Required: #4640 - Integrated Communications Adapter
Supported: EBCDIC Code is a standard feature
#9673-#9680 - Transparency (BTAM)
#9681-#9688 - ASCII Code (BTAM)
#9689-#9696 - 6-bit Transcode (BTAM)

2701 Data Adapter Unit on local channel: (QTAM,BTAM)
Supported: #1302,#1303,#1314 - Autocall
#3455 - Dual Code
#3463-#3465 - Dual Communication Interface (BTAM)
#8029 - Transparency (BTAM)
#9060 - EBCDIC Code (BTAM)
#9061 - ASCII Code (BTAM)
#9062 - 6-bit Transcode (BTAM)

2702 Transmission Control Unit on local channel: (QTAM,BTAM)
Supported: #1290 - Autocall
#1319 - Autopoll
#8055 - 2741 Break

2703 Transmission Control Unit on local channel: (QTAM,BTAM)
Supported: #1340,#1341 - Autocall
#7715 - EBCDIC Code (BTAM)
#7716 - ASCII Code (BTAM)
#7717 - 6-bit Transcode (BTAM)
#8055 - 2741 Break (BTAM)
#9100 - Transparency for ASCII (BTAM)

2715 Transmission Control Unit (mdl 1) on local channel: (BTAM)
Supported: See "2790" under *Local Terminals*

3704/3705-I/3705-II Communications Controller on local channel:
Supported: EBCDIC Code, ASCII Code, Autopoll and EBCDIC Transparency do not have special feature codes in the 3704/3705
EP/VS (QTAM,BTAM)
NCP/VS (VTAM)
PEP
#8002 - Two-Channel Switch (VTAM)

Local Terminals

2848 Display Control (mdls 1,2,3) on local channel: (QTAM,BTAM)
Supported: Attachment of 2260,1053
#3901 - Extended Cursor Control
#4787 - Line Addressing
#5340 - Non-Destructive Cursor
#5341 - Non-Destructive Cursor Adapter
Not Supported: Attachment of 1053 (QTAM)

2260 Display Station (mdls 1,2):
Supported: #3606 - Extended Cursor Control, Alphameric Keyboard
Not Supported: Tab feature of #3606

1053 Printer (mdl 4): (BTAM)
Supported: **#9567,#9597** - PTTC/BCD Code
#9571,#9591 - PTTC/EBCD Code

2790 Data Communication System on local channel: (BTAM)
2715 Transmission Control Unit (mdl 1):
Supported: Attachment of 2740,2791,2793
#3801 - Expanded Capability
#4850 - Local 2740 Adapter
Not Supported: #8110 - Two Processor Switch

2740 Communication Terminal (mdl 1)
2791 Area Station (mdls 1,2):
Supported: Attachment of 1035,2795,2796,2797,2798, 1053
1035 Badge Reader (mdl 1)
2795 Data Entry Unit (mdl 1)
2796 Data Entry Unit (mdl 1)
2797 Data Entry Unit (mdl 1)
2798 Guidance Display Unit (mdl 1)
1053 Printer (mdl 1)

2793 Area Station (mdl 1):
Supported: Attachment of 2795,2796,2797,2798,1053
2795 Data Entry Unit (mdl 1)
2796 Data Entry Unit (mdl 1)
2797 Data Entry Unit (mdl 1)
2798 Guidance Display Unit (mdl 1)
1053 Printer (mdl 1)

3270 Information Display System on local channel: (VTAM,BTAM)
3272 Control Unit (mdls 1,2):
Supported: Attachment of 3277,3284,3286,3287, 3288

3277 Display Station (mdls 1,2):
Supported: #6350 - Selector Light-Pen
#9089 - EBCDIC Character Set

DOS/VS (cont'd)

3284 Printer (mdls 1,2):
Supported: **#9089** - EBCDIC Character Set
3286 Printer (mdls 1,2):
Supported: **#9089** - EBCDIC Character Set
3287 Printer (mdls 1,2) [supported as a 3284 or 3286 attached to a 3272-1 or -2]:
Supported: **#9082** - EBCDIC Character Set
3288 Printer (mdl 2) (supported as a 3286-2):
Supported: **#9089** - EBCDIC Character Set

3270 Information Display System on local channel: (supported as a 3272)
3274 Control Unit (mdl 1B):
Supported: Attachment of 3230, 3268, 3277, 3278, 3284, 3286, 3287, 3288, 3289
3277 Display Station (mdls 1,2):
Supported: #6350 - Selector Light Pen
#9082 - EBCDIC Character Set
3230 Printer (mdl 2) [supported as 3286-2]
3268 Printer (mdl 2) [supported as 3286-2]
3278 Display Station (mdls 1,2,3,4) [supported as a 3277]:
Supported: #6350 - Selector Light Pen
#9082 - EBCDIC Character Set
3284 Printer (mdls 1,2):
Supported: **#9089** - EBCDIC Character Set
3286 Printer (mdls 1,2):
Supported: **#9089** - EBCDIC Character Set
3287 Printer (mdls 1,2) [supported as a 3284 or 3286]:
Supported: **#9082** EBCDIC Character Set
3288 Printer (mdl 2) [supported as a 3286-2]:
Supported: **#9089** EBCDIC Character Set
3289 Printer (mdls 1,2) [supported as a 3286-2]

3270 Information Display System on local channel: (VTAM, TCAM thru VTAM) [supported as 3790 with Configuration Support 9165]
3274 Control Unit mdl 1A):
Supported: Attachment of 3230, 3268, 3277, 3278, 3284, 3286, 3287, 3288, 3289
3277 Display Station (mdls 1,2):
Supported: #6350 - Selector Light-Pen
#9082 - EBCDIC Character Set
3278 Display Station (mdls 1,2,3,4):
Supported: #6350 - Selector Light Pen
#9082 - EBCDIC Character Set
3230 Printer (mdl 2) [supported as 3286-2)
3268 Printer (mdl 2) [supported as 3286-2]
3284 Printer (mdls 1,2):
Supported: **#9089** - EBCDIC Character Set
3286 Printer (mdls 1,2):
Supported: **#9089** - EBCDIC Character Set
3287 Printer (mdls 1,2) [supported as a 3284 or 3286]:
Supported: **#9082** - EBCDIC Character Set
3288 Printer (mdl 2) [supported as a 3286-2]:
Supported: **#9089** - EBCDIC Character Set
3289 Printer (mdls 1,2) [supported as a 3286-2]

3730 Distributed Office Communication System on local channel (VTAM)
3791 Controller (mdls 11C, 12A, or 12B with: Local Channel Attachment (#1515)
3732 Text Display Station
3736 Printer

3790 Communication System on local channel (VTAM): See appropriate pages for description of Configurations and Access Methods supported.

7770 Audio Response Unit (mdl 3) on local channel (QTAM,BTAM)

DOS/VS (cont'd)

TERMINAL SUPPORT CHART 1

Remote Attach (a)	VTAM via NCP/VS	QTAM or BTAM -- via EP/VS (d)	via 270X (e)	via ICA (e)	POWER /VS RTAM
SS Lines:					
1031	X		1,2,3	115/125	
1051	X	X	1,2,3	All 125	
2260		X	1	135	
2265		X	1	135	
2740-1,-2	X	X	1,2,3	All	
2741	X				
2760		X	1,2,3	All	
3101	X	X (g)	1	(g)	
3232-51	X	X (g)	-	(g)	
3767-1,-2 (2740-1)	X	X		All	
3767-1,-2,-3(2740-2)	X	X	1	All	
3767-1,-2 (2741)	X				
5100 (2741)	X	X		All	
5110 (2741)	X	X		All	
CMCST (2741)	X	X	1,2,3	All	
S/7 (2740-1)	X	X	1,2,3	All	
AT&T 83B3 or WU 115A Line Control Type	X	X	1,2,3	115/125	
CPT-TWX (M33/35) Line Control Type	X	X	1,2,3	All	
WT Telegraph	X	X	1,2,3	115/125	
BSC Lines:			**BTAM only --------**		
2715-2		X	1,3	All	
2772	X	X	1,3	All	X
2780	X	X	1,3	All	X
2972-8,-11	X	X	1,3	All	
3271-1,-2	X	X	1,3	All	
3274-1C (3271-1,-2)	X	X	1,3	All	
3275-1,-2	X	X	1,3	All	
3276 (3271-1,-2)	X	X	1,3	All	
3624-1,-2,-11,-12 (2772)		X			
3651-A25,-B25,-A75 -B75,-C75,-D75 (S/3)		X		All	
3651-A60,-B60 (S/3)		X		All	
3661 (S/3)		X		All	
3684		X		ALL	
3735	X	X	1,3	All	
3741-2,-4	X	X	1,3	All	X
3747	X	X	1,3	All	
3771-1,-2,-3 (2772)	X	X	1	All	X
3773-1,-2,-3 (2772)	X	X	1	All	X
3773-P1,-P2,-P3 (2772)	X	X	1	All	
3774-1,-2 (2772)	X	X	1	All	X
3774-P1,-P2 (2772)	X	X	1	All	X (f)
3775-1 (2772)	X	X	1	All	X
3775-P1 (2772)	X	X	1	All	X (f)
3776-1,-2 (2772/3780)	X	X	1	All	X
3777-1 (2772/3780)	X	X	1	All	X
3780 (2772)	X	X	1,3	All	X
5231-2 (3741-2,-4)		X	1,3	All	
5265 (3741-2,-4)		X		All	
5285/5288 (3271-2)	X	X	1,3	All	
5285/5288(3741)	X	X	1,3	All	
6670 (2770)	X	X			X
1131		X	1,3	All	
1826		X	1,3	All	
Series/1 (as System/3)	X	X	1	All	
System/3	X	X	1,3	All	
System/7 (System/3)	X	X	1,3	All	
System/32 (System/3)	X	X	1,3	All	
System/34 (System/3)	X	X	1,3	All	
System/34 (3271)	X	X	1,3	All	
System/36 (System/3)	X	X	1,3	All	
System/36 (3271)	X	X	1,3	All	
System/36 [S/360(b)]	X	X	1,3	All	
System/38 (System/3)	X	X	1,3	All	
System/38 (3271)	X	X	1,3	All	
S/360-20		X	1,3	All	
S/360 (b)		X	1,3	All	
S/370 (b)	X	X	1,3	All	
S/8100/DPPX	X	X (g)	X (g)	X (g)	
S/8100/DPPX/SP	X	X (g)	X (g)	X (g)	

SDLC Lines:	VTAM via NCP/VS	POWER/VS VTAM
3705 Remote	X	
3271-11,-12	X (c)	
3274-1C (3791)	X	
3275-11,-12	X (c)	
3276 (3791)	X	
3601	X	
3602	X	
3614	X	
3624	X	
3631	X	
3632	X	
3651-A25,B25,A75 B75,C75,D75(S/3)	X	
3651-A50,-B50	X	
3651-A60,-B60	X	
3661	X	
3684	X	
3694	8/81	
3767-1,-2,-3	X	
3771-1,-2,-3	X	X
3773-1,-2,-3	X	X
3773-P1,-P2,-P3	X	
3774-1,-2	X	X
3774-P1,-P2	X	
3775-1	X	X
3775-P1	X	
3776-1,-2,-3,-4	X	X
3777-1,-3	X	X
3791	X	X
5285/5288 (3274-1C)	X	
6670	X	
8130/DPCX-A21,-A23	X	X
8140/DPCX-A31, -A33,-A51,-A53	X	X
System/32 (3770)	X	X
System/34 (3770)	X	X
System/34 (3791)	X	X
System/34 (3274)	X	
System/36 (3770)	X	X
System/36 (3791)	X	X
System/36 (3274)	X	
System/38 (3770)	X	
System/38 (3274)	X	
S/8100/DPPX	X	
S/8100/DPPX/SP	X	

Local Channel Attach:	VTAM	QTAM	BTAM
ICAs, TCUs, Local Communications Controllers:			
ICA-M115		X	X
ICA-M125		X	X
ICA-M135		X	X
2701		X	X
2702		X	X
2703		X	X
2715-1			X
3704 (EP/VS)		X	X
3704 (NCP/VS)	X		
3705-I (EP/VS)		X	X
3705-I (NCP/VS)	X		
3705-II (EP/VS)		X	X
3705-II (NCP/VS)	X		
Local Terminals:			
2260		X	X
3272-1,-2	X		X
3274-1A (3791)	X		
3274-1B (3272-2)	X		X
3791	X		X
7770-3		X	X

DOS/VS (cont'd)

Legend:

SS	=	Start/Stop.
BSC	=	Binary Synchronous Communication.
SDLC	=	Synchronous Data Link Control.
Local	=	Local Channel Attachment.
X	=	Supported now.
(date)	=	Date when support will be available.

Notes:

(a) If shown, the terminal type in parenthesis designates the programming support provided by SCPs. E.g., "S/7 (2740-1)" means "the S/7 is supported as a 2740-1".

(b) S/360 mdls 25, 30, 40, 50, 65, 65MP, 67 (65 mode), 75, 85, 91, 195 with either BOS, BPS, DOS, or OS. Any virtual storage S/370 Processor with either BOS, BPS, DOS, OS, DOS/VS, OS/VS1, or OS/VS2.

(c) Nonswitched support only.

(d) 3704/3705 EP/VS, or the Partitioned Emulation Programming (PEP) extension to 3704/3705 NCP/VS, can be used to emulate the 270X.

(e) 270X = 2701, 2702, 2703; column shows last digit of 270X support. ICA = M115 ICA, M125 ICA, M135 ICA. All support without a date is available now.

(f) Support is for console printer and for data formatted as cards from diskette or keyboard (Logon).

(g) Supported for BTAM only.

DOS/VS (cont'd)

TERMINAL SUPPORT CHART 2

Terminal (a)	Communications Code EBCDIC norm	EBCDIC trans	ASCII norm	ASCII trans	Communications Network sw PTP	nonsw PTP	nonsw MP
SS Terminals:							
1031	-	-	-	-	-	-	X
1051	-	-	-	-	X	-	X
2260	-	-	-	-	-	-	X
2265	-	-	-	-	-	-	X
2740-1	-	-	-	-	X	X	X
2740-2	-	-	-	-	-	-	X
2741	-	-	-	-	X	X	-
2760	-	-	-	-	X	X	-
3101	-	-	X	-	X	-	-
3232-51	-	-	X	-	X	X	-
3767-1,-2 (2740-1)	-	-	-	-	X	X	X
3767-1,-2,-3(2740-2)	-	-	-	-	-	-	X
3767-1,-2 (2741)	-	-	-	-	X	X	-
5100 (2741)	-	-	-	-	X	X	-
5110 (2741)	-	-	-	-	X	X	-
CMCST (2741)	-	-	-	-	X	-	-
S/7 (2740-1)	-	-	-	-	X(e)	X	X
AT&T 83B3, WU 115A	-	-	-	-	-	-	X
CPT-TWX (M33/35)	-	-	-	-	X	-	-
WT Telegraph	-	-	-	-	-	X	-
BSC Terminals:							
2715-2	-	X	-	-	S	X	M
2772	X	X	X	-	S	X	M
2780	X	X	X	-	S	X	M
2972-8,-11	X	-	-	-	-	-	M
3271-1,-2	X	-	X	-	-	-	M
3274-1C (3271-1,-2)	X	-	X	-	-	-	M
3275-1,-2	X	-	X	-	S(f)	-	M
3276 (3271-1,-2)	X	-	X	-	-	-	M
3624-1,-2,-11,-12 (2772)	-	X	-	-	-	-	M
3651-A25,-B25,-A75 B75,C75,D75 (S/3)	-	X	-	-	D(h)	X	N
3651-A60,-B60 (S/3)	-	X	-	-	X	-	-
3661 (S/3)	-	X	-	-	X	-	-
3684	-	X	-	-	X	-	-
3735	X	-	X	-	S	-	M
3741-2,-4	X	X	X	-	S(g)	X	-
3747	X	X	-	-	S(g)	X	-
3771,3773,3774, 3775 (2772)	X	X	X	-	S	X	M
3776,3777-1 (2772/3780)	X	X	X	-	S	X	M
3780 (2772)	X	X	X	-	S	X	M
5110 (2772)	X	X	-	-	S	X	M
5231-2 (3741-2,-4)	X	-	-	-	X	X	M
5265 (3741)	X	-	-	-	X	X	-
5275 (3275-1,-2)	X	-	-	-	S(f)	-	M
5285/5288 (3271-2)	X	-	-	-	-	-	M
1131	X	X	-	-	S	X	M
1826	X	X	X	-	S	X	M
Series/1 (as System/3)	X	X	X	-	X	X	
System/3	X	X	X	-	S	X	M
System/7 (System/3)	X	X	X	-	X	X(h)	M
System/32 (System/3)	X	X	X	-	S	X	M
System/34 (System/3)	X	X	X	-	S	X	M
System/34 (3271)	X	-	-	-	-	-	M
System/36 (System/3)	X	X	X	-	S	X	M
System/36 [S/360(c)]	X	X	X	-	S	X	M
System/36 (3271)	X	-	-	-	-	-	M
System/38 (System/3)	X	X	X	-	S	X	-
System/38 (3271)	X	-	-	-	-	-	M
S/360-20	X	X	X	X	S	X	M
S/360 (b)	X	X	X	X	S	X	-
S/370 (b)	X	X	X	X	S	X	-
S/8100/DPPX DPPX/DSC	X	-	X	-	-	X	X
S/8100/DPPX/SP DPPX/SP/DSC	X	-	X	-	-	X	X
SDLC Terminals:							
3705 Remote	SDLC is insensitive				-	X	-
3271-11,-12	to data interchange				-	-	N
3274-1C (3791)	codes.				-	X	N
3275-11,-12					-	-	N
3276 (3791)					D	X	N
3601					X	X	N
3602					X	X	N
3614					-	X	N
3624					-	X	N
3631					X	X	N
3632					X	X	N
3651-A25,B25,A75 B75,C75,D75 (S/3)					D	X	N

Terminal (a)	Communications Code EBCDIC norm	EBCDIC trans	ASCII norm	ASCII trans	Communications Network sw PTP	nonsw PTP	nonsw MP
3651-A50,-B50					D	X	N
3651-A60,-B60					D	-	-
3661					D	-	-
3684					D	X	N
3694					X	X	N
3767-1,-2,-3					D	X	N
3771,3773,3774, 3775,3776,3777-1,-3					D	X	N
3791 (c)					D	X	N
5285/5288 (3274-1C)					D	X	-
8130/DPCX-A21,-A23					D	X	N
8140/DPCX-A31, -A33,-A51,-A53					D	X	N
System/32 (3770)					D	X	N
System/34 (3770, 3791)					D	X	N
System/36 (3770)					D	X	N
System/36 (3790)					D	X	N
System/36 (3274)					D	X	N
System/38 (3770)	-	-	-	-	D	X	N
System/38 (3274)	-	-	-	-	D	X	N
S/8100/DPPX					D	X	N
S/8100/DPPX/SP					D	X	N
Local Terminals:							
2260	-	-	-	-			
2715-1 (d)	-	X	-	-			
3272-1,-2	X	-	-	-			
3274-1A (3791)							
3274-1B (3272-2)	X	-	-	-			
3791 (c)	3791 local attachment is code insensitive.						
7770-3	-	-	-	-			

Legend:

SS = Start/Stop
BSC = Binary Synchronous Communication
SDLC = Synchronous Data Link Control
Local = Local Channel Attachment

X = Supported
\- = Not supported

D = Group of terminals which can communicate over the public switched telephone network to the same SDLC line appearance on a 3704 or 3705 attached to a S/370. All DTEs so communicating must be operating with the same clocking source (either modem or business machine) and at the same transmission speed.

M = Group of terminals which can operate on same BSC MP line and same line speed.

N = Group of terminals which can operate on same SDLC MP line and same line speed.

S = Group of terminals which can share the same phone number(s).

Notes:

(a) If shown, the terminal type in parenthesis designates the programming support provided by SCPs. E.g., "System/38 (3274)" means "the System/38 is supported as a 3274".

(b) S/360 Models 25, 30, 40, 50, 65, 65MP, 67 (65 mode), 75, 85, 91, 195 with either BOS, BPS, DOS or OS. Any virtual storage S/370 Processor with either BOS, BPS, DOS, OS, DOS/VS, OS/VS1 or OS/VS2.

(c) The 3791 Controller as part of the 3790 Communication System/Data Entry Configuration does not support ASCII code.

(d) Terminal operates on local channel using nonswitched BTAM programming support.

(e) Supported at 134.5 bps only.

(f) Switched network supported by BTAM only.

(g) The 3741/3747 can use the same switched network hardware at the 3704/3705 as other BSC terminals. However, the Network Control Program requires that the port be configured for 3741/3747 when the port is to be used for 3741/3747. Two separate versions of the NCP/VS must be maintained for the two separate configurations of the port, and the proper version loaded into the 3704/3705 for the way the port is to be used at the time.

(h) IPL of S/7 is not supported in this network configuration.

SYSTEM UTILITY PROGRAMS

The system utility programs maintain system control data at a system or organizational level. Except where specifically noted, support is provided for utility functions concerning the following physical devices:

2400-series Magnetic Tape Units
3400-series Magnetic Tape Units
2311 Disk Storage Drive
2314 Direct Access Storage Facility

DOS/VS (cont'd)

2319 Disk Storage
2321 Data Cell Drive
3330/3333 Disk Storage
3340 Disk Storage
3344 Disk Storage
3350 Disk Storage
3540 Diskette I/O Unit.

Additional system devices may be required for program execution; these may be assigned to any of the appropriate physical devices already listed under the heading *Control and Service Programs.*

The following are the utility functions provided:

Initialize Magnetic Tape - The program initializes up to sixteen tape volumes. For each volume the program creates from one to eight volume labels as required, one dummy header label, and a tape mark. The program may be used to initialize either EBCDIC tapes with IBM Standard Volume Labels or ASCII tapes with ANSI Standard Volume Labels.

Initialize Disk - The program initializes disk packs for further use by DOS/VS. The initialization procedure consists of VTOC label checking, home address generation, volume label creation, track descriptor (R0) record generation, and IPL and VTOC creation. 2311, 2314 and 2319 disk packs may be initialized with or without a test for defective tracks (surface analysis); however surface analysis should be included when a volume is initialized for the first time. For 3330 and 3333 disk packs and 3340 data modules, the initialization procedure does not include surface analysis or home address generation.

For 3330 compatibility volumes, home address and R0 will be rewritten on all tracks, including alternate tracks, surface analysis will be performed on tracks flagged as defective with such tracks being reclaimed if no errors are found, and IPL and VTOC records will be written. For 3340 and 3344 volumes, tracks flagged as defective will be analyzed to determine if they can be reclaimed via turning off the defective track bit. Defective HA/R0 areas will be rewritten with appropriate Skip Displacement (SD) values to allow the assignment of alternate tracks to them.

Initialize Data Cell - The program initializes from one to five data cells for use on a 2321 Data Cell Drive. The initialization procedure is identical to the initialization of a 2311 disk pack.

Assign Alternate Track - Disk - The program assigns an alternate track to a defective track on a disk and, if update records are supplied as input, replaces bad records on a track. The alternate tracks may be assigned either unconditionally or conditionally based upon the result of a surface analysis of the track. (For 3330 and 3333 disk packs and 3340 data modules only unconditional alternate track assignment is possible.)

Assign Alternate Track - Data Cell - The program performs for a 2321 Data Cell the functions of the Assign Alternate Track - Disk program just described.

Clear Disk - The program clears one or more areas of disk and preformats tracks containing an indicated base value throughout the area cleared.

Clear Data Cell - The program performs for a 2321 data cell the functions of the Clear Disk program just described.

VTOC Display - The program displays the labels contained in the Volume Table of Contents of a disk volume. The labels are identified by their location within the Volume Table of Contents and their format, type, and major fields are indicated by appropriate heading lines in the printed output.

Copy Disk to Disk - The program copies a volume or a file of data from one disk pack to another disk pack of the same type. The output records occupy areas of the disk identical to those of the original volume or file. Sequential, Indexed Sequential, and Direct Access files are all supported.

Copy and Restore Diskette - Support is provided to: Recovery data from a diskette on which the label information (on track zero) cannot be read ... Copy one 3540 diskette to another 3540 diskette. During this copy, error sectors and deleted records are eliminated. The utility can be used in a single or multiple 3540 configuration.

Copy and Restore Disk to Card - The programs allow the user to copy a volume or file of data from disk to punched cards, and to restore the data to a disk pack of the same type at a later date. The restored records occupy areas of the disk identical to those of the original volume or file. Sequential, Indexed Sequential, and Direct Access files are all supported.

The punched card output created by the copy program is designed for use by the restore program only.

Both copy and restore programs provide checkpoint and restart facilities. The checkpoint file may be assigned to either tape or disk.

Copy and Restore Disk or Data Cell to Magnetic Tape - The programs allow the user to copy a volume or file of data from disk or data cell to magnetic tape, and to restore the data to a disk pack or data cell of the same type at a later date. The functions of the programs are equivalent to those of the Copy and Restore Disk to Card programs just described.

Backup and Restore System Utility Programs: The programs allow fast backup of system and/or private libraries to tape with subsequent restore to disk. When the libraries are restored to disk, they are automatically condensed and may be reallocated to different sizes or to different DASD types. The restore program will accept the PID tape as input and allocate the libraries within a DOS/VS partition.

Copy File and Maintain Object Modules (OBJMAINT) Utility: This program is a multipurpose utility providing the following functions:

- File-to-file copy with blocking and deblocking of data sets on tape, card, disk or diskette.
- Update and expansion of object modules.
- Maintenance of PTF data sets.
- Comprehensive data set listing capability.

Fast Copy Disk Volume - The program copies the complete contents of a 3336 disk pack or a 3348 data module onto another 3336 or 3348, respectively. It copies either directly from disk to disk or uses magnetic tape as intermediate output. The program copies a complete 3336 or 3348 only, rather than specific files or extents. The pack may contain any combination of DOS/VS files and components.

Block/Deblock Function - The program blocks an 80/81 byte record file to a 3440-byte record file, and deblocks a 3440-byte file to create an 80-byte SYSIN file. The program is only meant to support IBM distribution files, that is, only 3440-byte blocked records, 80-byte deblocked records as output and 80 and/or 81-byte records as input will be processed. Other functions provided: deblocking of selected Program Temporary Fixes (PTFs) from a blocked PTF file, card to card copy function including 80cc to 96cc conversion and listing of a file with 3440-byte blocked records. Devices supported are the 2501, 3504 and 3505 Card Readers, 2540 Card Read Punch, 2560 MFCM, 3525 Card Punch, 2400/3400 series Magnetic Tape Units, 2311 Disk Storage Drive, 2314 DASF and 2319, 3330 and 3333 Disk Storages.

Access Method Services - An extensive service program package which can be used to:

- Define (create), print, copy, reorganize or delete a VSAM file.
- Convert an ISAM file or SAM file to a VSAM file.
- Add, alter, delete or print entries in the VSAM catalog.
- Create backup copies of VSAM files.
- Copy a VSAM file and catalog entries in a format which makes it easily portable to another DOS/VS system or to an OS/VS system.

OTHER UTILITY PROGRAMS

Analysis Program-1: The program provides a testing capability which assists the user in effective management of 3350/3344 DASDs.

AP-1 reports the operational status of the 3350/3344 hardware and media upon request by the operator. Brief messages (e.g., NO DRIVE PROBLEMS FOUND) appear on the console giving the user guidance for initiating further analysis. More detailed error analysis data, useful to the system programmer and system engineer, is directed to SYSLST.

AP-1 analyzes the operational status of the drive and the data and control paths for reading, writing, and arm movement. It further, at the direction of the operator, scans the volume to verify that all data is machine readable. With these aids, the user can determine whether an error situation is drive or media related and thus initiate the appropriate recovery procedures.

Maintain System History Utility: This program provides for a simplified and controlled installation of PTFs. It provides backup records and updates a PTF history. If severe problems occur after the application of a PTF, the system can be quickly restored using the copy saved previously.

COPYSERV: The program allows for automated merge of existing system and private libraries into newly created libraries, eliminating the manual effort of comparing directory listings and preparing the required copy cards thus reducing significantly the time required to prepare the new release for production status.

Recovery Management Support and Recording: Recovery Management Support (RMS) and Recovery Management Support Recording (RMSR) are standard functions under DOS/VS with the following exceptions:

- For mdls 115 and 125, recovery management support is a supervisor assembly option for all environments.
- Mdls 115 and 125 configurations which have no tapes, channel attached devices, or the integrated communications adapter, do not need Recovery Management Support Recording; the mdls 115 and 125 processors perform RMSR functions for processor errors and for natively attached input and output device errors.

The functions of RMS and RMSR are described below:

Recovery Management Support - The Recovery Management Routines attempt to recover from or otherwise reduce the impact of

DOS/VS (cont'd)

machine malfunctions indicated by machine check and channel check interruptions. They feature:

Transparent recovery after successful retry including error statistics collection.
Continuation if the error is unrecoverable but the affected job or task can be terminated.
Comprehensive error recording to support deferred maintenance.

Recovery Management Support Recording - RMSR collects and records on direct access storage (SYSREC) statistical and event data on matching errors. This recorded data facilitates early warning, rapid diagnosis and repair of failing components, providing greater system availability due to improved preventive maintenance and shorter duration of planned and unplanned maintenance.

The error recording file on direct access storage can be totally or selectively edited and printed or transferred to magnetic tape for later editing and printing by the Environmental Recording, Editing and Printing (EREP) Program. A number of functional enhancements have been made to this program including integration of the recording, editing and printing of ESTV records.

Tape and Disk Error Recovery Procedures - Routines that analyze error type and type of device in error and pass control to the proper ERP in an attempt to recover or to the ERP message writer in case of hard errors.

DIAGNOSTIC AIDS

DOS/VS provides a number of system tools and facilities to help to allocate responsibility for program repair. These include:

- The Online Test Executive Program (OLTEP) which allows execution of machine diagnostic programs in the real storage allocated to the background partition of a multiprogramming environment at the same time as other system and user programs are executed in foreground partitions. OLTEP can be executed in real mode only.
- The Teleprocessing Online Test Executive Program (TOLTEP) is provided for telecommunications networks under VTAM. See description of *Virtual Telecommunications Access Method - VTAM* for information on TOLTEP.
- Problem Determination and Serviceability Aids (PDAIDS) which allow the tracing of the following events as they occur during program execution: Fetching and loading of program phases (Fetch/Load Trace) ... Input and output activity (I/O Trace) ... Supervisor Calls (SVC Trace) ... Certain QTAM events (QTAM Trace) ... Program checks in transient areas (Transient Dump) ... Certain VTAM events ... VTAM Buffer Pool Trace.
- System Debugging Aids (SDAIDS) which use the Program Event Recording Facility and Monitor Calling Facility of S/370 to provide additional stop and dump facilities and the following additional trace facilities: Page Trace ... Instruction Trace ... Alter Main Storage Trace ... Alter General Register Trace ... Successful Branch Trace.
- The Dump Generation Program (DUMPGEN) which generates a stand-alone storage dump program tailored to the requirements of the individual installation.
- The PDZAP program which allows quick applying of ZAP fixes to phases and transients in the Core Image Libraries without requiring a reassembly and recataloging of the changed phase or transient.
- The High Speed Standalone Dump facility allows the user to dump all of main storage on a DASD device or magnetic tape in a minimal amount of time and to immediately re-IPL the system and to return to normal operation.
- The Page Data Set Dump (SYSVIS) program provides a complete or selective dump of the Page Data Set.
- The Label Cylinder Display Program (LSERV) which produces a formatted listing of the file label information contained on the tracks of the label cylinder of the system residence extent.
- The Main Storage Alter Command (ALTER) which allows the system operator to change the contents of up to 16 bytes of virtual or real storage from the system console starting from a specified address.
- The Main Storage Dump Command (DUMP) which allows the system operator to obtain a dump of the contents of main storage on the System List Device (SYSLST).
- Analysis Program-1 (AP-1) aids the operator in analyzing 3350 or 3344 DAS error situations and in isolating such errors into hardware or media related areas.

  AP-1 may be directed to test for hardware errors only or hardware and media errors. Simple result messages appear on the operator console. Detailed error related data are directed to SYSLST.

  AP-1 will only analyze errors associated with 3350 or 3344 devices and requires that one of these devices be on the system.

EMULATOR PROGRAMS

Three emulator programs are provided to allow the emulation under DOS/VS of the following IBM systems:

- S/360 mdl 20 (emulated on mdls 115, 125, 135, 135-3, and 138 only)
- 1401, 1440, and 1460 Data Processing Systems (emulated on all S/370 models supported by DOS/VS except mdl 115).
- 1410 and 7010 Data Processing Systems (emulated on mdl 145, 145-3, 148, 155II and 158).

Note: The 1401/1440/1460 Emulator Program and the 1410/7010 Emulator Program are no longer supplied as components of DOS/VS, but are available as an independent release. (Program No. 5747-CC3).

Execution of any emulator program requires the presence of the appropriate machine compatibility feature shown in the following table:

Emulation of Model:	115	125 135 135-3 138	145 145-3 148	155II 158
S/360 mdl 20	#7520	#7520	-----	-----
1401/1440/1460	-----	#4457 #4458	#4457 or	#3950
1410/7010	-----	-----	#4458	#3950

The combination of emulator program and compatibility feature enables programs written for the emulated system to be executed on S/370. Most programs require no change for execution under the emulator, though certain special and custom features of the original system may not be emulated. (Those features not emulated are listed below under the headings of the individual emulator programs.)

Both emulator jobs and S/370 native jobs may be placed in a single input job stream for execution. The emulator programs may be executed in a multiprogramming environment concurrently with user-written or IBM-supplied programs including other emulator programs, except that on mdl 125 only one 1401/1440/1460 emulator program can be executed at any given time and mdl 20 emulated jobs cannot be multiprogrammed with 1401/1440/1460 emulated jobs.

Card, tape, and disk programs are emulated. Cards and tapes used and created by the emulated system can be used by the emulator programs without change (except that 7-track tapes in mixed parity are not accepted by the Model 20 emulator program and that tapes in mixed density are not accepted by any emulator program). Disk files created by the emulated system must first be copied to tape on the original system by means of a suitable utility program, and then restored to disk on S/370 by emulating the restore function of the utility program.

The following paragraphs contain information relevant to specific emulator programs.

The S/360 mdl 20 Emulator Program - The S/360 mdl 20 Emulator Program enables programs written for the S/360 Model 20 to be executed under DOS/VS on S/370 mdls 115, 125, 135, 135-3, and 138 with the use of the machine compatibility features already listed.

Emulation is provided for mdl 20 systems with main storage sizes from 4K to 32K bytes. All basic features are emulated.

The following features and operations are *not* emulated:

- Selective Tape Listing (on 1403).
- Dual Feed Carriage (on 2203).
- Merging cards from primary and secondary feeds of 2560 (when the device is emulated by the combination of 3504/3505 and 3525).
- Punch files from either 2560 hopper (when the device is emulated by the combination of 3404/3505 and 3525).
- 2560 Sort/Merge.
- Punch stacker selection when 2560 is emulated by the combination of 3504/3505 and 3525.
- 1401/1440 Compatibility (on S/360 mdl 20 submodel 5)

The following types of mdl 20 program *cannot* be emulated:

- Time-dependent programs.
- Programs using mixed parity or mixed density on 7-track tape.
- Programs using ASCII code.
- Programs using the two commands associated with the 1403 Universal Character Set feature.

The emulated mdl 20 error conditions are always those of the mdl 20 submodel 5.

For full details on emulator restrictions, see *Model 20 DOS/VS Emulator on S/370* (GC33-5388).

DOS/VS (cont'd)

The following input/output devices are emulated: 2152 Printer-Keyboard ... 2501 Card Reader ... 2520 Card Read Punch ... 1442 Card Punch ... 2560 Multifunction Card Machine ... 1403 Printer ... 2203 Printer ... 2415 Printer ... 2401 Magnetic Tape Unit ... 2311 Disk Storage Drive.

Input and output devices *not* emulated are: 1255 Magnetic Character Reader ... 1259 Magnetic Character Reader ... 1270 Optical Character Reader ... 1419 Magnetic Character Reader ... Telecommunications Devices.

Full details on input and output device correspondence can be found in the manual: *Model 20 DOS/VS Emulator on System/370* (GC33-5388).

The emulator program provides the optional ability to emulate mdl 20 unit record input and output operations on S/370 tape or disk devices. This option is called 'device independence' and provides better job throughput than when mdl 20 unit record devices are emulated by equivalent S/370 unit record devices, particularly when mdl 20 programs use intermediate card files. Furthermore in the multiprogramming environment the user does not need to dedicate unit record devices to the partition in which the emulator is being executed.

Mdl 20 features and instructions *not* emulated when using the device independence option are: Stacker selection for input files ... Optional Card Print Feature on 2560 Model A1 ... Punch Feed Read instructions ... Read Column Binary on 2501, 2520, and 2560 ... The 2560 Sort/Merge program ... Selection of two stackers only is emulated for 2520 and 2560 ... Primary and secondary feeds of 2560 cannot interact.

When using the device independence option all tape and disk devices supported by the emulator program may be used to emulate Model 20 unit record devices.

A mdl 20/DOS/VS Disk Data Interchange program is provided with the emulator program to enable disk files organized in Model 20 format (accessible by mdl 20 emulated programs) to be converted to disk files organized in S/370 format (accessible by DOS/VS programs). The reverse conversion from DOS/VS format to mdl 20 DPS format is also provided. Sequential, Indexed Sequential, and Direct Access data organization are all supported.

When converting a file from mdl 20 format to DOS/VS format using the Data Interchange program the user may specify a new blocking factor; the blocksize specified must not exceed the capacity of a single track of the S/370 device. Files created under DOS/VS may be converted to mdl 20 format provided the necessary mdl 20 extents are initialized by a mdl 20 DPS job executed under the emulator program.

The Data Interchange program does not require the presence of the mdl 20 machine compatibility feature and may be executed in any partition of a DOS/VS system.

The 1401/1440/1460 Emulator Program - The 1401/1440/1460 Emulator Program enables programs written for the 1401, 1440, or 1460 Data Processing Systems to be executed under DOS/VS on S/370 mdls 115, 125, 135, 135-3, 138, 145, 145-3, 148, 155II and 158 with the use of the machine compatibility features already listed.

Emulation is provided for 1401, 1440, and 1460 systems with core storage sizes of from 1,400 to 16,000 positions of core storage. All basic features of these systems are emulated, together with the following optional features: Expanded Print Edit ... Inverted Print Edit ... High-Low-Equal Compare ... Multiply/Divide ... Processing Overlap ... Sense Switches ... Advanced Programming/Indexing ... Bit Test ... Print Storage ... Additional Print Control ... Space Suppression ... Column Binary ... Binary Transfer ... 51-column Card ... Punch-Feed Read ... Card Image (on 1442) ... Selective Stacker ... Scan Disk.

Features and operations *not* emulated are: Selective Tape Listing (on 1403) ... Compressed Tapes ... Mixed Density Tapes ... Read Compare Feature (on 1404).

The following input and output devices are emulated (full details of input and output device correspondence are to be found in the manual *1401/1440/1460 DOS/VS Emulator on S/370*): 1402 Card Read Punch ... 1442 Card Read Punch ... 1442 Card Reader ... 1444 Card Punch ... 1407 Console Inquiry Station ... 1447 Console ... 1403 Printer ... 1404 Printer (continuous forms only) ... 1443 Printer ... 729 Magnetic Tape Units ... 7330 Magnetic Tape Units ... 7335 Magnetic Tape Units ... 1301 Disk Storage ... 1311 Disk Storage ... 1405 Disk Storage.

Input and output devices *not* emulated are: 1445 Printer ... 7340 Hypertape Drive ... 1011 Paper Tape Reader ... 1012 Paper Tape Punch ... Optical Readers ... Magnetic Character Readers ... Teleprocessing Devices ... Audio Response Units.

Two tape formatting programs are provided with the emulator program: (1) to assist the user in converting his tape files before emulation so that they can be used more efficiently by the emulator program, and (2) to convert tape files produced during emulation back to the 1401/1440/1460 format so that they can then be used on the original system.

The 1410/7010 Emulator Program - The 1410/7010 Emulator Program enables programs written for the 1410 or 7010 Data Processing Systems to be executed under DOS/VS on S/370 mdls 145, 145-3, 148, 155II and 158 with the use of the machine compatibility features already listed.

Emulation is provided for 1410 and 7010 systems with core storage sizes of from 10,000 to 100,000 positions. All basic features are emulated, together with the following optional features: Processing Overlap ... Priority Processing ... Two Channels on 1410 ... Inverted Print Edit ... 7010 Second, Third and Fourth Data Channels ... 7010 Store and Restore Status ... 7010 Floating Point Arithmetic.

Features and operations *not* emulated are: 1410/1401 Compatibility Mode ... Column Binary ... 51-column Cards ... 1410/7010 Diagnostic Instruction Branch on C-bit ... 7010 Program Relocation and Storage Protection ... 7010 Interval Timer ... Stacker Select ... Mixed Density Tapes.

Input and output devices emulated are (full details of input and output device correspondence are to be found in the manual *1410/7010 DOS/VS Emulator on S/370* [GC33-5385]): 1402 Card Read Punch ... 1442 Card Reader ... 1415 Console ... 1403 Printer ... 729 Magnetic Tape Units ... 7330 Magnetic Tape Units ... 1301 Disk Storage ... 2302 Disk Storage.

Input and output devices *not* emulated are: 1311 Disk Storage Drive ... 1405 Disk Storage ... 7340 Hypertape Drive ... 1011 Paper Tape Reader ... 1012 Paper Tape Punch ... Magnetic Character Readers ... Optical Readers ... Teleprocessing Devices ... Audio Response Units.

Two tape formatting programs are provided with the emulator program: (1) to assist the user in converting his tape files before emulation so that they can be used more efficiently by the emulator program, and (2) to convert tape files produced during emulation back to the 1410/7010 format so that they can then be used on the original system.

Other Program Support: The *Program Product* section describes the Program Products supported under DOS/VS, including language processors, sort/merge processors, utility programs and application programs. These Program Products, in addition to providing extended functional capabilities over any predecessor Type I or Type II programs, also provide support for new input and output devices. The specific devices supported are shown in the description of each program.

Type I and Type II processors that run under DOS/VS are listed in those sections. In determining the applicability of these programs to a customer's needs particular attention must be given to the availability of appropriate device support within the programs.

DOS/VS FD Macros and Utility for the 3735 (5747-AZ1): Form Description Macros and Utility Support for the 3735 is available as a separate program operable under DOS/VS.

This SCP provides support for 3735 Programmable Buffered Terminal Users on DOS/VS systems with BTAM. It assembles user-written Form Description Programs and prepares them for subsequent transmission to the 3735.

3031 Processor Complex Support: The DOS/VS IBM 3031 Processor ICR is an extension of the 3031 support provided in "DOS/VS 3277 Console Support Enhancements". It provides support for the 3031 service support console and additional EREP functions to handle the machine and channel check records for the 3031 processor.

DOCUMENTATION: (available from Mechanicsburg)

IBM 3735 Programmable Buffered Terminal Concepts and Application (GA27-3043) ... *IBM 3735 Programmable Buffered Terminal Form Description Macro Instructions and Form Description Utility PLM* ... (GY30-3000), and *IBM 3735 Operator's Guide* (GA27-3061).

SCP PROGRAMMING SERVICES: Class 2 SCP

DISK OPERATING SYSTEM/ VIRTUAL STORAGE EXTENDED (DOS/VSE) 5745-020

(For information on the Disk Operating System, Basic Operating System, or Tape Operating System, see the "P 360" pages of your sales manual).

INTRODUCTION

The IBM Disk Operating System/Virtual Storage Extended (DOS/VSE), 5745-020, is a disk-resident system designed to provide operating system capabilities for the 4300 Processors in S/370 mode and ECPS:VSE mode and the 3031 Single Processor in addition to any virtual storage S/370 processor from 370/115 through 370/158, and their attachable input/output devices. DOS/VSE requires the clock comparator and the CPU timer (standard on all S/370 models except 135 and 145, and also standard on 4300 Processors).

DOS/VSE is an operating system optimized to the function and performance needed by the small and intermediate users of 4300 Processors, the 3031 single Processor and the S/370. It gives the user the ability to multiprogram five jobstreams concurrently which generally include the VSE/POWER spooling product, a real time subsystem, such as CICS/VS, one or two batch jobstreams, and an unscheduled work partition for quick turn-around jobs. The operating system supports most large DASD and most terminals and devices supported by the larger Operating System. This gives the DOS/VSE user the capability to start out on a small model of either S/370 or the 4300 Processors and grow his system and workload up through the S/370 and/or 4300 Processor line, as his DP business needs increase.

DOS/VSE is classified as IBM System Control Programming (SCP) for distribution, installation, and programming support purposes.

If the system operates on a S/370, 3031 Single Processor or on the 4300 Processors in S/370 mode, it runs in extended control (EC) mode only and uses the EC mode format of the program status word (PSW) and low-order storage locations from 0 to 511. Dynamic Address Translation (DAT) is used to provide virtual storage support. In ECPS:VSE mode of the 4300 Processors the new concept of relocating channels is exploited. The Program Event Recording (PER) Facility and Monitor Calling Facility are used to provide system debugging facilities (SDAIDS) for each model, S/370, 3031 Single Processor, and the 4300 Processors.

This section describes the individual components from which the DOS/VSE Operating System is built. For a description of basic concepts and facilities of DOS/VSE see the *Introduction to DOS/VSE*, GN33-8800. To obtain more detailed information the reader should consult the appropriate IBM reference manuals.

SYSTEM CONCEPTS AND ORGANIZATION

Virtual Storage Support

Virtual storage is the address space available to the DOS/VSE system. It starts at storage address 0, and its total size is determined by user specification at supervisor assembly time.

Real Storage Support

S/370 Mode:
up to 8,388,608 bytes.
(will not operate with more than 8,388,608 bytes)

ECPS:VSE Mode
up to 16,777,216 bytes.

SYSTEM COMPONENTS

The Disk Operating System/Virtual Storage Extended System Control Program consists of the following components:

- Control and Service Programs:

  Initial Program Load and Buffer Load
  Supervisor
  Job Control
  Attention routines, Initiators, Terminators
  Checkpoint/Restart
  Linkage Editor
  Librarian - Maintenance and Service
  Display Operator Console Support

- The Assembler
- Data Management:

  Sequential Access Methods:

  IOCS and Device Independent I/O
  Magnetic Tape IOCS
  Sequential Disk IOCS
  Paper Tape IOCS
  Diskette IOCS
  Magnetic Character Recognition IOCS
  Optical Character Recognition IOCS

  Direct Access Methods:

  Direct Access Method
  Indexed Sequential Access Method

- Utility Programs:

  System Utility Programs
  Utility Services

- Error Recovery:

  Recovery Management Support and Recording
  Environmental Recording and Editing Program
  Tape Error Recovery Procedures
  Disk Error Recovery Procedures

- Diagnostic Aids:

  Online Test Executive Program
  Problem Determination and System Debugging Aids

- Analysis Program Component (AP-1)

The following sections describe each of these components in more detail.

Control and Service Programs: The control and service programs form the central part of the IBM Disk Operating System/Virtual Storage Extended. The three control programs are initial program load, the supervisor, and job control; the two service programs are the linkage editor and the librarian. The functions of these five programs are outlined in the following paragraphs; details are in the *System Management Guide*.

Initial Program Load (IPL) initializes the system for execution by loading the supervisor into the real address area. At this time, the system operator has to specify the I/O devices and to create the page data file. Job Control is then loaded into the virtual address area associated with the background partition, and control is passed to it.

The Supervisor provides resident and transient control functions for use by all other system and user programs. Supervisor assembly macro instructions allow the user to create an individual supervisor tailored to the needs of his own system. The assembly options he may select include:

- The size of the virtual address to be supported.
- The number of partitions to be supported.
- The number of physical devices to be supported.
- The number of symbolic logical units to be supported.
- Extended cataloged procedure support.
- Rotational Position Sensing support.
- Fast Channel Command Word Translation.
- Cross Partition Event Control.
- Support of 4300 Processors when running in ECPS:VSE mode.
- Support of S/370 machines or 4300 Processors when running in S/370 mode.

This list is not exhaustive.

Specification of any of these or of any of the other available options will increase the processor storage requirement of the supervisor above the minimum requirements tabled below. Details of storage requirements of each individual option are in the *System Generation Manual*.

Minimum Supervisor:

Mdl 115	78K
Mdl 125	78K
Mdl 135, 135-3	78K
Mdl 138	86K
Mdl 145, 145-3	78K
Mdl 148	90K
Mdl 155II	86K
Mdl 158, 158-3	86K
3031 Processor	100K

	S/370 mode	ECPS:VSE mode
4331 Processor	84K	82K
4341 Processor	92K	86K

Note: From these supervisor sizes approximately 12K can be subtracted if part of the supervisor is made pageable at IPL time.

Installation improvement facilities are provided in DOS/VSE to ease:

- System generation
- DOS/VSE installation
- Transition to production system

Support Capabilities include:

- Pre-compiled I/O modules
- Pre-linked system components for immediate use
- New backup/restore library utilities
- System generation in a virtual partition

DOS/VSE (cont'd)

- Coded samples
- PTFs pre-applied
- Automated merge of libraries
- New delete procedure to aid in tailoring the system
- UCS-buffer load modules for 1403-N1
- New, easy to follow documentation for systems generation

HIGHLIGHTS

Support of New Processors

Support of the 4300 Processors in S/370 mode and ECPS:VSE mode: DOS/VSE supports both modes of operation, the S/370 mode and the ECPS:VSE mode of the 4300 Processors including each model's RAS requirements. The new concept of the 4300 Processors running in ECPS:VSE mode (virtual addresses in channel programs) is exploited by the Supervisor. The scanning of channel programs can be avoided completely by using the new IORB interface. Via this interface the user and IBM components can communicate to the Supervisor the pages to be fixed, thus reducing supervisor overhead. The elimination of real address space results in a new main storage layout in respect to partitions and system areas. The Assembler supports the new 4300 Processors privileged hardware instructions.

S/370 Support: DOS/VSE continues to support all S/370 Processors supported under previous DOS/VS releases, and also provides full support for the 3031 Single Processor.

NEW DEVICE SUPPORT

Support of 3310 and 3370 DASD device: The 3310 and 3370 DASD devices are supported for system files and by all current access methods except DAM and ISAM. Support for ISAM is available through VSAM by using the ISAM Interface Program (IIP). DOS/VSE also supports the Direct Access Storage Compatibility Feature (#7901) for system files and all access methods with the exception that system files other than SYSIN, SYSPCH, SYSLST and SYSLNK are not supported on 2311 DASD. Analysis Program - 1 (AP-1) has been enhanced to include support for 3310 and 3370 DASDs in fixed block mode. The 3310 and 3370 are not supported in S/370 mode, unless running under VM.

3310 Surface Analysis Utility: (See Note below) This utility allows reclamation of alternate blocks and surface analysis on a 3310 spindle. Blocks flagged defective by the factory are not reclaimed.

3370 Surface analysis utility: (See Note below) This utility allows reclamation of alternate blocks and surface analysis on a 3370 spindle. Blocks flagged defective by the factory are not reclaimed.

Note: These utilities are also separately orderable (Program No. 5747-SA1). They are available on tape only.

Initialize Emulated 231X/3330/3340 Data Formats on 3310/3370: (See Note below) Use of the Direct Access Storage Compatibility Feature (#7901) of the 4331 requires preformatting of emulated disk pack areas. This utility provides preformatting including writing of home addresses and R0, and assignment of alternates to blocks that are found defective during formatting. Space for formatted packs are reserved in the FBM-VTOC of the host 3310/3370 spindle. It is possible to format less than a full volume to optimize between native and emulated space on a spindle. Initialize disk is adapted accordingly to allow for not fully emulated volumes (subdisks).

Support of the 3370 and 3340 DASDs via the 3880 Control Unit: EREP and ERP routines are extended to support the specific characteristics of the 3370 and 3340 DASDs attached via the 3880 Control Unit.

Support of the 8809 Magnetic Tape Unit: There are four 8809 specific mode settings which can be specified as operands in the IPL ADD command, in the JCL ASSGN command and in the AR SETMOD command. The specification of the mode operand causes the 8809 to be set into Streaming mode or Start-Stop mode and to process long or short gaps. The Attention command SETMOD, which is valid for the 8809 only, can be used by the operator to adjust the tape speed to the actual I/O traffic at any point in time.

Start-Stop and Streaming modes are supported by the magnetic tape access method and the system utilities. The utilities Fast Copy Disk and Backup/Restore System permit operation of the 8809 at high speed for the 3310 and 3370 DASDs in fixed block mode. Note that high speed operation can be achieved in a dedicated processor environment. In a multiprogramming environment the 8809 performance is highly dependent on the system workload. Best performance in a multiprogramming environment can be achieved by operating the 8809 in long gap mode and by assigning the utility program to the highest priority batch partition.

Support of the 5424 Multufunction Card Unit: The functional capabilities of this new Multifunction Card Unit are fully supported. DOS/VSE supports the 5424 equivalent to the support provided for the Multifunction Card Unit and additional extensions to provide error logging and reporting.

Console Printer Support: DOS/VSE supports the 3284, 3286, 3287 and 3288 Console Printers in conjunction with native 3277 screen support.

3289 Model 4 Support: DOS/VSE supports the new 3289 mdl 4 Line Printer as a System Printer of the PRT1 class. Since the error signaling differs from the currently supported Line Printers, user written error recovery procedures need to be adjusted.

3278 Mod. 2A Support: DOS/VSE supports the 3278 Mod. 2A in 3277 compatibility mode.

3800 ICR Integration: Portions of the ICR have been merged into DOS/VSE. However, the DOS/VSE IBM 3800 Printing Subsystem independent release is required to support the IBM 3800.

ADDITIONAL HARDWARE SUPPORT

Use of Higher Resolution Timer: The timer support now uses the Time-of-Day Clock and the Clock Comparator instead of the Interval Timer. The Job Accounting times are calculated using the CPU Timer. These modifications result in improved time-interval control and in more accurate job accounting information. User interfaces are not affected.

2311/2314 Support for FAST COPY: Provides support for 2311 and 2314 in Fast Copy Disk Volume Utility to satisfy the need for better volume dump/restore performance due to non-removability in an emulated environment.

Alternate Path I/O for DASD: The channel switching support currently available for Magnetic Tape Units has been extended to be available also for DASDs. If a DASD is attached to a processor via two channels, DOS/VSE automatically switches to the second channel, should the first one be busy. The parameters for specifying a switchable device (IPL ADD statement) are the same as for Tape Units.

USABILITY IMPROVEMENTS

Simplified Command Syntax

- For IPL and JCL commands it is no longer required to specify operands in hexadecimal notation (X' ').
- Continuation is allowed for commands entered by the console operator and for librarian control statements.

Reduced Supervisor Options: Several supervisor generation options have been deleted. The corresponding functions are either made standard or, for a few specifications, are available as IPL or JCL commands/operands.

EXTENT Macro: This new IBM internal Supervisor service is used by the DOS/VSE data management routines to allocate extent information for both CKD and fixed block mode devices for DASD File Protect.

DASD Volume Recognition: This internal service allows the user to get the volume identification and the device description of all DASDs. The device may be selected via logical device specification, physical device address or by volume identifier. A job control command (VOLUME) is available for displaying of DASD information.

I/O Supervisor Improvements: The IO Supervisor performance has been improved by shortening the I/O interrupt path length. The number of LUBs has been increased so that each partition may use up to 255 symbolic logical units (including system units). More JIBs are available since they are no longer used for DASD file protect information.

Symbolic Label Access: A symbolic interface is provided to programs processing label information like OPEN and CLOSE routines. Although this interface is not available to the DOS/VSE user it provides enhancements in two areas:

- The label area space is dynamically managed to satisfy the individual requirements of each partition.
- The label area space is increased.

GETVIS for Real Partitions: Jobs executing in real mode are allowed to issue GETVIS requests. The SIZE operand on the EXEC statement must be used to specify a GETVIS area for the real partition.

Improved SVA bring up: The system now performs loading of modules into the SVA at IPL time without requesting any action from the user. An SVA including a System GETVIS area which is large enough to contain the required set of system modules and buffers is allocated automatically. Optionally the user may add additional modules at any Job Control time.

I/O Request Block Concept: The EXCP I/O concept has been extended. Besides a CCB it is allowed to specify an IORB (I/O Request Block) which contains a list of addresses (fixlist). Each entry of the fixlist contains the begin and end address of the I/O area that has to be fixed. By specifying the I/O area explicitly in the fixlist, the performance of the I/O Supervisor can be increased if running in ECPS:VSE mode because there is no need to scan the CCW-chains and calculate the I/O area from data address and CCW count.

SERVICEABILITY IMPROVEMENTS

MSHP (Maintain System History Program) is the new Maintenance Program with the following improvements over the DOS/VS Release 34 PTFHIST program:

DOS/VSE (cont'd)

- Creation of a history file

  A history file is created at each system installation where MSHP is used for system maintenance. The history file can be personalized with the user's name, address, etc.

- Installation of DLIBs, components and/or features

  MSHP installs DLIBs, new components and/or features. The technical status of these new programs is recorded in the history file. Safeguards against down-levelling the system are provided when installing features. The MSHP support includes "tapeless" users.

- Preventive Service Application.

  MSHP provides the function set for application of preventive service packages. Recording of applied PTFs is automatically done in the User History File.

- PTF application

  MSHP applies PTFs from cumulative PTF files or as single PTFs. Recording is done automatically; backout facilities are provided.

- History file list

  When listing the history file, the entries may be sorted by PTF, by APAR, by module name, by component and by feature. MSHP produces a quick history file list with a cross reference to the items listed above.

- History search

  Using SYSLOG, MSHP informs the user about an APAR, PTF, or status of a module.

- History file maintenance

  Miscellaneous functions are provided in order to maintain the history file.

Fast CORGZ: For CKD devices the performance of the copy/merge operation has been significantly improved. Fixed block mode support of the Librarian covers corresponding requirements for fixed block mode devices.

Common EREP for DOS/VSE and OS/VS: The EREP routines included in DOS/VSE are the same as the version of these routines available under OS/VS. This ensures that the EREP functions provided for OS/VS users are also available to DOS/VSE users. Most of the output from DOS/VSE and OS/VS EREP is compatible.

SDAID Improvements/PDAID Integration: The currently existing SDAID and PDAID programs have been consolidated in one program (SDAID). In addition several new functions are included.

OLTEP Partition Independence: Allows OLTEP to execute in any partition rather than to restrict the execution of OLTEP to the BG-partition.

138 MCC Enhancements:

Similar to the 145/148 an error anaylsis about the corrected storage errors is provided in the error logout.

Train cleaning utility: Provides for cleaning of print chains. Supported Printers are 3203 mdls 1, 2, 4 and 5, 1403 and 5203 provided that the UCB feature is installed.

COPYSERV Integration: The COPYSERV program is again included in the DOS/VSE system and continues to support CKD devices.

Dumps in SVA: DOS/VSE dump routines are now executing in the SVA rather than in the B-transient area. This allows for dumping the B-transient area and reduces the B-transient area contention.

Suppression of the Channel Program Scan (ECPS:VSE mode only): For a problem program starting an I/O operation on an EXCP level as has been coded in the past, DOS/VSE scans the associated channel program to determine which of the problem program's areas need to be fixed in processor storage for this I/O operation. By using the new IORB macro instead of the CCB macro in the problem program, you can pass to DOS/VSE the beginning and end addresses of the areas that are to be fixed for the particular I/O operation. At the same time, this indicates to DOS/VSE that there is no need for a scan of the associated channel program.

Miscellaneous Enhancements

Short XREF for Assembler Listings: The job control statement STDOPT and // OPTION support the new option SXREF. Specification of SXREF on the // OPTION statement causes the Assembler to suppress the printing of unreferenced labels in the label cross-reference list. This will result in a significant reduction of print time and paper volume when assembling some programs, e.g., CICS/DOS/VS. It also provides for better readability of the cross-reference list.

Long SETC: The DOS/VSE Assembler now allows a character string of up to 255 characters to be assigned to a SETC symbol.

Backup/Restore Enhancements: This item provides for performance and usability improvements of the Restore System Utility... Replacement of present trackwise sorting of core image library directory in Restore System by faster algorithm... Change of default file-identifier of private library in Restore System (same as of respective library on source pack)... New defaults for the the start addresses of private libraries.

Other Highlights

- Three supervisors are provided in the Core Image Library, one for S/370 or 4300 Processors in S/370 mode and DOC=3277, one for S/370 and DOC=125D, and one for the 4300 Processors in ECPS:VSE mode. Their source code (including JCL) is contained in the A sublibrary of the Source Statement Library.
- Pre-assembled versions of all I/O modules required for RPG II and PL/I Optimizer are provided in the Relocateable Library.
- Pre-Compiled I/O modules.

Job Control provides job initiation and job-to-job transition facilities for all partitions on the basis of control statements read from the system console (SYSLOG) or from the system reader (SYSRDR) for the partition in question. The supervisor loads job control into a virtual partition whenever the previous job in that partition comes to an end, or, if the partition is not in active use, on request from the system operator. Job control is always executed in virtual mode; it may initiate execution of jobs in either virtual or real mode dependent on user specification.

The control statements that make up the job control language allow the user to: name the program phase or phases to be executed ... select either virtual or real mode for their execution ... specify the quantity of virtual or real storage required ... specify the physical devices to be used ... specify the file labels of program files ... call a catalogued procedure from the procedure library ... overwrite statements within a catalogued procedure ... exercise general control functions over program execution.

Operator commands allow the system operator to intervene in the process if it is necessary to modify control statements to meet abnormal conditions in the operating environment.

Attention Routines, Initiators, Terminators - The Initiators allow the operator to communicate with the system through the Attention Routines. Terminator routines provide the support for program termination: under program control; through operator action; a program error; or certain I/O failures.

Checkpoint/Restart - The progress of a program that performs considerable processing in one job step can be protected against destruction in case the program is canceled. The checkpoint facility makes it possible to preserve information at regular intervals and in sufficient quantity to allow restarting a program at an intermediate point.

The Linkage Editor links and relocates separate program sections (relocatable modules) read from the system link device (SYSLNK) or from system or private relocatable libraries or from any combination of these three, creating executable object program phases which are then stored in the core image library selected by the user. If action REL has been specified, the linkage editor will form object program phases which can later be loaded for execution from any set of real or virtual storage locations. If action NOREL has been specified, object program phases will be absolute and must be executed from the storage locations to which they have been link-edited unless they have been written in such a way as to make them self-relocating. A program may be link-edited for execution in the virtual or real part of any partition regardless of the partition in which the linkage editor itself is executed.

The Librarian provides maintenance and service functions for all system and private libraries. The librarian is a collection of programs which allow the user to catalog, delete, rename, display, output, copy, condense, and reallocate the contents of libraries and to create and use new private libraries. Certain functions are restricted so that system libraries may only be modified by programs executed in the background partition. Details of these restrictions are given in the *System Management Guide.*

The control and service programs use the system logical units shown in the following lists. The types of physical device that may be assigned to each specific logical unit are shown individually, and summarized in the table at the end of this section.

The 3344 Disk Storage may be used where the 3340 is specified. Consideration should be given to the effect of locating multiple logical volumes on one physical spindle.

The system as a whole requires one of each of the following system logical units:

- **SYSRES** - The System Residence is the direct access storage device on which the operator has mounted the volume containing the system residence extent. The following physical devices may be used: 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2-11 Disk Storage ... 3333-1-11 Disk Storage ... 3340/3350/ 3310 and 3370 Disk Storage.

DOS/VSE (cont'd)

- **SYSLOG** - The System Log is the system console used for system and operator communication. It is normally assigned to one of the following physical devices: 3210 Console Printer-Keyboard ... 3215 Console Printer-Keyboard ... the Display Console for the mdl 138 with or without the 3286 Printer mdl 2 ... the Display Console for the mdl 148 with or without the 3286 Printer mdl 2 ... the Display Console for the mdl 158 with or without the 3213 Console Printer ... the display operator console for the mdl 115 or 125 with or without the 5213 Console Printer mdl 1 ... the Display Console 3278 mdl 2A for the 4300 Processors with or without the 3268 (4341 only) or 3287 Printer ... the 3277 Display Station in conjunction with the 3284, 3286, 3287, 3288 console printers (locally attached via 3272 Control Unit). To obtain more detailed information, consult the appropriate IBM reference manuals.

  Should the console printer-keyboard become inoperable, SYSLOG may be assigned to one of the following printers: 1403 Printer ... 1443 Printer ... 3203 Printer ... 3211 Printer ... 3289 Printer ... 3800 Printing Subsystem ... 5203-3 Printer.

  Such a printer assignment allows system operation to continue though with restricted operator-to-system communication.

- **SYSREC** - The System Recorder is the direct access storage device on which the operator has mounted the volume which is to contain records output by the Recovery Management Support Recorder. The following physical devices may be used: 2311 Disk Storage Drive ... 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11 Disk Storage ... 3333-1 Disk Storage ... 3340/3344/3350/3310 and 3370 Disk Storage.

- **SYSCAT** - The System Catalog is the direct access storage device on which the operator has mounted the volume containing the VSAM file catalog. The following physical devices may be used: 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11 Disk Storage ... 3333-1 Disk Storage .... 3340/3344/3350/3310 and 3370 Disk Storage ... 3540 Diskette I/O Unit.

  Note: Assignment of the System Catalog is not required if the Virtual Storage Access Method is not used.

The system may also require the following system logical unit:

- **SYSDMP** - The SYSDMP device is the destination of system-wide dumps that are to be analyzed using VSE/IPCS. SYSDMP is assigned at IPL time. SYSDMP may be assigned to any of the following devices: 2314 Direct Access Storage Facility, 2319 Direct Access Storage Facility, 3330-1,-2,-11 Disk Storage, 3333-1 Disk Storage, 3340/3344/3350 Disk Storage, 3310 and 3370 Disk Storage.

Each partition requires one of each of the following logical units:

- **SYSRDR** - The System Reader is the source of control statement input for the job control program. Each partition requires the assignment of a separate physical device as System Reader except when the assignment is made to a direct access storage device; in this case, separate System Reader extents may occupy the same direct access storage volume. System Readers may be assigned to any of the following devices: 1442 Card Read Punch ... 2501 Card Reader ... 2520 Card Read Punch ... 2540 Card Read Punch ... 2560 Multifunction Card Machine ... 3504 Card Reader ... 3505 Card Reader ... 3525 Card Punch (with Read Feature) ... 3540 Diskette Input/Output Unit (mdl 2 can be assigned to two partitions) ... 5425 Multifunction Card Unit ... 5424 Multifunction Card Unit ... 2400-Series Magnetic Tape Units ... 3400-Series Magnetic Tape Units ... 8809 Magnetic Tape Units ... 2311 Disk Storage Drive ... 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11/3333-1/3340/3344/3350/3310 and 3370 Disk Storage.

- **SYSIPT** - The System Input Device is the source of all system input other than that for the job control program. Each partition requires the assignment of a separate physical device as the System Input Device except when the assignment is made to a direct access storage device; in this case, separate System Input extents may occupy the same direct access storage volume. System Input Devices may be assigned to any of the physical devices listed under SYSRDR above.

  Within any one partition SYSRDR and SYSIPT may be assigned to the same physical device or to separate physical devices in accordance with user requirements.

- **SYSLST** - The System List Device is the destination of print lines or print line images output by the system. Each partition requires the assignment of a separate physical device as the System List Device except when the assignment is made to a direct access storage device; in this case, separate System List extents may occupy the same direct access storage volume. System List Devices may be assigned to any of the following physical devices: 1403 Printer ... 1443 Printer ... 3203 Printer ... 3211 Printer ... 3262 Printer ... 3800 Printing Subsystem ... 5203 Printer ...3289 Printer mdl 4 ... 2400-Series Magnetic Tape Units ... 3400-Series Magnetic Tape Units ... 8809 Magnetic Tape Units ... 2311 Disk Storage Drive ... 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11 Disk Storage ... 3333-1 Disk Storage ... 3340/3344/3350/3310 and 3370 Disk Storage ... 3540 Diskette I/O Unit.

- **SYSPCH** - The System Punch Device is the destination of all cards or card images output by the system. Each partition requires the assignment of a separate physical device as the System Punch Device except when the assignment is made to a direct access storage device; in this case, separate System Punch extents may occupy the same direct access storage volume. System Punch Devices may be assigned to any of the following physical devices: 1442 Card Read Punch ... 2520 Card Read Punch ... 2540 Card Read Punch ... 2560 Multifunction Card Machine ... 3525 Card Punch ... 5425 Multifunction Card Unit ... 5424 Multifunction Card Unit ... 2400-Series Magnetic Tape Units ... 3400-Series Magnetic Tape Units ... 8809 Magnetic Tape Units ... 2311 Disk Storage Drive ... 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11 Disk Storage ... 3333-1 Disk Storage ... 3340/3344/3350/3310 and 3370 Disk Storage ... 3540 Diskette I/O Unit.

  Within any one partition SYSLST and SYSPCH may be assigned to the same physical magnetic tape unit.

The number of unit record devices required to operate the system in the multiprogramming environment can be greatly reduced by use of the VSE/POWER licensed program.

Each partition may also require one or more of the following system logical units in order to perform particular control and service functions:

- **SYSLNK** - A System Link Device is a direct access storage device used to store input for the linkage editor program. It may be assigned to any of the following physical devices: 2311 Disk Storage Drive ... 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11 Disk Storage ... 3333-1 Disk Storage ... 3340/3344/3350/3310 and 3370 Disk Storage

- **SYSCLB** - A Core Image Library Device is a direct access storage device on which the operator has mounted a volume containing a private core image library.

- **SYSRLB** - A Relocatable Library Device is a direct access storage device on which the operator has mounted a volume containing a private relocatable library. It must be assigned to the same type of direct access storage device as SYSRES.

- **SYSSLB** - A Source Statement Library Device is a direct access storage device on which the operator has mounted a volume containing a private source statement library. It must be assigned to the same type of direct access storage device as SYSRES.

Display Operator Console Support provides the functions to operate and control the mdls 115, 125, 138, 148, 158, 3031, 4331 and 4341. Operator input entered through the alphameric keyboard and messages from system and problem programs are displayed on the screen of the cathode ray tube. System messages requiring operator reply or action will stay on the screen until the reply is received by the system. A hard copy record of the sequential activity on the video display is available and may be printed on the optional Console Printer via a utility.

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PERMISSIBLE DEVICE ASSIGNMENTS for the SYSTEM LOGICAL UNITS

Logical Unit	SYSRDR SYSIPT	SYSLST	SYSPCH	SYSLOG	SYSRES SYSCLB SYSRLB SYSSLB SYSDMP SYSCAT	SYSREC SYSLNK
Model 115 DOC				X		
Model 125 DOC				X		
Device Type						
1403		X		X		
1442	X		X			
1443		X		X		
2501	X					
2520	X		X			
2560	X		X			
3203		X		X		
2540	X		X			
3210				X		
3211		X		X		
3213				X		
3215				X		
3262		X		X		
3800		X		X		
3504/3505	X					
3525	X		X			
3540	X	X	X			
2400-series	X	X	X			
3400-series	X	X	X			
2311	X	X	X			
2314	X	X	X		X	X
2319	X	X	X		X	X
3330-1,-2,-11 3333-1-11	X	X	X		X	X
3340/3344/ 3350	X	X	X		X	X
5203		X		X		
5425	X		X			
5424	X		X			
3289-11,-12		X		X		
3203-5		X		X		
3278-2A				X		
8809-1A	X	X	X			
3310	X	X	X		X	X
3370	X	X	X		X	X

The Assembler: The Assembler is a programming tool for the implementation of programs written in S/370 and 4300 Processors Assembler Language. Assembler language gives the user access to machine and operating system functions and permits obtaining the best balance between storage utilization and speed of program execution. However, a problem solution expressed in Assembler language normally requires more coding effort than a solution to the same problem expressed in a higher level language.

The major features of the Assembler include:

Macro instructions, which provide the programmer with a powerful programming tool. Use of the system macro instructions provides access to all of the capabilities of DOS/VSE. Use of programmer-defined macro instructions can simplify the programming of particular applications and makes possible the definition of special-purpose languages.

Conditional assembly statements are used to alter the sequence in which statements are processed or to specify the selective assembly of sets of instructions. The conditional assembly feature is a key element of the macro feature.

Private libraries may be used to contain both Assembler language statements to be inserted into programs by means of COPY statements, and macro instruction definitions for use by the macro processor.

The hardware instructions of the 4300 Processor are supported. SETC symbols may be assigned to character strings of up to 255 characters. Unreferenced labels may be suppressed in the assembler listing using the new option SXREF.

The Assembler uses the S/370 Standard Instruction Set, and requires for execution a minimum partition size of 20K; it may be executed either in virtual or in real mode.

The Assembler reads source program input from SYSIPT and directs its output to SYSLST, SYSPCH, and SYSLNK, dependent on the user options in force. Library input may also be read from SYSSLB. All of these logical units may be assigned to any of the physical devices already indicated for the control and service programs. The Assembler further requires direct access storage space for three work files; any of the following physical devices may be used for this purpose:

2311 Disk Storage Drive
2314 Direct Access Storage Facility
2319 Disk Storage
3330-1,-2,-11/3333-1,-11 Disk Storage
3340 Disk Storage
3344 Disk Storage
3350 Disk Storage
3310 Disk Storage
3370 Disk Storage

DATA MANAGEMENT

The data management facilities of DOS/VSE are divided into two parts: The physical input/output control system (physical IOCS); and the logical input/output control system (logical IOCS). The user invokes the services of the IOCS routines by use of macro instructions.

The EXCP (execute channel program) and WAIT macro instructions of physical IOCS allow the user to handle input and output devices in a direct way by writing his own channel programs; it is usually more convenient for him however to use the macro instructions of logical IOCS, either using GET and PUT macro instructions to handle logical data records or using READ and WRITE macro instructions to handle physical data blocks. OPEN and CLOSE macro instructions perform the functions of creating, checking, and updating file labels for input and output files; the CNTRL macro instruction performs specific device-dependent control functions such as stacker selection, printer carriage movement, and magnetic tape positioning.

The individual component routines of logical IOCS are classified under three headings: the Sequential Access Method (SAM), the Direct Access Method (DAM) and the Indexed Sequential Access Method (ISAM).

When RPS is specified during System generation

- SAM and DAM will automatically include Rotational Position Sensing for 3330-1,-2,-11, 3333-1,-11, 3340, 3344 and 3350 Disk Storage.
- ISAM will automatically include Rotational Position Sensing for 3330-1, 2, 3333-1, 3340, 3344, and 3350 (in 3330-1 Compatibility Mode) Disk Storage.

Note: RPS is not applicable for the new 3310 or 3370 Disk Storage.

Sequential Access Method - SAM: The Sequential Access Method (SAM) enables files to be defined and accessed in a sequential manner beginning with the first logical record of the file and continuing in sequence till the last logical record of the file is reached. The components of the Sequential Access Method are described in the following paragraphs.

Basic Sequential IOCS provides support for definition, creation, and processing of files associated with unit record devices and the system console. The DTFCD macro instruction is used to define a punched card file; the DTFPR macro instruction is used to define a printer file; the DTFCN macro instruction is used to define a system console file.

By means of GET or PUT macro instructions, records are obtained or created starting with the first record of the logical file and continuing to the last record. Logical records are considered to be unblocked and may be of either fixed or variable length within the limits of the unit record medium to which they relate. Input and output operations may be overlapped with instruction processing by specification of two data areas for use by IOCS. Either the CNTRL macro instruction or first data character control may be used to effect any stacker selection or printer forms carriage movement required.

Basic Sequential IOCS supports the following devices:

1442 Card Read Punch
2501 Card Reader
2520 Card Read Punch
2540 Card Read Punch
2560 Multifunction Card Machine
2596 Card Read Punch
3504/3505 Card Reader
3525 Card Punch
5425 Multifunction Card Unit
5424 Multifunction Card Unit
1403 Printer
1443 Printer
3203 Printer

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3211 Printer
3262 Printer
3289 Line Printer mdl 4
3800 Printing Subsystem
3881 Optical Mark Reader
3210 Console Printer-Keyboard
3215 Console Printer-Keyboard
The display operator console for the mdl 115 or 125 with or without the 5213 Console Printer mdl 1.
The display console for the mdls 138 or 148 with or without the 3284, 3286, 3287 and 3288 Console Printers.
The display console for the mdl 158 with or without the 3213 Console Printer.
The display console of 4331 or 4341 with or without the 3268 (4341 only) or 3287 Console Printer.

Device-Independent IOCS provides support for definition, creation and processing of files associated with the system input and output logical units. The IOCS is used with the card readers, card punches and printers that act as system input and output units, and enables magnetic tape or direct access storage to be substituted for such devices at execution time without the need for program modification. The DTFDI macro instruction is used to define a device-independent file.

By means of GET or PUT macro instructions records are obtained or created starting with the first logical record of the file and continuing to the last record. Logical records are unblocked and of fixed length within the constraints of the unit record medium to which they may relate. First data character control must be used to specify any stacker selection or printer forms carriage movement required.

Device-Independent IOCS supports the following physical devices:

1442 Card Read Punch
2501 Card Reader
2520 Card Read Punch
2540 Card Read Punch
2560 Multifunction Card Machine
3504/3505 Card Reader
3525 Card Punch
5425 Multifunction Card Unit
5424 Multifunction Card Unit
1403 Printer
1443 Printer
3203 Printer
3211 Printer
3262 Printer
3289 Line Printer mdl 4
3800 Printing Subsystem
3540 Diskette I/O Unit
5203 Printer

Any of the following physical devices may be substitued for these devices at execution time:

2400-series Magnetic Tape Units
3400-series Magnetic Tape Units
8809 - Magnetic Tape Units
2311 Disk Storage Drive
2314 Direct Access Storage Facility
2319 Disk Storage
3330-1,-2,-11/3333-1,-11 Disk Storage
3340 Disk Storage
3344 Disk Storage
3350 Disk Storage
3310 Disk Storage
3370 Disk Storage

Sequential Tape IOCS provides support for definition, creation and processing of input and output files recorded on magnetic tape. The DTFMT macro instruction is used to define a magnetic tape file.

By means of GET or PUT macro instructions magnetic tape records are obtained or created starting with the first logical record of the file and continuing to the last record. Logical records may be either blocked or unblocked and may be of either fixed or variable length. Necessary blocking and deblocking of logical records is performed by the IOCS. Logical records, blocked or unblocked, may span multiple physical records. Input and output operations may be overlapped with instruction processing by the specification of two data areas for use by IOCS. The data within a file may be encoded either in EBCDIC or in ASCII. The CNTRL macro instruction enables the user to specify such control operations as forward space, backspace, rewind, and unload; the user may position magnetic tapes in accordance with the needs of the program.

Sequential Tape IOCS also provides support for definition creation and processing of magnetic tape work files; that is, files which serve as output and as input within the same program. In this case READ or WRITE macro instructions are used to obtain or create physical blocks; any necessary blocking or deblocking of logical records within physical blocks is the responsibility of the user. He may also issue the NOTE and the various POINT macro instructions to reposition magnetic tapes in accordance with the needs of his program.

Sequential Tape IOCS supports the following physical devices:

2400-series Magnetic Tape Units
3400-series Magnetic Tape Units
8809 - Magnetic Tape Units

Sequential Disk IOCS provides support for definition, creation, and processing of input and output files recorded on direct access storage devices. The DTFSD macro instruction is used to define a direct access storage file.

By means of GET or PUT macro instructions direct access records are obtained or created starting with the first logical record of the file and continuing to the last record. Logical records may be either blocked or unblocked and may be of either fixed or variable length. Necessary blocking and deblocking of logical records is performed by the IOCS. Logical records, blocked or unblocked, may span multiple physical records. Input and output operations may be overlapped with instruction processing by the specification of two data areas for use by IOCS.

Sequential Disk IOCS also provides support for definition, creation and processing of direct access storage work files; that is, files which serve as output and as input within the same program. In this case READ or WRITE macro instructions are used to obtain or create physical blocks; any necessary blocking or deblocking of logical records within physical blocks is the responsibility of the user. Users may also issue the NOTE and the various POINT macro instructions to logically reposition the file in accordance with the needs of their program.

Sequential Disk IOCS supports the following physical devices:

2311 Disk Storage Drive
2314 Direct Access Storage Facility
2319 Disk Storage
3330-1,-2,-11/3333-1,-11 Disk Storage
3340 Disk Storage
3344 Disk Storage
3350 Disk Storage
3310 Disk Storage
3370 Disk Storage

Sequential Diskette IOCS provides support for definition, creation and processing of input and output files recorded on IBM diskettes. The DTFDU macro instruction is used to define a diskette file.

By means of GET or PUT macro instructions, diskette records are obtained or created starting with the first logical record of the file and continuing to the last record. Logical records are fixed length and unblocked, but may be grouped together in the user's I/O AREA(s) for performance reasons through IOCS use of command chaining.

Sequential Diskette IOCS supports the following physical device:

3540 Diskette Input/Output Unit

Sequential Paper Tape IOCS provides support for definition, creation and processing of input and output files recorded in punched paper tape. The DTFPT macro instruction is used to define a paper tape file.

By means of GET or PUT macro instructions paper tape records are obtained or created starting with the first logical record of the file and continuing to the last record. Logical records may be either of undefined format, in which case they must be terminated by the end-of-record character, or of fixed length and unblocked, in which case the end-of-record character must not be present. Input and output operations may be overlapped with instruction processing by the specification of two data areas for use by IOCS. Any necessary translation of codes may be performed under the control of user-specified translation tables.

Sequential Paper Tape IOCS supports the following physical devices:

1017 Paper Tape Reader
1018 Paper Tape Punch
2671 Paper Tape Reader

Magnetic Character Recognition IOCS provides support for definition and processing of the input files associated with the IBM magnetic

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character recognition readers and certain optical character readers. The DTFMR macro instruction is used to define such a file.

The external interrupt feature is used to provide automatic entry to a user-written stacker selection routine on a first priority basis regardless of the priority of the partition in which the routine resides. Following stacker selection, the IOCS enables the user to access documents sequentially, process the data, and exercise control of non-MCR and non-OCR input and output devices. This normal processing (as opposed to stacker selection processing) takes the dispatching priority of the partition in which the problem program is executed.

Engage, disengage, stacker selection and document reading functions are invoked by the use of macro instructions. A buffer is maintained for each MCR device to provide the problem program with continous input data. GET macro instructions are used when a single reader is attached to the system; READ CHECK, and WAIT F macro instructions are used when the system is servicing a number of readers.

The supervisor and logical IOCS can support a maximum of six character readers which may operate in any combination in any or all partitions. The maximum number that may be effectively operated is application and configuration dependent. Pertinent timing information is provided in the *Supervisor and I/O Macros* manual.

Magnetic Character Recognition IOCS supports the following physical devices:

1255 Magnetic Character Reader
1259 Magnetic Character Reader
1419 Magnetic Character Reader

Note: Programs utilizing the Magnetic Character Recognition IOCS are highly time-dependent and should be executed in real mode only.

Optical Character Recognition IOCS provides support for definition and processing of input files associated with certain IBM optical character readers. The DTFOR macro instruction is used to define such a file for the 1287, 1288, and the 3886.

The 3886 is supported with special document definition macros used in a separate assembly to create a format record. Format records are stored in the Core Image Library for access by user 3886 processing programs.

The IOCS is used to read printed paper tapes or journal rolls such as those produced on cash registers and accounting machines. The IOCS is also used to read printed and hand-printed data and optical mark-read data from cut-form documents such as sales checks, utility stubs, and customer orders.

Optical Character Recognition support can be used in a multiprogramming environment. Factors affecting performance include the following:

Processor model.
Number of readers (a maximum of eight are supported).
Characterstics of tapes and documents.
Batch or multiprogramming environment.
Blocking of input data on printed paper tapes.
User programming.

In addition throughput is dependent on operator loading and unloading time. This handling time is significant when processing short printed paper tape rolls.

Optical Character Recognition IOCS supports operations on the following physical devices:

1287 Optical Reader
1288 Optical Page Reader
3886 Optical Character Reader (mdl 1)

Direct Access Method - DAM: The Direct Access Method (DAM) enables files to be defined on direct access storage volumes with any form of organization and access that the user may require. The records making up the file may be of fixed or variable length and may or may not contain key fields. All records are regarded as being unblocked; any necessary blocking or deblocking of logical records within physical records is the responsibility of the user. The DTFDA macro instruction is used to define a direct access file.

READ and WRITE macro instructions are used to retrieve and store physical records on the basis of information supplied by the user; such information may be either actual disk addresses or relative addresses within the file. Furthermore the address may be that of the actual record required or may indicate the point within the file at which a search for the required record is to begin.

The Direct Access Method allows the use of spanned records such that each record retrieved or stored spans multiple physical records. When this is the case, the physical segments making up the record are stored contiguously within the file.

The Direct Access Method supports the following physical devices:

2311 Disk Storage Drive
2314 Direct Access Storage Facility
2319 Disk Storage
3330-1,-2,-11/3333-1,-11 Disk Storage
3340 Disk Storage
3344 Disk Storage
3350 Disk Storage

Indexed Sequential Access Method - ISAM

The Indexed Sequential Access Method (ISAM) enables files to be defined on direct access storage volumes in such a way that records making up the file may be processed either in sequential order or in random order according to the needs of the accessing program. Logical records must be of fixed length, but may be blocked or unblocked; necessary blocking and deblocking of logical records is performed by the IOCS. Records can be added within the file without the necessity for sorting, recopying or merging. Records may also be updated as required. The DTFIS macro instruction is used to define an indexed sequential file.

GET and PUT macro instructions are used to process the file in sequential order, the user supplying control information for the *first record* to be processed. READ and WRITE macro instructions are used to process the file in random order, the user supplying control information for *each* record to be processed.

Optional features of the Indexed Sequential Access Method allow the user to speed up program execution in exchange for increased main storage requirements.

The Indexed Sequential Access Method supports the following physical devices:

2311 Disk Storage Drive
2314 Direct Access Storage Facility
2319 Disk Storage
3330-1,-2/3333-1 Disk Storage
3340 Disk Storage
3344 Disk Storage
3350 Disk Storage in 3330 mdl 1 Compatibility Mode.

Note: 3330-11, 3333-11 and 3350 in native mode are not supported.

DOS/VSE (cont'd)

DEVICE SUPPORT CHART

Device	S/370 Model 115	125	135, 135-3, 138	145, 145-3, 148	155II 158	3031	4341	4331
1017 Paper Tape Reader mdls 1, 2	2826	2826	2826	2826	2826	2826	2826	2826
1018 Paper Tape Punch	2826	2826	2826	2826	2826	2826	2826	2826
1255 Magnetic Character Reader mdls 1, 2, 3	m	m	X	X	X	X	X	X
1259 Magnetic Character Reader mdl 2	m	m	X	X	-	-	X	X
1270 Optical Character Reader mdls 1, 2, 3, 4	m	m	m	m	m	m	m	m
1275 Optical Character Reader mdls 2, 4	m	m	m	m	m	m	m	m
1287 Optical Reader mdls 1, 2, 3, 4	-	-	X	X	X	X	X	X
1287 Optical Reader mdl 5	m	m	X	X	X	X	X	X
1288 Optical Page Reader	-	-	X	X	X	X	X	X
1403 Printer mdls 2, 7, N1	n	n	2821	2821	2821	2821	2821	2821
mdl 3	-	-	2821	2821	2821	2821	-	-
1419 Magnetic Character Reader mdls 1,	m	m	X	X	X	X	X	X
1442 Card Read Punch mdl N1	m	m	X	X	X	X	X	X
1442 Card Punch mdl N2	m	m	X	X	X	X	X	X
1443 Printer mdl N1	m	m	X	X	X	X	X	X
2311 Disk Storage Drive mdl 1	-	-	2841	2841	2841	2841	2841	2841
2314 Disk Storage - A Series								
2312 Disk Storage mdl A1	-	-	2314-A1	2314-A1	2314-A1	2314-A1	2314-A1	2314-A1
2313 Disk Storage mdl A1	-	-	2314-A1	2314-A1	2314-A1	2314-A1	2314-A1	2314-A1
2314 Storage Control mdl A1	-	-	X	X	X	X	B	B
2318 Disk Storage mdl A1	-	-	2314-A1	2314-A1	2314-A1	2314-A1	2314-A1	2314-A1
2314 Disk Storage - B Series								
2314 Storage Control mdl B1	-	-	X	X	X	X	B	B
2319 Disk Storage mdl B1	-	-	2314-B1	2314-B1	2314-B1	2314-B1	2314-B1	2314-B1
2319 Disk Storage mdl B2	-	-	2319-B1	2319-B1	2319-B1	2319-B1	2319-B1	2319-B1
2319 Disk Storage - A Series								
2319 Disk Storage mdl A1	-	-	IFA	IFA	-	-	-	-
2319 Disk Storage mdl A2	-	-	-	2319-A1	-	-	-	-
2319 Disk Storage mdl A3	-	-	2319-A1	-	-	-	-	-
2401 Magnetic Tape Unit mdls 1 to 6, 8	-	-	2803/4	2803/4	2803/4	2803/4	2803/4	2803
2415 Magnetic Tape Unit and Control mdls 1 to 6	-	-	X	X	X	X	B	X
2420 Magnetic Tape Unit mdls 5, 7	-	-	2803	2803	2803	2803	2803	2803 Mdl 5 Only
2501 Card Reader mdls B1, B2	m	m	X	X	X	X	X	X
2520 Card Read Punch mdl B1	m	m	X	X	X	X	X	X
2520 Card Punch mdls B2, B3	m	m	X	X	X	X	X	X
2540 Card Read Punch	2821	2821	2821	2821	2821	2821	2821	2821
2560 Multifunction Card Machine	n	n	-	-	-	-	-	-
2596 Card Read Punch	m	m	X	X	X	X	-	-
2671 Paper Tape Reader	2822	2822	2822	2822	2822	2822	2822	2822
2803 Tape Control mdls 1, 2, 3	-	-	X	X	X	X	B	X
2804 Tape Control mdls 1, 2, 3	-	-	X	X	X	X	B	-
2816 Switching Unit	-	-	X	X	X	X	B	X
2821 Control Unit mdls 1, 2, 3, 5, 6	m	m	X	X	X	X	X	X
2822 Paper Tape Reader Control	m	m	X	X	X	X	X	X
2826 Paper Tape Control	m	m	m	m	m	m	m	m
2841 Storage Control	-	-	X	X	X	X	B	B
3203 Printer mdls 1, 2	n	n	-	-	-	-	-	-
3203 Printer mdl 4	-	-	n***	n***	-	-	-	-
3203 Printer mdl 5	m	m	X	X	X	X	X	-
3210 Console Printer-Keyboard mdl 1****	-	-	n	n	n**	-	-	-
3210 Console Printer-Keyboard mdl 2****	-	-	-	n	n**	-	-	-
3211 Printer	-	-	3811	3811	3811	3811	3811	3811
3213 Console Printer mdl 1	-	-	-	-	n*	-	-	-
3215 Console Printer-Keyboard	-	-	n	n	n**	-	-	-
3230 Printer mdl 2	3274	3274	3274	3274	3274	3274	3274	3274
3262 Printer mdls 1, 11	-	-	-	-	-	-	-	n
3262 Printer mdl 5	-	-	X	X	X*	X	X	X
3278 Display Console mdl 2A	-	-	-	-	-	-	n	n
3284 Printer mdls 1, 2	3272/74	3272/74	3272/74 n***	3272/74 n***	3272/74 n*	3272/74	3272/74	3272/74
3286 Printer mdls 1, 2	3272/74	3272/74	3272/74 n***	3272/74 n***	3272/74 n*	3272/74	3272/74 n	3272/74
3287 Printer mdls 1, 2	3272/74	3272/74	3272/74 n***	3272/74 n***	3272/74 n*	3272/74	3272/74 n	3272/74 n
3288 Printer mdl 2	3272/74	3272/74	3272/74 n***	3272/74 n***	3272/74	3272/74	3272/74	3272/74
3289 Printer mdls 01, 02	3274	3274	3274 n***	3274 n***	3274	3274	3274	3274
3289 Printer mdl 4	-	-	-	-	-	-	-	n
3310 Direct Access Storage Device	-	-	-	-	-	-	-	n
3330 Disk Storage mdls 1, 2 and 11	-	3333	3333, 3830-1 3880	3333, 3830-1 3880	3333, 3830-1 3880	3333, 3830-1 3880	3333 3830-1 3880	- - -
3333 Disk Storage and Control mdl 1 and 11	-	n	3830-2, IFA 3880	3830-2, 3345-3, -4,-5 ISC	3830-2, 3880	3830-2, 3880	3830-2 3880	- -
3340 Direct Access Storage Facility mdl A2	n	n	3830-2# IFA 3880	3830-2 3345-3, -4,-5, 3880 ISC	3830-2 3880 ISC*	3830-2 3880	3830-2 3880	n

DOS/VSE (cont'd)

DEVICE SUPPORT CHART (Cont'd)

Device	S/370 Model 115	125	135, 135-3, 138	145, 145-3, 148	155II 158	3031	4341	4331
3340 Direct Access Storage Facility mdls B1, B2	3340-A2	3340-A2	3340-A2	3340-A2	3340-A2	3340-A2	3340-A2	3340-A2
3344 Disk Storage	3340-A2&	3340-A2&	3340-A2	3340-A2	3340-A2	3340-A2	3340-A2	-
3345 Storage and Control Frame mdls 3, 4, 5	-	-	-	n	-	-	-	-
3350 Direct Access Storage and Control mdls A2, A2F, C2, C2F	-	-	3830-2 3880	3830-2, 3880 ISC	3830-2, 3880 ISC*	3830-2, 3880	3830-2 3880	-
3350 Direct Access Storage mdls B2, B2F, C2, C2F	-	-	3350-A2, -A2F	3350-A2, -A2F	3350-A2, -A2F	3350-A2, -A2F	3350-A2, -A2F	-
3370 Direct Access Storage	-	-	-	-	-	-	3880	n
3410 Magnetic Tape Unit mdls 1, 2, 3	3411	3411	3411	3411	3411	3411	3411	3411
3411 Magnetic Tape Unit and Control mdls 1,2,3	n	n	X	X	X	X	B	X
3420 Magnetic Tape Unit mdls 3, 5	3803-3	3803-3	3803-1	3803-1	3803-1	3803-1	3803-1	3803-1
3420 Magnetic Tape Unit mdl 7	-	-	3803-1	3803-1	3803-1	3803-1	3803-1	3803-1
3420 Magnetic Tape Unit mdl 4	-	-	3803-2	3803-2	3803-2	3803-2	3803-2	3803-2
3420 Magnetic Tape Unit mdls 6, 8	-	-	3803-2	3803-2	3803-2	3803-2	3803-2	-
3504 Card Reader mdls A1, A2	-	n	-	-	-	-	-	-
3505 Card Reader mdls B1, B2	m	m	X	X	X	X	X	X
3525 Card Punch mdls P1, P2, P3	3505-B1, -B2	n or 3505 -B1,-B2	3505-B1, -B2	3505-B1, -B2	3505-B1, -B2	3505-B1, -B2	3505-B1, -B2	3505-B1 -B2
3540 Diskette I/O Unit mdls B1, B2	m	m	X	X	X	X	X	X
3800 Printing Subsystem	-	-	-	X	X	X	X	X
3803 Tape Control mdl 1	-	-	X	X	X	X	B	X
3803 Tape Control mdl 2	-	-	S	S	S	S	B	B
3803 Tape Control mdl 3	n	n	-	-	-	-	-	-
3811 Printer Control Unit	-	-	X	X	X	X	X	X
3830 Storage Control mdl 2	-	-	X	X	X	X	B	-
3880 Storage Control	-	-	X	X	X	X	B	-
3881 Optical Mark Reader	m	m	m	m	m	m	m	m
3886 Optical Character Reader mdl 1	m	m	X	X	X	X	X	X
3890 Document Processor	m)	m)	X	X	X	X	X	X
3895 Document Reader/Inscriber	-	m&	X	X	X	X	X	X
5203 Printer mdl 3	n	-	-	-	-	-	-	-
5213 Printer mdl 1	n	n	-	-	-	-	-	-
5424 Multifunction Card Unit	-	-	-	-	-	-	-	n
5425 Multifunction Card Unit mdls A1, A2	n	n	-	-	-	-	-	-
8809 Magnetic Tape Unitmdls 1A, 2, 3	-	-	-	-	-	-	-	n

Notes:

- - Not attachable.
- n Natively attachable.
- X Attachable to any available channel.
- m Attachable to a multiplexer channel only.
- S Attachable to selector channel only.
- B Attachable to block multiplexer channel only.
- IFA On Integrated File Adapter.
- ISC On Integrated Storage Control.
- * Attachable to mdl 158 only.
- ** Attachable to mdl 155II only.
- *** Mdl 138 and 148 only
- **** Does not attach to the S/370 mdls 138 or 148.
-) RPQ required.
- # Not attachable if string contains 3344.
- & On 3115-2/3125-2 only.

TELECOMMUNICATIONS SUPPORT

Support of telecommunications devices is provided under DOS/VSE by three access methods:

- The Virtual Telecommunications Access Method (ACF/VTAM) with the Network Control Program (ACF/NCP) supporting the SNA/SDLC, the BSC and the S/S environment.
- The Virtual Telecommunications Access Method Entry (ACF/VTAME) in support of SNA-SDLC and BSC communication adapters and various channel attached devices, BSC support is for nonswitched 3270 only.
- The Basic Telecommunication Access Method (BTAM-ES) for BSC and S/S support.

For further information on telecommunication device support refer to the respective sales manual pages.

System Utility Programs: The system utility programs maintain system control data at a system or organizational level. Except where specifically noted, support is provided for utility functions concerning the following physical devices:

2400-series Magnetic Tape Units
3400-series Magnetic Tape Units
8809 - Magnetic Tape Unit
2311 Disk Storage Drive
2314 Direct Access Storage Facility
2319 Disk Storage
3330/3333 Disk Storage
3340 Disk Storage
3344 Disk Storage
3350 Disk Storage
3310 Disk Storage
3370 Disk Storage
3540 Diskette I/O Unit.

Additional system devices may be required for program execution; these may be assigned to any of the appropriate physical devices already listed under the heading *Control and Service Programs.*

The following are the utility functions provided:

Device Support Facilities - Initializes the count-key-data direct access storage volumes used with the operating system, inspects count-key-data DASD volumes for defective tracks and conditionally reclaims tracks previously flagged defective. Analyzes the operational status of the 3350/3344/3310 and 3370 drives and the data and control paths. For the IBM 3340, 3344, 3350 and 3375, Device Support Facilities utilizes the skip displacement bytes in an attempt to recover a defective track before assigning an alternate. The DOS/VSE system version of Device Support Facilities is seperately orderable via 5747-DS2, and includes a Standalone version which requires the operating system to dump a Standalone IPL tape. This aids the user in determining whether an error condition is drive or media related so the appropriate recovery procedures can be initiated.

Initialize Magnetic Tape - The program initializes up to sixteen tape volumes. For each volume the program creates from one to eight volume labels as required, one dummy header label, and a tape mark. The program may be used to initialize either EBCDIC tapes with IBM Standard Volume Labels or ASCII tapes with ANSI Standard Volume Labels.

Initialize Disk - The program initializes disk packs for further use by DOS/VSE. The initialization procedure consists of VTOC label checking, home address generation, volume label creation, track descriptor (R0) record generation, and IPL and VTOC creation. 2311, 2314 and 2319 disk packs may be initialized with or without a test for defective tracks (surface analysis); however surface analysis should be included when a volume is initialized for the first time. For 3330 and 3333 disk packs and 3340 data modules, the initialization procedure does not include surface analysis or home address generation.

DOS/VSE (cont'd)

For 3330 compatibility volumes, home address and R0 will be rewritten on all tracks, including alternate tracks, surface analysis will be performed on tracks flagged as defective with such tracks being reclaimed if no errors are found and IPL and VTOC records will be written. For 3340 and 3344 volumes, tracks flagged as defective will be analyzed to determine if they can be reclaimed via turning off the defective track bit. Defective HA/R0 areas will be rewritten with appropriate Skip Displacement (SD) values to allow the assignment of alternate tracks to them.

Assign Alternate Track - Disk - The program assigns an alternate track to a defective track on a disk and, if update records are supplied as input, replaces bad records on a track. The alternate tracks may be assigned either unconditionally or conditionally based upon the result of a surface analysis of the track. (For 3330 and 3333 disk packs and 3340 data modules only unconditional alternate track assignment is possible.)

Clear Disk - The program clears one or more areas of disk and preformats tracks containing an indicated base value throughout the area cleared.

VTOC Display - The program displays the labels contained in the Volume Table of Contents of a disk volume. The labels are identified by their location within the Volume Table of Contents and their format, type, and major fields are indicated by appropriate heading lines in the printed output.

Copy and Restore Diskette - Support is provided to: Recovery data from a diskette on which the label information (on track zero) cannot be read ... Copy one 3540 diskette to another 3540 diskette. During this copy, error sectors and deleted records are eliminated. The utility can be used in a single or multiple 3540 configuration.

Backup and Restore System Utility Programs: The programs allow fast backup of system and/or private libraries to tape with subsequent restore to disk. When the libraries are restored to disk, they are automatically condensed and may be reallocated to different sizes or to different DASD types. The restore program will accept the PID tape as input and allocate the libraries within a DOS/VSE partition.

Copy File and Maintain Object Modules (OBJMAINT) Utility: This program is a multipurpose utility providing the following functions:

- File-to-file copy with blocking and deblocking of data sets on tape, card, disk or diskette.
- Update and expansion of object modules.
- Maintenance of PTF data sets.
- Comprehensive data set listing capability.

Fast Copy Disk (CKD or fixed block mode - The program copies the contents of a CKD disk pack or a fixed block mode disk onto another CKD or fixed block mode disk respectively. It copies either directly from disk or uses magnetic tape (or disk in the case of fixed block mode) as intermediate output. The pack may contain any combination of DOS/VSE files and components. The program also copies specific files from a CKD or fixed block mode disk pack to another CKD or fixed block mode disk of the same device type.

Other Utility Programs

Assign Alternate Block: The program assigns an alternate block to a defective block of a fixed block mode device (conditionally or unconditionally). It copies data from the defective to the alternate block, replaces the contents of a specified block by data supplied as input to the utility, or lists/punches the contents of a specified block.

Surface Analysis (fixed block mode): The program performs surface analysis of complete fixed block mode disk packs. Defective blocks may be reclaimed.

Format Emulator Extent: The program formats a specific extent on a fixed block mode disk in order to prepare for later emulation of a 231X/3330/3340 DASD on the fixed block mode 3310 or 3370.

Printer Train Cleaning: The program is used by the operator to clean the printer train of a printer.

Analysis Program-1: The program provides a testing capability which assists the user in effective management of 3350/3344/3310 and 3370 DASDs.

AP-1 reports the operational status of the 3350/3344/3310 and 3370 hardware and media upon request by the operator. Brief messages (e.g., NO DRIVE PROBLEMS FOUND) appear on the console giving the user guidance for initiating further analysis. More detailed error analysis data, useful to the system programmer and system engineer, is directed to SYSLST.

AP-1 analyzes the operational status of the drive and the data and control paths for reading, writing and arm movement. It further, at the direction of the operator, scans the volume to verify that all data is machine readable. With these aids, the user can determine whether an error situation is drive or media related and thus initiate the appropriate recovery procedures.

MSHP (Maintain System History Program) is the new maintenance program with the following improvement over the DOS/VS Release 34 PTFHIST program:

- Creation of a history file: A history file is created at each system installation where MSHP is used for system maintenance. The history file can be personalized with the user's name, address, etc.
- Installation of DLIBs, components and/or features: The MSHP installs DLIBs, new components and/or features. The technical status of these new programs is recorded in the history file. Safeguards against down-levelling the system are provided when installing features. The MSHP support includes "tapeless" users.
- Preventive Service Application: MSHP provides the function set for application of preventive service packages. Recording of applied PTFs is automatically done in the User History File.
- PTF Application: MSHP applies PTFs from cumulative PTF files or as single PTFs. Recording is done automatically; backout facilities are provided.
- History File List: When listing the history file, the entries may be sorted by PTF, by APAR, by module name, by component and by feature. MSHP produces a quick history file list with a cross reference to the items above.
- History Search: Using SYSLOG, MSHP informs the user about an APAR, PTF, or status of a module.
- History File Maintenance: Miscellaneous functions are provided in order to maintain the history file.

COPYSERV: The program allows for automated merge of existing system and private libraries into newly created libraries, eliminating the manual effort of comparing directory listings and preparing the required copy cards thus reducing significantly the time required to prepare the new release for production status.

Recovery Management Support and Recording: Recovery Management Support (RMS) and Recovery Management Support Recording (RMSR) are standard functions under DOS/VSE with the following exception:

- For mdls 115 and 125, recovery management support is a supervisor assembly option.

The functions of RMS and RMSR are described below:

Recovery Management Support - The Recovery Management Routines attempt to recover from or otherwise reduce the impact of machine malfunctions indicated by machine check and channel check interruptions. They feature:

Transparent recovery after successful retry including error statistics collection.

Continuation if the error is unrecoverable but the affected job or task can be terminated.

Comprehensive error recording to support deferred maintenance.

Recovery Management Support Recording - RMSR collects and records on direct access storage (SYSREC) statistical and event data on matching errors. This recorded data facilitates early warning, rapid diagnosis, and repair of failing components, providing greater system availability due to improved preventive maintenance and shorter duration of planned and unplanned maintenance.

The error recording file on direct access storage can be totally or selectively edited and printed or transferred to magnetic tape for later editing and printing by the Environmental Recording, Editing and Printing (EREP) Program. A number of functional enhancements have been made to this program including integration of the recording, editing and printing of ESTV records.

Tape and Disk Error Recovery Procedures - Routines that analyze error type and type of device in error and pass control to the proper ERP in an attempt to recover or to the ERP message writer in case of hard errors.

DOS/VSE (cont'd)

Diagnostic Aids: DOS/VSE provides a number of system tools and facilities to help to allocate responsibility for program repair. These include:

- The Online Test Executive Program (OLTEP) which allows execution of machine diagnostic programs in the real storage allocated to any partition of a multiprogramming environment at the same time as other system and user programs are executed in foreground partitions. OLTEP can be executed in real mode only.
- System Debugging Aids (SDAID) which includes the functions of the program formerly named PDAID) allows the tracing of the following events as they occur during program execution: Fetching and loading of program phases (Fetch/Load Trace) ... Input and output activity (I/O Trace) ... Supervisor Calls (SVC Trace) ... Program checks in transient areas (Transient Dump) ... Certain VTAM events ... VTAM Buffer Pool Trace.

  It uses the Program Event Recording Facility and Monitor Calling Facility of S/370 to provide additional stop and dump facilities and the following additional trace facilities: Page Trace ... Instruction Trace ... Alter Main Storage Trace ... Alter General Register Trace ... Successful Branch Trace ... Channel Program Trace.

The program DOSVSDMP offers

- A facility for generating a stand-alone dump tailored to the installation's requirement e.g., medium for IPL and for output of stand-alone dump.
- A facility for printing (formatted if desired), the output from the stand-alone dump, the system dump and the DUMP command.
- The PDZAP program which allows quick applying of ZAP fixes to phases and transients in the Core Image Libraries without requiring a reassembly and recataloging of the changed phase or transient.
- The Page Data Set Dump program provides a complete or selective dump of the Page Data Set.
- The Label Cylinder Display Program (LSERV) which produces a formatted listing of the file label information contained on the tracks of the label cylinder of the system residence extent.
- The Main Storage Alter Command (ALTER) which allows the system operator to change the contents of up to 16 bytes of virtual or real storage from the system console starting from a specified address.
- The Main Storage Dump Command (DUMP) which allows the system operator to obtain a dump of the contents of storage on the System List Device (SYSLST).
- Analysis Program-1 (AP-1) aids the operator in analyzing nonremovable media error situations and in isolating such errors into hardware or media related areas.

  AP-1 may be directed to test for hardware errors only or hardware and media errors. Simple result messages appear on the operator console. Detailed error related data are directed to SYSLST.

  AP-1 will only analyze errors associated with nonremovable media devices and requires that one of these devices be on the system.

Other Program Support: The *Program Product* section describes the Program Products supported under DOS/VSE, including language processors, sort/merge processors, utility programs and application programs. These Program Products, in addition to providing extended functional capabilities over any predecessor Type I or Type II programs, also provide support for new input and output devices. The specific devices supported are shown in the description of each program.

Type I and Type II processors that run under DOS/VSE are listed in those sections. In determining the applicability of these programs to a customer's needs particular attention must be given to the availability of appropriate device support within the programs.

DOS/VS FD Macros and Utility for the 3735 (5747-AZ1): Form Description Macros and Utility Support for the 3735 is available as a separate program operable under DOS/VSE.

This SCP provides support for 3735 Programmable Buffered Terminal Users on DOS/VSE systems with BTAM. It assembles user-written Form Description Programs and prepares them for subsequent transmission to the 3735.

DOCUMENTATION
(available from Mechanicsburg)

IBM 3735 Programmable Buffered Terminal Concepts and Application (GA27-3043) ... *IBM 3735 Programmable Buffered Terminal Form Description Macro Instructions and Form Description Utility PLM* (GY30-3000) ... *IBM 3735 Operator's Guide* (GA27-3061).

SCP PROGRAMMING SERVICES: Class 1 SCP.

5745-030 - DOS/VSE R2 with VSE/AF DISK OPERATING SYSTEM/VIRTUAL STORAGE EXTENDED, RELEASE 2 TOGETHER with VSE/ADVANCED FUNCTIONS

PURPOSE

The Disk Operating System/Virtual Storage Extended, is a disk-resident system designed to provide operating system capabilities together with VSE/Advanced functions for the 4300 Processors in S/370 mode and ECPS:VSE mode and the 3031 Single Processor in addition to any virtual storage S/370 processor from 370/115 through 370/158, and their attachable input/output devices. VSE requires the clock comparator and the CPU timer feature (standard on all S/370 mdls except 135 and 145, and also standard on 4300 Processors).

DOS/VSE together with VSE/Advanced functions is an operating system optimized to the function and performance needed by the small and intermediate users of 4300 Processors, the 3031 single Processor and the S/370. It gives the user the ability to multiprogram up to twelve jobstreams concurrently which generally include the interactive functions provided with VSE/ICCF, VSE/POWER spooling product, a real time subsystem, such as CICS/VS, a TP access method such as ACF/VTAM, one or two batch jobstreams, and an unscheduled work partition for quick turn-around jobs. The operating system supports most terminals and DASD devices. This gives the VSE user the capability to start out on a small model of either S/370 or the 4300 Processors and grow his system and workload up through the S/370 and/or 4300 Processor line, as his DP business needs increase.

DOS/VSE is classified as System Control Programming (SCP) for distribution, installation, and programming support purposes.

DESCRIPTION

If the system operates on a S/370, 3031 Single Processor or on the 4300 Processors in S/370 mode, it runs in extended control (EC) mode only and uses the EC mode format of the program status word (PSW) and low-order storage locations from 0 to 511. Dynamic Address Translation (DAT) is used to provide virtual storage support. In ECPS:VSE mode of the 4300 Processors the new concept of relocating channels is exploited. The Program Event Recording (PER) Facility and Monitor Calling Facility are used to provide system debugging facilities (SDAIDS) for each model, S/370, 3031 Single Processor, and the 4300 Processors.

This section describes the individual components from which the VSE Operating System is built. For a description of basic concepts and facilities of VSE see the *Introduction to the VSE System*, GC33-6108. To obtain more detailed information the reader should consult the appropriate IBM reference manuals.

SYSTEM CONCEPTS AND ORGANIZATION

Virtual Storage Support: Virtual storage is the address space available to the DOS/VSE system. It starts at storage address 0, and its total size is determined by user specification at supervisor assembly time.

SYSTEM COMPONENTS:

The Disk Operating System/Virtual Storage Extended System Control Program together with VSE/Advanced Functions consists of the following components:

- Control and Service Programs:
  - Initial Program Load and Buffer Load
  - Supervisor
  - Job Control
  - Attention routines, Initiators, Terminators
  - Checkpoint/Restart
  - Linkage Editor
  - Librarian - Maintenance and Service
  - Display Operator Console Support
- The Assembler
- Data Management:
  - **Sequential Access Methods:**
  - IOCS and Device Independent I/O
  - Magnetic Tape IOCS
  - Sequential Disk IOCS
  - Paper Tape IOCS
  - Diskette IOCS
  - Magnetic Character Recognition IOCS
  - Optical Character Recognition IOCS
  - **Direct Access Methods:**
  - Direct Access Method
  - Indexed Sequential Access Method
- Utility Programs:
  - System Utility Programs
  - Utility Services
- Error Recovery:
  - Recovery Management Support and Recording
  - Environmental Recording and Editing Program
  - Tape Error Recovery Procedures
  - Disk Error Recovery Procedures
- Diagnostic Aids:
  - Online Test Executive Program
  - Problem Determination and System Debugging Aids
- DASD Service Utilities
  - Device Support Facilities (DSF)
- TP Line Service Utility
  - Line Trace Utility

The following sections describe each of these components in more detail.

Control and Service Programs: The control and service programs form the central part of the Disk Operating System/Virtual Storage Extended. The three control programs are initial program load, the supervisor, and job control; the two service programs are the linkage editor and the librarian. The functions of these five programs are outlined in the following paragraphs; details are in the *VSE/Advanced Functions System Management Guide* (SC33-6094).

Initial Program Load (IPL) initializes the system for execution by loading the supervisor into the real address area. At this time, a predefined automatic system initialization is involved, or the system operator has to specify the I/O devices and to create the page data set. Job Control is then loaded into the virtual address area associated with the background partition, and control is passed to it.

The Supervisor provides resident and transient control functions for use by all other system and user programs. Supervisor assembly macro instructions allow the user to create an individual supervisor tailored to the needs of his own system. The assembly options he may select include:

- The maximum number of partitions to be supported.
- The maximum number of physical devices to be supported.
- The number of symbolic logical units to be supported.
- Rotational Position Sensing support.
- Fast Channel Command Word Translation.
- Cross Partition Event Control.
- Support of 4300 Processors when running in ECPS:VSE mode.
- Support of S/370 machines or 4300 Processors when running in S/370 mode.

This list is not exhaustive.

Specification of any of these or of any of the other available options will increase the processor storage requirement of the supervisor above the minimum requirements tabled below. Details of storage requirements of each individual option are in the *VSE/Advanced Functions System Generation* (SC33-6096) .

Minimum Supervisor:

Mdl 125	84K	
Mdl 125	84K	
Mdl 135, 145	84K	
Mdl 138, 155II, 158	84K	
Mdl 148	96K	
3031 Processor	106K	
	S/370 mode	**ECPS:VS mode**
4331 Processor	90K	88K

Note: From these supervisor sizes approximately 18K can be subtracted if part of the supervisor is made pageable at IPL time.

Installation improvement facilities are provided in DOS/VSE to ease:

- System generation.
- VSE installation.
- Transition to production system.

Support Capabilities include:

- Pre-compiled I/O modules.
- Pre-linked system components for immediate use.
- System generation in a virtual partition.
- Coded samples.
- PTFs pre-applied.
- Automated merge of libraries.
- UCS-buffer load modules for 1403-N1.

HIGHLIGHTS

Support of Processors

Support of the 4300 Processors in S/370 mode and ECPS:VSE mode: VSE supports both modes of operation, the S/370 mode and the ECPS:VSE mode of the 4300 Processors including each model's RAS requirements. The new concept of the 4300 Processors running in ECPS:VSE mode (virtual addresses in channel programs) is exploited by the Supervisor. The scanning of channel programs can be avoided completely by using the IORB interface. Via this interface the user and IBM components can communicate to the Supervisor the pages to be fixed, thus reducing supervisor overhead. The Assembler supports the 4300 Processors privileged hardware instructions.

DOS/VSE R2 with VSE/Advanced Functions (cont'd)

S/370 Support: DOS/VSE continues to support all S/370 Processors supported under previous DOS/VS releases, and also provides full support for the 3031 Single Processor.

New Support

Device Support Facilities: Initializes direct access storage device (DASD) volumes for use with the Disk Operating System, inspects DASD volumes for defective tracks or blocks previously flagged as defective, and analyzes the operational status of supported Fixed Block Architecture (FBA) and Count Key Data (CKD) DASD and their data and control paths. These functions aid the user in determining whether an error situation is drive or media related so the appropriate recovery actions can be initiated. The functions provided by this SCP product are necessary for proper initialization, surface maintenance, and error recovery of supported FBA and CKD DASD.

Device Support Facilities provides an enhanced alternative to those similar functions provided in the following DOS/VSE utilities: Initialize Disk, Surface Analysis, and Assign Alternate Block. For the IBM 3340, 3344, 3350, and 3375, Device Support Facilities utilizes the skip displacement bytes in an attempt to recover a defective track before assigning an alternate. The DOS/VSE system version of Device Support Facilities is separately orderable via 5747-DS2 and includes the Stand-alone version which requires the operating system to dump a Stand-alone IPL tape.

4331 Communications Adapter Trace Facility: A line trace utility for the 4331 integrated communication adapter has been included.

Note: The Fast Copy Utility will not be included in DOS/VSE or VSE/Advanced Functions. Its functions have been enhanced and included in the VSE/Fast Copy Data Set Program (5746-AM4)

Other Highlights

- Three supervisors are provided in the Core Image Library, one for S/370 or 4300 Processors in S/370 mode and DOC = 3277, one for S/370 and DOC = 125D, and one for the 4300 Processors in ECPS:VSE mode. Their source code (including JCL) is contained in the A sublibrary of the Source Statement Library.
- Pre-assembled versions of all I/O modules required for RPG II and PL/I Optimizer are provided in the Relocateable Library.
- Pre-Compiled I/O modules

Job Control provides job initiation and job-to-job transition facilities for all partitions on the basis of control statements read from the system console (SYSLOG) or from the system reader (SYSRDR) for the partition in question. The supervisor loads job control into a virtual partition whenever the previous job in that partition comes to an end, or, if the partition is not in active use, on request from the system operator. Job control is always executed in virtual mode; it may initiate execution of jobs in either virtual or real mode dependent on user specification.

The control statements that make up the job control language allow the user to: name the program phase or phases to be executed ... select either virtual or real mode for their execution ... specify the quantity of virtual or real storage required ... specify the physical devices to be used ... specify the file labels of program files ... call a catalogued procedure from the procedure library ... overwrite statements within a catalogued procedure ... exercise general control functions over program execution.

Operator commands allow the system operator to intervene in the process if it is necessary to modify control statements to meet abnormal conditions in the operating environment.

Attention Routines, Initiators, Terminators - The Initiators allow the operator to communicate with the system through the Attention Routines. Terminator routines provide the support for program termination: under program control; through operator action; a program error; or certain I/O failures.

Checkpoint/Restart - The progress of a program that performs considerable processing in one job step can be protected against destruction in case the program is canceled. The checkpoint facility makes it possible to preserve information at regular intervals and in sufficient quantity to allow restarting a program at an intermediate point.

The Linkage Editor links and relocates separate program sections (relocatable modules) read from the system link device (SYSLNK) or from system or private relocatable libraries or from any combination of these three, creating executable object program phases which are then stored in the core image library selected by the user. If action REL has been specified, the linkage editor will form object program phases which can later be loaded for execution from any set of real or virtual storage locations. If action NOREL has been specified, object program phases will be absolute and must be executed from the storage locations to which they have been link-edited unless they have been written in such a way as to make them self-relocating. A program may be link-edited for execution in the virtual or real part of any partition regardless of the partition in which the linkage editor itself is executed.

The Librarian provides maintenance and service functions for all system and private libraries. The librarian is a collection of programs which allow the user to catalog, delete, rename, display, output, copy, condense, and reallocate the contents of libraries and to create and use new private libraries. System libraries may only be modified by programs executed in the background partition. Details of these restrictions are given in the *VSE/Advanced Functions System Management Guide (SC33-6094)*.

The control and service programs use the system logical units shown in the following lists. The types of physical device that may be assigned to each specific logical unit are shown individually, and summarized in the table at the end of this section.

The 3344 Disk Storage may be used where the 3340 is specified. Consideration should be given to the effect of locating multiple logical volumes on one physical spindle.

The system as a whole requires one of each of the following system logical units:

- **SYSRES** - The System Residence is the direct access storage device on which the operator has mounted the volume containing the system residence extent. The following physical devices may be used: 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1, -2, -11 Disk Storage ... 3333-1, -11 Disk Storage ... 3340/3350/3375/ 3310 and 3370 Disk Storage.
- **SYSLOG** - The System Log is the system console used for system and operator communication. It is normally assigned to one of the following physical devices: 3210 Console Printer-Keyboard ... 3215 Console Printer-Keyboard ... the Display Console for the mdl 138 with or without the 3286 printer mdl 2 ... the Display Console for the mdl 148 with or without the 3286 printer mdl 2 ... the Display Console for the mdl 158 with or without the 3213 Console Printer ... the display operator console for the mdl 115 or 125 with or without the 5213 Console Printer mdl 1 ... the 3278 Display Console mdl 2A for the 4300 Processors with or without the 3268 (4341 only) or 3287 Printer ... the 3277 Display Station in conjunction with the 3284, 3286, 3287, 3288 console printers (locally attached via 3272 Control Unit). To obtain more detailed information, consult the appropriate IBM reference manuals.

  Should the console printer-keyboard become inoperable, SYSLOG may be assigned to one of the following printers: 1403 Printer ... 1443 Printer ... 3203 Printer ... 3211 Printer ... 3262 Printer ... 3289 Printer...3800 Printing Subsystem ... 5203-3 Printer.

  Such a printer assignment allows system operation to continue though with restricted operator-to-system communication.
- **SYSREC** - The System Recorder is the direct access storage device on which the operator has mounted the volume which is to contain records output by the Recovery Management Support Recorder. The following physical devices may be used: 2311 Disk Storage Drive ... 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11 Disk Storage ... 3333-1 Disk Storage ... 3340/3344/3350/3375/3310 and 3370 Disk Storage.
- **SYSCAT** - The System Catalog is the direct access storage device on which the operator has mounted the volume containing the VSAM file catalog. The following physical devices may be used: 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11 Disk Storage ... 3333-1 Disk Storage .... 3340/3344/3350/3375/3310 and 3370 Disk Storage ... 3540 Diskette I/O Unit.

  Note: Assignment of the System Catalog is not required if the Virtual Storage Access Method is not used.

The system may also require the following system logical unit:

- **SYSDMP** - The SYSDMP device is the destination of system-wide dumps that are to be analyzed using VSE/IPCS. SYSDMP is assigned at IPL time. SYSDMP may be assigned to any of the following devices: 2314 Direct Access Storage Facility, 2319 Direct Access Storage Facility, 3330-1,-2,-11 Disk Storage, 3333-1 Disk Storage, 3340/3344/3350/3375 Disk Storage, 3310 and 3370 Disk Storage.

Each partition requires one of each of the following logical units:

- **SYSRDR** - The System Reader is the source of control statement input for the job control program. Each partition requires the assignment of a separate physical device as System Reader except when the assignment is made to a direct access storage device; in this case, separate System Reader extents may occupy the same direct access storage volume. System Readers may be assigned to any of the following devices: 1442 Card Read Punch ... 2501 Card Reader ... 2520 Card Read Punch ... 2540 Card Read Punch ... 2560 Multifunction Card Machine ... 3504 Card Reader ... 3505 Card Reader ... 3525 Card Punch (with Read Feature) ... 3540 Diskette Input/Output Unit (mdl 2 can be assigned to two partitions) ... 5425 Multifunction Card Unit ... 5424 Multifunction Card Unit ... 2400-Series Magnetic Tape Units ... 3400-Series Magnetic Tape Units ... 8809 Magnetic Tape Units ... 2311 Disk Storage Drive ... 2314 Direct Access Storage Facility ... 2319 Disk Storage ...

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3330-1,-2,-11/3333-1/3340/3344/3350/3375/3310 and 3370 Disk Storage.

- **SYSIPT** - The System Input Device is the source of all system input other than that for the job control program. Each partition requires the assignment of a separate physical device as the System Input Device except when the assignment is made to a direct access storage device; in this case, separate System Input extents may occupy the same direct access storage volume. System Input Devices may be assigned to any of the physical devices listed under SYSRDR above.

  Within any one partition SYSRDR and SYSIPT may be assigned to the same physical device or to separate physical devices in accordance with user requirements.

- **SYSLST** - The System List Device is the destination of print lines or print line images output by the system. Each partition requires the assignment of a separate physical device as the System List Device except when the assignment is made to a direct access storage device; in this case, separate System List extents may occupy the same direct access storage volume. System List Devices may be assigned to any of the following physical devices: 1403 Printer ... 1443 Printer ... 3203 Printer ... 3211 Printer ... 3262 Printer ... 3800 Printing Subsystem ... 5203 Printer ...3289 Printer mdl 4 ... 2400-Series Magnetic Tape Units ... 3400-Series Magnetic Tape Units ... 8809 Magnetic Tape Units ... 2311 Disk Storage Drive ... 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11 Disk Storage ... 3333-1 Disk Storage ... 3340/3344/3350/3375/3310 and 3370 Disk Storage ... 3540 Diskette I/O Unit.

- **SYSPCH** - The System Punch Device is the destination of all cards or card images output by the system. Each partition requires the assignment of a separate physical device as the System Punch Device except when the assignment is made to a direct access storage device; in this case, separate System Punch extents may occupy the same direct access storage volume. System Punch Devices may be assigned to any of the following physical devices: 1442 Card Read Punch ... 2520 Card Read Punch ... 2540 Card Read Punch ... 2560 Multifunction Card Machine ... 3525 Card Punch ... 5425 Multifunction Card Unit ... 5424 Multifunction Card Unit ... 2400-Series Magnetic Tape Units ... 3400-Series Magnetic Tape Units ... 8809 Magnetic Tape Units ... 2311 Disk Storage Drive ... 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11 Disk Storage ... 3333-1 Disk Storage ... 3340/3344/3350/3375/3310 and 3370 Disk Storage ... 3540 Diskette I/O Unit.

  Within any one partition SYSLST and SYSPCH may be assigned to the same physical magnetic tape unit.

The number of unit record devices required to operate the system in the multiprogramming environment can be greatly reduced by use of the VSE/POWER licensed program.

Each partition may also require one or more of the following system logical units in order to perform particular control and service functions:

- **SYSLNK** - A System Link Device is a direct access storage device used to store input for the linkage editor program. It may be assigned to any of the following physical devices: 2311 Disk Storage Drive ... 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11 Disk Storage ... 3333-1 Disk Storage ... 3340/3344/3350/3375/3310 and 3370 Disk Storage

- **SYSCLB** - A Core Image Library Device is a direct access storage device on which the operator has mounted a volume containing a private core image library.

- **SYSRLB** - A Relocatable Library Device is a direct access storage device on which the operator has mounted a volume containing a private relocatable library. It must be assigned to the same type of direct access storage device as SYSRES.

- **SYSSLB** - A Source Statement Library Device is a direct access storage device on which the operator has mounted a volume containing a private source statement library. It must be assigned to the same type of direct access storage device as SYSRES.

Display Operator Console Support provides the functions to operate and control the mdls 115, 125, 138, 148, 158, 3031, 4331 and 4341. Operator input entered through the alphameric keyboard and messages from system and problem programs are displayed on the screen of the cathode ray tube. System messages requiring operator reply or action will stay on the screen until the reply is received by the system. A hard copy record of the sequential activity on the video display is available and may be printed on the optional Console Printer via a utility.

Permissible Device Assignments for the System Logical Units

Logical Unit	SYSRDR SYSIPT	SYSLST	SYSPCH	SYSLOG	SYSRES SYSCLB SYSRLB SYSSLB SYSDMP SYSCAT	SYSREC SYSLNK
Model 115 DOC				X		
Model 125 DOC				X		
Device Type						
1403		X		X		
1442	X		X			
1443		X		X		
2501	X					
2520	X		X			
2560	X		X			
3203		X		X		
2540	X		X			
3210				X		
3211		X		X		
3213				X		
3215				X		
3262		X		X		
3800		X		X		
3504/3505	X					
3525	X		X			
3540	X	X	X			
2400-series	X	X	X			
3400-series	X	X	X			
2311	X	X	X			
2314	X	X	X		X	X
2319	X	X	X		X	X
3330-1,-2,-11 3333-1,-11	X	X	X		X	X
3340/3344/ 3350/3375	X	X	X		X	X
3203		X		X		
5425	X		X			
5424	X		X			
3289-4		X		X		
3203-5		X		X		
3278-2A				X		
8809-1A	X	X	X			
3310	X	X	X		X	X
3370	X	X	X		X	X

The Assembler: The Assembler is a programming tool for the implementation of programs written in S/370 and 4300 Processors Assembler language. Assembler language gives the user access to machine and operating system functions and permits obtaining the best balance between storage utilization and speed of program execution. However, a problem solution expressed in Assembler language normally requires more coding effort than a solution to the same problem expressed in a higher level language.

The major features of the Assembler include:

Macro instructions, which provide the programmer with a powerful programming tool. Use of the system macro instructions provides access to all of the capabilities of VSE. Use of programmer-defined macro instructions can simplify the programming of particular applications and makes possible the definition of special-purpose languages.

Conditional assembly statements are used to alter the sequence in which statements are processed or to specify the selective assembly of sets of instructions. The conditional assembly feature is a key element of the macro feature.

Private libraries may be used to contain both Assembler language statements to be inserted into programs by means of COPY statements, and macro instruction definitions for use by the macro processor.

The hardware instructions of the 4300 Processor are supported. SETC symbols may be assigned to character strings of up to 255 characters. Unreferenced labels may be suppressed in the assembler listing using the new option SXREF.

The Assembler uses the S/370 Standard Instruction Set, and requires for execution a minimum partition size of 20K; it may be executed either in virtual or in real mode.

The Assembler reads source program input from SYSIPT and directs its output to SYSLST, SYSPCH, and SYSLNK, dependent on the user options in force. Library input may also be read from SYSSLB. All of these logical units may be assigned to any of the physical devices already indicated for the control and service programs. The Assembler further requires direct access storage space for three work files which may reside in VSE/VSAM managed space. Any of the following physical devices may be used for this purpose:

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2311 Disk Storage Drive
2314 Direct Access Storage Facility
2319 Disk Storage
3330-1,-2,-11/3333-1,-11 Disk Storage
3340 Disk Storage
3344 Disk Storage
3350 Disk Storage
3375 Direct Access Storage
3310 Disk Storage
3370 Disk Storage

Data Management: The data management facilities of VSE are divided into two parts: the physical input/output control system (physical IOCS); and the logical input/output control system (logical IOCS). The user invokes the services of the IOCS routines by use of macro instructions.

The EXCP (execute channel program) and WAIT macro instructions of physical IOCS allow the user to handle input and output devices in a direct way by writing his own channel programs; it is usually more convenient for him however to use the macro instructions of logical IOCS, either using GET and PUT macro instructions to handle logical data records or using READ and WRITE macro instructions to handle physical data blocks. OPEN and CLOSE macro instructions perform the functions of creating, checking, and updating file labels for input and output files; the CNTRL macro instruction performs specific device-dependent control functions such as stacker selection, printer carriage movement, and magnetic tape positioning.

The individual component routines of logical IOCS are classified under three headings: the Sequential Access Method (SAM), the Direct Access Method (DAM) and the Indexed Sequential Access Method (ISAM).

When RPS is specified during System generation

- SAM and DAM will automatically include Rotational Position Sensing for 3330-1,-2,-11, 3333-1,-11, 3340, 3344, 3350 and 3375 Disk Storage.

  ISAM will automatically include Rotational Position Sensing for 3330-1, 2, 3333-1, 3340, 3344, and 3350 (in 3330-1 Compatibility Mode) Disk Storage.

Note: RPS is not applicable for the 3310 or 3370 Disk Storage.

Sequential Access Method - SAM

The Sequential Access Method (SAM) enables files to be defined and accessed in a sequential manner beginning with the first logical record of the file and continuing in sequence till the last logical record of the file is reached. The components of the Sequential Access Method are described in the following paragraphs.

Basic Sequential IOCS provides support for definition, creation, and processing of files associated with unit record devices and the system console. The DTFCD macro instruction is used to define a punched card file; the DTFPR macro instruction is used to define a printer file; the DTFCN macro instruction is used to define a system console file.

By means of GET or PUT macro instructions, records are obtained or created starting with the first record of the logical file and continuing to the last record. Logical records are considered to be unblocked and may be of either fixed or variable length within the limits of the unit record medium to which they relate. Input and output operations may be overlapped with instruction processing by specification of two data areas for use by IOCS. Either the CNTRL macro instruction or first data character control may be used to effect any stacker selection or printer forms carriage movement required.

Basic Sequential IOCS supports the following devices:

1442 Card Read Punch
2501 Card Reader
2520 Card Read Punch
2540 Card Read Punch
2560 Multifunction Card Machine
2596 Card Read Punch
3504/3505 Card Reader
3525 Card Punch
5425 Multifunction Card Unit
5424 Multifunction Card Unit
1403 Printer
1443 Printer
3211 Printer
3262 Line Printer mdl 1 or 11
3262 Line Printer mdl 5
3289 Line Printer mdl 4
3203 Printer
3800 Printing Subsystem
3881 Optical Mark Reader
3210 Console Printer-Keyboard
3215 Console Printer-Keyboard
The display operator console for the mdl 115 or 125 with or without the 5213 Console Printer mdl 1.
The display console for the mdls 138 or 148 with or without the 3284, 3286, 3287 and 3288 Console Printers.
The display console for the mdl 158 with or without the 3213 Console Printer.
The display console of 4331 or 4341 with or without the 3268 (4341 only) or 3287 Console Printer.

Device-Independent IOCS provides support for definition, creation, and processing of files associated with the system input and output logical units. The IOCS is used with the card readers, card punches, and printers that act as system input and output units, and enables magnetic tape or direct access storage to be substituted for such devices at execution time without the need for program modification. The DTFDI macro instruction is used to define a device-independent file.

By means of GET or PUT macro instructions records are obtained or created starting with the first logical record of the file and continuing to the last record. Logical records are unblocked and of fixed length within the constraints of the unit record medium to which they may relate. First data character control must be used to specify any stacker selection or printer forms carriage movement required.

Device-Independent IOCS supports the following physical devices:

1442 Card Read Punch
2501 Card Reader
2520 Card Read Punch
2540 Card Read Punch
2560 Multifunction Card Machine
3504/3505 Card Reader
3525 Card Punch
5425 Multifunction Card Unit
5424 Multifunction Card Unit
1403 Printer
1443 Printer
3203 Printer
3211 Printer
3262 Line Printer mdl 5
3289 Line Printer mdl 4
3800 Printing Subsystem
3540 Diskette I/O Unit
5203 Printer

Any of the following physical devices may be substitued for these devices at execution time:

2400-series Magnetic Tape Units
3400-series Magnetic Tape Units
8809 - Magnetic Tape Units
2311 Disk Storage Drive
2314 Direct Access Storage Facility
2319 Disk Storage
3330-1,-2,-11/3333-1,-11 Disk Storage
3340 Disk Storage
3344 Disk Storage
3350 Disk Storage
3375 Direct Access Storage
3310 Disk Storage
3370 Disk Storage

Sequential Tape IOCS provides support for definition, creation, and processing of input and output files recorded on magnetic tape. The DTFMT macro instruction is used to define a magnetic tape file.

By means of GET or PUT macro instructions magnetic tape records are obtained or created starting with the first logical record of the file and continuing to the last record. Logical records may be either blocked or unblocked and may be of either fixed or variable length. Necessary blocking and deblocking of logical records is performed by the IOCS. Logical records, blocked or unblocked, may span multiple physical records. Input and output operations may be overlapped with instruction processing by the specification of two data areas for use by IOCS. The data within a file may be encoded either in EBCDIC or in ASCII. The CNTRL macro instruction enables the user to specify such control operations as forward space, backspace, rewind, and unload; the user may position magnetic tapes in accordance with the needs of the program.

Sequential Tape IOCS also provides support for definition creation and processing of magnetic tape work files; that is, files which serve as output and as input within the same program. In this case READ or WRITE macro instructions are used to obtain or create physical blocks; any necessary blocking or deblocking of logical records within physical blocks is the responsibility of the user. He may also issue the NOTE and the various POINT macro instructions to reposition magnetic tapes in accordance with the needs of his program.

Sequential Tape IOCS supports the following physical devices:

2400-series Magnetic Tape Units
3400-series Magnetic Tape Units
8809 - Magnetic Tape Units

DOS/VSE R2 with VSE/Advanced Functions (cont'd)

Sequential Disk IOCS provides support for definition, creation, and processing of input and output files recorded on direct access storage devices. The DTFSD macro instruction is used to define a direct access storage file.

By means of GET or PUT macro instructions direct access records are obtained or created starting with the first logical record of the file and continuing to the last record. Logical records may be either blocked or unblocked and may be of either fixed or variable length. Necessary blocking and deblocking of logical records is performed by the IOCS. Logical records, blocked or unblocked, may span multiple physical records. Input and output operations may be overlapped with instruction processing by the specification of two data areas for use by IOCS.

Sequential Disk IOCS also provides support for definition, creation, and processing of direct access storage work files; that is, files which serve as output and as input within the same program. In this case READ or WRITE macro instructions are used to obtain or create physical blocks; any necessary blocking or deblocking of logical records within physical blocks is the responsibility of the user. Users may also issue the NOTE and the various POINT macro instructions to logically reposition the file in accordance with the needs of their program.

Sequential Disk IOCS supports the following physical devices:

2311 Disk Storage Drive
2314 Direct Access Storage Facility
2319 Disk Storage
3330-1,-2,-11/3333-1,-11 Disk Storage
3340 Disk Storage
3344 Disk Storage
3350 Disk Storage
3375 Direct Access Storage
3310 Disk Storage
3370 Disk Storage

Sequential Diskette IOCS provides support for definition, creation and processing of input and output files recorded on IBM diskettes. The DTFDU macro instruction is used to define a diskette file.

By means of GET or PUT macro instructions, diskette records are obtained or created starting with the first logical record of the file and continuing to the last record. Logical records are fixed length and unblocked, but may be grouped together in the user's I/O AREA(s) for performance reasons through IOCS use of command chaining.

Sequential Diskette IOCS supports the following physical device:

3540 Diskette Input/Output Unit

Sequential Paper Tape IOCS provides support for definition, creation, and processing of input and output files recorded in punched paper tape. The DTFPT macro instruction is used to define a paper tape file.

By means of GET or PUT macro instructions paper tape records are obtained or created starting with the first logical record of the file and continuing to the last record. Logical records may be either of undefined format, in which case they must be terminated by the end-of-record character, or of fixed length and unblocked, in which case the end-of-record character must not be present. Input and output operations may be overlapped with instruction processing by the specification of two data areas for use by IOCS. Any necessary translation of codes may be performed under the control of user-specified translation tables.

Sequential Paper Tape IOCS supports the following physical devices:

1017 Paper Tape Reader
1018 Paper Tape Punch
2671 Paper Tape Reader

Magnetic Character Recognition IOCS provides support for definition and processing of the input files associated with the IBM magnetic character recognition readers and certain optical character readers. The DTFMR macro instruction is used to define such a file.

The external interrupt feature is used to provide automatic entry to a user-written stacker selection routine on a first priority basis regardless of the priority of the partition in which the routine resides. Following stacker selection, the IOCS enables the user to access documents sequentially, process the data, and exercise control of non-MCR and non-OCR input and output devices. This normal processing (as opposed to stacker selection processing) takes the dispatching priority of the partition in which the problem program is executed.

Engage, disengage, stacker selection, and document reading functions are invoked by the use of macro instructions. A buffer is maintained for each MCR device to provide the problem program with continuous input data. GET macro instructions are used when a single reader is attached to the system; READ CHECK, and WAIT F macro instructions are used when the system is servicing a number of readers.

The supervisor and logical IOCS can support a maximum of six character readers which may operate in any combination in any or all partitions. The maximum number that may be effectively operated is application and configuration dependent. Refer to the appropriate MICR publications listed in the latest IBM S/370 bibliography for a more complete description of device timings.

Magnetic Character Recognition IOCS supports the following physical devices:

1255 Magnetic Character Reader
1259 Magnetic Character Reader
1419 Magnetic Character Reader

Note: Programs utilizing the Magnetic Character Recognition IOCS are highly time-dependent and should be executed in real mode only.

Optical Character Recognition IOCS provides support for definition and processing of input files associated with certain IBM optical character readers. The DTFOR macro instruction is used to define such a file for the 1287, 1288, and the 3886.

The 3886 is supported with special document definition macros used in a separate assembly to create a format record. Format records are stored in the Core Image Library for access by user 3886 processing programs.

The IOCS is used to read printed paper tapes or journal rolls such as those produced on cash registers and accounting machines. The IOCS is also used to read printed and hand-printed data and optical mark-read data from cut-form documents such as sales checks, utility stubs, and customer orders.

Optical Character Recognition support can be used in a multiprogramming environment. Factors affecting performance include the following:

Processor model.
Number of readers (a maximum of eight are supported).
Characteristics of tapes and documents.
Batch or multiprogramming environment.
Blocking of input data on printed paper tapes.
User programming.

In addition throughput is dependent upon operator loading and unloading time. This handling time is significant when processing short printed paper tape rolls.

Optical Character Recognition IOCS supports operations on the following physical devices:

1287 Optical Reader
1288 Optical Page Reader
3886 Optical Character Reader (mdl 1)

Direct Access Method - DAM: The Direct Access Method (DAM) enables files to be defined on direct access storage volumes with any form of organization and access that the user may require. The records making up the file may be of fixed or variable length and may or may not contain key fields. All records are regarded as being unblocked; any necessary blocking or deblocking of logical records within physical records is the responsibility of the user. The DTFDA macro instruction is used to define a direct access file.

READ and WRITE macro instructions are used to retrieve and store physical records on the basis of information supplied by the user; such information may be either actual disk addresses or relative addresses within the file. Furthermore the address may be that of the actual record required or may indicate the point within the file at which a search for the required record is to begin. The Direct Access Method allows the use of spanned records such that each record retrieved or stored spans multiple physical records. When this is the case, the physical segments making up the record are stored contiguously within the file.

The Direct Access Method supports the following physical devices:

2311 Disk Storage Drive
2314 Direct Access Storage Facility
2319 Disk Storage
3330-1,-2,-11/3333-1,-11 Disk Storage
3340 Disk Storage
3344 Disk Storage
3350 Disk Storage
3375 Direct Access Storage

Note: 3310 and 3370 are not supported.

Indexed Sequential Access Method - ISAM: The Indexed Sequential Access Method (ISAM) enables files to be defined on direct access storage volumes in such a way that records making up the file may be processed either in sequential order or in random order according to the needs of the accessing program. Logical records must be of fixed length, but may be blocked or unblocked; necessary blocking and deblocking of logical records is performed by the IOCS. Records can be added within the file without the necessity for sorting, recopying, or merging. Records may also be updated as required. The DTFIS macro instruction is used to define an indexed sequential file.

DOS/VSE R2 with VSE/Advanced Functions (cont'd)

GET and PUT macro instructions are used to process the file in sequential order, the user supplying control information for the *first record* to be processed. READ and WRITE macro instructions are used to process the file in random order, the user supplying control information for *each* record to be processed.

Optional features of the Indexed Sequential Access Method allow the user to speed up program execution in exchange for increased main storage requirements.

The Indexed Sequential Access Method supports the following physical devices:

2311 Disk Storage Drive
2314 Direct Access Storage Facility
2319 Disk Storage
3330-1,-2/3333-1 Disk Storage
3340 Disk Storage
3344 Disk Storage
3350 Disk Storage in 3330 mdl 1 Compatibility Mode.

Note: 3330-11, 3333-11 and 3350 in native mode are not supported, and 3310 and 3370 are not supported. 3375 is not supported.

DOS/VSE R2 with VSE/Advanced Functions (cont'd)

DEVICE SUPPORT CHART

Device	S/370 Model 115	125	135, 135-3, 138	145, 145-3, 148	155II 158	3031	4341	4331
1017 Paper Tape Reader mdls 1, 2	2826	2826	2826	2826	2826	2826	2826	2826
1018 Paper Tape Punch	2826	2826	2826	2826	2826	2826	2826	2826
1255 Magnetic Character Reader mdls 1, 2, 3	m	m	X	X	X	X	X	X
1259 Magnetic Character Reader mdl 2	m	m	X	X	-	-	X	X
1270 Optical Character Reader mdls 1, 2, 3, 4	m	m	m	m	m	m	m	m
1275 Optical Character Reader mdls 2, 4	m	m	m	m	m	m	m	m
1287 Optical Reader mdls 1, 2, 3, 4	-	-	X	X	X	X	X	X
1287 Optical Reader mdldel 5	m	m	X	X	X	X	X	X
1288 Optical Page Reader	-	-	X	X	X	X	X	X
1403 Printer mdls 2, 7, N1	n	n	2821	2821	2821	2821	2821	2821
mdl 3	-	-	2821	2821	2821	2821	-	-
1419 Magnetic Character Reader mdls 1,	m	m	X	X	X	X	X	X
1442 Card Read Punch mdl N1	m	m	X	X	X	X	X	X
1442 Card Punch mdl N2	m	m	X	X	X	X	X	X
1443 Printer mdl N1	m	m	X	X	X	X	X	X
2311 Disk Storage Drive mdl 1	-	-	2841	2841	2841	2841	2841	2841
2314 Disk Storage - A Series								
2312 Disk Storage mdl A1	-	-	2314-A1	2314-A1	2314-A1	2314-A1	2314-A1	2314-A1
2313 Disk Storage mdl A1	-	-	2314-A1	2314-A1	2314-A1	2314-A1	2314-A1	2314-A1
2314 Storage Control mdl A1	-	-	X	X	X	X	B	B
2318 Disk Storage mdl A1	-	-	2314-A1	2314-A1	2314-A1	2314-A1	2314-A1	2314-A1
2314 Disk Storage - B Series								
2314 Storage Control mdl B1	-	-	X	X	X	X	B	B
2319 Disk Storage mdl B1	-	-	2314-B1	2314-B1	2314-B1	2314-B1	2314-B1	2314-B1
2319 Disk Storage mdl B2	-	-	2319-B1	2319-B1	2319-B1	2319-B1	2319-B1	2319-B1
2319 Disk Storage - A Series								
2319 Disk Storage mdl A1	-	-	IFA	IFA	-	-	-	-
2319 Disk Storage mdl A2	-	-	-	2319-A1	-	-	-	-
2319 Disk Storage mdl A3	-	-	2319-A1	-	-	-	-	-
2401 Magnetic Tape Unit mdls 1 to 6, 8	-	-	2803/4	2803/4	2803/4	2803/4	2803/4	2803
2415 Magnetic Tape Unit and Control mdls 1 to 6	-	-	X	X	X	X	B	X
2420 Magnetic Tape Unit mdls 5, 7	-	-	2803	2803	2803	2803	2803	2803 Mdl 5 Only
2501 Card Reader mdls B1, B2	m	m	X	X	X	X	X	X
2520 Card Read Punch mdls B1	m	m	X	X	X	X	X	X
2520 Card Punch mdls B2, B3	m	m	X	X	X	X	X	X
2540 Card Read Punch	2821	2821	2821	2821	2821	2821	2821	2821
2560 Multifunction Card Machine	n	n	-	-	-	-	-	-
2596 Card Read Punch	m	m	X	X	X	X	-	-
2671 Paper Tape Reader	2822	2822	2822	2822	2822	2822	2822	2822
2803 Tape Control mdls 1, 2, 3	-	-	X	X	X	X	B	X
2804 Tape Control mdls 1, 2, 3	-	-	X	X	X	X	B	-
2816 Switching Unit	-	-	X	X	X	X	B	X
2821 Control Unit mdls 1, 2, 3, 5, 6	m	m	X	X	X	X	X	X
2822 Paper Tape Reader Control	m	m	X	X	X	X	X	X
2826 Paper Tape Control	m	m	m	m	m	m	m	m
2841 Storage Control	-	-	X	X	X	X	B	B
3203 Printer mdls 1, 2	n	n	-	-	-	-	-	-
3203 Printer mdl 4	-	-	n***	n***	-	-	-	-
3203 Printer mdl 5	m	m	X	X	X	X	X	X
3210 Console Printer-Keyboard mdl 1****	-	-	n	n	n**	-	-	-
3210 Console Printer-Keyboard mdl 2****	-	-	-	n	n**	-	-	-
3211 Printer	-	-	3811	3811	3811	3811	3811	3811
3213 Console Printer mdl 1	-	-	-	-	n*	-	-	-
3215 Console Printer-Keyboard	-	-	n	n	n**	-	-	-
3230 Printer mdl 2	3274	3274	3274	3274	3274	3274	3274	3274
3262 Printer mdls 1, 11	-	-	-	-	-	-	-	n
3262 Printer mdl 5	-	-	X	X	X*	X	X	X
3268 Printer mdl 2	3274	3274	3274	3274	3274	3274	3274 n	3274
3278 Display Console mdl 2A	-	-	-	-	-	-	n	n
3284 Printer mdls 1, 2	3272/74	3272/74	3272/74 n***	3272/74 n***	3272/74 n*	3272/74	3272/74	3272/74
3286 Printer mdls 1, 2	3272/74	3272/74	3272/74 n***	3272/74 n***	3272/74 n*	3272/74	3272/74 n	3272/74
3287 Printer mdls 1, 2	3272/74	3272/74	3272/74 n***	3272/74 n***	3272/74 n*	3272/74	3272/74 n	3272/74 n
3288 Printer mdl 2	3272/74	3272/74	3272/74 n***	3272/74 n***	3272/74	3272/74	3272/74	3272/74
3289 Printer mdls 01, 02	3274	3274	3274 n***	3274 n***	3274	3274	3274	3274
3289 Printer mdl 4	-	-	-	-	-	-	-	n
3310 Direct Access Storage Device	-	-	-	-	-	-	-	n
3330 Disk Storage mdls 1, 2 and 11	-	3333	3333, 3830-1	3333, 3830-1 3880	3333, 3830-1 3880	3333, 3830-1 3880	3333 3830-1 3880	-
	-	-						-
3333 Disk Storage and Control mdls 1 and 11	-	n	3830-2, IFA	3830-2, 3345-3, -4,-5, 3880 ISC	3830-2, 3880 ISC	3830-2, 3880 ISC	3830-2 3880	-

DOS/VSE R2 with VSE/Advanced Functions (cont'd)

DEVICE SUPPORT CHART (Cont'd)

Device	S/370 Model 115	125	135, 135-3, 138	145, 145-3, 148	155II 158	3031	4341	4331
3340 Direct Access Storage Facility mdl A2	n	n	3830-2# IFA	3830-2 3345-3, -4,-5, 3880 ISC	3830-2 3880 ISC*	3830-2 3880	3830-2 3880	n
3340 Direct Access Storage Facility mdls B1, B2	3340-A2	3340-A2	3340-A2	3340-A2	3340-A2	3340-A2	3340-A2	3340-A2
3344 Disk Storage	3340-A2&	3340-A2&	3340-A2	3340-A2	3340-A2	3340-A2	3340-A2	-
3345 Storage and Control Frame mdls 3, 4, 5	-	-	-	n	-	-	-	-
3350 Direct Access Storage and Control mdls A2, A2F, C2, C2F	-	-	3830-2, 3880	3830-2, 3880 ISC	3830-2, 3880 ISC*	3830-2, 3880	3830-2	-
3350 Direct Access Storage mdls B2, B2F, C2, C2F	-	-	3350-A2, -A2F	3350-A2, -A2F	3350-A2, -A2F	3350-A2, -A2F	3350-A2, -A2F	-
3375 Direct Access Storage	-	-	-	-	-	3880f	3880f	3880fg
3370 Direct Access Storage	-	-	-	-	-	-	3880	n
3410 Magnetic Tape Unit mdls 1, 2, 3	3411	3411	3411	3411	3411	3411	3411	3411
3411 Magnetic Tape Unit and Control mdls 1,2,3	n	n	X	X	X	X	B	X
3420 Magnetic Tape Unit mdls 3, 5	3803-3	3803-3	3803-1	3803-1	3803-1	3803-1	3803-1	3803-1
3420 Magnetic Tape Unit mdls 7	-	-	3803-1	3803-1	3803-1	3803-1	3803-1	3803-1
3420 Magnetic Tape Unit mdl 4	-	-	3803-2	3803-2	3803-2	3803-2	3803-2	3803-2
3420 Magnetic Tape Unit mdls 6, 8	-	-	3803-2	3803-2	3803-2	3803-2	3803-2	-
3430 Magnetic Tape and Control (as a 3411)	-	-	X	X	X	X	B	X
3430 Magnetic Tape (as a 3410)	-	-	3430 -A	3430 -A	3430 -A	3430 -A	3430 -A	3430 -A
3504 Card Reader mdls A1, A2	-	n	-	-	-	-	-	-
3505 Card Reader mdls B1, B2	m	m	X	X	X	X	X	X
3525 Card Punch mdls P1, P2, P3	3505-B1, -B2	n or 3505 -B1,-B2	3505-B1, -B2	3505-B1, ,-B2	3505-B1, -B2	3505-B1, -B2	3505-B1, -B2	3505-B1 -B2
3540 Diskette I/O Unit mdls B1, B2	m	m	X	X	X	X	X	X
3800 Printing Subsystem	-	-	-	X	X	X	X	X
3803 Tape Control mdl 1	-	-	X	X	X	X	B	X
3803 Tape Control mdl 2	-	-	S	S	S	S	B	B
3803 Tape Control mdl 3	n	n	-	-	-	-	-	-
3811 Printer Control Unit	-	-	X	X	X	X	X	X
3830 Storage Control mdl 2	-	-	X	X	X	X	B	-
3880 Storage Control	-	-	B	B	B	B	B	-
3881 Optical Mark Reader	m	m	m	m	m	m	m	m
3886 Optical Character Reader mdl 1	m	m	X	X	X	X	X	X
3895 Document Reader/Inscriber	-	m&	X	X	X	X	X	X
5203 Printer mdl 3	n	-	-	-	-	-	-	-
5213 Printer mdl 1	n	n	-	-	-	-	-	-
5424 Multifunction Card Unit	-	-	-	-	-	-	-	n
5425 Multifunction Card Unit mdls A1, A2	n	n	-	-	-	-	-	-
8809 Magnetic Tape Unit mdls 1A, 2, 3	-	-	-	-	-	-	-	n

Notes:

-	Not attachable.
n	Natively attachable.
X	Attachable to any available channel.
m	Attachable to a multiplexer channel only.
S	Attachable to selector channel only.
B	Attachable to block multiplexer channel only.
IFA	On Integrated File Adapter.
ISC	On Integrated Storage Control.
*	Attachable to mdl 158 only.
**	Attachable to mdl 155II only.
***	Mdl 138 and 148 only.
****	Does not attach to the S/370 mdls 138 or 148.
)	RPQ required.
#	Not attachable if string contains 3344.
&	On 3115-2/3125-2 only.
f	Attachable to channels with 1.86 megabyte data rate or greater.
g	4331 Model Group 2 processor only.

Telecommunications Support: Support of telecommunications devices is provided under DOS/VSE by three access methods:

- The Virtual Telecommunications Access Method (ACF/VTAM) with the Network Control Program (ACF/NCP) supporting the SNA/SDLC, the BSC and the S/S environment.
- The Virtual Telecommunications Access Method Entry (ACF/VTAME) in support of SNA-SDLC and BSC communication adapters and various channel attached devices, BSC support is for nonswitched 3270 only.
- The Basic Telecommunication Access Method (BTAM-ES) for BSC and S/S support.

For further information on telecommunication device support refer to the respective sales manual pages.

System Utility Programs: The system utility programs maintain system control data at a system or organizational level. Except where specifically noted, support is provided for utility functions concerning the following physical devices:

2400-series Magnetic Tape Units
3400-series Magnetic Tape Units
8809 - Magnetic Tape Unit
2311 Disk Storage Drive
2314 Direct Access Storage Facility
2319 Disk Storage
3330/3333 Disk Storage
3340 Disk Storage
3344 Disk Storage
3350 Disk Storage
3375 Direct Access Storage
3310 Disk Storage
3370 Disk Storage
3540 Diskette I/O Unit.

Additional system devices may be required for program execution; these may be assigned to any of the appropriate physical devices already listed under the heading *Control and Service Programs.*

The following are the utility functions provided:

Device Support Facilities: Initializes direct access storage device (DASD) volumes for use with the Disk Operating System, inspects DASD volumes for defective tracks or blocks previously flagged as defective, and analyzes the operational status of supported Fixed Block Architecture (FBA) and Count Key Data (CKD) DASD and their data and control paths. These functions aid the user in determining whether an error situation is drive or media related so the appropriate recovery actions can be initiated. The functions provided by this SCP product are necessary for proper initialization, surface maintenance, and error recovery of supported FBA and CKD DASD.

Device Support Facilities provides an enhanced alternative to those similar functions provided in the following DOS/VSE utilities: Initialize Disk, Surface Analysis, and Assign Alternate Block. For the IBM 3340, 3344, 3350, and 3375 Device Support Facilities utilizes the skip displacement bytes in an attempt to recover a defective track before assigning an alternate. The DOS/VSE system version of Device Support Facilities is separately orderable via 5747-DS2 and includes the Stand-alone version which requires the operating system to dump a Stand-alone IPL tape.

DOS/VSE R2 with VSE/Advanced Functions (cont'd)

Initialize Magnetic Tape - The program initializes up to sixteen tape volumes. For each volume the program creates from one to eight volume labels as required, one dummy header label, and a tape mark. The program may be used to initialize either EBCDIC tapes with IBM Standard Volume Labels or ASCII tapes with ANSI Standard Volume Labels.

Initialize Disk - The program initializes CKD disk packs for further use by VSE. The DSF initialization procedure consists of VTOC label checking, home address generation, volume label creation, track descriptor (R0) record generation, and IPL and VTOC creation. 2311, 2314 and 2319 disk packs may be initialized with or without a test for defective tracks (surface analysis); however surface analysis should be included when a volume is initialized for the first time.

The initialize disk program initiates FBA disks for further use by VSE. The initialization procedure consists of VTOC label checking, volume label creation IPL, and VTOC creation and an optional clearing of all data fields.

Assign Alternate Track - Disk - The DSF program assigns an alternate track to a defective track on a CKD disk. The alternate tracks may be assigned either unconditionally or conditionally based upon the result of a surface analysis of the track.

Clear Disk - The program clears one or more areas of CKD disk and preformats tracks containing an indicated base value throughout the area cleared.

VTOC Display - The program displays the labels contained in the Volume Table of Contents of a disk volume, in alphabetical order. The labels are identified by their location within the Volume Table of Contents and their format, type, and major fields are indicated by appropriate heading lines in the printed output. A list of free space is also provided.

Copy and Restore Diskette - Support is provided to: Recovery data from a diskette on which the label information (on track zero) cannot be read ... Copy one 3540 diskette to another 3540 diskette. During this copy, error sectors and deleted records are eliminated. The utility can be used in a single or multiple 3540 configuration.

Backup and Restore System Utility Programs

The programs allow fast backup of system and/or private libraries to tape with subsequent restore to disk. When the libraries are restored to disk, they are automatically condensed and may be reallocated to different sizes or to different DASD types. The restore program will accept the PID tape as input and allocate the libraries either as specified within the control statements, or in response to a prompting request.

Copy File and Maintain Object Modules (OBJMAINT) Utility: This program is a multipurpose utility providing the following functions:

- File-to-file copy with blocking and deblocking of data sets with record size 80 or 81 bytes on tape, card, disk or diskette
- update and expansion of object modules
- Comprehensive data set listing capability with record size 80 or 81 bytes

Other Utility Programs: Assign Alternate Block: The program assigns an alternate block to a defective block of a fixed block mode device (conditionally or unconditionally). It copies data from the defective to the alternate block, replaces the contents of a specified block by data supplied as input to the utility, or lists/punches the contents of a specified block.

Surface Analysis (fixed block mode): The program performs surface analysis of complete fixed block mode disk packs. Defective blocks may be reclaimed.

Format Emulator Extent: The program formats a specific extent on a fixed block mode disk in order to prepare for later emulation of a 2311 or 2314 disk on the native fixed block mode disk.

Printer Train Cleaning: The program is used by the operator to clean the printer train of a printer.

Device Support Facilities - Stand-alone: Initializes direct access storage device (DASD) volumes for use with the Disk Operating System, inspects DASD volumes for defective tracks or blocks, conditionally reclaims tracks or blocks previously flagged as defective, and analyzes the operational status of supported Fixed Block Architecture (FBA) and Count Key Data (CKD) DASD and their data and control paths. These functions aid the user in determining whether an error situation is drive or media related so the appropriate recovery actions can be initiated. For the IBM 3340, 3344, 3350, and 3375 Device Support Facilities utilizes the skip displacement bytes in an attempt to recover a defective track before assigning an alternate. Device Support Facilities Stand-alone is shipped as part of the system version or may be ordered separately via 5747-DS1. The version shipped with the system version requires the operating system to dump a Stand-alone tape.

MSHP (Maintain System History Program) is the new maintenance program with the following improvement over the DOS/VS Release 34 PTFHIST program:

- Creation of a history file: A history file is created at each system installation where MSHP is used for system maintenance. The history file can be personalized with the user's name, address, etc.
- Installation of DLIBs, components and/or features: The MSHP installs DLIBs, new components and/or features. The technical status of these new programs is recorded in the history file. Safeguards against down-levelling the system are provided when installing features. The MSHP support includes "tapeless" users.
- Preventive Service Application: MSHP provides the function set for application of preventive service packages. Recording of applied PTFs is automatically done in the User History File.
- PTF Application: MSHP applies PTFs from cumulative PTF files or as single PTFs. Recording is done automatically; backout facilities are provided.
- History File List: When listing the history file, the entries may be sorted by PTF, by APAR, by module name, by component and by feature. MSHP produces a quick history file list with a cross reference to the items above.
- History Search: Using SYSLOG, MSHP informs the user about an APAR, PTF, or status of a module.
- History File Maintenance: Miscellaneous functions are provided in order to maintain the history file.

COPYSERV: The program allows for automated merge of existing system and private libraries on CKD devices into newly created libraries, eliminating the manual effort of comparing directory listings and preparing the required copy cards thus reducing significantly the time required to prepare the new release for production status.

Recovery Management Support and Recording: Recovery Management Support (RMS) and Recovery Management Support Recording (RMSR) are standard functions under VSE with the following exception:

- For mdls 115 and 125, recovery management support is a supervisor assembly option.

The functions of RMS and RMSR are described below:

Recovery Management Support - The Recovery Management Routines attempt to recover from or otherwise reduce the impact of machine malfunctions indicated by machine check and channel check interruptions. They feature:

Transparent recovery after successful retry including error statistics collection.

Continuation if the error is unrecoverable but the affected job or task can be terminated.

Comprehensive error recording to support deferred maintenance.

Recovery Management Support Recording - RMSR collects and records on direct access storage (SYSREC) statistical and event data on matching errors. This recorded data facilitates early warning, rapid diagnosis, and repair of failing components, providing greater system availability due to improved preventive maintenance and shorter duration of planned and unplanned maintenance.

The error recording file on direct access storage can be totally or selectively edited and printed or transferred to magnetic tape for later editing and printing by the Environmental Recording, Editing and Printing (EREP) Program. A number of functional enhancements have been made to this program including integration of the recording, editing, and printing of ESTV records.

Tape and Disk Error Recovery Procedures - Routines that analyze error type and type of device in error and pass control to the proper ERP in an attempt to recover or to the ERP message writer in case of hard errors.

Diagnostic Aids: VSE provides a number of system tools and facilities to help to allocate responsibility for program repair. These include:

- The Online Test Executive Program (OLTEP) which allows execution of machine diagnostic programs in the real storage allocated to any partition of a multiprogramming environment at the same time as other system and user programs are executed in foreground partitions. OLTEP can be executed in real mode only.
- System Debugging Aids (SDAID) which includes the functions of the program formerly named PDAID) allows the tracing of the following events as they occur during program execution: Fetching and loading of program phases (Fetch/Load Trace) ... Input and output activity (I/O Trace) ... Supervisor Calls (SVC Trace) ... Program checks in transient areas (Transient Dump) ... Certain VTAM events ... VTAM Buffer Pool Trace.

  It uses the Program Event Recording Facility and Monitor Calling Facility of S/370 to provide additional stop and dump facilities and the following additional trace facilities: Page Trace ... Instruction Trace ... Alter Main Storage Trace ... Alter General Register Trace ... Successful Branch Trace ... Channel Program Trace.

DOS/VSE R2 with VSE/Advanced Functions (cont'd)

- The program DOSVSDMP offers a facility for generating a stand-alone dump tailored to the installation's requirements; e.g., medium for IPL and for output of stand-alone dump. DOSVSDMP also provides a facility for printing (formatted if desired) the stand-alone dump, the system dump and the output of the DUMP command.
- The PDZAP program which allows quick applying of ZAP fixes to phases and transients in the Core Image Libraries without requiring a reassembly and recataloging of the changed phase or transient.
- The Label Cylinder Display Program (LSERV) which produces a formatted listing of the file label information contained on the tracks of the label cylinder of the system residence extent.
- The Main Storage Alter Command (ALTER) which allows the system operator to change the contents of up to 16 bytes of virtual or real storage from the system console starting from a specified address.
- The Main Storage Dump Command (DUMP) which allows the system operator to obtain a dump of the contents of storage on a printer, tape or disk device.
- DSF Analysis Function which aids the operator in analyzing nonremovable media error situations and in isolating such errors into hardware or media related areas.

  DSF Analysis Function may be directed to test for hardware errors only or hardware and media errors. Simple result messages appear on the operator console. Detailed error related data are directed to SYSLST.

  DSF Analysis Function will only analyze errors associated with nonremovable media devices and requires that one of these devices be on the system.

Other Program Support: The *Program Product* section describes the Program Products supported under VSE, including language processors, sort/merge processors, utility programs and application programs. These Program Products, in addition to providing extended functional capabilities over any predecessor Type I or Type II programs, also provide support for new input and output devices. The specific devices supported are shown in the description of each program.

Type I and Type II processors that run under VSE are listed in those sections. In determining the applicability of these programs to a customer's needs particular attention must be given to the availability of appropriate device support within the programs.

FD Macros and Utility for the 3735 (5747-AZ1): Form Description Macros and Utility Support for the 3735 is available as a separate program operable under VSE.

This SCP provides support for 3735 Programmable Buffered Terminal Users on VSE systems with BTAM. It assembles user-written Form Description Programs and prepares them for subsequent transmission to the 3735.

DOCUMENTATION
(available from Mechanicsburg)

IBM 3735 Programmable Buffered Terminal Concepts and Application (GA27-3043), *IBM 3735 Programmable Buffered Terminal Form Description Macro Instructions and Form Description Utility PLM* (GY30-3000), and *IBM 3735 Operator's Guide* (GA27-3061).

SCP PROGRAMMING SERVICES: Class 1 SCP.

5745-030 - DOS/VSE R3 with VSE/AF DISK OPERATING SYSTEM/VIRTUAL STORAGE EXTENDED, RELEASE 3 TOGETHER with VSE/ADVANCED FUNCTIONS

(For information on the Disk Operating System, Basic Operating System, or Tape Operating System, see the "P 360" pages of your sales manual).

PURPOSE

The Disk Operating System/Virtual Storage Extended, is a disk-resident system designed to provide operating system capabilities together with VSE/Advanced Functions for the 4381 Processors in S/370 mode and the 4331, 4341 and 4361 Processors in S/370 mode and ECPS:VSE mode, and the 3031 Single Processor in addition to any virtual storage S/370 processor from 370/115 through 370/158, and their attachable input/output devices. VSE requires the clock comparator and the CPU timer feature (standard on all S/370 mdls except 135 and 145, and also standard on 4300 Processors).

DOS/VSE together with VSE/Advanced functions is an operating system optimized to the function and performance needed by the small and intermediate users of 4300 Processors, the 3031 single Processor and the S/370. It gives the user the ability to multiprogram up to twelve jobstreams concurrently which generally include the interactive functions provided with VSE/ICCF, VSE/POWER spooling product, a real time subsystem, such as CICS/VS, a TP access method such as ACF/VTAM, one or two batch jobstreams, and an unscheduled work partition for quick turn-around jobs. The operating system supports most terminals and DASD devices. This gives the VSE user the capability to start out on a small model of either S/370 or the 4300 Processors and grow his system and workload up through the S/370 and/or 4300 Processor line, as his DP business needs increase.

DOS/VSE is classified as System Control Programming (SCP) for distribution, installation, and programming support purposes.

If the system operates on a S/370, 3031 Single Processor or on the 4300 Processors in S/370 mode, it runs in extended control (EC) mode only and uses the EC mode format of the program status word (PSW) and low-order storage locations from 0 to 511. Dynamic Address Translation (DAT) is used to provide virtual storage support. In ECPS:VSE mode of the 4331, 4341 and 4361 Processors, the new concept of relocating channels is exploited. The Program Event Recording (PER) Facility and Monitor Calling Facility are used to provide system debugging facilities (SDAIDS) for each model, S/370, 3031 Single Processor, and the 4300 Processors.

DESCRIPTION

This section describes the individual components from which the VSE Operating System is built. For a description of basic concepts and facilities of VSE see the *Introduction to the VSE System*, GC33-6108. To obtain more detailed information the reader should consult the appropriate IBM reference manuals.

SYSTEM CONCEPTS AND ORGANIZATION

Virtual Storage Support: Virtual storage is the address space available to the DOS/VSE system. It starts at storage address 0, and its total size is determined by user specification at supervisor assembly time.

SYSTEM COMPONENTS: The Disk Operating System/Virtual Storage Extended System Control Program together with VSE/Advanced Functions consists of the following components:

- Control and Service Programs:
  - Initial Program Load and Buffer Load
  - Supervisor
  - Job Control
  - Attention routines, Initiators, Terminators
  - Checkpoint/Restart
  - Linkage Editor
  - Librarian - Maintenance and Service
  - Display Operator Console Support
- The Assembler
- Data Management:
  - **Sequential Access Methods:**
  - IOCS and Device Independent I/O
  - Magnetic Tape IOCS
  - Sequential Disk IOCS
  - Paper Tape IOCS
  - Diskette IOCS
  - Magnetic Character Recognition IOCS
  - Optical Character Recognition IOCS
  - **Direct Access Methods:**
  - Direct Access Method
  - Indexed Sequential Access Method
- Utility Programs:
  - System Utility Programs
  - Utility Services
- Error Recovery:
  - Recovery Management Support and Recording
  - Environmental Recording and Editing Program
  - Tape Error Recovery Procedures
  - Disk Error Recovery Procedures
- Diagnostic Aids:
  - Online Test Executive Program
  - Problem Determination and System Debugging Aids
- DASD Service Utilities
  - Device Support Facilities (DSF)
- TP Line Service Utility
  - Line Trace Utility

The following sections describe each of these components in more detail.

Control and Service Programs: The control and service programs form the central part of the Disk Operating System/Virtual Storage Extended. The three control programs are initial program load, the supervisor, and job control; the two service programs are the linkage editor and the librarian. The functions of these five programs are outlined in the following paragraphs; details are in the *VSE/Advanced Functions System Management Guide* (SC33-6094).

Initial Program Load (IPL) initializes the system for execution by loading the supervisor into the real address area. At this time, a predefined automatic system initialization is involved, or the system operator has to specify the I/O devices and to create the page data set. Job Control is then loaded into the virtual address area associated with the background partition, and control is passed to it.

The Supervisor provides resident and transient control functions for use by all other system and user programs. Supervisor assembly macro instructions allow the user to create an individual supervisor tailored to the needs of his own system. The assembly options he may select include:

- The maximum number of partitions to be supported.
- The maximum number of physical devices to be supported.
- The number of symbolic logical units to be supported.
- Rotational Position Sensing support.
- Fast Channel Command Word Translation.
- Cross-Partition Event Control.
- Support of 4331, 4341 and 4361 Processors when running in ECPS:VSE mode.
- Support of S/370 machines or 4300 Processors when running in S/370 mode.

This list is not exhaustive.

Specification of any of these or of any of the other available options will increase the processor storage requirement of the supervisor above the minimum requirements tabled below. Details of storage requirements of each individual option are in the *VSE/Advanced Functions System Generation* (SC33-6096) .

Minimum Supervisor:

All models of S/370: 112K, 24K thereof can be made pageable.

4331, 4341, 4361 or 4381 Processors:

–S/370 mode: 112K, 24K thereof can be made pageable.

–ECPS:VS mode: 106K, 26K thereof can be made pageable.

Note: From these supervisor sizes approximately 18K can be subtracted if part of the supervisor is made pageable at IPL time.

Installation improvement facilities are provided in DOS/VSE to ease:

- System generation.
- VSE installation.
- Transition to production system.

Support Capabilities include:

- Pre-compiled I/O modules.
- Pre-linked system components for immediate use.
- System generation in a virtual partition.
- Coded samples.
- PTFs pre-applied.
- Automated merge of libraries.
- UCS-buffer load modules for 1403-N1.

HIGHLIGHTS

Support of Processors

DOS/VSE R3 with VSE/Advanced Functions (cont'd)

Support of the 4300 Processors in S/370 mode and ECPS:VSE mode: VSE supports both modes of operation, the S/370 mode and the ECPS:VSE mode of the 4331, 4341 and 4361 Processors including each model's RAS requirements. (4381 Processors are supported only in S/370 mode.) The new concept of the 4300 Processors running in ECPS:VSE mode (virtual addresses in channel programs) is exploited by the Supervisor. The scanning of channel programs can be avoided completely by using the IORB interface. Via this interface the user and IBM components can communicate to the Supervisor the pages to be fixed, thus reducing supervisor overhead. The Assembler supports the 4300 Processors privileged hardware instructions.

S/370 Support: DOS/VSE continues to support all S/370 Processors supported under previous DOS/VS releases, and also provides full support for the 3031 Single Processor.

New Support

Device Support Facilities: Initializes direct access storage device (DASD) volumes for use with the Disk Operating System, inspects DASD volumes for defective tracks or blocks previously flagged as defective, and analyzes the operational status of supported Fixed Block Architecture (FBA) and Count Key Data (CKD) DASD and their data and control paths. These functions aid the user in determining whether an error situation is drive or media related so the appropriate recovery actions can be initiated. The functions provided by this SCP product are necessary for proper initialization, surface maintenance, and error recovery of supported FBA and CKD DASD.

Device Support Facilities provides an enhanced alternative to those similar functions provided in the following DOS/VSE utilities: Initialize Disk, Surface Analysis, and Assign Alternate Block. For the IBM 3340, 3344, 3350 and 3375 Device Support Facilities utilizes the skip displacement bytes in an attempt to recover a defective track before assigning an alternate. The DOS/VSE system version of Device Support Facilities is separately orderable via 5747-DS2 and includes the Stand-alone version which requires the operating system to dump a Stand-alone IPL tape

4331 Communications Adapter Trace Facility: A line trace utility for the 4331 integrated communication adapter has been included.

Note: The Fast Copy Utility will not be included in DOS/VSE or VSE/Advanced Functions. Its functions have been enhanced and included in the VSE/Fast Copy Data Set Program (5746-AM4)

Other Highlights

- Three supervisors are provided in the Core Image Library, one for S/370 or 4300 Processors in S/370 mode and DOC = 3277, one for S/370 and DOC = 125D, and one for the 4331, 4341 and 4361 Processors in ECPS:VSE mode. Their source code (including JCL) is contained in the A sublibrary of the Source Statement Library.
- Pre-assembled versions of all I/O modules required for RPG II and PL/I Optimizer are provided in the Relocatable Library.
- Pre-Compiled I/O modules

Job Control provides job initiation and job-to-job transition facilities for all partitions on the basis of control statements read from the system console (SYSLOG) or from the system reader (SYSRDR) for the partition in question. The supervisor loads job control into a virtual partition whenever the previous job in that partition comes to an end, or, if the partition is not in active use, on request from the system operator. Job control is always executed in virtual mode; it may initiate execution of jobs in either virtual or real mode dependent on user specification.

The control statements that make up the job control language allow the user to: name the program phase or phases to be executed ... select either virtual or real mode for their execution ... specify the quantity of virtual or real storage required ... specify the physical devices to be used ... specify the file labels of program files ... call a catalogued procedure from the procedure library ... overwrite statements within a catalogued procedure ... exercise general control functions over program execution.

Operator commands allow the system operator to intervene in the process if it is necessary to modify control statements to meet abnormal conditions in the operating environment.

Attention Routines, Initiators, Terminators - The Initiators allow the operator to communicate with the system through the Attention Routines. Terminator routines provide the support for program termination: under program control; through operator action; a program error; or certain I/O failures.

Checkpoint/Restart - The progress of a program that performs considerable processing in one job step can be protected against destruction in case the program is canceled. The checkpoint facility makes it possible to preserve information at regular intervals and in sufficient quantity to allow restarting a program at an intermediate point.

The Linkage Editor links and relocates separate program sections (relocatable modules) read from the system link device (SYSLNK) or from system or private relocatable libraries or from any combination of these three, creating executable object program phases which are then stored in the core image library selected by the user. If action REL has been specified, the linkage editor will form object program phases which can later be loaded for execution from any set of real or virtual storage locations. If action NOREL has been specified, object program phases will be absolute and must be executed from the storage locations to which they have been link-edited unless they have been written in such a way as to make them self-relocating. A program may be link-edited for execution in the virtual or real part of any partition regardless of the partition in which the linkage editor itself is executed.

The Librarian provides maintenance and service functions for all system and private libraries. The librarian is a collection of programs which allow the user to catalog, delete, rename, display, output, copy, condense, and reallocate the contents of libraries and to create and use new private libraries. System libraries may only be modified by programs executed in the background partition. Details of these restrictions are given in the *VSE/Advanced Functions System Management Guide (SC33-6094)*.

The control and service programs use the system logical units shown in the following lists. The types of physical device that may be assigned to each specific logical unit are shown individually, and summarized in the table at the end of this section.

The 3344 Disk Storage may be used where the 3340 is specified. Consideration should be given to the effect of locating multiple logical volumes on one physical spindle.

The system as a whole requires one of each of the following system logical units:

- **SYSRES** - The System Residence is the direct access storage device on which the operator has mounted the volume containing the system residence extent. The following physical devices may be used: 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1, -2, -11 Disk Storage ... 3333-1, -11 Disk Storage ... 3340/3350/3375/ 3310 and 3370 Disk Storage.
- **SYSLOG** - The System Log is the system console used for system and operator communication. It is normally assigned to one of the following physical devices: 3210 Console Printer-Keyboard ... 3215 Console Printer-Keyboard ... the Display Console for the mdl 138 with or without the 3286 printer mdl 2 ... the Display Console for the mdl 148 with or without the 3286 printer mdl 2 ... the Display Console for the mdl 158 with or without the 3213 Console Printer ... the display operator console for the mdl 115 or 125 with or without the 5213 Console Printer mdl 1 ... the 3278 Display Console mdl 2A for the 4300 Processors with or without the 3268 (4341 only) or 3287 Printer ... the 3277 Display Station in conjunction with the 3284, 3286, 3287, 3288 console printers (locally attached via 3272 Control Unit). To obtain more detailed information, consult the appropriate IBM reference manuals.

  Should the console printer-keyboard become inoperable, SYSLOG may be assigned to one of the following printers: 1403 Printer ... 1443 Printer ... 3203 Printer ... 3211 Printer ... 3262 Printer ... 3289 Printer ... 3800 Printing Subsystem ... 4245 Printer ... 5203-3 Printer.

  Such a printer assignment allows system operation to continue though with restricted operator-to-system communication.
- **SYSREC** - The System Recorder is the direct access storage device on which the operator has mounted the volume which is to contain records output by the Recovery Management Support Recorder. The following physical devices may be used: 2311 Disk Storage Drive ... 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11 Disk Storage ... 3333-1 Disk Storage ... 3340/3344/3350/3375/3310 and 3370 Disk Storage.
- **SYSCAT** - The System Catalog is the direct access storage device on which the operator has mounted the volume containing the VSAM file catalog. The following physical devices may be used: 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11 Disk Storage ... 3333-1 Disk Storage .... 3340/3344/3350/3375/3310 and 3370 Disk Storage ... 3540 Diskette I/O Unit.

  Note: Assignment of the System Catalog is not required if the Virtual Storage Access Method is not used.

The system may also require the following system logical unit:

- **SYSDMP** - The SYSDMP device is the destination of system-wide dumps that are to be analyzed using VSE/IPCS. SYSDMP is assigned at IPL time. SYSDMP may be assigned to any of the following devices: 2314 Direct Access Storage Facility, 2319 Direct Access Storage Facility, 3330-1,-2,-11 Disk Storage, 3333-1 Disk Storage, 3340/3344/3350/3375 Disk Storage, 3310 and 3370 Disk Storage.

Each partition requires one of each of the following logical units:

- **SYSRDR** - The System Reader is the source of control statement input for the job control program. Each partition requires the

DOS/VSE R3 with VSE/Advanced Functions (cont'd)

assignment of a separate physical device as System Reader except when the assignment is made to a direct access storage device; in this case, separate System Reader extents may occupy the same direct access storage volume. System Readers may be assigned to any of the following devices: 1442 Card Read Punch ... 2501 Card Reader ... 2520 Card Read Punch ... 2540 Card Read Punch ... 2560 Multifunction Card Machine ... 3504 Card Reader ... 3505 Card Reader ... 3525 Card Punch (with Read Feature) ... 3540 Diskette Input/Output Unit (mdl 2 can be assigned to two partitions) ... 5425 Multifunction Card Unit ... 5424 Multifunction Card Unit ... 2400-Series Magnetic Tape Units ... 3400-Series Magnetic Tape Units ... 8809 Magnetic Tape Units ... 2311 Disk Storage Drive ... 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11/3333-1/3340/3344/3350/3375/3310 and 3370 Disk Storage.

- **SYSIPT** - The System Input Device is the source of all system input other than that for the job control program. Each partition requires the assignment of a separate physical device as the System Input Device except when the assignment is made to a direct access storage device; in this case, separate System Input extents may occupy the same direct access storage volume. System Input Devices may be assigned to any of the physical devices listed under SYSRDR above.

  Within any one partition SYSRDR and SYSIPT may be assigned to the same physical device or to separate physical devices in accordance with user requirements.

- **SYSLST** - The System List Device is the destination of print lines or print line images output by the system. Each partition requires the assignment of a separate physical device as the System List Device except when the assignment is made to a direct access storage device; in this case, separate System List extents may occupy the same direct access storage volume. System List Devices may be assigned to any of the following physical devices: 1403 Printer ... 1443 Printer ... 3203 Printer ... 3211 Printer ... 3262 Printer mdl 1 or 11 ... 3262 Printer mdl 5 ... 3289 Printer mdl 4 ... 3800 Printing Subsystem ... 4245 Printer ... 5203 Printer ... 2400-Series Magnetic Tape Units ... 3400-Series Magnetic Tape Units ... 8809 Magnetic Tape Units ... 2311 Disk Storage Drive ... 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11 Disk Storage ... 3333-1 Disk Storage ... 3340/3344/3350/3375/3310 and 3370 Disk Storage ... 3540 Diskette I/O Unit.

- **SYSPCH** - The System Punch Device is the destination of all cards or card images output by the system. Each partition requires the assignment of a separate physical device as the System Punch Device except when the assignment is made to a direct access storage device; in this case, separate System Punch extents may occupy the same direct access storage volume. System Punch Devices may be assigned to any of the following physical devices: 1442 Card Read Punch ... 2520 Card Read Punch ... 2540 Card Read Punch ... 2560 Multifunction Card Machine ... 3525 Card Punch ... 5425 Multifunction Card Unit ... 5424 Multifunction Card Unit ... 2400-Series Magnetic Tape Units ... 3400-Series Magnetic Tape Units ... 8809 Magnetic Tape Units ... 2311 Disk Storage Drive ... 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11 Disk Storage ... 3333-1 Disk Storage ... 3340/3344/3350/3375/3310 and 3370 Disk Storage ... 3540 Diskette I/O Unit.

  Within any one partition SYSLST and SYSPCH may be assigned to the same physical magnetic tape unit.

The number of unit record devices required to operate the system in the multiprogramming environment can be greatly reduced by use of the VSE/POWER licensed program.

Each partition may also require one or more of the following system logical units in order to perform particular control and service functions:

- **SYSLNK** - A System Link Device is a direct access storage device used to store input for the linkage editor program. It may be assigned to any of the following physical devices: 2311 Disk Storage Drive ... 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11 Disk Storage ... 3333-1 Disk Storage ... 3340/3344/3350/3375/3310 and 3370 Disk Storage

- **SYSCLB** - A Core Image Library Device is a direct access storage device on which the operator has mounted a volume containing a private core image library.

- **SYSRLB** - A Relocatable Library Device is a direct access storage device on which the operator has mounted a volume containing a private relocatable library. It must be assigned to the same type of direct access storage device as SYSRES.

- **SYSSLB** - A Source Statement Library Device is a direct access storage device on which the operator has mounted a volume containing a private source statement library. It must be assigned to the same type of direct access storage device as SYSRES.

Display Operator Console Support provides the functions to operate and control the mdls 115, 125, 138, 148, 158, 3031, 4331, 4341, 4361 and 4381. Operator input entered through the alphameric keyboard and messages from system and problem programs are displayed on the screen of the cathode ray tube. System messages requiring operator reply or action will stay on the screen until the reply is received by the system. A hard copy record of the sequential activity on the video display is available and may be printed on the optional Console Printer via a utility.

Permissible Device Assignments for the System Logical Units

Logical Unit	SYSRDR SYSIPT	SYSLST	SYSPCH	SYSLOG	SYSCLB SYSRLB SYSSLB SYSDMP SYSCAT	SYSREC SYSLNK
Model 115 DOC				X		
Model 125 DOC				X		
Device Type						
1403		X		X		
1442	X		X			
1443		X		X		
2501	X					
2520	X		X			
2560	X		X			
3203		X		X		
2540	X		X			
3210				X		
3211		X		X		
3213				X		
3215				X		
3262-1,11		X		X		
3262-5		X		X		
4245		X		X		
3800		X		X		
3504/3505	X					
3525	X		X			
3540	X	X	X			
2400-series	X	X	X			
3400-series	X	X	X			
2311	X	X	X			
2314	X	X	X		X	X
2319	X	X	X		X	X
3330-1,-2,-11 3333-1,-11	X	X	X		X	X
3340/3344/ 3350/3375	X	X	X		X	X
3203		X		X		
5425	X		X			
5424	X		X			
3289-4		X		X		
3203-5		X		X		
3278-2A				X		
8809-1A	X	X	X			
3310	X	X	X		X	X
3370	X	X	X		X	X

The Assembler: The Assembler is a programming tool for the implementation of programs written in S/370 and 4300 Processors Assembler Language. Assembler language gives the user access to machine and operating system functions and permits obtaining the best balance between storage utilization and speed of program execution. However, a problem solution expressed in Assembler language normally requires more coding effort than a solution to the same problem expressed in a higher level language.

The major features of the Assembler include:

Macro instructions, which provide the programmer with a powerful programming tool. Use of the system macro instructions provides access to all of the capabilities of VSE. Use of programmer-defined macro instructions can simplify the programming of particular applications and makes possible the definition of special-purpose languages.

Conditional assembly statements are used to alter the sequence in which statements are processed or to specify the selective assembly of sets of instructions. The conditional assembly feature is a key element of the macro feature.

Private libraries may be used to contain both Assembler language statements to be inserted into programs by means of COPY statements, and macro instruction definitions for use by the macro processor.

The hardware instructions of the 4300 Processor are supported. SETC symbols may be assigned to character strings of up to 255 characters. Unreferenced labels may be suppressed in the assembler listing using the new option SXREF.

DOS/VSE R3 with VSE/Advanced Functions (cont'd)

The Assembler uses the S/370 Standard Instruction Set, and requires for execution a minimum partition size of 20K; it may be executed either in virtual or in real mode.

The Assembler reads source program input from SYSIPT and directs its output to SYSLST, SYSPCH, and SYSLNK, dependent on the user options in force. Library input may also be read from SYSSLB. All of these logical units may be assigned to any of the physical devices already indicated for the control and service programs. The Assembler further requires direct access storage space for three work files which may reside in VSE/VSAM managed space. Any of the following physical devices may be used for this purpose:

2311 Disk Storage Drive
2314 Direct Access Storage Facility
2319 Disk Storage
3330-1,-2,-11/3333-1,-11 Disk Storage
3340 Disk Storage
3344 Disk Storage
3350 Disk Storage
3375 Direct Access Storage
3310 Disk Storage
3370 Disk Storage

Data Management: The data management facilities of VSE are divided into two parts: the physical input/output control system (physical IOCS); and the logical input/output control system (logical IOCS). The user invokes the services of the IOCS routines by use of macro instructions.

The EXCP (execute channel program) and WAIT macro instructions of physical IOCS allow the user to handle input and output devices in a direct way by writing his own channel programs; it is usually more convenient for him however to use the macro instructions of logical IOCS, either using GET and PUT macro instructions to handle logical data records or using READ and WRITE macro instructions to handle physical data blocks. OPEN and CLOSE macro instructions perform the functions of creating, checking, and updating file labels for input and output files; the CNTRL macro instruction performs specific device-dependent control functions such as stacker selection, printer carriage movement, and magnetic tape positioning.

The individual component routines of logical IOCS are classified under three headings: the Sequential Access Method (SAM), the Direct Access Method (DAM) and the Indexed Sequential Access Method (ISAM).

When RPS is specified during System generation

- SAM and DAM will automatically include Rotational Position Sensing for 3330-1,-2,-11, 3333-1,-11, 3340, 3344, 3350 and 3375 Disk Storage.

  ISAM will automatically include Rotational Position Sensing for 3330-1, 2, 3333-1, 3340, 3344, and 3350 (in 3330-1 Compatibility Mode) Disk Storage.

Note: RPS is not applicable for the 3310 or 3370 Disk Storage.

Sequential Access Method - SAM

The Sequential Access Method (SAM) enables files to be defined and accessed in a sequential manner beginning with the first logical record of the file and continuing in sequence till the last logical record of the file is reached. The components of the Sequential Access Method are described in the following paragraphs.

Basic Sequential IOCS provides support for definition, creation, and processing of files associated with unit record devices and the system console. The DTFCD macro instruction is used to define a punched card file; the DTFPR macro instruction is used to define a printer file; the DTFCN macro instruction is used to define a system console file.

By means of GET or PUT macro instructions, records are obtained or created starting with the first record of the logical file and continuing to the last record. Logical records are considered to be unblocked and may be of either fixed or variable length within the limits of the unit record medium to which they relate. Input and output operations may be overlapped with instruction processing by specification of two data areas for use by IOCS. Either the CNTRL macro instruction or first data character control may be used to effect any stacker selection or printer forms carriage movement required.

Basic Sequential IOCS supports the following devices:

1442 Card Read Punch
2501 Card Reader
2520 Card Read Punch
2540 Card Read Punch
2560 Multifunction Card Machine
2596 Card Read Punch
3504/3505 Card Reader
3525 Card Punch
5425 Multifunction Card Unit
5424 Multifunction Card Unit
1403 Printer
1443 Printer
3203 Printer
3211 Printer
4245 Printer
3262 Line Printer mdl 1 or 11
3262 Line Printer mdl 5
3289 Line Printer mdl 4
3800 Printing Subsystem
3881 Optical Mark Reader
3210 Console Printer-Keyboard
3215 Console Printer-Keyboard
The display operator console for the mdl 115 or 125 with or without the 5213 Console Printer mdl 1.
The display console for the mdls 138 or 148 with or without the 3284, 3286, 3287 and 3288 Console Printers.
The display console for the mdl 158 with or without the 3213 Console Printer.
The display console of 4300 with or without the 3268 or 3287 Console Printer.

Device-Independent IOCS provides support for definition, creation, and processing of files associated with the system input and output logical units. The IOCS is used with the card readers, card punches, and printers that act as system input and output units, and enables magnetic tape or direct access storage to be substituted for such devices at execution time without the need for program modification. The DTFDI macro instruction is used to define a device-independent file.

By means of GET or PUT macro instructions records are obtained or created starting with the first logical record of the file and continuing to the last record. Logical records are unblocked and of fixed length within the constraints of the unit record medium to which they may relate. First data character control must be used to specify any stacker selection or printer forms carriage movement required.

Device-Independent IOCS supports the following physical devices:

1442 Card Read Punch
2501 Card Reader
2520 Card Read Punch
2540 Card Read Punch
2560 Multifunction Card Machine
3504/3505 Card Reader
3525 Card Punch
5425 Multifunction Card Unit
5424 Multifunction Card Unit
1403 Printer
1443 Printer
3203 Printer
3211 Printer
3262 Line Printer mdl 5
3289 Line Printer mdl 4
3800 Printing Subsystem
3540 Diskette I/O Unit
4245 Printer
5203 Printer

Any of the following physical devices may be substituted for these devices at execution time:

2400-series Magnetic Tape Units
3400-series Magnetic Tape Units
8809 - Magnetic Tape Units
2311 Disk Storage Drive
2314 Direct Access Storage Facility
2319 Disk Storage
3330-1,-2,-11/3333-1,-11 Disk Storage
3340 Disk Storage
3344 Disk Storage
3350 Disk Storage
3375 Direct Access Storage
3310 Disk Storage
3370 Disk Storage

Sequential Tape IOCS provides support for definition, creation, and processing of input and output files recorded on magnetic tape. The DTFMT macro instruction is used to define a magnetic tape file.

By means of GET or PUT macro instructions magnetic tape records are obtained or created starting with the first logical record of the file and continuing to the last record. Logical records may be either blocked or unblocked and may be of either fixed or variable length. Necessary blocking and deblocking of logical records is performed by the IOCS. Logical records, blocked or unblocked, may span multiple physical records. Input and output operations may be overlapped with instruction processing by the specification of two data areas for use by IOCS. The data within a file may be encoded either in EBCDIC or in ASCII. The CNTRL macro instruction enables the user to specify such control operations as forward space, backspace, rewind, and unload; the user may position magnetic tapes in accordance with the needs of the program.

DOS/VSE R3 with VSE/Advanced Functions (cont'd)

Sequential Tape IOCS also provides support for definition creation and processing of magnetic tape work files; that is, files which serve as output and as input within the same program. In this case READ or WRITE macro instructions are used to obtain or create physical blocks; any necessary blocking or deblocking of logical records within physical blocks is the responsibility of the user. He may also issue the NOTE and the various POINT macro instructions to reposition magnetic tapes in accordance with the needs of his program.

Sequential Tape IOCS supports the following physical devices:

2400-series Magnetic Tape Units
3400-series Magnetic Tape Units
8809 - Magnetic Tape Units

Sequential Disk IOCS provides support for definition, creation, and processing of input and output files recorded on direct access storage devices. The DTFSD macro instruction is used to define a direct access storage file.

By means of GET or PUT macro instructions direct access records are obtained or created starting with the first logical record of the file and continuing to the last record. Logical records may be either blocked or unblocked and may be of either fixed or variable length. Necessary blocking and deblocking of logical records is performed by the IOCS. Logical records, blocked or unblocked, may span multiple physical records. Input and output operations may be overlapped with instruction processing by the specification of two data areas for use by IOCS.

Sequential Disk IOCS also provides support for definition, creation, and processing of direct access storage work files; that is, files which serve as output and as input within the same program. In this case READ or WRITE macro instructions are used to obtain or create physical blocks; any necessary blocking or deblocking of logical records within physical blocks is the responsibility of the user. Users may also issue the NOTE and the various POINT macro instructions to logically reposition the file in accordance with the needs of their program.

Sequential Disk IOCS supports the following physical devices:

2311 Disk Storage Drive
2314 Direct Access Storage Facility
2319 Disk Storage
3330-1,-2,-11/3333-1,-11 Disk Storage
3340 Disk Storage
3344 Disk Storage
3350 Disk Storage
3375 Direct Access Storage
3310 Disk Storage
3370 Disk Storage

Sequential Diskette IOCS provides support for definition, creation and processing of input and output files recorded on IBM diskettes. The DTFDU macro instruction is used to define a diskette file.

By means of GET or PUT macro instructions, diskette records are obtained or created starting with the first logical record of the file and continuing to the last record. Logical records are fixed length and unblocked, but may be grouped together in the user's I/O AREA(s) for performance reasons through IOCS use of command chaining.

Sequential Diskette IOCS supports the following physical device:

3540 Diskette Input/Output Unit

Sequential Paper Tape IOCS provides support for definition, creation, and processing of input and output files recorded in punched paper tape. The DTFPT macro instruction is used to define a paper tape file.

By means of GET or PUT macro instructions paper tape records are obtained or created starting with the first logical record of the file and continuing to the last record. Logical records may be either of undefined format, in which case they must be terminated by the end-of-record character, or of fixed length and unblocked, in which case the end-of-record character must not be present. Input and output operations may be overlapped with instruction processing by the specification of two data areas for use by IOCS. Any necessary translation of codes may be performed under the control of user-specified translation tables.

Sequential Paper Tape IOCS supports the following physical devices:

1017 Paper Tape Reader
1018 Paper Tape Punch
2671 Paper Tape Reader

Magnetic Character Recognition IOCS provides support for definition and processing of the input files associated with the IBM magnetic character recognition readers and certain optical character readers. The DTFMR macro instruction is used to define such a file.

The external interrupt feature is used to provide automatic entry to a user-written stacker selection routine on a first priority basis regardless of the priority of the partition in which the routine resides. Following stacker selection, the IOCS enables the user to access documents sequentially, process the data, and exercise control of non-MCR and non-OCR input and output devices. This normal processing (as opposed to stacker selection processing) takes the dispatching priority of the partition in which the problem program is executed.

Engage, disengage, stacker selection, and document reading functions are invoked by the use of macro instructions. A buffer is maintained for each MCR device to provide the problem program with continuous input data. GET macro instructions are used when a single reader is attached to the system; READ CHECK, and WAIT F macro instructions are used when the system is servicing a number of readers.

The supervisor and logical IOCS can support a maximum of six character readers which may operate in any combination in any or all partitions. The maximum number that may be effectively operated is application and configuration dependent. Refer to the appropriate MICR publications listed in the latest IBM S/370 bibliography for a more complete description of device timings.

Magnetic Character Recognition IOCS supports the following physical devices:

1255 Magnetic Character Reader
1259 Magnetic Character Reader
1419 Magnetic Character Reader

Note: Programs utilizing the Magnetic Character Recognition IOCS are highly time-dependent and should be executed in real mode only.

Optical Character Recognition IOCS provides support for definition and processing of input files associated with certain IBM optical character readers. The DTFOR macro instruction is used to define such a file for the 1287, 1288, and the 3886.

The 3886 is supported with special document definition macros used in a separate assembly to create a format record. Format records are stored in the Core Image Library for access by user 3886 processing programs.

The IOCS is used to read printed paper tapes or journal rolls such as those produced on cash registers and accounting machines. The IOCS is also used to read printed and hand-printed data and optical mark-read data from cut-form documents such as sales checks, utility stubs, and customer orders.

Optical Character Recognition support can be used in a multiprogramming environment. Factors affecting performance include the following:

Processor model.
Number of readers (a maximum of eight are supported).
Characteristics of tapes and documents.
Batch or multiprogramming environment.
Blocking of input data on printed paper tapes.
User programming.

In addition throughput is dependent upon operator loading and unloading time. This handling time is significant when processing short printed paper tape rolls.

Optical Character Recognition IOCS supports operations on the following physicaldevices:

1287 Optical Reader
1288 Optical Page Reader
3886 Optical Character Reader (mdl 1)

Direct Access Method - DAM: The Direct Access Method (DAM) enables files to be defined on direct access storage volumes with any form of organization and access that the user may require. The records making up the file may be of fixed or variable length and may or may not contain key fields. All records are regarded as being unblocked; any necessary blocking or deblocking of logical records within physical records is the responsibility of the user. The DTFDA macro instruction is used to define a direct access file.

READ and WRITE macro instructions are used to retrieve and store physical records on the basis of information supplied by the user; such information may be either actual disk addresses or relative addresses within the file. Furthermore the address may be that of the actual record required or may indicate the point within the file at which a search for the required record is to begin. The Direct Access Method allows the use of spanned records such that each record retrieved or stored spans multiple physical records. When this is the case, the physical segments making up the record are stored contiguously within the file.

The Direct Access Method supports the following physical devices:

2311 Disk Storage Drive
2314 Direct Access Storage Facility
2319 Disk Storage
3330-1,-2,-11/3333-1,-11 Disk Storage
3340 Disk Storage
3344 Disk Storage
3350 Disk Storage
3375 Direct Access Storage

Note: 3310 and 3370 are not supported.

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Indexed Sequential Access Method - ISAM: The Indexed Sequential Access Method (ISAM) enables files to be defined on direct access storage volumes in such a way that records making up the file may be processed either in sequential order or in random order according to the needs of the accessing program. Logical records must be of fixed length, but may be blocked or unblocked; necessary blocking and deblocking of logical records is performed by the IOCS. Records can be added within the file without the necessity for sorting, recopying, or merging. Records may also be updated as required. The DTFIS macro instruction is used to define an indexed sequential file.

GET and PUT macro instructions are used to process the file in sequential order, the user supplying control information for the *first record* to be processed. READ and WRITE macro instructions are used to process the file in random order, the user supplying control information for *each* record to be processed.

Optional features of the Indexed Sequential Access Method allow the user to speed up program execution in exchange for increased main storage requirements.

The Indexed Sequential Access Method supports the following physical devices:

2311 Disk Storage Drive
2314 Direct Access Storage Facility
2319 Disk Storage
3330-1,-2/3333-1 Disk Storage
3340 Disk Storage
3344 Disk Storage
3350 Disk Storage in 3330 mdl 1 Compatibility Mode.

Note: 3330-11, 3333-11 and 3350 in native mode are not supported, and 3310 and 3370 are not supported. 3375 is not supported.

DEVICE SUPPORT CHART

1017 Paper Tape Reader mdls 1, 2
1017 Paper Tape Reader mdls 1, 2
1018 Paper Tape Punch
1255 Magnetic Character Reader mdls 1, 2, 3
1259 Magnetic Character Reader mdl 2
1270 Optical Character Reader mdls 1, 2, 3, 4
1275 Optical Character Reader mdls 2, 4
1287 Optical Reader mdls 1, 2, 3, 4, 5
1288 Optical Page Reader
1403 Printer mdls 2, 3, 7, N1
1419 Magnetic Character Reader mdl 1
1442 Card Read Punch mdl N1
1442 Card Punch mdl N2
1443 Printer mdl N1
2311 Disk Storage Drive mdl 1
2314 Disk Storage - A Series
  2312 Disk Storage mdl A1
  2313 Disk Storage mdl A1
  2314 Storage Control mdl A1
  2318 Disk Storage mdl A1
2314 Disk Storage - B Series
  2314 Storage Control mdl B1
  2319 Disk Storage mdl B1, B2
2319 Disk Storage - A Series
  2319 Disk Storage mdl A1, A2, A3
2401 Magnetic Tape Unit mdls 1 to 6, 8
2415 Magnetic Tape Unit and Control mdls 1 to 6
2420 Magnetic Tape Unit mdls 5, 7
2501 Card Reader mdls B1, B2
2520 Card Read Punch mdls B1
2520 Card Punch mdls B2, B3
2540 Card Read Punch
2560 Multifunction Card Machine
2596 Card Read Punch
2671 Paper Tape Reader
2803 Tape Control mdls 1, 2, 3
2804 Tape Control mdls 1, 2, 3
2816 Switching Unit
2821 Control Unit mdls 1, 2, 3, 5, 6
2822 Paper Tape Reader Control
2826 Paper Tape Control
2841 Storage Control
3203 Printer mdls 1, 2
3203 Printer mdl 4
3203 Printer mdl 5
3210 Console Printer-Keyboard mdl 1, 2
3211 Printer
3213 Console Printer mdl 1
3215 Console Printer-Keyboard
3230 Printer mdl 2
3232 Printer-Keyboard mdl 11
3262 Line Printer mdl 1, 5, 11
3268 Printer mdl 2
3278 Display Console mdl 2, 2A
3279 Color Display Console mdl 2A, 2C
3284 Printer mdls 1, 2
3286 Printer mdls 1, 2
3287 Printer mdls 1, 2
3288 Printer mdl 2
3289 Printer mdls 01, 02, 04
3310 Direct Access Storage Device
3330 Disk Storage mdls 1, 2 and 11
3333 Disk Storage and Control mdls 1 and 11
3340 Direct Access Storage Facility mdl A2, B1, B2
3344 Disk Storage
3345 Storage and Control Frame mdls 3, 4, 5
3350 Direct Access Storage and Control mdls A2, A2F, B2, B2F, C2, C2F
3370 Direct Access Storage
3375 Direct Access Storage
3410 Magnetic Tape Unit mdls 1, 2, 3
3411 Magnetic Tape Unit and Control mdls 1, 2, 3
3420 Magnetic Tape Unit mdls 3, 4, 5, 6, 7, 8
3430 Magnetic Tape and Control (as a 3411)
3430 Magnetic Tape (as a 3410)
3504 Card Reader mdls A1, A2
3505 Card Reader mdls B1, B2
3525 Card Punch mdls P1, P2, P3
3540 Diskette I/O Unit mdls B1, B2
3800 Printing Subsystem
3803 Tape Control mdl 1, 2, 3
3811 Printer Control Unit
3830 Storage Control mdl 2
3880 Storage Control
3881 Optical Mark Reader
3886 Optical Character Reader mdl 1
3895 Document Reader/Inscriber
4245 Line Printer
5203 Printer mdl 3
5213 Printer mdl 1
5424 Multifunction Card Unit
5425 Multifunction Card Unit mdls A1, A2
8809 Magnetic Tape Unit mdls 1A, 2, 3

Telecommunications Support: Support of telecommunications devices is provided under DOS/VSE by three access methods:

- The Virtual Telecommunications Access Method (ACF/VTAM) with the Network Control Program (ACF/NCP) supporting the SNA/SDLC, the BSC and the S/S environment.
- The Virtual Telecommunications Access Method Entry (ACF/VTAME) in support of SNA-SDLC and BSC communication adapters and various channel attached devices, BSC support is for nonswitched 3270 only.
- The Basic Telecommunication Access Method (BTAM-ES) for BSC and S/S support.

For further information on telecommunication device support refer to the respective sales manual pages.

System Utility Programs: The system utility programs maintain system control data at a system or organizational level. Except where specifically noted, support is provided for utility functions concerning the following physical devices:

2400-series Magnetic Tape Units
3400-series Magnetic Tape Units
8809 - Magnetic Tape Unit
2311 Disk Storage Drive
2314 Direct Access Storage Facility
2319 Disk Storage
3330/3333 Disk Storage
3340 Disk Storage
3344 Disk Storage
3350 Disk Storage
3375 Direct Access Storage
3310 Disk Storage
3370 Disk Storage
3540 Diskette I/O Unit.

Additional system devices may be required for program execution; these may be assigned to any of the appropriate physical devices already listed under the heading *Control and Service Programs.*

The following are the utility functions provided:

Device Support Facilities: Initializes direct access storage device (DASD) volumes for use with the Disk Operating System, inspects DASD volumes for defective tracks or blocks previously flagged as defective, and analyzes the operational status of supported Fixed Block Architecture (FBA) and Count Key Data (CKD) DASD and their data and control paths. These functions aid the user in determining whether an error situation is drive or media related so the appropriate recovery actions can be initiated. The functions provided by this SCP product are necessary for proper initialization, surface maintenance, and error recovery of supported FBA and CKD DASD.

Device Support Facilities provides an enhanced alternative to those similar functions provided in the following DOS/VSE utilities: Initialize Disk, Surface Analysis, and Assign Alternate Block. For the IBM 3340,

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3344, 3350, and 3375, Device Support Facilities utilizes the skip displacement bytes in an attempt to recover a defective track before assigning an alternate. The DOS/VSE system version of Device Support Facilities is separately orderable via 5747-DS2 and includes the Stand-alone version which requires the operating system to dump a Stand-alone IPL tape.

Initialize Magnetic Tape - The program initializes up to sixteen tape volumes. For each volume the program creates from one to eight volume labels as required, one dummy header label, and a tape mark. The program may be used to initialize either EBCDIC tapes with IBM Standard Volume Labels or ASCII tapes with ANSI Standard Volume Labels.

Initialize Disk - The program initializes CKD disk packs for further use by VSE. The DSF initialization procedure consists of VTOC label checking, home address generation, volume label creation, track descriptor (R0) record generation, and IPL and VTOC creation. 2311, 2314 and 2319 disk packs may be initialized with or without a test for defective tracks (surface analysis); however surface analysis should be included when a volume is initialized for the first time.

The initialize disk program initiates FBA disks for further use by VSE. The initialization procedure consists of VTOC label checking, volume label creation IPL, and VTOC creation and an optional clearing of all data fields.

Assign Alternate Track - Disk - The DSF program assigns an alternate track to a defective track on a CKD disk. The alternate tracks may be assigned either unconditionally or conditionally based upon the result of a surface analysis of the track.

Clear Disk - The program clears one or more areas of CKD disk and preformats tracks containing an indicated base value throughout the area cleared.

VTOC Display - The program displays the labels contained in the Volume Table of Contents of a disk volume, in alphabetical order. The labels are identified by their location within the Volume Table of Contents and their format, type, and major fields are indicated by appropriate heading lines in the printed output. A list of free space is also provided.

Copy and Restore Diskette - Support is provided to: Recovery data from a diskette on which the label information (on track zero) cannot be read ... Copy one 3540 diskette to another 3540 diskette. During this copy, error sectors and deleted records are eliminated. The utility can be used in a single or multiple 3540 configuration.

Backup and Restore System Utility Programs

The programs allow fast backup of system and/or private libraries to tape with subsequent restore to disk. When the libraries are restored to disk, they are automatically condensed and may be reallocated to different sizes or to different DASD types. The restore program will accept the PID tape as input and allocate the libraries either as specified within the control statements, or in response to a prompting request.

Copy File and Maintain Object Modules (OBJMAINT) Utility: This program is a multipurpose utility providing the following functions:

- File-to-file copy with blocking and deblocking of data sets with record size 80 or 81 bytes on tape, card, disk or diskette
- update and expansion of object modules
- Comprehensive data set listing capability with record size 80 or 81 bytes

Other Utility Programs: Assign Alternate Block: The program assigns an alternate block to a defective block of a fixed block mode device (conditionally or unconditionally). It copies data from the defective to the alternate block, replaces the contents of a specified block by data supplied as input to the utility, or lists/punches the contents of a specified block.

Surface Analysis (fixed block mode): The program performs surface analysis of complete fixed block mode disk packs. Defective blocks may be reclaimed.

Format Emulator Extent: The program formats a specific extent on a fixed block mode disk in order to prepare for later emulation of a 2311 or 2314 disk on the native fixed block mode disk.

Printer Train Cleaning: The program is used by the operator to clean the printer train of a printer.

Device Support Facilities - Stand-alone: Initializes direct access storage device (DASD) volumes for use with the Disk Operating System, inspects DASD volumes for defective tracks or blocks, conditionally reclaims tracks or blocks previously flagged as defective, and analyzes the operational status of supported Fixed Block Architecture (FBA) and Count Key Data (CKD) DASD and their data and control paths. These functions aid the user in determining whether an error situation is drive or media related so the appropriate recovery actions can be initiated. For the IBM 3340, 3344, 3350, and 3375, Device Support Facilities utilizes the skip displacement bytes in an attempt to recover a defective track before assigning an alternate. Device Support Facilities Stand-alone is shipped as part of the system version or may be ordered separately via 5747-DS1. The version shipped with the system version requires the operating system to dump a Stand-alone IPL tape.

MSHP (Maintain System History Program) is the new maintenance program with the following improvement over the DOS/VS Release 34 PTFHIST program:

- Creation of a history file: A history file is created at each system installation where MSHP is used for system maintenance. The history file can be personalized with the user's name, address, etc.
- Installation of DLIBs, components and/or features: The MSHP installs DLIBs, new components and/or features. The technical status of these new programs is recorded in the history file. Safeguards against down-levelling the system are provided when installing features. The MSHP support includes "tapeless" users.
- Preventive Service Application: MSHP provides the function set for application of preventive service packages. Recording of applied PTFs is automatically done in the User History File.
- PTF Application: MSHP applies PTFs from cumulative PTF files or as single PTFs. Recording is done automatically; backout facilities are provided.
- History File List: When listing the history file, the entries may be sorted by PTF, by APAR, by module name, by component and by feature. MSHP produces a quick history file list with a cross reference to the items above.
- History Search: Using SYSLOG, MSHP informs the user about an APAR, PTF, or status of a module.
- History File Maintenance: Miscellaneous functions are provided in order to maintain the history file.
- Preprocessor: Generates MSHP jobs for:
  - Listing of Program Update Tape (PUT) documentation.
  - Application of corrective and preventive service.

COPYSERV: The program allows for automated merge of existing system and private libraries on CKD devices into newly created libraries, eliminating the manual effort of comparing directory listings and preparing the required copy cards thus reducing significantly the time required to prepare the new release for production status.

Recovery Management Support and Recording: Recovery Management Support (RMS) and Recovery Management Support Recording (RMSR) are standard functions under VSE with the following exception:

- For mdls 115 and 125, recovery management support is a supervisor assembly option.

The functions of RMS and RMSR are described below:

Recovery Management Support - The Recovery Management Routines attempt to recover from or otherwise reduce the impact of machine malfunctions indicated by machine check and channel check interruptions. They feature:

Transparent recovery after successful retry including error statistics collection.

Continuation if the error is unrecoverable but the affected job or task can be terminated.

Comprehensive error recording to support deferred maintenance.

Recovery Management Support Recording - RMSR collects and records on direct access storage (SYSREC) statistical and event data on matching errors. This recorded data facilitates early warning, rapid diagnosis, and repair of failing components, providing greater system availability due to improved preventive maintenance and shorter duration of planned and unplanned maintenance.

The error recording file on direct access storage can be totally or selectively edited and printed or transferred to magnetic tape for later editing and printing by the Environmental Recording, Editing and Printing (EREP) Program. A number of functional enhancements have been made to this program including integration of the recording, editing, and printing of ESTV records.

Tape and Disk Error Recovery Procedures - Routines that analyze error type and type of device in error and pass control to the proper ERP in an attempt to recover or to the ERP message writer in case of hard errors.

Diagnostic Aids: VSE provides a number of system tools and facilities to help to allocate responsibility for program repair. These include:

- The Online Test Executive Program (OLTEP) which allows execution of machine diagnostic programs in the real storage allocated to any partition of a multiprogramming environment at the same time as other system and user programs are executed in foreground partitions. OLTEP can be executed in real mode only.
- System Debugging Aids (SDAID) which includes the functions of the program formerly named PDAID) allows the tracing of the following events as they occur during program execution: Fetching

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and loading of program phases (Fetch/Load Trace) ... Input and output activity (I/O Trace) ... Supervisor Calls (SVC Trace) ... Program checks in transient areas (Transient Dump) ... Certain VTAM events ... VTAM Buffer Pool Trace.

It uses the Program Event Recording Facility and Monitor Calling Facility of S/370 to provide additional stop and dump facilities and the following additional trace facilities: Page Trace ... Instruction Trace ... Alter Main Storage Trace ... Alter General Register Trace ... Successful Branch Trace ... Channel Program Trace.

- The program DOSVSDMP offers a facility for generating a stand-alone dump tailored to the installation's requirements; e.g., medium for IPL and for output of stand-alone dump. DOSVSDMP also provides a facility for printing (formatted if desired) the stand-alone dump, the system dump and the output of the DUMP command.
- The PDZAP program which allows quick applying of ZAP fixes to phases and transients in the Core Image Libraries without requiring a reassembly and recataloging of the changed phase or transient.
- The Label Cylinder Display Program (LSERV) which produces a formatted listing of the file label information contained on the tracks of the label cylinder of the system residence extent.
- The Main Storage Alter Command (ALTER) which allows the system operator to change the contents of up to 16 bytes of virtual or real storage from the system console starting from a specified address.
- The Main Storage Dump Command (DUMP) which allows the system operator to obtain a dump of the contents of storage on a printer, tape or disk device.
- DSF Analysis Function which aids the operator in analyzing nonremovable media error situations and in isolating such errors into hardware or media related areas.

  DSF Analysis Function may be directed to test for hardware errors only or hardware and media errors. Simple result messages appear on the operator console. Detailed error related data are directed to SYSLST.

  DSF Analysis Function will only analyze errors associated with nonremovable media devices and requires that one of these devices be on the system.

Other Program Support: The *Program Product* section describes the Program Products supported under VSE, including language processors, sort/merge processors, utility programs and application programs. These Program Products, in addition to providing extended functional capabilities over any predecessor Type I or Type II programs, also provide support for new input and output devices. The specific devices supported are shown in the description of each program.

Type I and Type II processors that run under VSE are listed in those sections. In determining the applicability of these programs to a customer's needs particular attention must be given to the availability of appropriate device support within the programs.

FD Macros and Utility for the 3735 (5747-AZ1): Form Description Macros and Utility Support for the 3735 is available as a separate program operable under VSE.

This SCP provides support for 3735 Programmable Buffered Terminal Users on VSE systems with BTAM. It assembles user-written Form Description Programs and prepares them for subsequent transmission to the 3735.

DOCUMENTATION
(available from Mechanicsburg)

IBM 3735 Programmable Buffered Terminal Concepts and Application (GA27-3043), *IBM 3735 Programmable Buffered Terminal Form Description Macro Instructions and Form Description Utility PLM* (GY30-3000), and *IBM 3735 Operator's Guide* (GA27-3061).

SCP PROGRAMMING SERVICES: Class 1 SCP.

DEVICE SUPPORT FACILITIES - STANDALONE
5747-DS1

DESCRIPTION

Initializes count-key-data (CKD) or fixed block architecture (FBA) direct access storage device (DASD) volumes fo operating system use, inspects DASD volumes for defective tracks or blocks, conditionally reclaims tracks or blocks previously flagged as defective, and analyzes the operational status of supported FBA and CKD DASD and their data and control paths. These functions aid the user in determining whether an error situation is drive or media related so that the appropriate recovery actions can be initiated. For the IBM 3340, 3344, 3350, 3375 and 3380, Device Support Facilities utilizes the skip displacement bytes in an attempt to recover a defective track before assigning an alternate.

Device Support Facilities Standalone is designed to run on any System/370; IBM 303X UP, AP, MP; 3081 (370 mode only); or IBM 4300 Processor with a minimum of 332K bytes of available real storage for all supported DASD except the 3375 and 3380 Disk Storage Devices. For the 3375 and3380, 384K bytes of available real storage is required. The Standalone version can run on a System/370 Model 125 only if the 1050 emulation feature is active. On the System/370 Model 168, the 3066 console is not supported.

Device Support Facilities Standalone is shipped as part of the system versions for MVS, VS1, or DOS/VSE, or may be ordered separately via 5747-DS1.

VIRTUAL MACHINE FACILITY VM/370 (5749-010)

PURPOSE

Virtual Machine Facility/370, a multiple-access system for S/370 mdls 135, 135-3, 138, 145, 145-3, 148, 155II, 158, 158AP, 165II, 168, 168AP, the 3031, 3031AP, 3032, 3033, 4321, 4331, 4341 and 4361 Processors contains four major elements: [1] A control program, CP, which controls the resources of the real computer to provide multiple virtual machines. Each virtual machine can run a different operating system such as OS (/VS), DOS (/VS), CMS, and RSCS and can provide virtual storage support for operating systems that do not offer such support, [2] The Conversational Monitor System, CMS, a component that gives users a wide range of conversational facilities including creation and management of files and compilation, testing, and execution of problem programs, [3] The Remote Spooling Communications Subsystem, RSCS, a component that enables users to transmit files to and receive files from remote stations in the RSCS teleprocessing network, [4] The Interactive Problem Control System, IPCS, a component that enhances the support of VM/370 by providing interactive online facilities for problem management, problem determination and problem isolation. VM/370 also supports the S/370 mdls 158AP, 168AP, 3031AP and 3033AP. S/370 mdls 158MP, 168MP, 4321, 4331 and 4341 are also supported but only when running in uniprocessor mode or with an asymmetric I/O configuration. In an asymmetric I/O configuration, all I/O attached to the system must be attached to one processor. Operation of VM/SP on a 4321 processor is recommended in a VM/CMS-only environment.

DESCRIPTION

THE VIRTUAL MACHINE:

The control program (CP) of VM/370 manages the resources of a S/370 to provide virtual storage support through the implementation of virtual machines.

Each virtual machine user appears to have the functional capabilities of a dedicated S/370 available. The remote terminal acts as the virtual systems console for the virtual machine. Other users may be running batch, teleprocessing, testing or timesharing jobs at the same time.

Each user can specify the configuration required: the number, type and I/O addresses of all devices to be used, and from 8192 bytes to 16 million bytes of storage, provided sufficient resources are available with the real machine's configuration.

Virtual devices, excepting virtual channel-to-channel adapters, must have real counterparts. For example, many users' virtual readers, punches and printers can be "mapped" or redirected onto common spool disks. VM/370 allows a physical disk pack to be logically subdivided into many separate minidisks, or virtual disks, each with its own virtual I/O address and each encompassing a user-determined number of contiguous cylinders. The use of virtual disks significantly expands the number of different users or operating systems that can have concurrent access to direct access storage devices, and may improve the utilization of available disk space without compromising the integrity of any user's data stored on the disk.

Each user's virtual computer comprises a processor operator's console (the user's remote terminal), a virtual Processor with or without Dynamic Address Translation, a virtual storage size ranging from 8192 bytes to 16 million bytes, and virtual I/O channels and I/O devices. Virtual machine configurations may also include transmission control units and channel-to-channel adapters. Virtual I/O devices are logically controlled by the virtual machine's operating system and not by VM/370, with the exception of those virtual unit-record devices that are spooled by VM/370 to/from disk. The basic device support for the proper number and type of I/O devices must be generated into the operating system's supervisor or nucleus.

The following operating systems can execute in VM/370 virtual machines: DOS, DOS/VS, OS/PCP, OS/MFT, OS/MVT, OS/VS1, OS/VS2, OS-TSO, OS-ASP, PS44, RSCS, APL/DOS-360 (with CP option), VM/370 and CMS. The control program intercepts, translates and schedules all real I/O operations of the virtual machine. All virtual machines execute in problem state, and the control program intercepts and processes all interrupts and privileged instructions. Only the control program executes in the supervisor state.

The user can select various versions and levels of IBM operating systems, including OS/VS, DOS/VS, OS and DOS, to run in the virtual machine, subject to the following major restrictions:

- Machine or program timing dependencies may not exist. (That is, there is no reliance on a certain action or activity being completed within a fixed interval of time.)
- The **DIAGNOSE** instruction may not be used for machine control by an operating system running in a VM/370 virtual machine. Use of the **DIAGNOSE** instruction for communication with VM/370 is permitted and recommended. See *VM/370: System Programmer's Guide* (GC20-1807).
- The **READ DIRECT** and **WRITE DIRECT** instructions may not be used in a VM/370 virtual machine.
- No dynamic modification of channel programs is permitted except within a virtual = real machine or when performed by either the OS Indexed Sequential Access Method (ISAM), OS/VS1 BTAM Autopoll, or the OS/VS Telecommunications Access Method (TCAM) Level 5 and above. (A dynamically modified channel program is one that is changed by the processor or the channel during the interval between the execution of the **START I/O** instruction and the channel end interrupt.)
- VM/370 supports OS/VS TCAM Level 5 and above in a virtual environment. This support is intended for use by TCAM applications in a testing environment and is not recommended for production systems. When attempting to identify problems which are encountered when using TCAM under VM/370, it may be advantageous to recreate the problem in a standalone OS/VS1 or OS/VS2 environment.
- DOS Emulation under OS in a virtual machine is not supported. VM/370 provides its own method of running DOS and OS systems concurrently.
- OS/VS2 must run in uniprocessor mode.

For a comprehensive list of restrictions, see the *IBM Virtual Machine Facility/370: Planning and System Generation Guide* (GC20-1801).

THE CONTROL PROGRAM:

The control program (CP) of VM/370 creates and controls virtual machines, multiprogramming the resources of the real computer to offer concurrent execution of multiple virtual machines. Local and remote terminals on the real computing system are controlled either by CP as virtual system consoles or by a multiple-access operating system executing in a virtual machine (e.g., RSCS).

All virtual machines execute in problem state, providing the basic mechanism for control by permitting either CP or the Virtual Machine Assist hardware feature to trap and process all interrupts and privileged instructions. Extended Control-Program Support for VM/370 is an expansion of Virtual Machine Assist to further reduce the real supervisor state time used by VM/370 while performing its control functions. The reduction in VM/370 supervisor state time is accomplished in three ways. 1) Certain privileged instructions are emulated by the hardware rather than simulated by the software. 2) A hardware assist has been implemented for VM/370 that is designed to be executed only by VM/370. 3) Extended Control-Program Support for VM/370 also includes support of an interval timer in a virtual machine. The heavily used portions of CP are kept in main storage. All portions of CP execute in supervisor state with Dynamic Address Translation off.

Execution under VM/370 does not require communication between CP and the virtual machine operating system since, subject to the restrictions listed above, the virtual machine interface is that of the real machine. Communication is available however through use of the Diagnose interface: CMS utilizes the **DIAGNOSE** instruction for many operations including I/O operations; and VS1 Release 4 and above utilizes it to support VM/VS Handshaking.

Time Management: CP periodically gives each virtual machine access to the real processor for a small amount of time, called a "time slice". To determine how frequently and for how much time a virtual machine should gain access to the real processor, CP examines the number of console requests or terminal interrupts the virtual machine has issued during its past time slices. If these were many, CP defines the virtual machine as a conversational user and assigns it the smaller of two possible time slices. If they were few, the virtual machine is considered a nonconversational user and is assigned the larger time slice. CP gives conversational users more frequent access to the processor, and the major objective of its algorithms is to provide interactive users with the best possible response times.

Storage Management: Each virtual machine's storage is created and controlled by CP as virtual storage and is organized into 4K blocks called pages and 64K blocks called segments. For each virtual machine, CP creates and maintains a set of segment and page tables to describe the virtual storage and to reflect the allocation in real storage. In addition CP creates a set of shadow page tables for each virtual machine that creates and controls virtual storage of its own.

The active pages from all logged-on virtual machines and from the pageable routines of CP compete for available page frames. When the number of page frames available for allocation falls below a threshold value, CP determines which virtual storage pages currently allocated to real storage are relatively inactive and initiates suitable page-out operations to disk for them. Paging is done on demand, thus a page-in operation does not occur until a page is referenced during virtual machine execution.

One or more virtual storage segments can be read-shared among virtual machines. The information to be shared must be part of an operating system (e.g., CMS) that does not create or control virtual storage and that has been recorded ("saved") in page-format on a VM/370 system disk. These segments can be outside the address spaces of the virtual machines.

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Virtual I/O Management: Because virtual machines execute in problem state, CP gains control whenever a **START I/O** instruction is issued by a virtual machine operating system. CP copies into its own work area the channel command list and pages into real storage all virtual storage locations required for data transfer. If a virtual device is a minidisk, any cylinder numbers specified are modified to reflect the true location of the data; the virtual device address is mapped to the real device address. The virtual machine is given a suitable condition code to indicate the status of the START I/O operation, and CP reflects the interrupts caused by the I/O operation to the virtual machine enabling it to initiate any required error recovery operations.

Since a virtual disk device (full disk or minidisk) may be shared among multiple virtual machines and a particular virtual machine may have read-only or read/write access to a shared disk, CP verifies each virtual machine I/O operation against parameters in the virtual machine's configuration to ensure device integrity.

Spooling: CP spooling facilites allow multiple virtual machines to share unit record devices by intercepting and modifying the Start I/O operations to those virtual unit record devices designated as spooled in the virtual machine configuration. CP uses its paging I/O mechanism to create the disk records which act as intermediate storage between the real unit record devices and the virtual machines.

The spooling facilities allow data files to be transferred between virtual machines or between different operating systems executing at different times in the same virtual machine. In addition, virtual machine console input/output data may be spooled to disk for later printing.

CP Commands: CP commands allow control of the real computing system and VM/370 and provide user control of virtual machines and associated CP facilities. CP commands can be used at any time without regard to which operating system is executing in the virtual machine. A user's privilege class(es), defined as part of his virtual machine configuration, defines his allowable subset of CP commands.

THE CONVERSATIONAL MONITOR SYSTEM:

A generalized conversational facility for interactive program development, problem solving and end-user applications is offered by the Conversational Monitor System (CMS) component of VM/370.

The CMS command language provides each user with a wide range of capabilities at his remote terminal, such as:

- Creating source programs, data and text files directly on disk.
- Adding, deleting, modifying, rearranging, extracting or merging files and/or portions of files.
- Compiling, testing and debugging some types of OS, DOS problem programs under CMS. These tasks can also be performed for CMS problem programs as well. Languages supported under CMS include the latest levels of COBOL, PL/I, FORTRAN, BASIC, APL and Assembler.
- Creating complete job streams to be passed to batch operating systems such as DOS or OS for compilation and/or execution. The resultant output can be printed on a high-speed printer or directed back to CMS for analysis and correction by the user.
- Submitting high-resource jobs to a background CMS Batch Facility for serial execution.
- Extending CMS facilities to suit his own requirements, e.g., creating additional commands from his own programs or developing command procedures as CMS EXEC files.

CMS allows a programmer to increase his productivity by reducing or eliminating requirements for JCL preparation and by permitting the user to assemble and test whenever he wants, as often as he desires, and for as long as he needs, provided that sufficient I/O devices are available. A programmer can concentrate his efforts on one project at a time, completing projects faster, and putting applications into productive use sooner. The VM/370 data security and user-isolation features protect other users from his errors, and, likewise, protect his data, programs, and disk files from access or destruction by others.

CMS is a single task system designed specifically for the virtual machine environment of VM/370. Each CMS user executes in his own virtual machine. User programs and CMS commands executing under CMS communicate with the user via I/O to the virtual operator's console. Programs coded using CMS macros or certain OS or DOS macros will execute under CMS with restrictions in the following major areas:

ISAM
Multitasking
TP access methods
Overlay program structures
Other I/O-related restrictions

For more detailed information about the execution-time restrictions of assembler language programs under CMS, refer to the publication *IBM VM/370: System Programmer's Guide* (GC20-1807). Refer to the section *IBM Program Product Support for VM/370* for additional information on the Compiler Program Products supported under CMS.

The CMS file system utilizes chained, fixed-length blocks that are allocated and deallocated automatically as required by the logical file size. Programs executing under CMS can read and write these CMS files via CMS I/O macros, OS BSAM, QSAM or BDAM macros, or DOS sequential I/O macros. CMS files are identified by a three part designator consisting of filename, filetype and filemode; filename and filetype are self-explanatory, and filemode describes the location and access mode of the file. CMS files may be read and written only by programs executing under CMS.

CMS offers the capability of reading, but not writing or updating, OS sequential and partitioned data sets using the CMS **MOVEFILE** command and OS QSAM, BPAM, and BSAM macros. Under CMS, users can also read DOS SAM data files using the same commands and macros used for reading OS data sets as well as the DOS sequential I/O macros. To provide data portability and compatibility between CMS, OS and DOS, CMS supports read, update and write access to VSAM data sets from COBOL, PL/I, and VS BASIC programs.

VM/370 ASSEMBLER:

The language of the VM/370 Assembler is the same as the language of the OS/VS Assembler. Four system macro libraries are distributed and contain CMS macros as well as OS Release 20.6 macros. The language of the DOS/VS Assembler is a subset of the language supported by the VM/370 Assembler. Assembler language programs written using DOS/VS macro instructions may be processed by the VM/370 Assembler if the user-installation has created a CMS library containing a copy of the DOS/VS macros found in the DOS/VS source statement library. However, no option is available to flag uses of the extended features of the language which are supported by the VM/370 Assembler but not by the DOS/VS Assembler.

REMOTE SPOOLING COMMUNICATIONS SUBSYSTEM - RSCS:

VM/370 remote spooling support is provided for the general user in the form of the Remote Spooling Communications Subsystem (RSCS) component. RSCS, using the existing VM/370 spool file system, allows spooling of data between any virtual machine and 2770, 2780, 3770 (except 3777-2) as a 2770; 3776 and 3777-1 also as a 3780, and 3780 terminals as well as 8100/DPPX running DPPX/RJE (BSC) or 8100/DPPX/SP running DPPX/SP/RJE (BSC) and HASP supported workstations and main processors running HASP, ASP, RES, JES2 and JES3.

RSCS is a multitasking supervisor supporting multiple, concurrent remote spooling operations while running in a single VM/370 virtual machine. It is designed so that a separate task supports the specific device characteristics of each remote terminal or workstation attached to the virtual machine via a teleprocessing line. The RSCS supervisor provides each task with a common access method to the VM/370 spool file system and an Execute Channel Program (EXCP) level interface for I/O to the teleprocessing line.

Printer or punch files that the VM/370 virtual machine user wants to have transmitted to a supported remote device need only be spooled to the RSCS virtual machine with the destination designated via the CP **TAG** command. The proper task for the remote device will be initiated and the files will be sent. For files being transmitted from the remote device to a virtual machine, RSCS will read data from the remote device, produce VM/370 spool files from the data and spool the files to the virtual machine designated by the user; these files will remain in the virtual machine's card reader until disposed of by the user.

RSCS supported remote stations are of two general types; *nonprogrammable* and *programmable.* Support is provided for both types of stations.

Non-Programmable Terminal Support: This task under RSCS provides support for the 2770, 2780, 3770 (except 3773-2 and 3773P Models) as a 2770; (3776/3777-1 also as a 3780), and 3780 terminals via the 3704/3705 Communications Controller in emulation mode only, via the 2701 Transmission Control Units, via the Integrated Communications Adapter available on the 135, 135-3, 138, or, for the 2770, 2780 and 3780 terminals, via the 2703 Transmission Control unit.

Programmable Terminal Support: Any processor now supported as a HASP workstation when programmed to run as a HASP workstation is supported as a workstation by the Spool MULTI-LEAVING (SML) support under RSCS. The DOS/VS Remote Job Entry Workstation Program (PRPQ WF0358) is also supported. Any processor running HASP, ASP, RES, JES2, and JES3 is supported as a main processor by RSCS when it itself assumes the role of a HASP programmable workstation. For specific configurations supported, refer to the HASP pages.

RSCS offers these advantages:

- A multitasking supervisor designed to facilitate transmission of data to and from VM/370 systems.
- Common support for the 2770, 2780, 3770 (except 3777-2) as a 2770; 3776/3777-1 also as a 3780 and 3780.
- Access to main processors running HASP, ASP, RES, JES2 and JES3.

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- Access to HASP Programmable Workstations.
- Access to System/34 with SSP (MRJE).
- Access to System/36 with SSP (MSRJE) or "and MSRJE".
- Access to 8100/DPPX with DPPX/RJE (BSC) or 8100/DPPX/SP with DPPX/SP/RJE (BSC).
- Multiple telecommunications workstation lines supported by one RSCS virtual machine for remote data transmission.
- Common command language for all data control functions.
- Command language compatible with the VM/370 system operator's spool file control commands.
- Entry of a subset of the control commands from the remote station.
- RSCS access security provided by password validation by the tasks of remote stations before data transmission begins.

INTERACTIVE PROBLEM CONTROL SYSTEM - IPCS:

VM/370 IPCS support is intended for use by systems programmers and IBM Program Support Representatives (PSRs).

IPCS is intended to reduce the time expended in managing and resolving programming problems and to reduce the necessity of doing problem management, problem determination and problem isolation using hardcopy documentation.

The problem management facilities provide individual disk resident problem reports and includes commands that allow viewing and updating of a disk resident problem status file. These facilities allow both the system programmer and the PSR to manage problems from their occurrence through their resolution.

Problem determination facilities standardize the problem reporting process, identify previous occurrences of the same problem on that system and allow faster and more specific identification with similar problems previously experienced by the entire VM/370 customer base. Duplicate problem recognition: 1) reduces the amount of unnecessary hardcopy documentation and 2) allows faster identification of available fixes that can be applied to the system.

Online problem isolation facilities provide the capability to view and diagnose disk resident problem related data; e.g., CP abend dumps without the use of hardcopy documentation. This allows the system programmer or PSR to interactively diagnose a CP abend dump from a VM/370 supported terminal to determine the need to output the dump in hardcopy.

VM/370 teleprocessing support allows the use of IPCS by support personnel located remotely from the customer's location. There is the dependency upon the availability of the necessary teleprocessing facilities on the customer's system and at the remote location.

VM/370 architecture provides the facilities necessary to restrict data access to any given user of the system including a PSR using IPCS facilities. It is the customer's responsibility to determine what data the system needs for protection. In allowing the PSR to work in an online environment, the system programmer using standard VM/370 facilities can control the PSR's access to only the necessary and pertinent data files associated with the problem being diagnosed.

VM/370 HIGHLIGHTS

- Provides virtual machine and virtual storage capabilities for S/370.
- Offers a general-purpose, conversational timesharing system suitable for problem solving, program development and end-user applications.
- Allows many types of batch problem-solving applications to be run from a remote terminal with no change to the batch program.
- Allows DOS/VS, OS/VS1 and OS/VS2 virtual machines, as well as those running DOS or OS, to run concurrently on the same S/370. Where your customer has specific throughput or terminal response requirements, you should plan to benchmark VM/370 to ensure that any proposed configuration will meet the customer's performance needs.
- Allows multiple copies of the same operating system to run concurrently in different virtual machines, eliminating the need for DOS customers for example, to multitask unrelated jobs together in the same partition and permitting the use of specialized virtual machine systems.
- Allows system generation, system update and system testing, as well as operating system conversion and testing activities concurrent with other work.
- Provides a high degree of security, isolation and integrity for each user's operating system, programs and data. Restricts a user's capability to access or alter any portion(s) of other users' virtual machines.
- Provides disk "password" protection to limit authorized access to users' disks; and "read only" disk protection to minimize the possibility of destruction of information or to allow shared reading of disk files.
- Provides device address independence for all operating systems that run under the control of VM/370.
- Provides facilities which supplement the reliability, availability and serviceability (RAS) characteristics of the S/370 architecture.
- Allows operating systems which do not themselves support the Dynamic Address Translation facility to use virtual storage as though it were real storage.
- Provides the ability to subdivide physical disk packs into virtual disks, each with its own virtual I/O device address, disk label, Volume Table of Contents (VTOC) and a user-specified number of contiguous cylinders starting with virtual cylinder zero.
- Allows one or more users to test privileged code in their own virtual machines.
- Allows new computer operators to get "hands on" experience using a remote terminal and their own virtual machines.
- Permits shared use by all virtual machines of the 2770, 2780, 3770 (except 3777-2) (as a 2770; 3776/3777 also as a 3780), and 3780 terminals for remote printing, punching and card reading.
- Supports communication with other Processors running HASP, ASP, JES2, JES3, RES, the DOS/VS RJE PRPQ, DPPX/RJE, DPPX/SP/RJE and VM/370.
- Provides the full capabilities of the 3270 to users of VS APL through support of the 3270 Data analysis APL Feature. VS APL support of the Feature aids in the interchange of APL terminal procedures and applications among APL and 3270 users by providing a consistent terminal protocol across these applications.
- Provides options to improve the performance of selected virtual machines.
- Provides support for a virtual and/or real channel to channel adapter. VM/370 can run on either or both of two processors coupled by a real channel-to-channel adapter. Support of the virtual channel to channel adapter allows the user to run control programs designed to operate on directly coupled systems under VM/370.
- Allows the use of virtual machines for backup of programs currently being run on other S/360 or S/370 computers having equivalent devices but differing I/O addresses and storage size.
- Provides the potential for programmers to increase productivity through use of the Conversational Monitor System.
- Eliminates the need for JCL (Job Control Language) preparation in most cases when compiling, assembling and/or testing in CMS.
- Simplifies the creation and manipulation of source programs on disk, and allows the user to examine selected portions of program listings and storage dumps at his remote terminal.
- Allows any user to set up frequently used sequences of commands into special procedures to eliminate the repetitious re-keying of those command sequences.
- Allows the spooling of virtual machine console input and output, including CP commands and responses.
- Allows the use of one or more dedicated channels by any number of virtual machines depending on the total number of real channels available on the system. VM/370 must have at least one selector or block multiplexer channel for use by paging, spooling and VM/370 system residence devices. I/O devices attached to a dedicated channel can be accessed only by the virtual machine to which the channel is dedicated.

RELEASE 6 HIGHLIGHTS:

VM/370 Support for the 3033 Attached Processor: Support for the 3033 attached processor and channel-set switching is supported.

VM/370 Support for the 4321, 4331, 4341 and 4361 Processors: Support for the 4321, 4331, 4341 and 4361 Processors is provided in S/370 compatibility mode.

ECPS:VM/370 Assist is a performance option available in S/370 compatibility mode. The ECPS:VM/370 Assist and ECPS:VS1 Assist are mutually exclusive on the 4341 processor.

Support is also provided for the new 20 line Operator Display Console (3278 mdl 2A) in both display mode and printer/keyboard mode. In printer/keyboard mode, support for 3268 Printer mdl 2 (4341 only) or 3287 Printer mdls 1 and 2 is provided.

The Communications Adapter feature of the 4321 Processor and 4331 processor will be supported by Release 6. The SDLC line protocol of the Communications Adapter requires new programming support that is now available. This support allows a DOS/VSE guest virtual machine with ACF/VTAME active to operate in a VM/370 environment. The

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START/STOP and BSC line protocols do not require additional programming support.

Support of the 3800 Printing Subsystem: VM/370 supports the 3800 printing subsystem as follows:

- Use as a dedicated device.

  This support will allow a 3800 to be attached to a virtual machine for its exclusive use.

- Use as a VM/370 real spooling device.

  VM/370 real spooling device support is extended to include support of the 3800 printing subsystem. This support allows spool files normally directed for printing on a 1403, 3211 or 3203 printer to be printed on the 3800 printing subsystem.

  VM/370 3800 printing subsystem support provides an installation with the capability to specify the following options for each spool file:

  – Selection of one character arrangement table.
  – Graphic character modifications.
  – One forms control buffer.
  – Forms overlay (flashing).
  – Copy modifications.

  Additionally, thru delayed purging, VM/370 recovery procedures for spool files have been extended to be cognizant of the characteristics of the 3800 printing subsystem. Thus loss of spool files due to hardware malfunction is minimized.

VM/370 Support for the 3850 Mass Storage System is Extended: Virtual machines, including CMS, can access Mass Storage volumes containing VM/370 minidisks or entire Mass Storage Volumes dedicated to the virtual machine. These volumes appear to the virtual machine as 3330 volumes and are accessed using 3330 device support. Unit allocation, volume mounting and volume demounting are controlled by CP. Staging, initiated by access to a Mass Storage Volume, is normally in cylinder fault mode. Virtual Machines running OS/VS1 or MVS containing MSS support can also access Mass Storage Volumes using existing dedicated device support.

Communication with the Mass Storage Control component of MSS is achieved by installation of either OS/VS1 or MVS in a virtual machine. The VM/370 control program (CP) will initiate volume mounts and demounts via intersystem communication with an application program running under either OS/VS1 or MVS.

Support for the 3203 Printer Model 5: Support is provided for the channel attached 3203 printer mdl 5 as a dedicated device to a virtual machine and as a real spooling device to CP.

Additional Data Collection by VM/370 Measurement Facility: The VM/370 Measurement Facility (Monitor) has been enhanced to collect the following additional data:

- AP/UP utilization.
- Channel and device utilization.
- Storage utilization.
- Selective seeks.
- Alternate path statistics.

VM/370 Measurement Facility enhancements also include Monitor to Disk support for real time. This support will enable the system analyst to specify periodic closing of the active Monitor spool file with high enough frequency to support real time data reduction and display.

Journaling and Security Enhancements: Through the generation of unique accounting records, an installation may optionally track unsuccessful logon attempts as well as successful and unsucessful link attempts.

VM/370 security facilities have been enhanced by Release 6 with the support of forced password masking available for Link and Logon commands as an installation option.

Unprotected Shared Segments: With Release 6, an installation will have the option to run with shared segments unprotected. This support eliminates the overhead involved in scanning for changed shared pages in both AP and UP systems in switching page table pointers, and in maintaining duplicate copies of shared systems in an AP environment.

Elimination of Automatic UNSHARE Processing: VM/370 shared segment processing will be changed to eliminate the automatic UNSHARE process. With previous releases of VM/370 a shared page, once changed, was made private and given to the user. When an installation runs with protected shared segments, the user that modifies a page within a shared segment is sent a message informing him of the violation and the terminal is placed in console function mode. The changed page is returned to storage. The next reference to that page will cause a fresh copy to be brought into storage. When an installation runs with unprotected shared segments, any changes to those shared segments will not be detected by VM/370.

Trace Table Size as a System Generation Option: As of Release 6 an installation will have the option to override the default setting governing the size of the trace table by specifying the Trace Table size at system generation time. The size of the trace table can only be enlarged, not diminished beyond the default value.

Multiple Alternate Console System Generation Support: Support has been added to allow the specification of multiple alternate system consoles at system generation time. Only one alternate console specified can be active at any one point in time.

New CP Commands: A new CP command "SMSG", will be available with Release 6 that provides the general user with the ability to send a message to another virtual machine's storage. That virtual machine must be prepared to receive the message. This command may be issued by either a terminal user or a program running in a virtual machine.

A new CP command "VMDUMP", will be available with Release 6 that allows a virtual machine to initiate its own dumps. The output of this command is a reader spool file that can be sent from one virtual machine to another. This command may be issued by either a terminal user or a program running in a virtual machine.

RELEASE 5 HIGHLIGHTS:

Support of the 3033 Processors: VM/370 now supports the 3033 Processor. This support includes the following:

- Use of the channel attached consoles as primary system console and alternate console.
- Use of the new processor numbers to determine the duration of the time slice.
- Integrated channels.
- CPEREP changes to recognize and process logout formats of the new processor. EREP processing has been enhanced to allow EREP processing to be independent of the content and EC level of the extended logut areas of the 3033 Processor. This is accomplished by reading frames stored on the 7443 Service Recording File and using them to format and interpret error records.
- The CP error recording logic has been changed to allow recording on from two to nine cylinders, as specified by the user during system generation. Error record types are intermixed in the error recording area.

Release 5 does not contain virtual support for the S/370 Extended Facility on the 303X Processors or the S/370 Extended Feature on the 158/168 Processors.

Support of Channel Check Reflection: Support for the reflection of channel checks has been added in Release 5. This support includes reflection of channel control checks, interface control checks and channel data checks to virtual machines.

The support includes integrated channels on the 135, 135-3, 138, 145, 145-3, 148, 155-II, 158, 158-3, 3031, 3032 and 3033. It also includes support for the standalone 2860, 2870 and 2880 channels on the 165-II, 168 and 168-3 processors.

CMS Support of DOS/34: Release 5 contains support in CMS/DOS and CMS VSAM for new devices and new function introduced in DOS/VS Release 34.

- Support of 3330-11 native.
- Support of 3350 native.
- Increase page length flexibility when producing printed output from Access Method Services.
- Support of the 3203 Printer mdl 4 as a 3211 compatible printer.

  This support removes the restriction on use of the 3330-11 and 3350 with VSAM under CMS.

IPCS as a Basic Component: IPCS has been made a basic component of VM/370.

- Separate installation of IPCS is no longer required.
- As of Release 5, VM/370 will no longer include the VMFDUMP module DMKEDM. IPCS VMFDUMP is the improved functional replacement.

Monitor to Disk: This support provides the user with the option of recording output from the VM/370 Measurement Facility on disk. The previous support required the user to dedicate a tape drive to the Measurement Facility for those periods of time that the user wished to record performance data. The new support makes it more practical for the user to make frequent measurements. By doing so and by using the VM/370 Performance/Monitor Analysis Program FDP, the user can gain a better understanding of the operation of the system and its performance.

AP HIGHLIGHTS:

The VM/370 AP support provides for concurrent execution of work on the two processors of an Attached Processor System in the following states:

VM/370 (5749-010) (cont'd)

- Both processors can execute in the problem state concurrently.
- Either processor can execute in the supervisor state while the other processor executes in the problem state.
- In some instances both processors can execute in the supervisor state concurrently.
- Because of the system design, all I/O requests must be issued by the host processor and all I/O interrupts will be received on the host processor.
- The VM/370 AP support makes use of the Virtual Machine Assist feature (if present) on either or both instruction processors in an AP system.
- The VM/370 AP support will include automatic processor recovery. If the Attached Processor is unable to function because of hardware malfunctions, VM/370 will attempt to execute in uniprocessor mode on the host processor. Should the host processor experience hardware malfunction, VM/370 will terminate operation since no I/O capabilities exist on the Attached Processor.
- The VM/370 AP support makes use of AP hardware features including:
  - Shared Main Storage.
  - Prefixing.
  - Processor Signaling.
  - Processor Address.

HIGHLIGHTS OF RELEASE 4:

VM/370 Support for the 3850 Mass Storage System (MSS): The Mass Storage System (MSS) is a hierachical storage system that makes up to 472 billion bytes available online via 3330 devices. Access and storage are controlled by the 3850 Mass Storage System. The Mass Storage Control (MSC) accepts requests for Data from up to four S/370 processors. When data is no longer needed, it is moved to slower, less expensive storage medium, freeing the fast-access DASD space for current use.

VM/370 supports up to four dedicated paths for each 3850 MSS. VM/370 dedicated MSS support allows up to four virtual machines concurrently running VS1, SVS or MVS operating systems generated with 3850 MSS support to each control an interface to a common 3850 MSS. Each of the Mass Storage Control (MSC) connections can be attached to a different VM/370 virtual machine or a different processor. Each virtual machine using an MSC port reduces by one the number of other real processors that may be connected to the 3850 Mass Storage System. Other virtual machines not using the MSS can be run concurrently.

Alternate Path Support: VM/370 Alternate Path Support will provide for up to four channels on one control unit to be attached to VM/370 through the use of the Two Channel Switch and Two Channel Switch, Additional Features. Since one device may be attached to two real control units by use of the String Switch feature, eight paths to a given device are available to the control program when the maximum number of alternate channels and alternate control units are specified.

If the primary path to a device is busy when a I/O request is received for that device, VM/370 can select a free path, allowing for immediate I/O initiation on the available alternate path. When no available path exists for a device, the I/O request is queued off multiple busy/scheduled paths. When a path becomes available, the waiting I/O request is initiated on that path.

Virtual Reserve/Release Support: VM/370 will support Reserve/Release operation codes for shared DASD as though each virtual machine has a separate channel path to a shared device. The Reserve/Release operation codes will be simulated on a virtual basis for minidisks, including full extent minidisks.

Removal of Free Storage Abend when Adding Virtual Devices: VM/370 will no longer abend if a request for free storage cannot be obtained when virtual devices are being added to a user's configuration. Instead, an appropriate message will be issued.

Interactive Problem Control System (IPCS) Enhancements: Contained in Release 4 are enhancements to the IPCS VMFDUMP command and DUMPSCAN command.

Support of S/370 Models 158 and 168 Attached Processors: The VM/370 AP support will provide for concurrent execution of work on the two processors of an Attached Processor System in the following states:

- Both processors can execute in the problem state concurrently.
- Either processor can execute in the supervisor state while the other processor executes in the problem state.
- In some instances both processors can execute in the supervisor state concurrently.

Because of the system design, all I/O requests must be issued by the host processor and all I/O interrupts will be received on the host processor.

The VM/370 AP support makes use of the Virtual Machine Assist feature (if present) on either or both instruction processors in an AP system.

The VM/370 AP support will include automatic processor recovery. If the Attached Processor is unable to function because of hardware malfunctions, VM/370 will attempt to execute in uniprocessor mode on the host processor. Should the host processor experience hardware malfunction, VM/370 will terminate operation since no I/O capabilities exist on the Attached Processor.

The VM/370 AP support makes use of AP hardware features including:

- Shared Main Storage.
- Prefixing.
- Processor Signaling.
- Processor Address.

RELEASE 3 PLC 8 HIGHLIGHTS:

VM/370 support for the S/370 mdls 135-3, 138, 145-3 and 148 includes the standard feature of Extended Control Program Support (ECPS) which is available only on these models. This feature is an expansion of the current virtual machine assist. Extended Control Program Support is a hardware assist that reduces Processor time needed to execute certain frequently used VM/370 supervisor functions by as much as 55%. The performance improvement is in addition to that resulting from the improved internal instruction rate of the hardware and the current virtual machine assist. Extended Control Program Support will be used if a test performed during IPL shows it to be present and compatible, thus allowing a particular VM/370 system to be run on the newly supported models as well as on other models. Console support for the mdls 138 and 148 is provided in both display and printer/keyboard modes. The 3286 Printer mdl 2 support is provided in the printer/keyboard mode. The 3203 printer mdl 4, which is natively attached for the S/370 mdls 138 and 148, is also supported as a real or virtual device.

'SET AUTOPOLL ON' substantially reduces the overhead required by CP to service BTAM autopoll channel programs by bypassing the testing of the channel program and allowing notification to CP via a DIAGNOSE interface whenever an autopoll CCW has been modified. (Supported by OS/VS1 Release 6 only.)

VM/370 support of the 3270 Data Analysis/Text Keyboard includes:

- Extensions to the CP commands 'TERMINAL' and 'QUERY'.
- Access to 151 characters. Included is the 120 character TN, T11 character set plus 32 graphics, code and control characters, allowing new approaches to text applications.
- The COPY function to copy text characters from a screen to a 3284-2 or 3286-2 matrix printer (equipped with feature 1066 for hard copy printouts).

Support of many of the OS/VS2 EREP parameters allows the installation more flexible definition of the contents of the EREP output. Data from the error recording area can now be concatenated to data previously recorded on an output tape. Most of the original VM/370 operands have been replaced with their OS/VS2 equivalents due to conflict in meaning and usage between the original VM/370 operands and the OS/VS2 parameters. The HELP operand has been deleted.

The Virtual Machine Communication Facility allows virtual machines to communicate via a CP DIAGNOSE protocol. The support provides a number of functions that can be invoked by DIAGNOSE instructions to establish and control communications. These include authorization to establish communications, data transfer and signaling, and control functions. The interface is provided for use by user written programs executing in virtual machines.

HIGHLIGHTS OF RELEASE 3:

CMS support of VSAM provides indexed file capability to high level language programs executing under CMS, data compatibility with OS and DOS, enlarged file capacity for CMS end user applications, and record I/O for users of VS BASIC. CMS will support VSAM via integration of the DOS/VS VSAM component and simulation of DOS/VS supervisor and I/O functions. CMS support of VSAM will permit user programs written in COBOL, PL/I or VS BASIC to utilize VSAM function under CMS and will include a new command to invoke VSAM Access Method Services. Assembler program usage of VSAM function and the ISAM Interface Program (IIP) are not supported.

CMS support of DOS/VS program execution adds a new option to the SET command of CMS to enable the terminal user to specify the DOS environment in CMS and invoke a new set of CMS commands. In the DOS environment CMS simulates DOS/VS supervisor and I/O functions thereby allowing execution of many DOS programs. Execution of DOS programs is initiated via commands entered at the CMS terminal or via entry to the CMS Batch Facility. Assembler

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program execution is supported only insofar as the program utilizes DOS/VS services required in CMS for COBOL and PL/I compiler and execution library support.

Support of the 3270 Data Analysis-APL Feature brings increased productivity to the CMS user of VS APL through improved interactive data processing. The new Feature added to the efficiencies of the 3270 Information Display is designed to increase S/370 use by data processing professionals and to attract new applications of new users. The Feature:

- Provides a US EBCDIC extension set for APL characters, as well as dual case, and characters of the "TN" print train (which are displayable and printable only).
- Retains full editing (substitute, delete, insert) and formatting capabilities of the 3270, on current and planned applications.
- Requires minimal retraining either for keyboard/printer users of APL or for 3270 users.
- Operates with Featured and non-Featured devices on the same Featured control unit.
- Is orderable from the factory or installable in the field.

Support of the new program product VS APL provides a shared variable facility that allows APL users to communicate with non-APL programs called "auxiliary processors" operating outside the APL environment. This provides the APL user selected data management services and selected CP and CMS command service, offering enhanced facilities for problem solving and end-user applications in CMS.

Support of the DOS/VS COBOL and DOS PL/I Optimizing Compiler and library program products provides additional program development and end-user application facilities in CMS to DOS-based installations.

Support of the new 3350 and 3344 Direct Access Storage provides VM/370 support as well as support in DOS/VS, OS/VS1, and OS/VS2 running in a VM/370 virtual machine.

Extended shared segment usage by CMS provides sharing of VSAM and DOS/VS supervisor and I/O functions among CMS users. In addition, the CMS editor, the EXEC command processor, and the OS simulation routines are now reentrant and can be placed in a discontiguous shared segment by the installation. CMS is utilizing CP extensions to the current support of named and saved systems to share segments which are outside the address space of a virtual machine.

Extended CP protection of shared segments allows the Virtual Machine Assist feature to be activated for shared, named systems, thus allowing shared CMS systems to take advantage of the performance improvements of this feature.

Improved spool file recovery adds a new checkpoint start procedure to the recovery options available to the VM/370 operator at IPL. Another RAS improvement includes enhancements to the procedure for generating the CPEREP program. Extended local 3270 support provides a COPY function for the 3284, 3286, 3287 (as a 3284/3286) and 3288 printers.

Support of the dial feature (#3440) for the 3275 Display Station mdl 2 allows the 3275 to be used over switched lines as a virtual machine operator's console.

The VM/370 publications library now includes: *VM/370: CMS User's Guide, VM/370: System Logic and Problem Determination Guide, VM/370: Operating Systems in a Virtual Machine* and *VM/370: Data Areas and Control Blocks Logic.* Additional information on the 3270 Data Analysis-APL Feature is in the publication *An Introduction to the IBM 3270 Data Analysis-APL Feature* (GA27-2788).

OPTIMIZING VIRTUAL MACHINE PERFORMANCE

An operating system executing in a VM/370 virtual machine is normally slower compared to standalone execution on the same S/370. The operating system executes concurrently with other virtual machines and executes in problem state to allow the CP component to control the resources of the real machine. VM/370 allows an installation to improve the performance of selected virtual machines by specifying one or more of the following options:

- Virtual Machine Assist, a hardware assist available on S/370 mdls 135, 135-3, 138, 145, 145-3, 148, 158, 158AP, 168, 168AP, the 3031, 3031AP, 3032 and 3033 Processors and the 4331, 4341 and 4361 Processors makes possible throughput improvements for virtual machine users. See *Desirable Features* under *System Configuration* for a description of the Virtual Machine Assist. Virtual Machine Assist on the 168, 168AP, 3032 and 3033 is an RPQ.
- The S/370 135-3, 138, 145-3, 148 and the 4341 Processor include Extended Control Program Support. The Extended Control Program Support on the 4321 and 4331 is a subset of that provided on the 4341. Extended Control Program Support for VM/370 is a hardware assist that is an expansion to the current Virtual Machine Assist. This support includes an operator command to disable the new assist, allowing the user to run with the previous support, if he desires.
- APL Assist feature, (#1005) on the S/370 mdl 135 and on the S/370 mdl 145, which may be used with the VS APL Program Product (5748-AP1) to enhance performance of VS APL under CMS on the mdls 135 and 145. APL Assist is standard on S/370 135-3, 138, 145-3, and 148. The APL Assist feature (1005) is mutually exclusive with the APL Assist RPQ (S00256) on the S/370 mdl 145.
- APL Assist, an RPQ (S00256) on the S/370 mdl 145 which may be used with VS APL (5748-AP1) to enhance performance of APL under CMS on the mdl 145.
- Favored Execution, an option which attempts to provide a specified percentage of real processor time to a particular virtual machine.
- Reserving "n"number of page "frames" (i.e., 4096 byte blocks) of real main storage for the exclusive use of one virtual machine to minimize paging in that virtual machine.
- Designating the virtual machine as "Virtual=Real", to eliminate paging in that virtual machine and to reduce the normal control program overhead. This is accomplished by giving that virtual machine a contiguous block of real main storage equal in size to its virtual storage and at real storage addresses which correspond to its virtual addresses, with the exception of page zero (i.e., the first 4096 bytes of storage). Page zero is relocated, but locked into real storage.
- Locked page frames.
- Assigning higher priorities to one or more virtual machines.

The options of favored execution, with a percentage specified, reserved page frames and virtual = real, listed above, can be specified for only **one** virtual machine at a time. Three different virtual machines may each have one of these three options, or several options may be specified for the same virtual machine.

There is no VM/370 restriction on the number of virtual machines that may simultaneously use the Extended Control-Program Support for VM/370, Virtual Machine Assist, the APL Assist, and the locked page frame or priority options. Locked page frames are restricted by the amount of real storage available. Use of any or all of these options, **except** for the Extended Control-Program Support for VM/370, Virtual Machine Assist and the APL Assist, will reduce the performance of other virtual machines.

For a more detailed description of these performance options, see the *IBM Virtual Machine Facility/370: Introduction* (GC20-1800), or the *IBM Virtual Machine Facility/370: System Programmer's Guide* (GC20-1807).

OS/VS1 improvements under VM/370, VM/VS Handshaking, will enable VS1 when running under VM/370 to enhance its operational characteristics and to avoid many instructions and procedures which are redundant in a virtual machine environment. With this support, handshaking will be initiated automatically during nucleus initialization of VS1 when running under VM/370 if the VS1 system has been generated with a new VS1 option call *VM* . In handshaking mode, VS1 will:

- Close CP spool files at job end to permit VM/370 to begin final output processing earlier.
- Provide a unique mode of execution which will eliminate paging by VS1 and reduce the number of privileged instructions executed whenever the virtual machine size is equal to the VS1 virtual address space. This mode makes possible performance improvements for VS1 where address space is less than or equal to 16 MB under VM/370 by reducing the real supervisor state time necessary to control the operation of the VS1 virtual machine.
- Optionally process a new virtual interrupt that allows VM/370 to return control to the VS1 virtual machine prior to resolution of a real page fault. The VS1 supervisor may then perform a task switch to allow other tasks access to the system.

Final evaluation of the performance of each operating system under VM/370 must be made in terms of each installation's throughput requirements and of the function provided by concurrently executing virtual machines.

INTEGRATED EMULATORS UNDER VM/370

Emulator-dependent programs which run on a particular S/370 equipped with the appropriate compatibility feature(s) listed below can be run on that S/370 in DOS or OS virtual machines under VM/370.

The following chart shows by S/370 Model number which integrated emulators can run under VM/370 and the compatibility feature numbers that are required:

VM/370 (5749-010) (cont'd)

System	1401 1440 1401 1440 1460	1401 1440 1460 1410 7010	7070 7074	7080	709 7090 7094 7094II	S/360 Mdl 20
135,135-3,138	#4457					#7520
145,145-3,148	#4457	#4458				
155II,158,158AP		#3950(2)	#7117(1,2)			
165II			#7117	#7118	#7119	
168,168AP			#7127	#7128	#7129	
4331	#3950					

No changes are required to these emulators, DOS, OS, or to VM/370 itself to allow emulator-dependent programs to run in virtual machines.

(1) For the mdl 158 only, this feature is not available if the Virtual Machine Assist feature (#8740) is loaded. See "System Configuration" section.

(2) For the mdl 158 only, this feature is not available if the OS/VS1 ECPS (Extended Control Program Support) Feature (#8750) is loaded.

Integrated emulators will not be supported on the 3033 processor.

SIMULATED HANDS-ON PROCESSOR CONSOLE DEBUGGING: To aid programmers in solving obscure or complex problems that are difficult to isolate in any other way except by hands-on debugging at the processor console, VM/370 offers the following console debugging facilities from the user's remote terminal:

- Examining or altering the contents of the following: Real or virtual storage, general registers, floating-point registers, the instruction counter and other fixed-location fields such as Program Status Words (PSWs) and the Channel Status Word (CSW).
- Dumping on the high-speed printer the contents of all registers plus any part of storage, and selected blocks of disk records.
- Setting an Instruction Address Stop to stop execution of the user's program at a predetermined point in the program.
- Simulating external or I/O interrupts to the user's virtual machine (e.g., pressing the external interrupt key or readying the card reader).
- Dynamically tracing any or all of the following:
  - I/O events.
  - Successful branches.
  - Supervisor Call Interrupts (SVCs).
  - User program check interrupts.
  - Channel command sequences.
  - Total instruction trace.

SERVICE CLASSIFICATION: VM/370 is System Control Programming (SCP). Refer to sales manual GI section for a detailed description of SCP support. VM/370 does not alter or affect in any way the current service classification of any IBM operating system, language, program product or any other type of IBM program supported by VM/370 while under the control of VM/370.

PROGRAMS SUPPORTED in VM/370 VIRTUAL MACHINES

For information on those programs and program products supported to run under an operating system such as OS or DOS in a virtual machine environment under VM/370, see the appropriate sales pages. In addition, the RSCS Networking program product (5748-XP1) executes in a VM/370 virtual machine. See the appropriate sales manual pages for details.

System Extensions Program Products Supported by VM/370 System Control Program: The VM/Basic System Extensions program product (5748-XX8) and the VM/System Extensions program product (5748-XE1) extend the services and facilities of the VM/370 System Control Program. For information on these program products see the appropriate sales manual pages.

IBM PROGRAM PRODUCT SUPPORT FOR VM/370-CMS: The IBM program products supported under CMS are as follows:

OS Full American National Standard COBOL Version 4 Compiler and Library	5734-CB2
OS Full American National Standard COBOL Version 4 Library	5734-LM2
OS/VS COBOL Compiler and Library	5746-CB1 (1)
OS/VS COBOL Library Only	5746-LM1 (1)
COBOL Interactive Debug	5734-CB4 (1)
DOS/VS COBOL Compiler and Library	5746-CB1 (5)
OS FORTRAN IV (G1)	5734-FO2
OS FORTRAN IV Library (Mod I)	5734-LM1
OS Code and Go FORTRAN	5734-FO1
OS FORTRAN IV (H Extended)	5734-FO3
OS FORTRAN IV Library (Mod II)	5734-LM3
FORTRAN Interactive Debug	5734-FO5
OS PL/I Optimizing Compiler	5734-PL1
OS PL/I Resident Library	5734-LM4
OS PL/I Transient Library	5734-LM5
OS PL/I Optimizing Compiler and Libraries	5734-PL3
OS PL/I Checkout Compiler	5734-PL2 (2)
DOS PL/I Optimizing Compiler	5736-PL1 (5)
DOS PL/I Resident Library	5736-LM4 (5)
DOS PL/I Transient Library	5736-LM5 (5)
DOS PL/I Optimizing Compiler and Libraries	5736-PL3 (5)
VS BASIC	5748-XX1 (3)
MATH/BASIC	5734-XM8
STAT/BASIC	5734-XA3
Business Analysis/BASIC	5734-XMB
Planning System Generator/CMS (PSG/CMS)	5748-XT1
APL/CMS	5799-ALK (4)
VS APL	5748-AP1
Document Composition Facility	5748-XX9 (6)
Data Language/1 DOS/VS Version 1 Release 4	5746-XX1
DOS/VS RPG Release 3	5746-RG1
VM/370 Directory Maintenance Program Product	5748-XE4
Display Management System for CMS	5748-XXB
Interactive File System	5748-XXC

Notes:

(1) COBOL Interactive Debug operates as a command processor under CMS on programs produced by the following compilers using the **TEST** option:

- OS Full American National Standard COBOL Compiler Version 4 Release 1 Modification Level 2 (5734-CB2)
- OS/VS COBOL (5740-CB1).

(2) CMS supports the OS PL/I Checkout Compiler Release 2, Modification Level 1 and above.

(3) VS BASIC is the recommended BASIC product for use with VM/370 CMS. CALL-OS BASIC Release 1.2 under CMS is withdrawn and no longer orderable in any form.

All correct BASIC programs that run under CMS with CALL-OS BASIC, 360A-CX-44X, will run under CMS with VS BASIC after adjustment of file input/output statements. CMS editing commands can be used to change these statements to conform to VS BASIC syntax.

Additionally, under CALL-OS BASIC, if an **OPEN** statement is issued for a file already open, the file is repositioned to its beginning. Under VS BASIC, an **OPEN** statement for a file already open is ignored. CALL-OS BASIC programs containing such **OPEN** statements should be converted by adding a **CLOSE** statement before the **OPEN** statement.

Files created under CALL-OS BASIC which run under CMS can be read by VS BASIC after being converted to VS BASIC format using the VS BASIC service program VSBUTIL.

A new VS BASIC release was available on 4/26/76. This new release, in conjunction with Release 3 of VM/370 CMS, removes the restriction on the use of record input/output for users of VS BASIC under CMS.

(4) VS APL Program Product (5748-AP1) makes the APL language available to CMS users under VM/370 on any virtual storage S/370 Processor and 3031, 3031AP, 3032, and 3033 Processor except 3115 and 3125. This system provides language, function and performance enhancements over the APL/360 systems.

In addition, a no charge RPQ for the S/370 mdl 145 is available to enhance the performance of VS APL (5748-AP1) on the mdl 145. The APL Assist (#1005) for the mdl 145 can be ordered

directly through AAS. Note: APL Assist is standard on the S/370 mdls 135-3, 138, 145-3, and 148.

(5) CMS support is as of VM/370 Release 3.

(6) The Document Composition Facility consists of a general document handling program, called SCRIPT/VS, and an optional feature called the Foreground Environment Feature. SCRIPT/VS can be run directly in the foreground of CMS with the Foreground Environment Feature installed.

For program product ordering information, see the respective program product sales manual pages. Further details on the languages supported appear in the publication *IBM Virtual Machine Facility/370: Introduction* (GC20-1800), and in the Program Product section of the sales manual.

Installed User Programs: SCRIPT/370 Version 3 (5796-PHL), an Installed User Program (IUP), is available to provide text-processing capabilities directly under CMS.

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The Statistics Generating Package for VM/370, or VM/SGP (5796-PDD), an IUP, is available and consists of a data selection and reporting language, a translator, and a library of reduction programs to handle most classes of VM Monitor output from the VM/370 Measurement Facility.

VM/370 Performance Monitor Analysis FDP (5798-CPX) is available for reduction of VM Monitor output from the VM/370 Measurement Facility.

MUSIC III, the McGill University System for Interactive Computing (5796-AJC), an IUP, is available and can complement CMS when run under VM/370 by providing a high-performance limited-function timesharing subsystem.

VS/REPACK (5796-PDZ), an IUP, allows the user to collect and graphically display the pattern of activity of the program or system, analyze this data to predict how rearranging will increase efficiency and verify that the program is operating correctly.

Field Developed Programs: The VM/370 Control and Accounting System (5798-AYP), a Field Developed Program (FDP), is available for use under CMS

The CMS Sort for VM/370, an FDP, is available for use under CMS.

CUSTOMER RESPONSIBILITIES

- Ordering and installing all the required communications facilities.
- Generating the appropriate 3704/3705 Communications Controller programs.
- Allocating and formatting direct access storage space for the VM/370 control program, the CMS system residence area, and user work areas.
- Generating and updating user directory and virtual machine descriptions.
- Making the final evaluation as to which programs should be run under VM/370 in his environment.
- Training personnel to operate the VM/370 system.
- Teaching users VM/370 commands and how to operate the remote terminals.
- For existing CP-67/CMS customers, planning for the conversion from the S/360 mdl 67 to the S/370.

It is recommended that a customer system programmer become familiar with the internal operation of the VM/370 system in order to obtain maximum benefit from the virtual machine environment.

COMPATIBILITY STATEMENT FOR CP-67/CMS USERS

VM/370 is based on the CP-67/CMS system and is designed specifically for the S/370. The Dynamic Address Translation facility on the S/370 is conceptually similar to the same feature on the S/360 mdl 67, but differs in hardware implementation. Consequently, CP-67/CMS is not supported on the S/370, and, likewise, VM/370 is not supported on the S/360 mdl 67.

The internal structure of VM/370 differs from that used in CP-67/CMS. User modifications to CP-67/CMS are not compatible with VM/370.

The Conversational Monitor System of VM/370 is based on the Cambridge Monitor System of CP-67/CMS. Some commands are unchanged, but most have additional parameters or options which offer enhanced function and more precise control. Some command names have been changed or dropped with functions moved to other commands in the Conversational Monitor System.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

The following systems and devices are supported by VM/370 except as otherwise noted below:

Processors

IBM S/370 mdl 135
IBM S/370 mdl 135-3
IBM S/370 mdl 138
IBM S/370 mdl 145
IBM S/370 mdl 145-3
IBM S/370 mdl 148
IBM S/370 mdl 155II
IBM S/370 mdl 158
IBM S/370 mdl 158-3
IBM S/370 mdl 158 Attached Processor
IBM S/370 mdl 158MP (See note)
IBM S/370 mdl 165II
IBM S/370 mdl 168
IBM S/370 mdl 168 Attached Processor
IBM S/370 mdl 168MP (See note)
The IBM 3031 Processor
The IBM 3031 Attached Processor
The IBM 3033 Attached Processor
The IBM 3032 Processor
The IBM 3033 Processor
The IBM 3033 MP (see Note)
The IBM 4321 Processor and 4331 Processor (except devices attached via the 4331 Loop Adapter)
The IBM 4341 Processor

Note: IBM S/370 mdls 158 MP, 168 MP and 3033 MP are supported when running in uniprocessor mode, or with an asymmetric I/O configuration. In an asymmetric I/O configuration, all I/O attached to the system must be attached to one processor.

As of Release 5, the 303X processors will be supported. All S/370 Processors must have at least 393,216 (384K) bytes of real main storage.

Required Processor and Channel Features and Facilities

- The System Timing facility (#2001) (which includes the Clock Comparator and the CPU Timer) on mdls 135 and 145. (Clock Comparator and CPU Timer are standard on S/370 mdls 135-3, 138, and 148. They are a pre-requisite on the mdl 145-3.)
- The Floating Point feature
  - For the 135, feature (#3900) (Note)
  - For the 145, feature (#3910) (Note)

  Note: Floating-Point Arithmetic is standard on S/370 mdls 135-3, 138, 145-3, and 148. Extended Procession Floating-Point is standard on S/370 mdls 138, 145-3, and 148 and the 4321, 4331, 4341 and 4361 Processors.
- The Channel Indirect Data Addressing features on each of the following standalone I/O channels on the mdls 165II, 168, and 168AP: 2860 (#1861, #1862, #1863), 2870 (#1861), 2880 (#1861, #1862).
- The Word Buffer feature (#8810), available with the S/370 mdl 145, is required for selector channels if a 2305 mdl 2 Fixed Head Storage Device or any model of the 3340 DASF is attached.

  Note: Word Buffer is a prerequisite on S/370 mdl 145-3 and is standard on S/370 mdl 148.

Desirable Processor Features

- Virtual Machine Assist. Throughput improvements for VS systems running under VM/370 are possible with a hardware assist available on the S/370 processors 3135, 3135-3, 3138, 3145, 3145-3, 3148, 3158, 3158AP and 3168, the 3031, 3031AP, 3032 and 3033 processors and the 4321, 4331 and 4341 Processors. VMA on the 3168, 3032 and 3033 is an RPQ. The Virtual Machine Assist makes performance improvements possible by allowing a significant reduction in the real supervisor state time used by VM/370 to control the operation of virtual machines running under VM/370.

  This reduction in VM/370 supervisor state time is accomplished by using emulation, rather than software simulation, for certain privileged operation codes used by the VS system supervisors. Emulation is also used to update the shadow page table and to handle SVC interrupts.

  The Virtual Machine Assist is available on the S/370 mdls 135, 145 and 158 as a hardware feature (#8740), on the mdl 168 as an RPQ (S20573), on the 3032 as an RPQ (8P0723) and on the 3033 as an RPQ (EJ1156 and S20587). It is standard on the S/370 mdls 135-3, 138, 145-3, 148, the 3031 and 3031AP Processors and on the 4331 and 4341 Processors. On the S/370 mdl 158AP, Virtual Machine Assist function is also included in and enabled by OS/VS1 ECPS (Extended Control Program Support) Feature (#8750). Contact your Product Marketing Group for further information on availability of the RPQ. See the "Machines" section for details on the availability of the hardware feature. On the S/370 mdl 158 VMA Function is also included in and enabled by OS/VS1 ECPS (Extended Control-Program Support) Feature (#8750).

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- The IBM S/370 135-3, 138, 145-3, and 148 and the 4321, 4331, 4341 and 4361 Processors include Extended Control Program Support. The Extended Control Program support on the 4321/4331/4361 Processors is a subset of that provided on the 4341. A hardware assist has been added as an expansion to the current Virtual Machine Assist. This support will include an operator command to disable the new assist, if desired. Extended Control Program Support for VM/370 is an expansion of Virtual Machine Assist to further reduce the real supervisor state time used by VM/370 while performing its control functions. The reduction in VM/370 supervisor state time is accomplished in three ways. 1) Certain privileged instructions are emulated by the hardware rather than simulated by the software. 2) A hardware assist has been implemented for VM/370 that is designed to be executed only by VM/370. 3) Extended Control Program Support for VM/370 also includes support of an interval timer in a virtual machine.
- The Extended Precision Floating Point feature, although not required, will improve the execution of programs which use Extended Precision Floating Point instructions under VM/370 on mdls 135, 155II and 158.
  - For the 135, feature #3840
  - For the 155II, feature #3700
  - For the 158, feature #3700

  The Extended Floating Point Function is also included in and enabled by OS/VS1 ECPS (Extended Control Program Support) Feature (#8750).

  The OS/VS1 ECPS (Extended Control Program Support) (#8750) cannot be used when VM/370 is running in the Attached Processor mode.

  Note: Floating Point Arithmetic is standard on S/370 mdls 135-3, 138, 145-3, 148, 3031 and 3031AP. Extended Precision Floating Point is standard on S/370 mdl 138, 145-3, 148 and the 4321, 4331 and 4341 Processors.
- The Word Buffer feature (#8810), on the S/370 mdl 145, is recommended for selector channels if 2314 Storage Units are attached and required if 3330 (with the Integrated File Adapter), 3340, 3344 or 3350 Disk Storage units are attached.

  Note: Word Buffer is a prerequisite on S/370 mdl 145-3 and is standard on S/370 mdl 148.

SOFTWARE REQUIREMENTS

VM/370 is written in S/370 Assembler Language and uses S/370 instructions not available on the S/360. All program releases and SCP programming support will use CMS as an installing and updating vehicle.

VM/370 I/O SUPPORT

Direct Access Storage Devices

2314 Direct Access Storage Facility
2319 Disk Storage
3330 Disk Storage mdls 1, 2, and 11
3333 Disk Storage and Control mdls 1 and 11
3340 Direct Access Storage Facility, mdls A2, B1 and B2; and the 3348 Data Module, mdls 35, 70 and 70F
3344 Disk Storage mdls B2 and B2F
3350 Disk Storage mdls A2, A2F, B2, B2F, C2 and C2F
2305 Fixed Head Storage mdl 1 (Processors 3165II, 3168, 3168AP and 3033 only)
2305 Fixed Head Storage mdl 2
3850 Mass Storage System.

All of the above direct access devices with the exeception of the 3850 Mass Storage System are supported as VM/370 system residence, paging and spooling devices. All except the 2305 are supported by CMS and RSCS.

Direct Access Control Units

3345 Integrated Storage Control mdls 3, 4, and 5 on the mdl 145 for 3330 Disk Storage mdls 1 and 2; 3333 Disk Storage and Control mdls 1 and 11 and 3340 mdl A2
2835 Storage Control mdl 1 for 2305 mdl 1 (Processors 3165II, 3168, 3168AP, 3031, 3032, 3033 only)
2835 Storage Control mdl 2 for 2305 mdl 2
2844 Auxiliary Storage Control for 2314 and 2319
3830 Storage Control mdl 1 for 3330 mdls 1 and 2 only
3830 Storage Control mdl 2 for 3333 mdls 1 and 11 and 3340 mdl A2
3830 Storage Control mdl 3
3851 Mass Storage Facility
IFA (Integrated File Adapter) (#4650) on S/370 mdls 135, 135-3, and 145 for 2319
IFA (Integrated File Adapter) (#4655) on the mdl 135, 135-3, 138, for 3330 mdls 1, 2 and 11, 3333 mdls 1 and 11, 3340 mdls A2, B1 and B2, and 3344 mdls B2 and B2F
ISC (Integrated Storage Control) (#4460) on the mdls 145, 145-3, 148, 155II and 168 for 3330 mdls 1, 2 and 11, 3333 mdls 1 and 11, 3340 mdls A2, B1 and B2, 3344 mdls B2 and B2F, and 3350 mdls A2, A2F, B2, B2F, C2 and C2F.
DASD Adapter (#3201) of the IBM 4321/4331/4361 with attached 3340-A2, B2, B2F, 3344-B2, B2F

Magnetic Tapes

2401, 2402, and 2403 Magnetic Tape Units
2415 Magnetic Tape Unit, mdls 1, 2, 3, 4, 5 and 6
2420 Magnetic Tape Unit, mdls 5 and 7
3420 Magnetic Tape Unit, mdls 3, 4, 5, 6, 7 and 8
3410 Magnetic Tape Unit, mdls 1, 2, and 3, 9-track only
3411 Magnetic Tape Unit and Control, mdls 1, 2 and 3, 9-track only.

Tape Control Units

2804 Tape Control
2803 Tape Control
3803 Tape Control
3411 Magnetic Tape Unit and Control.
3088 Multisystem Channel Communication Unit, mdls 1 and 2

Printers

1403 Printers mdls 2, 3, 7 and N1 (with minimum of 132 print positions)
1443 Printer mdl N1 (with 144 print positions)
3203 Printer mdl 4
3203 Printer mdl 5
3211 Printer (Right Indexing only)
3213 Printer (in 3215 Emulator Mode)
3284 Printer mdls 2 and 3
3286 Printer mdls 2 and 3
3287 Printer mdls 1 and 2 (as a 3284/3286)
3288 Printer mdl 2
3800 Printer

Readers/Punches

2501 Card Reader mdls B1 and B2
2540 Card Read Punch mdl 1
3505 Card Reader mdls B1 and B2
3525 Card Punch mdls P1, P2 and P3
2520 Card Punch mdls B2 and B3

Unit Record Control Units

2821 Control Unit
3811 Printer Control Unit
IPA (Integrated Printer Adapter) (#4670, #4672 or #4677) on the 3135 Processor
IPA (#4670, #4672, #4677, #8075 or #8076) on the 3138 processor
IPA (#8075 or #8076) on the 3148 processor.

TELECOMMUNICATIONS SUPPORT SUMMARY

Terminals: The following devices are supported as virtual machine operator consoles (and consequently as CMS user terminals):

2741 Communication Terminal
1050 Data Communication System
3101 Display Terminal (mdls 10, 12, 13, 20, 22, 23) on switched lines 110-1200 bps
CPT-TWX (mdl 33/35) Line Control Type Terminals
3232 Keyboard Printer (mdl 51) on switched lines at 200-1200 bps
3275 Display Station (mdl 2)
3277 Display Station (mdl 2) via a 3271 Control Unit (mdl 2) or a 3272 Control Unit (mdl 2)
3767 Communication Terminal (as a 2741)
5100/5110 Computer System (as a 2741).
IBM S/370 mdl 138 Display Console printer-keyboard is supported in printer-keyboard mode (3286-2 required) or display mode.
IBM S/370 mdl 148 Display Console printer-keyboard is supported in printer-keyboard mode (3286-2 required) or display mode.
3066 System Console mdls 1 and 2 for S/370 mdls 165II and 168.
3036 Console for 3031, 3032 and 3033 Processors.
3278 mdl 2A/3279 mdl 2C Console for the 4331, 4341 and 4361
6733 Typewriter Communication Module as a CPT/TWX 33/35 on switched and nonswitched lines at 110, 150, 300 and 1200 bps

Supported by VM/370 Remote Spooling Communications Subsystem (RSCS):

2770 Data Communication System
2780 Data Transmission Terminal
3770 Data Communication System, (except 3777-2) non-programmable models as a 2772;3776/3777-1 also as a 3780; 3777-2 as a S/360-20)
3780 Data Communications Terminal
HASP supported programmable workstations.
System/34 with SSP (MRJE)
System/36 with SSP and MSRJE

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8100/DPPX with DPPX/RJE (BSC)
8100/DPPX/SP with DPPX/SP/RJE (BSC)

Terminal Control Units

3271 Control Unit mdl 2
3272 Control Unit mdl 2
8100/DPPX with DPPX/DSC (as a 3271)
8100/DPPX/SP with DPPX/SP/DSC (as a 3271)
System/34 (as a 3271)

Transmission Control Units

ICA (Integrated Communications Adapter) (#4640) available on the mdls 135, 135-3, 138
2701 Data Adapter Unit
2702 Transmission Control
2703 Transmission Control
3704 Communications Controller
3705-I Communications Controller
3705-II Communications Controller
4321 Level 19 at shipment of processor
4331/4361 Communication Adapter (#1601)

VM/370 supports the 3704 and 3705 Communications Controllers in network control mode, emulation mode, or in network control or emulation mode of the Partitioned Emulation Programming (PEP) extension of NCP/VS. CMS supports the generation of 3704/3705 programs for these modes of operation and CP provides commands to load, dump, trace and control the operation of the 3704/3705.

The 3704 or 3705 in network control mode or in the network control mode of PEP may be used by VM/370 for the control of virtual machine operator's consoles. Concurrent with the use of the network control mode of PEP by VM/370, the emulation mode of PEP may be used by multi-access virtual machine operating systems.

Use of network control mode by a virtual machine operating system requires that the 3704 or 3705 be dedicated to the virtual machine. The 3704 or 3705 may be attached to a virtual machine running DOS/VS, OS/VS1 or OS/VS2 with either VTAM or TCAM to support the network control mode of operation. In this case, communications between the 3704/3705 and the terminals attached to it are completely under the control of the virtual machine operating system, not VM/370.

Note: Customers using VM/370 support for the 3704/3705 must order one of the two OS/VS 3704/3705 Network Control Program Support Packages listed below. These are the only 3704/3705 support packages that contain the CMS files required for generating and loading 3704/3705 control programs.

ORDER NUMBER

5744-BA1 (Supported by VM/370 in network control mode, emulation mode, or in network control or emulation mode of PEP.)

5744-BA2 (Supported by VM/370 in emulation mode only.)

RPQ AVAILABILITY

Prior availability of an RPQ does not guarantee or imply current or future availability. Refer to the General Information section or the RPQ section of the sales pages for order information concerning the RPQs mentioned below.

TERMINALS SUPPORTED AS VIRTUAL MACHINE OPERATOR'S CONSOLES

Terminals which are equivalent to those explicitly supported may also function satisfactorily. The customer is responsible for establishing equivalency. IBM assumes no responsibility for the impact that any changes to the IBM-supplied programs or products may have on such terminals.

1. The following **system consoles** and the remote terminals listed below in items 2, 3, 4, 5 (excepting those terminals attached via binary synchronous lines) and 6 are supported by VM/370 as real as well as virtual Processor operator's consoles:

   3210 Console Printer-Keyboard mdls 1 and 2
   3215 Console Printer-Keyboard mdl 1
   2150 Console with 1052 Printer-Keyboard mdl 7
   IBM S/370 mdl 138, 148, and 158 Display Console printer-keyboard is supported in printer-keyboard mode (3286-2 required) or in display mode.
   7412 Console (via RPQ AA2846) with 3215 Console Printer-Keyboard mdl 1
   3066 System Console mdls 1 and 2 for S/370 mdls 165II and 168.
   3066 System Console mdl 3 for S/370 mdl 168AP.
   3036 Console for the 3031, 3032 and 3033 Processors.
   3278 mdl 2A/3279 mdl 2C Console for the 4331 and 4341 Processors.

2. **2741 Communication Terminal** on either switched or point-to-point nonswitched lines with these features:

   PTTC/EBCD (**#9571**, P/N 1167963) or standard Correspondence **#9812**, Part 1167043) print elements
   Transmit Interrupt (#7900) or Transmit Interrupt Control RPQ (E40681)
   Receive Interrupt (#4708).

   Required with switched lines:

   Data Set Attachment **#9114**
   Dial Up (#3255).

   One of the following is required for point-to-point nonswitched lines:

   Data Set Attachment (**#9115** for facility D1), or
   Data Set Attachment (**#9116** for facility B2), or
   Data Set Attachment (**#9120** for facility B1 or D1), or
   IBM Line Adapter (#4635 for 4-wire limited distance line), or
   IBM Line Adapter (#4691-#4694 for 4-wire shared nonswitched line), or
   IBM Line Adapter (#4647 for 4-wire nonswitched line).

   The following features, although not required, will enhance the convenience and usability of the terminal:

   Print Inhibit (#5501)
   Red Ribbon Control RPQ (868019)
   Typamatic Keys (#8341)
   Pin Feed Platen (**#9509**).

3. **1050 Data Communication System** on either switched or point-to-point nonswitched lines with these components:

   1051 Control Unit (mdl 1 or 2) with these features:

   Transmit Interrupt (#7900) or
   Transmit Interrupt Control RPQ (E26903)
   Receive Interrupt (#6100) or
   Receive Interrupt Control RPQ (E27428)
   Text Time-Out Suppression (**#9698**)
   First Printer Attachment (#4408).

   Required with switched lines:

   Data Set Attachment **#9114**.

   One of the following is required for point-to-point nonswitched lines:

   Data Set Attachment **#9115** for facility D1, or
   Data Set Attachment **#9116** for facility B2, or
   Data Set Attachment (**#9120** for facility B1 or D1), or
   IBM Line Adapter #4691-#4694 for 4-wire shared nonswitched line, or
   IBM Line Adapter #4647 for 4-wire nonswitched line.
   1052 Printer-Keyboard (mdl 1 or 2) with the following feature:
   PTTC/EBCD print element **#9571**, P/N 1167963.

   The following features, although not required, will enhance the convenience and usability of the terminal:

   Automatic Ribbon Shift and Line Feed Select (#1295)
   EOB on Carrier Return RPQ (E28235).

4. **Terminals** on switched lines compatible **with the line control used by the IBM Telegraph Control Type II Adapter** (8-level ASCII code at 110 bps).

4.1 **The 3101 Display Terminal** (mdls 10, 12, 13, 20, 22, 23) is supported on switched lines at 110-1200 bps as a virtual machine console.

4.2 **The 6733 Typewriter Communication Module** is supported as a CPT-TWX 33/35 on switched lines at 110, 150, 300 and 1200 bps.

4.3 **3232 Keyboard Printer** (mdl 51) is supported on switched lines at 300-1200 bps.

5. **3270 Information Display System** with these components, including the Data Analysis-APL Feature (#1066) if APL or text characters are to be displayed or printed via copy.

   3271 Control Unit mdl 2 on nonswitched, point-to-point, binary synchronous transmission lines. (Note 3)

   3272 Control Unit mdl 2 on a multiplexer, block multiplexer or selector channel.

   3277 Display Station mdl 2 with one of the following features required by VM/370:

   66 Key EBCDIC Typewriter Keyboard (#4630) [Note 2]
   66 Key EBCDIC Data Entry Keyboard (#4631)
   78 Key Operator Console - Keyboard (#4632)
   78 Key EBCDIC Typewriter Keyboard (#4633)
   66 Key EBCDIC/APL Typewriter Keyboard (#4637) [Note 2]
   78 Key EBCDIC/APL Typewriter Keyboard (#4638)
   78 Key Text Keyboard (#4639)

   The following features, while not required, will enhance the convenience and usability of the terminal:

   Audible Alarm (#1090)
   Operator Identification Card Reader (#4600)
   Lower Case Character Display RPQ (8K0366).

   The following feature recommended for use with either Keyboard 4637 or 4638 only, provides APL, dual case US EBCDIC, and

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(output only) TN print train capability; used with keyboard #4639, it provides access to the 120 TN, T11 character set:

Data Analysis-APL (#1066).

3275 Display Station mdl 2 with the same features required as the 3277 mdl 2. The Data Analysis-APL Feature (#1066) and the EBCDIC/APL Typewriter Keyboards do not apply to the 3275. 3275 includes its own control unit function and is supported when attached via nonswitched, point-to-point, binary synchronous transmission lines or via switched connection if the 3275 is equipped with feature #3440. [Note 3]

3284 Printer mdls 2 and 3 [Note 1]

3286 Printer mdl 2 [Note 1]

3287 Printer mdls 1 and 2 (as a 3284/3286)

3288 Printer mdl 2 [Note 1]

Note 1: The 3284, 3286, 3287 (as a 3284/3286) and 3288 Printers are supported by VM/370 only to the extent of the COPY function which allows transferring display screens of data from local and remote 3270 system terminals to hard copy printers. The COPY function is invoked by depression of a program function key. The remote support is effective only when both the printers and the terminals are attached via the same 3271 Control Unit mdl 2 or 3275 Display Station mdl 2.

Note 2: These display terminals are not supported for use with the 3284, 3286, 3287 (as a 3284/3286) or 3288 printers.

Note 3: The maximum number of binary synchronous transmission lines supported by the CP component of VM/370 for its own use is sixteen minus the number of 3704/3705 Communications Controllers operating in network control mode.

Note 4: The APL Feature is not available for the 3288 printer.

6. **3767 Communication Terminal** (as a 2741) on switched or point-to-point nonswitched lines with these features:

   2741 Start/Stop (#7113)
   Correspondence Keyboard **#9381**, or
   EBCDIC Keyboard **#9391**
   EIA Interface with Clock (#3719), or
   1200 bps Integrated Modem (#5500 or #5505).

7. **5100 Portable Computer** (as a 2741) on switched or point-to-point nonswitched lines with the Communications Adapter (#1525).

TERMINALS SUPPORTED FOR REMOTE SPOOLING

The VM/370 Remote Spooling Communications Subsystem (RSCS) supports the following terminals and workstations.

1. **2770 Data Communication System**

   The 2770 Data Communication System with the 2772 Multipurpose Control Unit (hereafter called 2770) can be connected to the central S/370 via a switched or nonswitched point-to-point communication line.

   The following devices and features are required for operating a 2770 as an RSCS non-programmable terminal:

   One 2213 Printer mdl 2 or one 2203 Printer or one 1053 Printer
   One 2502 Card Reader, mdl A1 or A2
   EBCDIC Transmission Code.

   Other supported equipment and features are as follows:

   One 545 Output Punch, mdl 3 or 4, with or without (#3950) attachment
   EBCDIC Transparency (#3650)
   Additional Buffer Expansion (#1491)
   Space Compression/Expansion (#6555)
   Synchronous Clock (#7705).

2. **2780 Data Transmission Terminal**

   The IBM 2780 Data Transmission Terminal, mdl 1 and 2, can be connected to the central S/370 via a switched or nonswitched point-to-point line. EBCDIC Transmission Code is required.

   The following features are optional:

   EBCDIC Transparency (#8030)
   120/144-Character Print Line (#5820 or #5821)
   Multiple Record Transmission (#5010)
   Synchronous Clock (#7705).

3. **3770 Data Communication System**

   The 3770 Data Communications System (except 3777-2) with the non-programmable models of the 3771, 3773, 3774, 3775, 3776 and 3777-1 Communication Terminals (hereafter called 3770) can be connected to the central S/370 via a switched or nonswitched point-to-point communication line. The following features are required for operating a 3770 as an RSCS non-programmable terminal:

   EBCDIC Transmission Code **#9761**
   SDLC/BSC, Switch Control (#1460), or
   BSC Point-to-Point (#1461).

4. **3780 Data Communications Terminal**

   The 3780 Data Communications Terminal can be connected to the central S/370 via a switched or nonswitched point-to-point communication line. EBCDIC Transmission Code is required.

   The following devices and features are optional:

   One 3781 Card Punch.
   Component Selection (#1601, required for the 3781).
   EBCDIC Transparency (#3601).
   Additional Print Positions (#5701).
   Synchronous Clock (#7705).

5. **Programmable Terminals**

   Any processor now supported as a HASP workstation when programmed to run as a HASP workstation is supported as a workstation by the Spool MULTI-LEAVING (SML) support under RSCS. The DOS/VS Remote Job Entry Workstation Program (PRPQ WF0358) is also supported. Any processor running HASP, ASP, RES, JES2 and JES3 is supported as a main processor by RSCS when it itself assumes the role of a HASP programmable workstation. For specific configurations supported, refer to the HASP pages.

TRANSMISSION CONTROL UNITS SUPPORTED BY VM/370

1. **2701 Data Adapter Unit**

   For CPT-TWX (mdl 33/35) Line Control Type Terminals

   Telegraph Adapter Type II (#7885).

   For 2770, 2780, 3270, 3770 (except 3777-2) as a 2770; 3776/3777-1 also as a 3780; 3777-2 as a S/360-20 MULTI-LEAVING Workstation) and 3780 Terminals

   Synchronous Data Adapter Type II (#7698)

   EBCDIC Code **#9060**
   EBCDIC Transparency (#8029).

   For 1050 and 2741 Terminals

   IBM Terminal Adapter Type I, mdl II (#4640)

   Selective Speed (134.5 bps) **#9581**
   2741 Break Feature RPQ (M53193), and Break Command RPQ (858492).

   As Needed

   Expanded Capability (#3815) - required if more than two low speed adapters (either IBM Type I mdl II, or Telegraph Type II), or more than one high-speed adapter (Synchronous Data Adapter Type II), or one high-speed and at least one low-speed adapter are to be attached to the same 2701.

   Expansion Feature (#3855) - required for each line adapter after the first.

2. **2702 Transmission Terminal**

   For 1050 and 2741 Terminals

   Terminal Control Base for IBM Terminal Control **#9696**.

   IBM Terminal Control Type I (#4615)

   Selective Speed (134.5 bps) **#9684**
   Type I Terminal Interrupt (#8200)
   Data Set Line Adapter (#3233) and/or IBM Line Adapter (#4635) (4-wire)

   For CPT-TWX (mdl 33/35) Line Control Type Terminals

   Terminal Control Base for Telegraph Terminal Control **#9697**.

   Telegraph Terminal Control Type II (#7912)

   Pluggable End Characterst (return key generates an interrupt) RPQ (E62920)
   Data Set Line Adapter (#3233).

   Terminal Control Expansion (#7935) - required if both of the above terminal control bases are to be attached to the same 2702.

   As Needed

   31 Line Expansion (#7955).

3. **2703 Transmission Control Unit**

   For 1050 and 2741 Terminals

   Start-Stop Base Type I (#7505) or Type II (#7506).

   IBM Terminal Control Base (#4619).

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IBM Terminal Control Type I (#4696)

Line Speed Option (134.5 bps) (#4878)
Type I Terminal Interrupt (#8200)
Data Line Set (#3205), and/or IBM Line Set 1B (#4687).

For CPT-TWX (mdl 33/35) Line Control Type Terminals

Telegraph Terminal Control Base (#7905).

Telegraph Terminal Control Type II (#7912)

Line Speed Option (110 bps) (#4877)
Data Line Set (#3205)
Pluggable End Characters† (return key generates an interrupt) RPQ (E66707).

For 2770, 2780, 3270, 3777-2 (as a S/360-20 MULTI-LEAVING Workstation) and 3780 Terminals

Synchronous Base (#7703, #7704 or #7706).

Synchronous Terminal Control for EBCDIC (#7715)

Transparency **#9100**
Synchronous Line Set (#7710).

As Needed

Base Expansion (#1440) - required if more than one base type is to be attached to the same 2703.

4. **Integrated Communications Adapter (ICA)** (#4640) (available on the S/370 mdl 135, 135-3, 138)

Additional Lines (#4722-#4728).

For 1050, 2741, 3767 (as a 2741) and 5100 (as a 2741) Terminals

Terminal Adapter Type I mdl II **#9721-#9728**

Switched Network Facility
#9625, #9632 [optional]
Write Interrupt **#9745, #9752**
Read Interrupt **#9737, #9744**
Unit Exception Suppression
#9729, #9730) [optional]

For the 3767 only (as a 2741)

200 bps (#2711-#2718), or
300 bps **#9593, #9600**.

For the 5100 only (as a 2741)

300 bps **#9593, #9600**.

For 2770, 2780, 3270, 3770 (except 3777-2) as a 2770; 3776/3777-1 also as a 3780; 3777-2 (as a S/360-20) and 3780 Terminals

Synchronous Data Adapter Type II **#9649, #9656**

Half-Duplex Facility **#9617, #9624**
EBCDIC Transparency **#9673, #9680**)

For CPT-TWX (mdl 33/35) Line Control Type Terminals

Telegraph Adapter Type II **#9785, #9792**

Switched Network Facility **#9625, #9632**.

5. **3704/3705-I/3705-II Communications Controller**

See the 3704/3705-I/3705-II machine pages for required feature codes.

6. **4331 Communications Adapter**

See the 4321 or 4331 machine pages for required feature codes.

Note: CPT-TWX (mdl 33/35) terminals or equivalent devices are supported only at 110 bps by the 3704/3705 Network Control Program under VM/370.

† Although not required, these features enhance the usability of these terminals.

TWO-CHANNEL SWITCHES: VM/370 has Alternate Path Support and does not take advantage of the Two Channel Switch, and Two Channel Switch, additional features.

DEDICATED DEVICES: With VM/370 Release 2 and 3, any input/output device not supported by VM/370 but which is attachable to an IBM S/370 and conforms to S/370 architecture may be eligible for dedicated use by a virtual machine under VM/370. The subclass of the device should be specified during VM/370 system generation so that virtual CCW strings directed to the unsupported device will be translated correctly; refer to the *VM/370: Planning and System Generation Guide,* GC20-1801, for details. The standard device and program restrictions also contained in that publication must be observed. The device must be tested in this environment to ensure proper operation.

CONFIGURATIONS SUPPORTED BY CMS

- Virtual storage size: Recommended minimum of 320K bytes up to 16 million bytes in multiples of 4096 bytes.
- Virtual console - any terminal supported by VM/370 as a virtual machine operator's console.
- Any virtual card readers, card punches (except the 2520) and printers supported by VM/370 as spooling devices.
- Up to ten virtual 2314, 2319, 3330, 3333, 3340, 3344 or 3350 direct access storage devices as well as the 3850 Mass Storage System 3330V volumes as 3330s. Each virtual disk is at minimum one cylinder. The CMS file system constrains virtual disk sizes as follows: a maximum of 115 cylinders on each virtual 3350 in native mode, a maximum of 246 cylinders on each virtual 3330 or 3333, a maximum of 348 cylinders on each virtual 35MB 3340, and a maximum of 682 cylinders on each virtual 70MB 3340. Note that OS and DOS virtual disks read by CMS are not constrained by these limits. The CMS system disk is required and reduces the number of user disks online at any given time to nine.
- Up to four 2400, 2415, 2420 or 3420 (7- or 9-track), or 3410 (9-track only) Magnetic Tape Units.

MINIMUM VM/370 CONFIGURATION

Processors	One of the S/370 Processors previously designated with at least 393,216 bytes of real main storage
One	Console
One	Printer
One	Card Reader *
One	Card Punch *
Two	Spindles of Direct Access Storage
One	9-track Magnetic Tape Unit
One	Transmission Control Unit (or the Integrated Communications Adapter on the S/370 mdl 135, 135-3, 138). If only local 3277 Display Stations are used as terminals, then only a 3272 Control Unit is required.
One	Multiplexer Channel **
One	Selector or Block Multiplexer Channel **
One	Communication Terminal

* Not required if support for a cardless VM/370 system is used.

** A Multiplexer, Selector or Block Multiplexer Channel is not required on those processors (e.g., the 4331 Processor) that support integrated adapters.

The requirement for at least one transmission control unit, line and remote terminal can be eliminated if the customer plans to run only two virtual machines using the primary and alternate system consoles. The requirement is also eliminated if the only terminals to be used are 3277 Display Stations attached to a 3272 Control Unit. These conditions permit a customer to install VM/370 earlier and gain experience with multiple concurrent virtual machine operation and/or CMS timesharing before the installation of his teleprocessing terminals, control units and lines.

VM/370 requires a minimum of 384K bytes of accessible main storage. This storage size will support a mixed-mode environment, that is, CMS running concurrently with another virtual machine. A mimimum 384K system provides limited performance capability. Therefore, installation of VM/370 for mixed mode environment in an already installed S/370 should consider at least a main storage upgrade.

VM/370 supports a cardless environment. By using the facility to spool accounting records in VM/Basic System Extensions or VM/System Extensions and altering the system generation procedures to use tape devices, the need for a card reader/punch can be eliminated. This capability requires the installation of either VM/Basic System Extensions program product (5748-XX8) or the VM/System Extensions program product (5748-XE1). Further information is contained in the *VM/370 Planning and System Generation Guide* (see updates SN25-0499 and SN25-0757). Specific details relevant to the minimum configuration required for hardware maintenance should be directed to the Field Engineering Division.

REPRESENTATIVE VM/370 CONFIGURATION

3145	512K storage
3215	Console Printer-Keyboard
1403	Printer mdl N1 (two)
3330 or 3340	DASF drives as needed to meet the requirements of VM/370, the virtual machine operating systems and the users.
3420	Magnetic Tape Units (two)
2540	Card Read Punch
3704	Communications Controller
3277	Display Stations, as needed with the 3271 or 3272 Control Unit
2741	or Communication Terminals (as needed)
3232-51	Keyboard Printer
3767	Communication Terminals (as 2741s) (as needed)

VM/370 (5749-010) (cont'd)

Two	Block multiplexer channels (#1421, #1422) with Word Buffer feature (#8810)
One	Multiplexer channel
6733	Typewriter Communication Module with Electronic Typewriter 85 (as needed) as a CPT-TWX 33/35

FIELD ENGINEERING CONSIDERATIONS

Engineering Change Levels: For a listing of engineering change (EC) levels at which the operation of VM/370 has been verified, refer to *VM/370: Release 2 Guide* (GC20-1815).

UCW CONSIDERATIONS: It is essential to the operation of VM/370 that sufficient Unit Control Words (UCWs) are installed for the S/370 mdl 135, 135-3, 138, 145, 145-3, 148, 155II or 158 multiplexer channel. Before ordering, contact your local FE Installation Planning Representative for assistance in determining the necessary quantity of UCWs for your configuration. Installation options controlling the use of UCWs should be carefully reviewed with Field Engineering prior to installing VM/370 on any S/370.

RELIABILITY, AVAILABILITY AND SERVICEABILITY

The VM/370 system is based on the proven concepts of the CP-67/CMS system which has been in use by customers since 1968. VM/370 utilizes S/370 architecture, including RMS, to enhance its own reliability, availability and serviceability (RAS). The environment of multiple concurrent virtual machines may result in improved RAS for many S/360 operating systems that are run under VM/370.

The VM/370 features that improve reliability are:

- User isolation, each in his own virtual machine.
- Read-only protection of "shared" or critical disks.
- Restricting access to other users' disks via password protection.
- Screening of all interrupts by the control program to prevent abnormal termination of OS due to receiving I/O interrupts from devices not included in the OS nucleus.
- Nucleus protection in CMS.

Availability is enhanced for the following reasons:

- VM/370 allows users to run concurrently as many versions, levels, types and copies of operating systems as they require.
- Customers can generate, update and test operating systems without the need for a dedicated machine. Premature conversion of a customer's production work to an insufficiently-tested new environment can be avoided.
- When the control program detects a permanent storage error in a main storage page frame that is being used by a virtual machine, the frame will be marked unusable. If the page frame has not been altered by the virtual machine, a new page frame is assigned to the virtual machine and a fresh copy of the page is brought in the next time the page is referenced.

  The storage error is transparent to the virtual machine user. If the frame has been altered, VM/370 resets the virtual machine, clears its virtual storage to zeros and sends an appropriate message to the user. Normal system operation continues for all other users.
- If, in writing out a page on the paging device, the control program encounters a defective area on the disk, that area is marked as unusable and the page is written elsewhere on the paging device.
- Upon abnormal termination, the control program will automatically dump and reload itself without system operator intervention. Completed spool files will be saved, and communication lines will be re-initialized following the reload. Each user can then re-initialize his virtual machine.
- When a terminal or line error is detected for a virtual machine operator's console, VM/370 breaks connection with that user. However, that user is not logged off by VM/370 for fifteen more minutes, giving him that period of time to attempt to re-establish connection with the system for that virtual machine.

Serviceability is improved by:

- Providing various commands to trace, examine and alter the operation of a virtual machine.
- Providing IPCS commands and facilities which analyze CP abend dumps, generate user-detected problem reports, allow viewing of disk-resident CP abend dumps and allow management of problems and their status.
- Recording on the VM/370 system residence disk machine checks, channel checks and I/O errors for Customer Engineering use. The above data can be printed by running the appropriate VM/370 service programs in a virtual machine.
- Allowing a Customer Engineer to run, concurrently with customer production, any of his system-supported and stand-alone diagnostics that avoid the VM/370 restrictions stated in the *IBM Virtual Machine Facility/370: Planning and System Generation Guide* (GC20-1801).

Serviceability of the 3704/3705 Under VM/370: VM/370 provides a concurrent problem determination capability for use with the 3704/3705 as a function of the **NETWORK TRACE** command. Options to this command allow tracing each basic transmission unit sent to and received from the 3704/3705 and also activating the network control program line trace for a particular 3704/3705 resource. For details on the **NETWORK TRACE** command, refer to *VM/370: Operator's Guide* (GC20-1806).

VM/370 utilizes the Online Test Standalone Executive Program (OLTSEP) as the primary interface for diagnostic online tests (OLTs) for all devices attached to the system. This means of support restricts the function of diagnostic tests that are provided for the 3704/3705 in network control mode when used by VM/370 for control of virtual machine operators' consoles. The following defines the serviceability aids that are or are not available for the 3704/3705 when used in this manner:

3704/3705 Internal Function Tests (IFTs): IFTS run under OLTSEP and provide the full level of device serviceability in this mode of operation that is available for the 3704/3705. An IFT requires the entire 3704/3705 for its use. The 3704/3705 is therefore not available for normal system use.

Down-line Tests

Terminal Tests - The 3700 series Online Terminal Test (OLTT) programs that are required to maintain the terminals supported by VM/370 through the Network Control Program will function under OLTSEP. This mode of operation will require the dedication of the 3704/3705 to the OLTSEP virtual machine, and therefore, the 3704/3705 cannot be used for normal system operations for the duration of the test.

Line/Modem Tests - The 3700 series Online Terminal Test (OLTT) programs do not function under OLTSEP. The 2700 series OLT programs can be executed under OLTSEP if the line or lines to be tested are partitioned emulation lines, and are set to emulation mode. The 2700 series OLTs are terminal tests that are also able to aid in line error detection.

Additional terminal serviceability aids and line problem determination aids are provided for the Network Control Program by the 3704/3705 Control Panel Tests, as outlined in the *IBM 3704 and 3705 Communications Controller Operator's Guide* (GA27-3055) and the VM/370 **ECHO** command as defined in the *VM/370: Command Language Reference for General Users* (GC20-1820).

SECURITY and AUDITABILITY HIGHLIGHTS

Since the virtual machines created by VM/370 are essentially equivalent to standalone S/370 machines, the isolation between virtual machine programs approaches the isolation between physically separate systems. This same isolation protects the VM/370 Control Program (CP) from inadvertent or malicious modification, thus protecting the protection mechanisms. Some of the security features provided are as follows:

- Main storage isolation - Virtual machine is restricted to its own address space; shared storage (if any) is enforced read-only.
- CP privilige classes restrict usage of the sensitive CP facilities to installation-authorized virtual machines.
- Password protection is provided both for access to the CP system and for access to user DASD files.
- Installation exits are provided to allow for extension of the access restrictions or for implementation of access journaling.
- Built-in traps prevent password penetration through repetition of access attempts.
- All virtual machine I/O is monitored and checked against extent authorization controls in the virtual configuration.

An additional security-related feature of VM/370 is that explicit installation action is required to permit the VM Measurement Facility to monitor potentially sensitive data transmitted to/from each user terminal.

PERFORMANCE

VM/370 has been designed to handle a diverse set of requirements with virtual machines.

The performance of systems and programs running in virtual machines, as compared to real machines, will be reduced by varying degrees. Thus, performance will be influenced by such factors as: The total amount of real storage available; the speed, capacity, and number of paging devices; CCW translation, privileged instruction and I/O interrupt handling for virtual machines; and the use of CP performance options.

Because of the dynamic nature of the virtual machine environment, no specific statement can be made concerning general performance.

VM/370 (5749-010) (cont'd)

However, it can be said that VM/370 gives highest priority to the interactive users for short periods of time, while the heavy computing user will be given less frequent but longer periods of use.

VM/370 system performance data is obtainable by users both at the console and, in an extended form, through a general-purpose data collection and recording facility with the VM/370 Measurement Facility, as follows:

Data obtainable at the console will show current load conditions on the system. Information on utilization and contention for major system resources (Processor, real storage and devices) will allow the system analyst to identify possible bottleneck conditions.

The data collection and recording facility can record a wide range of performance related statistical data for more detailed information. Several classes of data collection are provided which may be activated either separately or together. The accumulated data is recorded on tape for later examination and reduction by the user.

The 3270 remote and binary-synchronous line configurations affect response times observed at the 3270 remote display devices. On the basis of the speed of the communication line, users of the CMS Editor may choose between multiple line transmission to the 3270 device (similar to CMS editor support for local 3270s) and a single line at a time mode (as though the display screen were a 2741).

Considerations regarding performance can also be found in the *IBM VM/370: Introduction* (GC20-1800), "Virtual Machine Operating System" section and in the *VM/370: System Programmer's Guide* (GC20-1807).

INSTALLATION PLANNING

Generating and installing the initial release of VM/370 requires coordinated planning between the customer, DP marketing representative, systems engineers (providing marketing support services), FE programming and service representatives and the communications common carrier. The *IBM Virtual Machine Facility/370: Planning and System Generation Guide* (GC20-1801) should be reviewed thoroughly before ordering or generating the VM/370 system.

PROGRAMMING UPDATE SERVICE

Programming update service for VM/370 is provided using the VM/370 Program Level Change (PLC) service.

A given release of VM/370 consists of the release base as well as all updates made available to date via the VM/370 PLC service. The release is designated by both the base number and the PLC number. Support for a given release of VM/370 will be available for six months following the next subsequent release of VM/370. PLCs issued to distribute fixes to an old base, after a new base is released, do not constitute a new release of the system.

The VM/370 PLC is a system update service that can include new functions as well as cumulative system changes. The latest PLC tape is made available at PID as well as all previous updates since the last VM/370 release base. Field Engineering is responsible for initially ordering the PLC service. Thereafter, PID will automatically ship the PLC tapes to the the FE location, and FE is responsible for applying the updates to the user's system. These tapes are not automatically distributed to customers of record by PID.

DOCUMENTATION
(available from Mechanicsburg)

Title	Number
VM/370 System Logic and Problem Determination Guide Vol.1. Control Program (CP)	SY-0886
VM/370 System Logic and Problem Determination Guide Vol 2. Conversational Monitor System (CMS)	SY-0887
VM/370 System Logic and Problem Determination Guide Vol 3. Remote Spooling Communications System(RSCS)	SY-0888
VM/370 Planning and System Generation Guide	GC20-1801
VM/370 Operator's Guide	GC20-1806
VM/370 System Programmer's Guide	GC20-1807
VM/370 System Messages	GC20-1808
VM/370 Terminal User's Guide	GC20-1810
VM/370 RSCS User's Guide	GC20-1816
VM/370 CMS Command and Macro Reference	GC20-1818
VM/370 CMS User's Guide	GC20-1819
VM/370 CP Command Reference for General Users	GC20-1820
VM/370 Release 6 Guide	GC20-1834
VM/370 Interactive Problem Control System User's Guide	GC20-1823
OS/VS and VM/370 Assembler Programmer's Guide	GC33-4021
VM/370 Introduction	GC20-1800
VM/370 OLTSEP and Error Recording Guide	GC20-1809
VM/370 Glossary and Master Index	GC20-1813
VM/370 Operating Systems in a Virtual Machine	GC20-1821
VM/370 Quick Guide for Users (Reference Summary)	GX20-1826
VM/370 Summary of VM/370 CP and CMS Commands reference card)	GX20-1961
VM/370 Service Routines Program Logic	SY20-0882
VM/370 Data Areas and Control Block Logic	SY20-0884
VM/370 Control Program Listings Microfiche	SYB0-0900
VM/370 Conversational Monitor System Listings Microfiche	SYB0-0901
VM/370 Remote Spooling Communications Subsystem Microfiche	SYC0-9000
VM/370 Interactive Problem Control System Microfiche	SYC0-9001
VS2 EREP Microfiche	SJD2-4350
VM/370 Environmental Recording, Editing and Printing (EREP) Program	GC29-8300
VM/370 Environmental Recording, Editing and Printing (EREP) Program Logic	SY25-7701
OS/VS, DOS/VS and VM/370 Assembler Language	GC33-4010
OS/VS and VM/370 Assembler Logic	SY33-8041

SCP PROGRAMMING SERVICES: Class 1 SCP

5752-VS2 - OPERATING SYSTEM/VIRTUAL STORAGE 2

PURPOSE

Operating System/Virtual Storage 2 (OS/VS2) (also known as VS2) is an operating system, upward compatible from MFT, MVT and OS/VS1. OS/VS2 Release 1 (SVS) makes available a single address space of 16 megabytes for programs and data. In MVS (VS2 Release 2 and subsequent MVS releases), each job or timesharing user is provided with individual 16 megabyte virtual address space. The 16 megabytes include the space required for system code and tables. OS/VS2 supports the S/370 mdls 145, 148, 155II, 158, 165II, 168 and the 3031, 3032 and 3033 Processors. In addition, MVS supports the 158MP, 168MP, 158AP, 168AP and 3031AP systems.

DESCRIPTION

MVS Release 3.8 is a refresh release with SUs integrated in the release described in Chart 1 of the Announcement Letter.

In MVS Release 2, Job Entry Subsystem 2 (JES2), which is upward compatible with HASP, is provided. MVS Release 3 allows two to seven JES2 systems to operate in a JES2 Multi-Access Spool environment. JES3 is an SU to MVS Release 3.7 and Release 3.8 and is upward compatible with ASP. Both have been incorporated in the system control program as an SCP component. One or the other must be used for job entry.

Virtual storage can exceed the available main storage ("real storage") in the system. This is possible because virtual storage resides on direct access devices as well as in real storage.

Virtual storage is organized in 4K-byte blocks called pages which are loaded from direct access storage into real storage for execution and written out to direct access storage when not actively being used and the space they occupy is needed and an exact copy does not exist on the paging device.

Virtual storage reduces the need for programmers to be aware of storage constraints.

Real storage utilization can be increased, providing the capability to increase multiprogramming and resource utilization.

TSO user regions are paged. Real storage utilization for TSO reflects actual requirements to execute the program as compared to fixed MVT time shared region.

Virtual storage allows most programs to run in a system with less real storage than the program was designed for. This enables testing and backup on smaller real storage systems.

Link Pack Area (LPA) is paged. All transient SVCs, transient ERPs, Appendages, most data management and most job management modules as well as any reentrant programs can be included in LPA without dedicating real storage for each program. A portion of the LPA may be fixed in real storage.

OS/VS2 includes features which are designed to improve the integrity of the system. These include Region Protection, Authorized Program Facility and DEB Validity Checking. The combination of fetch protection, a standard feature on VS2 supported Processors and the dispatcher's manipulation of segment table validity bits prevents unauthorized access of user regions. The use of control program services may be restricted to designated programs, using Authorized Program Facility (APF). The DEB Validity Checking facility aids in preventing an unauthorized user from modifying direct access extents or gaining control in supervisor state.

Note: For SVS restrictions, refer to the *OS/VS2 Planning Guide* (GC28-0600) and for MVS the *Introduction to OS/VS2 Release 2* (GC28-0661).

Facilities to Support Virtual Storage

Enhancements to the Linkage Editor permit the programmer to group related CSECTs together and place them on page boundaries. The result is the ability to localize references within a page, and help to reduce the number of pages brought into real storage.

Extensions to System Management Facilities (SMF) are made to record information regarding paging activity.

Additional VS2 Facilities Over MVT

An enhancement to IEBCOPY to allow unloading a partitioned data set to a removable volume and loading it at a later date to the same or a different type of volume.

RMS facilities are expanded to check for missing interrupts and alert the operator so that action can be taken.

VS2 Assembler supports all available S/370 instructions, improved macro instructions, conditional assembly statements and dynamic work area.

A Quick-Start IPL can be performed when a previously created LPA is in external page storage eliminating the necessity of having to recreate pageable LPA in external page storage and to reconstruct the BLDL table during each IPL.

SVS HIGHLIGHTS

In addition to the availability of 16 megabytes of virtual address space described previously, SVS provides the following facilities:

Virtual Telecommunications Access Method - VTAM: Refer to the VTAM section below for a description.

Resource Management

Dynamic dispatching is a feature of the task supervisor included in the system when the automatic priority group (APG) option is selected. Installation-designated groups of tasks are dispatched based on their operational characteristics: Processor-oriented or I/O-oriented. Processor and I/O characteristics of the group of tasks are constantly monitored during their execution and changes are taken into account in the dispatching process.

VS2 will select low priority jobs and migrate their pages from the primary paging device to the secondary paging device when the system specified level of activity on the primary paging device is reached.

I/O load balancing provides an improved method of allocating data sets that do not have a specific volume assignment, based upon the use of devices across the entire configuration.

HASP II Version 4 and ASP Version 3.2 are supported under SVS.

Analysis Program-1 (AP-1: aids the operator in analyzing 3350 or 3344 DASD error situations and in isolating such errors into hardware or media related areas.

AP-1 may be directed to test for hardware errors only or hardware and media errors. Simple result messages appear on the operator console. Detailed error related data are directed to SYSPRINT.

AP-1 will only analyze errors associated with 3350 or 3344 devices and requires that one of these devices be on the system.

MVS HIGHLIGHTS

Multiprocessing With Shared Real Storage

Support either two Model 158MP processors or two mdl 168MP processors providing flexibility in the use of computing resources through shared main storage, alternate path I/O control, and inter-processor communication.

Provide the potential for improved installation workload scheduling over that attainable with two separate uniprocessing systems by pooling resources such as main storage, secondary storage and central processing units.

Can be operated as an MP system or partitioned through operator commands. While one system continues operation, the other system may be reinitialized with another operating system. The two systems are then operated as two independent systems.

Extend MP availability with an alternate Processor recovery (ACR) facility allowing the non-failing Processor to attempt recovery processing for the operating system without using the failing Processor. The timing facility allows continued operation after failure of the time-of-day clock on one of the Processors. A new recovery facility allows resetting a specific channel or subchannel and attempts the restart of I/O operations by the non-failing Processor. Storage reconfiguration facilities allow logical isolation of failing main storage in 4K byte elements.

Provide less disabled code through the use of a new locking structure in the control program. The existence of multiple locks allows the processing of non-intersecting queue structures without interference from the other Processor.

Allow an installation to specify that a specific program (e.g., emulator) should run on a certain Processor.

On 168MP systems, channels attached to a stopped Processor may be accessed via the Channel 6 interface of the still running Processor via Channel Reconfiguration Hardware (CRH) support. With this support, all channels in both the stopped and the running Processor remain accessible for I/O. Note that CRH cannot be activated when DSS is active in the system.

Attached Processor support of the attachment of a 3052 or 3062 APU.

Work Scheduling: In MVS the job scheduler has been restructured so that the Job Entry Subsystem now performs: reading ... writing ... job queuing ... job selection... warm start processing.

Job Entry Subsystem 2 (JES2) is upward compatible from HASP Versions 2, 3 and 4 and streamlines job processing by providing:

- Preallocated external storage for SYSIN and SYSOUT data sets.
- Transparent buffering and spooling.
- Control of starting and stopping initiators.
- Optional SYSOUT writing at data set close time rather than at the end of a job.

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- MULTI-LEAVING to intelligent workstations.
- Support for high-speed binary synchronous terminals through 270X or 3704/3705 in emulation mode.
- a warm start facility allowing installations to perform warm start processing concurrent with other jobs or following high priority jobs.

In MVS Release 3, JES2 support is extended to allow from two to seven systems to share the JES2 input, job, and output queues through use of Shared DASD to support a JES2 Multi-Access Spool environment.

An SU to MVS Release 3.7 provides Job Entry Subsystem 2 (JES2) Release 4 support for the non-programmable models of the 3770 SDLC Terminals, the System/32, the 3790 Communication System, the 8100 Information System under DPPX, the 8100 Information System under DPPX/SP, and the 8100/DPCX Information System (as Remote Job Entry devices) via VTAM and the 3704/3705 in network control mode. The 3790 RJE workstation is also supported via Local Channel Attachment (LCA).

An SU to MVS Release 3.7 and MVS Release 3.8 when available, provides Job Entry Subsystem 3 (JES3) Release 3 support for the 3770 SDLC terminals (except for the 3773 P1, P2, P3, all models are supported), the S/32, and the 3790 Communication System (as Remote Job Entry devices) via VTAM and the 3704/3705 in network control mode. The 3790 RJE workstation is also supported via Local Channel Attachment (LCA). JES3 Release 3 support is designed to be generally upward compatible from the JES3 ICR, Release 2, and Release 2.1 as well as ASP Versions 3.0, 3.1 and 3.2. In addition to the basic JES facilities, JES3 Release 3 provides:

- Generalized job selection.
- Deadline scheduling.
- Dependent job control.
- Dynamic system interchange.
- Centralized operator interface.
- Single Global control of access to a single job queue with shared spool for MVS Release 3.7 and release 3.8 processors.
- Centralized device scheduling.
- Loosely coupled asymmetric system support.
- Support of OS/MVT and SVS operating systems as attached ASP main processors.
- Dynamic system interchange.
- Centralized operator interface.
- Single Global control of access to a single job queue with shared spool for MVS Release 3.7 and Release 3.8 processors.
- Centralized device scheduling.
- Loosely coupled asymmetric system support.
- Support of OS/MVT and SVS operating systems as attached ASP main processors.

Other job scheduler changes in MVS include:

The elimination of **SYS1.SYSJOBQE** - Each initiator now has its own scheduler work area (SWA), a pageable portion of each address space. The SWA contains most of the control blocks that were part of the job queue data set, thus reducing contention caused by frequent access to the job queue. To facilitate recovery, the control blocks can be recorded on direct access storage. Since control blocks are not built until a job is selected for execution, auxiliary storage requirements are less.

Revised I/O devices and data set allocation routines - installations can specify priorities for device types during allocation. Requests for different device types can now be satisfied in parallel. In addition, serialization on operator action is reduced. The routines also provide for more extensive recovery processing and data set release before job end. Permanently resident and reserved direct access devices have direct, unserialized allocation paths, allowing increased parallelism in allocation and deallocation.

Dynamic allocation extensions - dynamic allocation supports both background and foreground jobs. Support also includes most of the allocation options available via JCL such as all device types ... multi-volume or multi-unit data sets ... generation data groups ... concatenation of data sets ... optional freeing of data sets at CLOSE.

Data Management: In MVS the system paging mechanism can be used to perform data set access. This is known as virtual I/O; it handles data in page-size (4K) blocks. System-named temporary data sets accessed with BSAM, QSAM, BDAM, BPAM, XDAP, and EXCP can be processed by virtual I/O. This facility can be used without change to JCL or object code.

The VSAM master catalog has become the MVS system catalog. In addition to optionally containing pointers to VSAM user catalogs, it may also contain pointers to OS control volume catalogs. JCL extensions are also provided for the user to designate specific catalogs to be used for his job or job step.

The virtual telecommunications access method (VTAM) is a new direct-control teleprocessing access method. VTAM facilities are available to application programs including those using TCAM.

Virtual Storage Support: Extended virtual storage support in MVS provides each system user with a private 16-megabyte virtual address space (region) for user programs, system programs and work areas, and shared program and data areas. This design provides:

- More address space for jobs than could be provided in the fixed real regions of MVT or the virtual regions of SVS, permitting the use of programming techniques such as real storage addressing for "spill files".
- A potential for a high level of multiprogramming, since the number of concurrent users or jobs is limited only by the amount of auxiliary storage available for paging and the amount of real storage available for required resident system programs and control blocks.
- Elimination of inter-region virtual storage fragmentation.
- Extended protection features, since each job or foreground user is isolated in an independent address space.
- Effective management of large real storage.

Timesharing: Timesharing (an option in OS/MVT and SVS) is integrated and standard in the control program in MVS. With MVS:

Each timesharing user has a private virtual address space. Inter-user scheduling dependencies caused by sharing of storage regions by multiple users have been eliminated.

The data set handling commands are extended to allow allocation of multi-volume and multi-unit data sets, non-direct access data sets, and VSAM and virtual I/O data sets. Terminal users can allocate and unallocate concatenated data sets (other than VSAM and ISAM). Timesharing users may be selectively authorized by the installation to allocate data sets requiring volume mounting. Under installation control, timesharing users can direct SYSOUT data sets to remote stations defined to either Job Entry Subsystem.

The installation may specify a time interval which establishes a period that will permit a timesharing user to reconnect to the system in the event of a line disconnect. Should the interval lapse prior to the user reconnecting to the system, then the system will automatically save any data set which the user was in the process of editing.

Remote Entry Subsystem workstations are identified to the system in the same manner as TSO terminal users.

Resource Management: In MVS, the control program can dynamically regulate the utilization of most system resources. A central set of system resource management routines coordinates the scheduling of various system resources attempting to both maintain efficient resource utilization and also to satisfy installation specified performance objectives.

With this support ...

Each job/user will belong to one of several installation defined performance groups. The scheduling of system resources will then be controlled so that each job/user receives resources at a rate prescribed for the associated performance group by the installation.

The load on various system resources in monitored and resource scheduling decisions are made which will attempt to correct detected imbalances and overloads.

A measurement facility, MF/1, is provided which allows the installation to obtain System Profile reports on the utilization of Processor, paging activity, channels, devices, and performance groups. Overlap information between Processor and channels will also be available. This is in addition to SMF.

SYSTEM INTEGRITY

At the time MVS System Control Programming became available, it was stated that all known System Integrity exposures had been removed from MVS. This statement was based on IBM's knowledge of System Integrity at that time. Because it is never possible to certify that any system has perfect integrity, it was expected that additional exposures would come to light; and, therefore, it was also stated at that time that APARs describing additional exposures would be accepted. Since the release of MVS, a number of APARs on MVS System Integrity problems have been accepted as valid.

Since development of MVS began, a System Integrity Programming standard has been in place within IBM, and specific design and coding guidelines for System Integrity have been in use. As APARed integrity problems have been investigated and corrected, understanding of System Integrity has increased, more effective use has been made of

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the design and coding guidelines, and procedures have been established to make application of these guidelines a formal part of the design/development process.

System Integrity is defined for MVS as the inability of any program not authorized by a mechanism under the customer's control to:

1. Circumvent or disable store or fetch protection.
2. Access a password-protected or a RACF-protected resource. (RACF is the Resource Access Control Facility), or
3. Obtain control in an authorized state, that is, in Supervisor state, with a protection key less than eight (8), or APF-authorized.

MVS System Integrity does not specifically include data protection between concurrently executing applications within a single address space (e.g., one CICS/VS application's in-storage data from another CICS/VS application); the level of protection in such situations will be addressed in product documentation.

Program documentation, subject to change as IBM deems appropriate, informs the customer of what action must be taken and which facilities must be restricted to complement the System Integrity support provided by MVS. The customer is responsible for the selection, application, adequacy, and implementation of these actions and restrictions, and for appropriate controls.

SUPERVISOR (SVS and MVS)

The VS2 Supervisor is a part of the System Control Programming that monitors each unit of work being done in the system. The Supervisor, in general, automatically controls the use of the Processor, I/O, and real and virtual storage. It provides a variety of services such as allocating virtual storage space, performing I/O operations, loading programs into virtual storage, moving pages of programs into and out of real storage, and maintaining the address space (virtual storage) on auxiliary storage devices. To perform its function, the supervisor receives control of the Processor following an interruption which may have resulted from a specific service request or through an automatic interruption by the computing system.

SVS SUPERVISOR

The SVS Supervisor performs the same functions as the OS/MVT Supervisor. In addition to interruption handling, the SVS Supervisor performs Task Dispatching, Task Supervision, PCI Fetch, Contents Supervision, Timer Supervision - (using TOD Clock, Comparator and Processor Timer), Storage Supervision (virtual), I/O Supervision, Page Supervision, and Main Storage Supervision.

A function that has been added to support Dynamic Address Translation is paging supervision.

VS2 takes advantage of Dynamic Address Translation hardware. The system operates on the basis of virtual storage and real storage. Real storage is the storage of S/370 from which the central processing unit can directly obtain instructions and data and to which it can directly return results. Virtual storage is address space that appear to the user as real storage. From this address space, both system and user instructions and data are mapped into real storage locations. The size of virtual storage is limited by the addressing scheme of the computing system and available auxiliary storage space, not by the actual number of real storage locations. Regions are assigned from available virtual storage; the system assigns real storage only as it is actually needed for program use. In SVS, paged regions are assigned from one 16-megabyte virtual address space.

The VS2 virtual storage concept operates through Dynamic Address Translation. When a program executes, the system translates each virtual address into a corresponding real storage address as the instruction is executed.

With address translation, all 24 bits of an address are usable. Thus virtual address space can be (and real storage can appear to be) 16 megabytes. This address space is divided into 256 segments of 64K bytes each. The segments are subdivided into 16 pages of 4K bytes each.

VS2 requires that the system nucleus be in the non-paged part of real storage at IPL time. SQA and LSQA which is an extension of the TSO concept are fixed in real storage as required. An installation specifies a limit for the amount of real storage which can be used for non-pageable jobs. However, the real storage for non-pageable (virtual equals real) jobs, but not assigned to them, will be made available for paging tasks.

The remaining real storage is allocated for pages of the problem programs currently executing, paged system services and functions such as Link Pack Area, etc.

Real Storage is automatically managed by the operating system in discrete blocks of 4K bytes called pages. As a page in virtual storage is referenced, it is brought into real storage for processing, if it is not already in real storage. When pages are not being used and the real storage space is needed by another task, the page is written out onto auxiliary storage unless an exact copy already exists (i.e., the page was not modified during execution). This procedure is called demand paging. Paging Supervision consists of a set of functions that efficiently manages the contents of real storage as tasks are executing in a multiprogrammed, demand paging environment. It is responsible for:

Ensuring that the contents of real storage are addressable through the hardware DAT feature.

Exchanging virtual pages between auxiliary storage and real storage on a demand paging basis.

Interfacing with and servicing auxiliary requests such as fixing virtual pages in real storage prior to I/O and while I/O is in progress.

Paging Supervision directly initiates page movement from real storage to auxiliary storage, when required. All other page movement comes about as a consequence of an implicit or explicit request from an external source.

VS2 is able to assume the image of a large contiguous real storage by keeping only required virtual pages in real storage during execution.

The job of the supervisor is to provide the resources and services that programs need in such a way that at any given time as many services and resources as possible are in use.

MVS SUPERVISOR

Additional supervisor functions are provided in MVS. These include: Resource management ... Multiprocessing ... Multiple address space supervision ... Service management ... Recovery management ... IOS redesign.

Multiple address space supervision is provided by real storage management routines, auxiliary storage management routines, and virtual storage management routines. The functions performed by the real storage manager (RSM) and the auxiliary storage manager (ASM) correspond to those performed by the SVS paging supervisor with some additions to support multiple virtual address spaces and the virtual I/O facility. The real storage manager: directs the movement of virtual pages between real storage and auxiliary storage ... creates a segment table for each job or timesharing (TSO) user in the system (each segment table defines an individual virtual address space) ... handles virtual page requests (e.g., fix, free, page-in, page-out).

The auxiliary storage manager: initiates the actual paging I/O necessary to transfer pages in and out of real storage ... performs space management for all external page storage which includes temporary virtual I/O data sets.

The virtual storage manager services the **GETMAIN** and **FREEMAIN** macro instructions by allocating/deallocating storage within the virtual address space.

The service management function consists of new dispatching and queuing techniques that provide the potential for system components to provide services that execute enabled, unserialized, and in parallel on a tightly-coupled multiprocessing (MP) as well as a uniprocessing system. The basic control structure used by the service manager incorporates two levels of system priority; global and local. Service requests queued at the global level are given a higher priority than that of any address space, regardless of the address space in which they will be dispatched. (An address space is allocated for each job.) Service requests queued at the local level are given a priority equal to that of the address space in which they will be dispatched, but higher than any task within that address space.

Recovery management monitors the flow of control through recovery processing for; system, address space, and task failures, and performs normal and abnormal task and address space termination processing. It provides to system functions, and optionally to problem programs, the means necessary to intercept, attempt recovery, and record unexpected or expected error situations. The recovery processing is designed to operate at different levels of control. If a recovery routine for a process operating at one level of control is unable to recover from an error, the error is passed to a recovery routine at a previous (higher) level of control.

The I/O supervisor (IOS) routines have been redesigned for MVS to provide the potential for greater parallelism on multiprocessing systems as well as a reduced amount of page fixing for I/O operation. Concurrent execution of I/O operations and other supervisory functions on multiprocessing systems is made possible by a hierarchical structure of locks.

MVS Release 3 Supervisor Additions: The number of UCBs supported is increased to up to 1,023. They may reside between locations 4,096 and 65,535.

A new **EVENTS** macro allows the user to wait on the completion of one of n events without the POST routine and the user application repeatedly scanning a long list of Event Control Blocks.

Additional recovery capability for the 168MP system (Channel Reconfiguration Hardware support) permits all channels in a running Processor and a stopped Processor to remain accessible for I/O. The channels attached to the stopped Processor can be accessed via the

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Channel 6 interface of the still running Processor. It should be noted that CRH cannot be activated when DSS is active in the system.

JOB MANAGEMENT (SVS and MVS)

VS2 job management is a part of the system control program that controls the processing of jobs. It performs a variety of functions that include processing commands, reading and interpreting job and step definitions, allocating data sets and I/O devices, scheduling jobs, and writing system messages and job output.

SVS JOB MANAGEMENT

The master scheduler and job scheduler are major parts of the operating system that control the processing of jobs. The master scheduler initializes the system and responds to operator commands by initiating the requested actions. The job scheduler reads and interprets job definitions, schedules the jobs for processing, initiates and terminates the processing of jobs and job steps, and records job output data.

Master Scheduler: The master scheduler is one of the system tasks established when the system is loaded. Its functions can be divided into two categories: initializations and command processing.

Master scheduler initialization functions are: Initializing the time-ofday clock ... Initializing the system log ... Initializing the System Management Facilities (SMF) ... Initializing the Resource Manager ... Initializing Missing Interrupt Handler Task ... Establishing an ESTAE environment to handle system task failure during initialization.

Command processing is the reading, scheduling, and executing of operator commands issued via either a console device or an input job stream.

The reading of commands entered via a console device is performed by routines operating under a console communication task; the reading of commands entered via an input job stream is performed by routines operating under a converter task associated with JES2.

The scheduling of a command consists of storing the command and the readying of a task to continue processing the command. A command scheduling routine operates under either the console communications task (when the command was issued via a console device) or a JES2 task (when the command was issued via an input job stream).

The executing of a command is the performance of the function specified in the command. The functions are performed either as new tasks established by the master scheduler or as parts of existing system tasks.

Job Scheduler: The job scheduler is divided into three major parts: the converter/interpreter, the initiator/terminator, and the output writer. Each part is a separate task and thus can be executed concurrently with and independently of the others.

Converter/Interpreter: The converter/interpreter performs as a subroutine of JES2, analyzes the definitions, and builds control blocks and tables that are used during execution of the job steps. The converter also analyzes commands encountered in the input stream.

The control blocks and tables constructed by the interpreter contain job attributes, job step attributes, information needed to assign devices to data sets, and data set attributes.

Initiator/Terminator: The initiator/terminator invokes JES2 to obtain jobs and job steps to be executed. It analyzes the I/O device requirements of the job steps, allocates devices to them, creates tasks for them, and at completion of the jobs, supplies control information to JES2 for writing job output on a system output unit.

After receiving an interpreted job to be executed, the initiator/terminator examines the types of regions requested for the job. If the job requires nonpageable storage for execution, the initiator/terminator reserves a unique non-zero protection key for the job.

During allocation, in order to reduce contention for I/O devices, a new algorithm for I/O load balancing is used. The new algorithm allocates devices for data sets that have nonspecific device requests. Rather than basing the algorithm on a count of allocated data sets on a device (as in MVT), in VS2 the actual number of I/O requests to a tape or direct access device will be monitored to get a more accurate picture. of I/O load. The device determined to be the best candidate for allocation to a given data set is then selected.

All user pageable regions have the same protect key value, that is "8" including TSO regions. Each nonpageable region is assigned a unique protect key value within the range of 9 to 15. Pageable regions are allocated virtual storage in 64K byte segments while nonpageable regions are allocated real storage in 4K byte increments.

Output Writer: The output writer transfers system messages and system output data sets from the direct access volume on which they were initially written by the system to a specified output device.

Output data sets can be directed to a class of devices, and references to the data are then placed on an output work queue. Because the queue is maintained in priority sequence, the system output writers can select jobs in the output work queue on a priority basis.

MVS JOB MANAGEMENT

In MVS, job management functions are performed by the master scheduler, JES2, and the job scheduler.

The master scheduler initializes the system and responds to operator commands by initiating the requested actions. The job entry subsystem reads job definitions, schedules the jobs for processing, and records job output data. The job scheduler builds control blocks in the scheduler work area (SWA) and initiates and terminates the processing of jobs and job steps.

Master Scheduler: The master scheduler is a system-initiated task that is established when the system is loaded. Its functions can be divided into two categories: initialization and command processing.

Master scheduler initialization consists of:

Initializing the communications task to handle all communication with the operator console.
Initializing the time-of-day clock.
Creating the subsystem CVTs.
Initializing the SWA management function.
Initializing the system management facilities (SMF).
Initializing the missing interruption checker.
Establishing an ESTAE environment to handle system task failures during initialization.

Command processing includes the reading, scheduling, and executing of operator commands issued through a console device, an input job stream or a remote workstation.

The scheduling of a command consists of storing the command and readying of a task to continue processing the command. A command scheduling routine operates under either the console communications task (when the command was issued from a console device), or the reader task (when the command was issued through an input job stream).

The executing of a command is the performance of the function specified by the command. The functions are performed either as new tasks established by the master scheduler or as parts of existing system tasks.

JOB ENTRY SUBSYSTEM 2 - JES2 (MVS)

JES2 is an integral part of MVS and provides support in the areas of job management, data management for subsystem data sets, and Remote Job Entry. JES2 operates as a system task in a private address space and communicates with MVS via formally defined subsystem interfaces.

Features that may add to system performance are efficient SPOOL management routines and the MULTI-LEAVING line manager. MULTI-LEAVING is employed with all Processor workstations and will tend to maximize line effectiveness and provide concurrent operation of all supported workstation devices.

The job input and output services provided for local peripheral devices along with a subset of the JES2 operator command capability are optionally extended to remote workstations, including both Processor and non-Processor terminals. Workstation programs for S/360/370 Processors, 1130, and S/3 are generated as extensions to JES2 and operate in the workstation on a 'stand-alone' basis. The JES2 RJE implementation for binary synchronous Processor workstations is based upon the HASP MULTI-LEAVING philosophy which provides the capability for concurrent operation for all supported terminal job input, output, and console devices. Concurrent operation of devices on SNA Workstations is provided through support for the Multiple Logical Unit (MLU) protocols of SNA.

JES2 Description: JES2 is a specialized program which operates in the same Processor with MVS to perform the peripheral functions associated with batch job processing.

JES2 is started as a job entry subsystem. Control of designated unit-record devices is taken, the specified intermediate storage direct access device(s) are initialized, and job processing begins. JES2 has four major processing stages which relate to its four major external functions. These are:

1. **INPUT STAGE** - This stage reads jobs simultaneously from a variable number of various types of online card readers and remote terminals. These jobs are then entered into a priority queue to await processing by the next stage.
2. **CONVERTER STAGE** - This stage passes the Job Control Language (JCL) to the MVS Converter which merges the specified procedures from the appropriate Procedure Library, performs a basic syntactical scan, and converts the JCL statements into an "internal text" format which JES2 SPOOLs for later use by the MVS Interpreter. The jobs are then queued by job class to await processing by the next stage.
3. **EXECUTION STAGE** - This stage removes jobs based upon priority and class from the queue established by the Converter Stage and passes those jobs to MVS for processing. Input cards are supplied as required to the executing program and print and punch records

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are received and written onto JES2 intermediate storage. This stage can simultaneously control all jobs being processed by MVS. At the completion of a job, it is placed in a queue to await processing by the next stage.

4. OUTPUT STAGE - This stage transcribes the print and punch output generated by jobs in the previous stage to printers and punches. A variable number of various types of printers, punches, and remote terminals can be operated simultaneously.

All of these processes are controlled by reenterable code so that no additional code is required to support multiple, simultaneous functions. Since all of the above functions can occur simultaneously and asynchronously, a continuous flow of jobs may pass through the system.

Following are some of the more significant algorithms employed by JES2 to improve function and performance:

Specialized Direct-Access Storage Allocations: JES2, through the use of an allocation bit map in main storage, dynamically allocates space for intermediate storage on a record basis, within definable track groups, for jobs. The use of this technique offers the following advantages:

1. Disk-arm motion and interference is minimized by dynamically allocating space based upon the position of the access mechanism.
2. Disk area fragmentation is automatically eliminated by allocation of the smallest possible increment of space.
3. The data for a single data set can be spread across multiple direct-access volumes. In addition to further optimizing arm motion, this capability allows for multiple selector channels to increase the data rate for a given job.
4. Space is allocated as required, minimizing the loss of space as a result of over-estimated output requirements.
5. The release of previously used space is accomplished by a simple algorithm which requires no I/O operations.

Unit Record Device Command Chaining: While operating any reader, printer or punch, rather than handling each record separately, JES2 constructs a chained sequence of channel command words to pass to the channel. Thus, instead of the overhead of the EXCP and the ensuing interrupts for each record transmitted, only one EXCP and associated interrupt is required for a series of records. For example, when reading a job into the system, JES2 might chain 40 commands together to instruct a card reader. This would cause the next 40 cards to be read into storage without requiring the execution of any Processor instructions.

Transparent Blocking: All input, print and punch for every job is automatically blocked by JES2 to improve performance. Since all deblocking is also done by JES2, any program, even if designed to operate with unblocked records, can benefit from the blocking.

JES2 Standard Features: The standard features of JES2 are as follows:

- **Job input service** provides for low-overhead reading of job streams and storing of data on SPOOLing volumes for later high-speed retrieval for up to 99 concurrently active local card readers in any combination of devices as follows: 2540 reader ... 2501 reader ... 2520 punch (with read feature) ... 3505 reader (80-column punched cards only) ... 3525 punch (with read feature).
- **Converter service** provides for the merging of the submitted JCL with user or installation selected procedure libraries and for an early scan of this combined JCL for syntactical errors.
- **Execution service** provides for selection of jobs and execution monitoring for up to 99 concurrently executing jobs as follows: selection of jobs based upon job class and initiator priority class list of up to 36 classes for each initiator ... automatic delaying of jobs with duplicate OS jobnames ... automatic deblocking and blocking of user SYSIN/SYSOUT data ... counting of lines, cards, and execution duration with optional operator notification and/or cancellation ... interface for SMF counting of SYSIN data.
- **Multiple SPOOLing volume support** provides for balanced utilization of up to 36 volumes for any combination of any models of the following devices (one required): 2314 ... 3330 ... 2305.
- **Warm start capability** provides for checkpointing critical JES2 information sufficient for: optionally restarting jobs which were executing ... restarting print and punch at the last checkpoint.
- **Job output print service** provides for low overhead printing of job stream, system message, and user data print output for up to 99 concurrently active local printers in any combination of devices as follows: 1403 Printer ... 3211 Printer.
- **Special forms support** provides for the routing of print (on a job or data set basis) and punch data (on a data set basis) to special forms output queues for output as directed by the operator.
- **Internal Reader facility** provides the ability for any task within the system to submit jobs to JES2 for batch execution as though entered from a JES2 card reader.
- **Console Support** provides for direct entry for JES2 commands and JES2 abbreviated replies to WTORs through MVS operator consoles.
- JES2 interfaces directly with the MVS SMF writer to produce seven SMF records (types 6, 26, 43, 45, 47, 48, and 49). JES2 also provides two user SMF exits (IEFUSO and IEFUJP).

JES2 Optional Features: In addition to the standard features, the following optional features are available:

- **Job output punch service** provides for low overhead punching of job stream user punch output for up to 99 concurrently active local punches in any combination of devices as follows: 2520 punch ... 2540 punch ... 3525 punch.
- **Execution Batching** provides the facility for passing jobs directly to a processing program such as a "one-step" monitor, reducing the overhead of OS scheduling and allocation for short running jobs requiring limited system facilities.
- **Priority Aging** provides for automatically increasing the JES2 scheduling priority of jobs which have been in the system for extended periods of time.
- **Remote Job Entry** provides for high speed communications with binary synchronous and SDLC batch workstations which may be used for job stream input and output as well as operator control of the devices and jobs associated with the remote (see *JES2 RJE Features).*

JES2 RJE Features: Those features common to all JES2 RJE configurations are as follows:

- JES2 RJE supports up to 255 remote workstations communicating over nonswitched (point-to-point) or switched lines.
- JES2 RJE provides for concurrent operations over up to 255 lines assigned to unique communication line adapter addresses of the following types: SDA Type II on a 2701 for Binary Synchronous ... Synchronous Base on a 2703 for Binary Synchronous ... 3704 providing 270X emulation ... 3705 providing 270X emulation.
- Output routing control provides for print and punch output to be directed to the devices attached to the remote, to the central system, or to other remotes as designated by JES2 initialization parameters, by control cards submitted with the job, or by operator command.
- Remote operator control provides a subset of the JES2 operator commands for display of information and control of jobs and devices associated with the remote.
- Operator message output provides for transmission of messages and responses to remote operators with online MULTI-LEAVING workstations with consoles immediately and optional saving of messages for all other remotes until the remote is online and has a printer available.
- Workstation programs, when required, are supplied as extensions of JES2 and are contained on the JES2 distribution libraries in source form.
- Terminal support on the central system provides for communication with: 2772 (Binary Synchronous) ...2780 (Binary Synchronous) ... 3780 (Binary Synchronous) ... 5110 Computer (as a 2772 BSC) ... S/360 mdls 20, 25, 30, 40, 50, 65, 65MP, 67 (in 65 mode), 75, 85, and 195 (MULTI-LEAVING) ... All virtual storage S/370 Processors (MULTI-LEAVING) ... 1131 (MULTI-LEAVING) ... System/3 (MULTI-LEAVING) ... System/32 or System/34 (MULTI-LEAVING as a System/3) and System/32 or System/34 (SDLC as a 3770) (MULTI-LEAVING) ... System/36 (MULTI-LEAVING as a System/3 or MULTI-LEAVING as a S/360 or S/370) and System/36 (SDLC as a 3770 or multiple logical units) ... 5285 and 5288 (MULTI-LEAVING as a System/3 and SDLC as a 3770) and 8100/DPPX (multiple logical unit SDLC) or 8100/DPPX/SP (multiple logical unit SDLC).
- The sign-on feature provides for remote identification and line security through remote and line passwords.
- Remote characteristics support utilizes the unique features on each remote as follows: full text transparency (required for object decks) ... text compression ... print line width truncation ... buffer size and blocking capabilities.

  Note: Multipoint or multidrop line features are prohibited.
- Remote job priority adjustment provides for favoring or limiting the JES2 scheduling priority of jobs submitted from each remote workstation.
- Line restart feature provides for warm starting of print output after remote workstation or line failures.

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- Line error recovery provides for continuous retry until successful transmission.

JES2 MULTI-LEAVING RJE Features

MULTI-LEAVING is a term which describes a computer-to-computer communication technique developed for use by the HASP system. In a gross sense, MULTI-LEAVING can be defined as the fully-synchronized, pseudo-simultaneous, bi-directional transmission of a variable number of data streams between two or more computers utilizing binary synchronous communications facilities. Those features common to all JES2 RJE configurations are provided with MULTI-LEAVING configurations with additional features as follows:

- **Concurrent device operation capability** provides for all supported devices to operate concurrently in accordance with the device characteristics, line speed, and characteristics of the data streams.
- **Dual reader/punch device support** provides for use as both reader and punch under automatic or operator control.
- **Unit record error recovery** provides a minimum of operator intervention and continued operations using unaffected devices on operator console configurations.

JES2/2770 RJE Workstation: The 2770 is supported by the JES2 RJE feature as a Binary Synchronous workstation for submission (and control) of jobs to JES2 for MVS processing and has the following features:

Device support of the 2772 provides for job stream input and output on the following devices: 2213 Printer mdl 2... 2203 Printer mdl A1 or A2 ... 2502 Reader mdl A1 or A2 ... 0545 Output Punch mdl 3 or 4.

Note: The standard keyboard provided with the 2772 may be used as a 2502 reader for text which is compatible with card input. Such input is limited to entry of commands and extremely short job stream input (a job stream must fit entirely within the 2772 buffer).

Extended support provides for special features: Buffer expansion ... Buffer expansion additional ... EBCDIC or ASCII transmission code ... Full text transparency for EBCDIC ... Space compression/expansion ... Horizontal format control ... 144 character print line (2203 only, requires buffer expansion).

The Terminal ID and Security ID features may be present but are not supported by JES2.

Note: Other features not prohibited by JES2 RJE and transparent to line control programming are permitted.

JES2/2780 RJE Workstation: The 2780 is supported by the JES2 RJE feature as a Binary Synchronous workstation for submission (and control) of jobs to JES2 for MVS processing and has the following features:

Device support provides for job stream input and output on the following 2780 configurations: Mdl 1 Printer and Reader ... Mdl 2 Printer, Reader, and Punch.

Extended support provides for special features: Multi-record transmission ... 120 and 144 character print line ... Horizontal format control ... EBCDIC or ASCII transmission code ... Full text transparency for EBCDIC.

The Terminal ID and Security ID features may be present but are not supported by JES2.

Note: Other features not prohibited by JES2 RJE and transparent to line control programming are permitted.

JES2/3741 RJE Workstation: The 3741 Data Station, mdl 2, and 3741 Programmable Work Station, mdl 4, are supported by the JES2 RJE feature as Binary Synchronous workstations for submission (and control) of jobs to JES2 for MVS processing. The support operates in 2780-compatible mode and allows for diskette jobstream input and output to diskettes. Supported features are: Fixed, unblocked input up to 80 character records ... Fixed, unblocked output up to 128 characters, including printer control characters ... EBCDIC or ASCII Transmission Code ... Multiple data sets on multiple diskettes or a single data set on multiple diskettes can be transmitted to MVS, however, the data will be concatenated into a single job or data set ... Null records (STX ETX) are accepted but not used as data set delimiters ... Status message (SOH) is accepted.

No special features are required.

JES2/3777-2 MULTI-LEAVING Workstation: The 3777 mdl 2 is supported as a S/360 mdl 20 Binary Synchronous MULTI-LEAVING Workstation for submission of jobs to JES2 for MVS processing and has the following features:

The RMTM20 workstation program is generated by JES2 remote generation procedures for a S/360-20 Submodel 5 with 12K of main storage.

Device support provides concurrent operations on each reader, printer, punch and console device: 3203-3 Printer (required) (specify 1403) ... 2502 Reader (required) (specify 2501) ... 3521 Punch (optional) (specify 1442) ... Console Display (optional) (specify 2152).

JES2/3780 RJE Workstation: The 3780 is supported by the JES2 RJE feature as a Binary Synchronous workstation for submission (and control) of jobs to JES2 for MVS processing and has the following features:

Device support provides for job stream input and output on the following devices: Card Reader ... Line Printer ... Card Punch.

Supported features are: 512 character buffer ... Variable length record ... Space compression/expansion ... EBCDIC or ASCII transmission code ... Full text transparency for EBCDIC ... Print positions (additional) for 144 character print line ... Horizontal format control.

The Terminal ID and Security ID features may be present but are not supported by JES2.

JES2/360-20 MULTI-LEAVING Workstation: The S/360 mdl 20 with Binary Synchronous adapter and JES2-provided workstation program is supported as a Binary Synchronous MULTI-LEAVING workstation for submission of jobs to JES2 for MVS processing and has the following features:

The RMTM20 workstation program is generated by JES2 remote generation procedures and requires a minimum of 8K main storage on a Model 20 submodels 2, 4, 5, and 6. Larger core (up to 32K) may be used for additional buffer storage if available.

Device support provides concurrent operations on one of each reader, printer, punch, and console device: 2203 Printer or 1403 Printer (one required) ... 2501, 2520, or 2560 Reader device (one required) ... 1442, 2520, or 2560 Punch device (optional) ... 2152 Console (optional).

Dual 2520 device support provides automatic determination of function as follows: Operator places blank cards in feed designating punch ... Operator places job stream in feed designating reader.

Dual 2560 device support provides selection of functions by feed hopper as follows: Primary feed assigned to reader ... Secondary feed assigned to punch.

Unit record data checks which require operator intervention may be corrected without stopping other functions when the 2152 console is available.

Communications adapter support on the workstation provides for EBCDIC code (transparency optional) over all available Binary Synchronous line speeds; however, speeds requiring the high speed feature (19.2K baud and above) are not recommended for the submodels 2 or 4.

JES2/360/370 MULTI-LEAVING Workstation: Any S/360/370 Processor except 2022 and 2020 with Binary Synchronous adapter and JES2-provided workstation programs are supported as Binary Synchronous MULTI-LEAVING workstations for submission of jobs to JES2 for MVS processing and have the following features:

The RMTM360 workstation program is generated by JES2 remote generation procedures and requires a minimum of 8K main storage to support single reader, printer, punch, and console device configurations. Larger storage (up to 32K) may be used as space for additional buffers and to support additional devices for up to seven readers, printers, punches (the number of printers when added to the number of punches must not exceed eight).

Device support provides for concurrent operations on each of the supported devices as follows: 2501 Reader ... 1442 Reader/Punch and Punch ... 2520 Reader/Punch and Punch ... 2540 Reader Punch ... 1403 Printer ... 3203 Printer ... 3211 Printer ... 4245 Printer ... 5203 Printer ... 1052 Printer-Keyboard ... 3210 Printer-Keyboard ... 3215 Printer-Keyboard.

Notes: At least one reader and one printer along with the printer-keyboard are required ... Each device (including communications adapter) must be on a separate non-shared subchannel.

Dual reader/punch support for 1442 and 2520 provides for automatic determination of function as follows: Operator places blank cards in feed designating punch ... Operator places job stream in feed designating reader.

Note: 2540 reader/punch has two independent card paths which operate concurrently.

Communications adapter support on the workstation provides for EBCDIC transmission (transparency optional) via: SDA Type II on a 2701 ... Synchronous base on a 2703 ... 270X emulation mode in a 3704 or 3705 ... Integrated Binary Synchronous adapter on mdls 25, 115, 125, and 135.

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JES2/1130 MULTI-LEAVING Workstation: The 1130 Computing System with Binary Synchronous adapter and JES2-provided workstation program is supported as a Binary Synchronous MULTI-LEAVING workstation for submission of jobs to JES2 for MVS processing and has the following features:

The RTP1130 workstation program is generated by JES2 remote generation procedures and requires a minimum of 8K main storage to operate all supported devices concurrently. Larger core (up to 32K) may be used for additional buffer storage.

Device support of the 1131 provides for concurrent operations on each of the supported devices as follows: 2501 Reader ... 1442 Reader/Punch or Punch ... 1132 Printer ... 1403 Printer ... Standard Printer-Keyboard.
Note: At least one reader required.

Dual reader/punch support for the 1442 provides for operator assignment of function.

Console output support provides for color-coded messages for separation of JES2 messages from workstation messages and operator input.

Single 1403 printer configurations support 132-character lines (RPQ feature required).
Note: This feature does not include support for UCS printers.

Communications adapter support on the workstation provides for EBCDIC code (transparency optional) at any speed available to the standard Binary Synchronous adapter attachable to the 1131.

JES2 System/3 MULTI-LEAVING Workstation: The System/3 with Binary Synchronous adapter and JES2-provided workstation program is supported as a Binary Synchronous MULTI-LEAVING workstation for submission of jobs to JES2 for MVS processing and has the following features:

The Syste,/3 workstation program is generated by JES2 remote generation procedures and requires a minimum of 8K main storage to operate all supported devices concurrently. Larger core is utilized when available.

Device support provides for concurrent operations on each of the supported devices as follows: 5424 Reader/Punch ... 1442 Reader/Punch ... 5203 Printer ... 1403 Printer ... 5471 Printer-Keyboard (console) ... 5475 Data Entry Keyboard (in lieu of 5471).
Note: At least one card reader and printer are required.

Dual reader/punch support for 1442 and 5424 provides for automatic determination of each card path as follows: Operator places blank cards in feed to designate punch ... Operator places job stream in feed to designate reader.

Each 96-column card punched is interpreted.

Communications adapter support on the workstation provides for EBCDIC code (transparency optional) at any speed available to the Binary Synchronous adapter selected (either Binary Synchronous Adapter #1 or Binary Synchronous Adapter #2).

Printer support provides for extra print positions and UCS images of LC and PN trains (PN recommended).

System/32 MULTI-LEAVING Work Station for JES2: The System/32 with Binary Synchronous Communications Adapter and its associated MRJE/WS System Utility Program is supported as a Binary Synchronous MULTI-LEAVING workstation for submission of jobs to JES2 for MVS processing and has the following features:

For remote workstation support by JES2, the System/32 must be specified as a System/3. The System/32 MRJE/WS System Utility Program is supplied as a component of the System/32 SCP.

Device support provides for concurrent operations on each of the supported facilities of the 5320 System Unit: Disk storage simulation of card I/O and/or printer data streams ... Line or serial printing ... Keyboard/display (console).

Communications adapter support on the workstation provides for EBCDIC code (Text Transparency optional) at any speed available to the Binary Synchronous Communications Adapter special feature.

System/34 MULTI-LEAVING Workstation for JES2: The System/34 with Communications Adapter and its associated MRJE System Utility Program is supported as a Binary Synchronous MULTI-LEAVING workstation for submission of jobs to JES2 for MVS processing and has the following features:

For remote workstation support by JES2, the System/34 must be specified as a System/3. The System/34 MRJE System Utility Program is supplied as a component of the System/34 SSP.

Device support provides for concurrent operations on each of the supported facilities of the 5340 System Unit: Disk storage simulation of card I/O and/or printer data streams ... line or serial printing ... keyboard/display (console).

Communications adapter support on the workstation provides for EBCDIC code (Text transparency optional) at any speed available to the Communications Adapter.

System/36 MULTI-LEAVING Workstation for JES2: The System/36 with its Communications Adapter and its associated MSRJE feature of the System Support Program (SSP) is supported as a Binary Synchronous MULTI-LEAVING workstation for submission of jobs to JES2 for MVS processing and has the following features:

For remote workstation support by JES2, the System/36 must be specified as a System/3 or as a S/360. The System/36 MSRJE is a feature of the System Support Program and also requires the Communications Extension feature of the SSP as well as the SSP.

Device support provides for concurrent operations on each of the supported facilities of the 5360 System Unit: Disk storage simulation of card I/O and/or printer data streams ... line or serial printing ... keyboard/display (console). Disk files are sent in card image (80 characters) and are received and built into a final form from card images.

Communications adapter support on the workstation provides for EBCDIC code (text transparency optional) at any speed available to the Communications Adapter.

5280 MULTI-LEAVING Work Station for JES 2: The 5280 Distributed Data System with the Communications Adapter and the Communications Utilities licensed program is supported as a Multileaving workstation for submission of jobs to JES 2 for MVS processing. See *5280 Communications Utilities* (5208-DC1) licensed program for details of the support.

Job Entry Subsystem 2 (Release 4.1): Subsequent to MVS Release 3, JES2 supports the non-programmable models of the 3770 Data Communication System, the S/32 (as a 3770), the 3600 Finance Communication System [i.e., 3602 Controller and the 3694 Document Processing System, when the IBM program product CHX/3694 (5748-F53) is used to supply the interface], and the 3790 Communication System as Remote Job Entry devices. Transmission to the 3770 terminals and to the 3602 and 3694 systems is via Synchronous Data Link Control (SDLC). Transmission to the 3790 system is via SDLC and LCA. This provides JES2 remote entry support for SDLC terminals in a terminal-sharing environment where multiple applications may establish logical connections with the terminal on a per-session basis. To achieve this flexibility of terminal-sharing, JES2 uses the VTAM application program interface for the support of the SDLC terminals which are attached to a 3704/3705 in network control mode.

SDLC Terminal Support: SDLC terminals supported by JES2 in MVS are the non-programmable models of the 3771, 3773, 3774, 3775, 3776 and 3777 Communication Terminals, 5285 and 5288 (as a 3770), the System/32 (as a 3770), the 3602 and 3694 with program product CHX/3694 (5748-F53), the System/34 (as a 3770), the System/36 (as a 3770 with multiple logical units), the 6670 Information Distributor (through the program product MVS/Information Distribution Workstation Support (5740-AMA), the 3790 Communication System and the 8100/DPCX Information System. Support for the 3770 family of devices includes the 3784 Line Printer, the 3521 Card Punch, the 3501 Card Reader and the 2502 Card Reader.

Functional characteristics of the JES2 support for 3770 SDLC terminals are as follows: Half-duplex flow ... Multipoint operation ... Serial data transmission operation (e.g., no concurrent operation of printer and punch on the outbound flow from JES2 to the SDLC terminals other than 3776-3,-4 and 3773-3 Multiple Logical Unit models) ... Multiple Logical Unit models of 3776 and 3777 support up to 6 independent and concurrent sessions inbound and outbound ... 3770 disk operation is transparent to JES2 ... Data stream provides compression of repeated characters outbound (3771, 3773, 3774, 3775), inbound and outbound (3776, 3777). Decompaction of outbound compacted data stream is supported by 3776 mdls 3 and 4 and the 3777 mdls 1 and 3.

JES support for the 3602 and 3694 Systems is limited to users of the program product CHX/3694 (5748-F53). Functional characteristics are as follows: Half-Duplex flow ... Multipoint Operation ... Concurrent device operation ... Full outbound compression and compaction of printer data sets to improve transmission line efficiency.

Support for the 3790 Data Communication System and the 8100/DPCX Information System provides: Printer features; Disk (spool), 3277 mdls 1 and 2 as consoles; 3277 mdls 1 and 2, 3276 mdls 2-4 and 12-14, and the 3278 as input devices.

Functional characteristics of the JES2 support for the 3790 System and 8100/DPCX System are as follows: Half-Duplex flow ... Multipoint Operation ... Concurrent device operation (Multiple printer features, maximum 2; Reader and Printer functions; Keyboard to disk and host communications) ... Outbound remote spooling - allowing data from host to be stored on disk for subsequent printing ... Full outbound compression of Printer data sets with an additional technique called compaction (combining pairs of characters into a single byte) to further improve transmission line efficiency.

OS/VS2 (5752-VS2) (cont'd)

Support for the 8100 Information System under DPPX or DPPX/SP includes device support through the DPPX or DPPX/SP Device Independent Interface. This support includes the print functions, Disk (Spool), and DPPX- or DPPX/SP-supported keyboard/printer or keyboard/display as a console (or a pair of DPPX or DPPX/SP data sets or a card/reader-printer) combination as a console substitute and any DPPX or DPPX/SP devices supported for sequential input.

Functional characteristics of the JES2 support for 8100/DPPX or 8100/DPPX/SP are:

Half-Duplex Flow.

Multipoint Operation (SNA only).

Concurrent Device Operations:

Multiple printers.
Reader and printer functions.
Keyboard to disk and host communication.

Outbound remote spooling (Printer Sharing Function), allowing data from the host to be stored for subsequent printing.

Full outboard decompression of printer data sets with an additional technique called compaction (combining pairs of characters into a single byte) to further improve transmission efficiency.

In addition, the JES2 Output Service function is extended to include support for the 3800 Printing Subsystem as a standard JES2 output device.

The JES2 support of the 3344 and 3350 Direct Access Storage devices is extended to incorporate a new technique for track address allocation called "Track Celling" and to provide for simultaneous formatting of SPOOL volumes.

The JES2 installation procedure is simplified by the elimination of all JES2 generation parameters. JES2 will now use parameters defined in the initialization parameter library to establish table values at initialization time rather than build the system from input parameters supplied during generation. This allows more dynamic changes to processing options and simplifies user tuning techniques.

Output device routing is enhanced by allowing symbolic names to be assigned to output devices and output to be routed to these symbolic names through user-coded control cards (JCL) and through operator commands.

Improvements are made to operator commands including modifications to make the commands more keyword oriented, and to provide routing extensions which allow routing to specific local devices using symbolic destination names.

JES2 serviceability is enhanced through the integration of all applicable updates and through a new service map concept which permits rapid and accurate diagnosis of current code level. A new module and control block map eases analysis of diagnostic dumps by providing a quick reference to the location of all modules and control blocks.

Job Entry Subsystem 2 Multi-Access Spool (MVS Release 3): In addition to those functions supported in JES2 in MVS Release 2, a new feature of JES2 allows from two to seven MVS Release 3 systems to share the JES2 input, job, and output queues through the use of Shared DASD. This feature This feature may be used to share the workload or a pool of JES2-controlled devices among processors. Jobs may be routed to any specific system or all systems in this multi-access spool complex. Furthermore, JES2-controlled unit record and remote devices need not, but may, be attached to each processor.

Each processor operates asynchronously within the multi-access spool complex, i.e., there is no master-slave relationship. Because of this operating design, any system in the complex can recover the workload accepted into the complex by any other system. Another system in the complex can have the RJE, TSO and unique unit record devices of the failing system physically switched to it and continue processing those jobs previously entered into the spool queue.

Another function supplied by the JES2 multi-access spool feature is the ability to isolate a processor for testing purposes. A processor may be designated as operating in independent mode, and in so doing, will only process jobs that are both routed to it and are themselves designated to be executed on that processor in independent mode.

The operator command set for JES2 in MVS Release 3 is much the same as the JES2 command set used in MVS Release 2. Additional facilities, however, have been added to control the multi-access spool complex. These facilities allow an operator to:

Add, delete, or explicitly identify the system affinity (routing) of jobs.

Display active and queued jobs for any processor or group of processors in the complex.

Take a system in the complex out of or place it into independent mode.

JOB ENTRY SUBSYSTEM 3 - JES3
(SU on MVS Release 3.7 and Release 3.8)

JES3 provides a generally compatible extension of ASP Release 3.2 and is designed to improve the operational environment of the computer installation by aiding many of the operator functions. JES3 can improve installation workload scheduling, increase the workload capacity, and reduce turnaround time. JES3 provides a single system image for the execution of many jobs concurrently on the connected processors.

JES3 can support up to eight JES3 processors, any of which can be a tightly coupled multiprocessor, operating under the control of MVS Release 3.7 and Release 3.8. JES3 can also support ASP main processors, operating under the control of OS/MVT or SVS. JES3 can logically interconnect up to 32 processors. A JES3 configuration consists of a global processor that controls all job input and output, and the scheduling of time sharing users, batch jobs and, optionally, devices. One to seven additional JES3 processors, called *JES3 local processors,* can be connected to the JES3 global processor. Each processor is attached to the JES3 global processor by a channel-tochannel (CTC) adapter which is used to interchange control information. The JES3 global processor handles all SYSIN and SYSOUT to and from peripheral devices.

JES3 design and the shared spool concept help to improve the overall availability of MVS Release 3 by permitting any JES3 local processor, if properly configured, to assume JES3 global functions. Should the JES3 global processor fail in a loosely coupled multiprocessing configuration, the operator can move the JES3 global function to any properly configured JES3 local processor. The degree of this availability depends on the presence of appropriate alternate CTC paths and switchable peripheral devices.

The JES3 global processor must operate under MVS Release 3.7 or Release 3.8. JES3 supports ASP main processors. Remote job processing from binary synchronous communication (BSC) and system network architecture (SNA) terminals is supported. JES3 also provides multiprogrammed background utilities which the operator can invoke.

As the installation workload grows, capacity can be increased by increasing the size of processors, by using multiprocessor configurations, and/or by adding additional JES3 local processors, operating under the control of MVS Release 3.7 or Release 3.8 or ASP main processors, operating under the control of OS/MVT or SVS. JES3 enables such expansion with minimal disruption to the operational environment. Jobs are distributed to available processors depending on job priority, device requirements, user specification, and processor dependencies. (A processor dependency is an attribute of a job that requires it to execute on a specific JES3 or ASP main processor. For example, if a job uses a device that is attached to only one processor, then the job has a processor dependency and must execute on the processor than can access the device).

Some of the features of JES3 are:

- Automatic scheduling of attached OS/MVT and SVS ASP main processors and MVS Release 3 JES3 local processors (including multiprocessors).
- New JCT Access Method with optional core resident JCTs. This access method facilitates reduced contention for JCT resources.
- Single operator interface to the entire system.
- Centralized console service.
- Logical device grouping with consoles defined for the group.
- Installation-specified, operator-controlled job selection algorithms for scheduling JES3 and ASP processors.
- Automatic scheduling of interdependent jobs (dependent job control).
- Deadline scheduling.
- Simulated console support for non-programmable remote terminals (2770, 2780, 3780).
- Multitasking of the MVS Release 3.7 or Release 3.8 Converter and Interpreter and the SVS Reader/Interpreter.
- Checkpoint/Restart support for jobs that execute under MVS Release 3.7 or Release 3.8.
- SMF support.
- Generalized peripheral scheduling and improved output service that includes related **INQUIRY/MODIFY** processing.
- Early JCL diagnosis through JES3's use of the VS2 Converter and Interpreter or the Reader/Interpreter.
- ASP to JES3 migration features.
- Support of TSO Foreground Initiated Background functions.
- Extensive RAS capability, for example:

OS/VS2 (5752-VS2) (cont'd)

Functional recovery routines.

Alternate Path Channel to Channel (ACTC).

Shared DASD for spool and JES3 checkpoint data sets.

Dynamic system interchange.

Spool I/O error recovery.

Dynamic device reconfiguration (DDR) support for non-shared setup devices.

HOTSTART of JES3 address space.

WARMSTART of JES3 system.

- Operation in a virtual machine in the IBM Virtual Machine Facility (VM/370).

REMOTE JOB PROCESSING (RJP)

Binary Synchronous Communication (BSC): JES3 Remote Job Processing (RJP) permits the input, processing, and output of jobs to and from terminals remote from the installation. This function is achieved through the use of the 3704 or 3705 Communications Controller (emulator mode), the 2701 Data Adapter, or the 2703 Transmission Control Unit to interface with binary synchronous communication (BSC) terminals. BSC remote terminals are used as remote card readers, printers, and card punches, with job output routed optionally to any remote terminal or local output device.

For detailed information related to JES3 BSC RJP see *Introduction to JES3* GC28-0607.

Synchronous Data Link Control (SDLC): JES3 SNA RJP will support the 3600 Finance Communication System (3602 and 3694), the 3790 Communication System, 8100/DPCX Information System and certain SDLC models of the 3770 Data Communication System and the 5280 Distributed Data System. JES3 SNA RJP will support the 8100 Information System under DPPX or the 8100 Information System under DPPX/SP with DPPX/SP/RJE with the Remote Job Entry Workstation Facility (DPPX/RJE) licensed program at the first customer shipment of DPPX/RJE or DPPX/SP/RJE. Transmission to the 3770 and the 3790 is via Synchronous Data Link Control (SDLC) through VTAM and NCP. This provides JES3 remote job processing support for SNA terminals in a terminal-sharing environment where multiple applications may establish logical connections with the terminal on a per-session basis. To achieve this flexibility of terminal-sharing, JES3 uses the VTAM application program interface for the support of the SDLC terminals which are attached to a 3704/3705 in network control mode. This use of the performance-oriented authorized path of VTAM enhances the performance of JES3 SNA RJP.

SDLC job entry stations supported by JES3 are 3600 Finance Communication System (3602 and 3694), the 8100 Information System under DPPX, the 8100 Information System under DPPX/SP, the 8100/DPCX Information System, the 5280 Distributed Data System, the System/34 (as a 3770 with multiple logical units), the System/36 (as a 3770 with multiple logical units), the 3790 Communication System and the 3770 Data Communication System (except for the 3773 P1, P2, P3, all SDLC models are supported). Multiple Logical Unit (MLU) 3776 mdls 3, 4 and 3777 mdl 3 with up to six independent and concurrent sessions are supported. Also supported are the 3784 Line Printer, the 3203-3 Printer, the 3521 Card Punch, the 3501 Card Reader and the 2502 Card Reader when attached to a 3770. In addition, JES3 supports the 6670 Information Distributor (SNA version) through the MVS/Information Distribution Workstation Support (see program product 5740-AMA). The 3790 Communication System and 8100/DPCX Information System support a single RJE workstation which can handle up to five logical concurrent processing sessions with JES3.

Functional characteristics of the JES3 SNA RJP support for SDLC terminals are as follows:

- Half-duplex session flow.
- Multidrop operation.
- 3770 diskette, 5280 diskette, 8100/DPPX and 8100/DPPX/SP disk operations, 8100/DPCX disk operations, and 3790 disk operations are transparent to JES3.
- Data stream provides compression of repeated characters outbound to the 8100 Information System under DPPX with DPPX/RJE or the 8100 Information System under DPPX/SP with DPPX/SP RJE, the 3790 Communication System, the 5280 Distributed Data System, the System/34 with the SSP (SRJE MLU), the System/36 with the SSP and MSRJE (MLU), the 8100/DPCX Information System, the 3600 Finance Communication System (3602 and 3694), and to the 3770 Data Communication System.
- Data compaction is supported outbound to the 8100 Information System under DPPX with DPPX/RJE, the 8100 Information System under DPPX/SP with DPPX/SP/RJE, the 3790 Communication System, the 3776 mdls 3 and 4 , the 3600 Finance Communication System (3602 and 3694), 3777 mdls 1 and 3 of the 3770 Data Communication System, the 5280 Distributed Data System and 8100/DPCX Information System.
- Single or multiple LUs (allowing multiple sessions) in a job entry station.
- Provides device setup for the 3600, the 3790 and the 8100 Information System under DPPX with DPPX/RJE, or the 8100 Information System under DPPX/SP with DPPX/SP/RJE, and 8100/DPCX by use of the Peripheral Data stream Information Record (PDIR).

JES3 support for the 3600 Finance Communication System is limited to users of program product CHX/3694 (5748-F53).

Job Scheduler: The job scheduler is divided into two major parts: the Converter and Interpreter and the Initiator/Terminator. The Converter and Interpreter consists of two separate subroutines that can be executed concurrently. The Converter may be executed independently of the Initiator/Terminator.

Converter/Interpreter: JCL interpretation is performed in two phases. The first phase (Converter) syntax checks the JCL and converts it along with procedures read from **SYS1.PROCLIB** into an internal text data set. The second phase (Interpreter) processes the internal text data set and builds control blocks for the job into a JES3 system data set. The job entry subsystem was designed to invoke the Converter and Interpreter before job selection so that jobs with JCL syntax errors will not be passed to an initiator for execution.

After job selection, the initiator invokes a job entry subsystem routine which reads the job's control blocks from the JES3 system data set and builds control blocks in the scheduler work area (SWA). The tables and control blocks constructed by the Interpreter contain the following information: job attributes ... job step attributes ... information needed to assign devices to data sets ... data set attributes.

Initiator/Terminator: The initiator/terminator requests a job from the job entry subsystem. It analyzes the I/O device requirements of the job steps, allocates devices to them and creates tasks for them. At the completion of the job, it informs the job entry subsystem the job has ended.

After the job entry subsystem selects a job, the initiator examines the type of address space requested for the job. If the job requires non-pageable real storage for execution, the initiator reserves a unique non-zero protection key for the job.

All user pageable address spaces, including timesharing address spaces, have the same protect key value, that is "8". Each non-pageable region is assigned a unique protect key value within the range of 9 to 15.

I/O device and data set allocation routines have been revised for VS2. Installations can now specify priorities for allocation of device types. Data sets may be released before job completion. Increased parallel processing is provided by changes such as the direct unserialized path through allocation for permanently resident and reserved direct access. Dynamic allocation processing is extended to background users and provides new functions for both foreground and background users.

Device, Volume and Data Set Management: JES3 device, volume and data set management provides for reservation of system resources ('SETUP').

JES3 3850 MSS Features include:

Allocation to mounted volumes for non-specific requests for new, non-VSAM data sets.

Access to Mass Storage Volumes can be shared by all JES3 system processors physically connected to the same 3850

Virtual units may be partitioned (fenced) for use by specific job class groups or dependent job networks

Data reuse is encouraged (without access to 3850 controller tables)

JES3 algorithms attempt to equalize the amount of staging/destaging activity across Staging Drive Groups

Multiple 3850s can be supported in a JES3 loosely coupled processor configuration, where each 3850 is attached to a separate host (as previously announced, one operating system can only be attached to one MSS)

JES3 Release 3 contains all the functions provided by the JES3/3850 Selectable Unit which extend the 'SETUP' facility of JES3 Release 2 to include the 3850 Mass Storage System. SETUP highlights include:

Centralized scheduling and control of pooled and non-pooled I/O devices.

High watermark setup.

Early resource release.

Dynamic allocation and unallocation of data sets and devices.

OS/VS2 (5752-VS2) (cont'd)

Reserving of devices to dependent job control networks and job class groups.

Projected mounting and verifying of private data volumes, including:

DASD data set setup on a system-wide basis which honors JCL disposition parameters.

Volume location control, i.e., use awareness.

Job Management: Some of the major facilities provided by job management are multiple console support, system log, hardcopy log, checkpoint/restart, and system management facilities.

Multiple Console Support - MCS: Multiple console support (MCS) allows one operating system to use many operator consoles. Each console in a multiple console configuration is defined by specifying the operator commands the system will accept from that console, a console to act as an alternate if a failure occurs, and the types of messages the console will receive.

In a system with MCS, one console acts as the master console and the rest (up to thirty-one) are secondary consoles. The master console is the basic console required for operator-system communication; it alone can accept all possible operator commands, change the status of the hardcopy log and the messages to be recorded on it, switch to a different master console, and receive all messages not specifically assigned to any other console. A secondary console is any console other than the master console; it handles one or more functions assigned to it (for example, it might handle tape activity).

Console devices supported: 158 Console (5) (6) ... 1403 (1) ... 1443-N1 (1) ... 2150/1052-7 ... 2260 (3) (5) ... 2540 (1) ... 2520 (1) ... 2740-1 ... 3036 (5) ... 3066 (5) ... 3505 (1) ... 3210 ... 3211 (1) ... 3215 ... 3525 (1) ... 3277 (4) (5) ... 3284 (4) (5) ... 3213 (1) (6) ... 3286 (4) (5) ... 3287-1,2 (as a 3284/3286) (5) (7) ... 3288-2 (as a 3286-2) (4) (5) ... 3767 (as a 2740-1) ... 2250 (2) (5).

Notes:

(1) A composite console must consist of a printer-keyboard or a card reader and printer to simulate the actions of a printer-keyboard. MCS allows output only consoles as secondary consoles.

(2) 2250 mdls 1 and 3.

(3) 2260 mdl 1 on 2848 mdl 3 (local attachment).

(4) The 3277 mdl 1, 3284 mdl 1 and 3286 mdl 1 attach via a 3272 mdl 1 or 2. The 3277 mdl 2, 3284 mdl 2, 3286 mdl 2 and 3288 mdl 2 attach via a 3272 mdl 2 only. The 3278 mdls 1-4 are only supported in default mode via 3274 mdl 1B attachment.

(5) DIDOCS supported.

(6) 158 Display Console is supported in printer-keyboard or display mode. When in printer-keyboard mode, a 3213 is required. When used in display mode, it is suggested that addresses 014 or 016 be used for the console and 015 or 017 for the 3213.

(7) 3287 mdls 1 and 2 with 3271/3272 Attachment (8330) and 480 character print operation (9520) attaches via a 3272 mdl 1 or 2. 3287 mdls 1 and 2 with 3271/3272 Attachment (8330) and 1920 character print operation (9522) attaches via a 3272 mdl 2 only.

Device-Independent Display Operator Console Support (DIDOCS) Status Display Support (SDS): Device independent display operator console support (DIDOCS) is a facility of VS2 that enables graphic display devices to be used as operator consoles. Its use can result in faster communication between the system and the operator than can be achieved with standard printer-keyboard or composite console devices.

DIDOCS provides the following advantages to the operator: He can respond to a message or enter a command while messages are being written to the screen ... He sees action messages to be answered and can delete any he no longer needs ... He can use the cursor, or selector light-pen when available, to delete messages and perform other display-oriented functions ... He can initiate automatic command entry either with the selector light-pen or with the program function keyboard (PFK) by an operator command.

Status display support (SDS) provides a clear and understandable presentation of information to a system operator. It provides the following advantages to the operator: He can obtain a contiguous out-of-line display within specified display screen areas ... He can obtain a dynamic status display from an operator command.

System Log: The system log consists of data sets on which the communication between problem programs, operators, and the system is recorded. It may contain the following kinds of information: Operating data entered by problem programs using a write-to-log (**WTL**) macro instruction ... Descriptions of unusual events that occurred during a shift ... Write-to-operator (**WTO**) and write-to-operator with reply (**WTOR**) messages ... Accepted replies to **WTOR** messages ... Commands issued through operator's consoles and the input stream, and commands issued by the operating system.

Hardcopy Log: The hardcopy log is a permanent record of system activity that is mandatory for systems with an active graphic console or multiple active consoles; for other systems, the primary console device serves as the hardcopy log. The hardcopy log is kept on another, non-graphic, console device or can also be kept on the system log.

Since multiple console support allows more than one console in a system, an installation might find it helpful to record all the messages issued by and to a system. The hardcopy log is a place to collect these messages, and therefore, an installation can review system activity by reviewing message activity.

Checkpoint/Restart: If a job step is terminated before successful completion, checkpoint/ restart can make it possible to resume execution from the beginning of the step or from a place within the step. Either way, the restart can be made to occur automatically when the failure occurs.

The **CHKPT** macro instruction is coded in the user's program at a checkpoint to be taken. A checkpoint is the point at which information about the status of a job can be recorded so that the job step can be later restarted.

Checkpoint/restart includes a checkpoint routine and several restart routines.

The checkpoint routine gathers and records on a checkpoint data set enough information about the status of the job step and its related control blocks to allow a restart from the place where the checkpoint is taken.

The restart routines can be invoked when a job step is resubmitted for restart, or they can be invoked automatically when a failure occurs. The functions performed by restart routines depend upon the type of restart that is requested.

If the restart is to be made from the beginning of a job step, for deferred restart only, the **RESTART** parameter of the JOB statement must contain the name of the step to be restarted, and routines of the initiating task simply bypass preceding steps and begin processing with the named step.

If a step is to be restarted from the beginning automatically, the **RD** parameter is used, then restart processing begins during step termination. The step termination routine of job management invokes routines to verify that a restart can be performed and requests the operator to authorize the restart.

If a step is to be restarted from a place where a checkpoint was taken and the job is resubmitted, the **RESTART** parameter of the JOB statement must identify the step and checkpoint identifier and a **SYSCHK DD** statement must describe the checkpoint data set.

If a step is to be restarted automatically from a place where a checkpoint was taken, the step termination routine invokes routines to ensure that all data sets for the step are kept.

In MVS, restarted jobs are processed by the job entry subsystem, JES, which returns them to its job execution queue for subsequent initiation based upon priority and resource availability.

SYSTEM MANAGEMENT FACILITIES - SMF

System Management Facilities (SMF) collect and record system information. The information obtained can be used in management information reports that describe system efficiency, performance, and usage. The SMF records contain such data as: System configuration ... Job and job step identification ... Processor wait time (SVS only) ... Processor and input/output device usage ... Temporary and non-temporary data set usage and status ... Virtual and real storage usage ... Status of removable direct access volumes ... Allocation recovery records ... Paging statistics.

SMF provides exits to installation-supplied routines that can monitor the operation of a job or job step and generate the installation's own SMF records. The exit routines can cancel jobs, write records to the SMF data set, open and close user-defined data sets, suppress the writing of certain SMF records, and enforce installation standards (such as identification of users). Dummy routines are automatically provided for all unused exits. Changes to SMF for VS2 are: SMF is a standard facility of VS2 ... SMF records in VS2 contain additional accounting information to reflect new system environmental characteristics ... SMF in VS2 provides one new exit from the system control program, which receives control each time an SMF record has been formatted and is ready to be written out; this exit can prevent the record from being written ... In MVS a new exit is provided whenever a job is ready to be purged from the system ... In VS2, SMF recording data sets must reside on a direct access device ... In SVS, the OUTLIM facility is not supported; in MVS, OUTLIM is supported.

System Activity Measurement Facility - MF/1 (MVS): The system activity measurement facility (MF/1) is a standard feature in MVS. It collects information about system activities, including hardware resource utilization, performance group management, and paging.

MF/1 produces, optionally, measurement outputs in two forms. Data may be written to the SMF data set and/or reports may be formatted

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and printed in real time. Measurements are obtained for such system areas as: Processor Activity ... Channel Activity ... Channel-Processor Overlap Activity ... I/O Device Activity and Contention: Unit Record; Graphics; Direct Access Storage; Communications Equipment; Magnetic Tape ... Paging Activity ... Performance Group Activity.

The measurement data and formatted reports produced by MF/1 can aid in: Improving system performance ... Analysis of system trends ... Evaluating future system requirements.

Interactive Problem Control System - MVS IPCS: The Interactive Problem Control System (IPCS) provides MVS TSO installations with expanded capabilities for diagnosing software failures and facilities for managing problem information and status.

IPCS (SU57) executes as a command processor under MVS TSO and provides both the customer's system programmer and the IBM Programming Service Representative (PSR) with facilities for interactive examination and analysis of MVS storage image dumps. In addition to the various data formatting options available, functions are provided to locate link pack area modules and key MVS control blocks and to validate them, where possible. The support also includes high-level summaries of several key system components.

IPCS provides functions in the installation to centrally maintain problem status data, including specifics associated with problem occurrence, environment, responsibility, severity and resolution, as well as an abstract and problem description. It also allows users to record the names of data sets containing problem-specific data.

The enhanced diagnostic capability provided by IPCS should improve the service by:

- Reducing problem analysis time.
- Reducing the number of dumps to be printed and thus printing costs.
- Providing a centralized reference point for locating problem-related data.
- Providing a structure within which the new interactive dump examination and analytic facilities can be used in conjunction with existing tools such as CLISTs and AMDPRDMP exits.

Highlights

- Dump Data Examination.
  - IPCS need only be operational on one MVS/TSO system within an installation. It can be used to analyze any DASD-resident catalogued data set containing an MVS (Release 3.7 with SU7) high speed stand-alone SVC, or SYSMDUMP (produced by SU 33) dump. For dump data sets not on devices accessible from that TSO system, MVS data set utility functions may be used to move or copy the dump.
  - The user may tailor the formatting of dumps to provide: hexadecimal displays character displays traditional dump formatting of combined hexadecimal and character displays.
  - Facilities are provided to scan control blocks and to search for specific values or character sequences within the dump.
  - The user can reference and find link pack area modules and key MVS control blocks by name.
  - Users can equate symbolic names to specific addresses in dump storage for debugging purposes and assign attributes to them such as length, offset, address space, or data type.
- Specific Analytic Routines
  - The status of auxiliary storage management is summarized, highlighting any outstanding WTOR messages, and those to which messages have been queued but not yet transmitted.
  - ENQ/DEQ resource management chains are summarized. A selective display of the chains associated with a major resource name is provided.
  - The status of the I/O supervisor component is summarized highlighting critical statistics and the location of key data areas.
  - The ASCBs, ASXBs, TCBs, and RBs are located, formatted and summarized.
  - IBM and user-written command processors, as well as CLISTs, may be invoked from IPCS. CLISTs invoked from IPCS may contain IPCS subcommands interspersed among the normal command procedure language, TSO commands and TSO CLISTs invocation statements. Exceptions are command processors which require authorization, have an entry point name (except TIME), or do not expect the standardized command processor parameter list (e.g. TEST).
  - User exits for the AMDPRDMP-supported interface for TCB, ASCB, and user control statement exits can be invoked under IPCS.
  - For Display Stations supported by TSO (3275 mdl 2, 3277 mdl 2, and 3276 mdls 2 and 12 and the 3278 mdl 2 via the 3276 and 3274), a full-screen option is available for examining virtual storage dumps. This option provides functions to utilize these display stations in a preformatted display mode. Data entry, cursor placement, or program function keys (where available) may be used for basic operations such as scrolling or splitting the screen to display multiple areas or multiple formats within a dump.
  - IPCS function allows access to the titles of the dumps in the system dump data sets (SYS1.DUMPnn) so that the user may decide which dumps may be discarded without printing or copying.
  - TSO HELP information is provided for IPCS commands and subcommands.

Account Facility (MVS): The account facility is available in MVS. It enables a batch-entry or remote user to update the user attribute data set (UADS) and the broadcast data set in a background environment.

RECOVERY MANAGEMENT SUPPORT (SVS and MVS)

SVS recovery management consists of five functions: machine check handling, channel check handling, dynamic device reconfiguration, alternate path retry, and missing interrupt checking. In addition, MVS provides alternate Processor recovery.

SVS RECOVERY MANAGEMENT SUPPORT

The Machine Check Handler (MCH) records all machine checks and determines if recovery from a malfunction was made by the Instruction Retry or Error Correction Code facilities of the S/370 Processor. If the malfunction is not corrected by the machine facilities, MCH assesses the damage and attempts to repair intermittent storage errors. If recovery is not possible, a determination is made whether system operation can continue either in full or degraded mode and isolates the failure to a task for orderly, selective termination of the task.

The Channel Check Handler (CCH) analyzes information which results from Channel Data Checks, Channel Control Checks, and Interface Control Checks. CCH attempts to have the error corrected and determines whether or not the system can continue operation. The Channel Check Handler formats and records appropriate error records.

Dynamic Device Reconfiguration (DDR) allows a demountable volume not marked permanently resident to be moved from one device to another. The request to move a volume may be initiated by the system or by the operator. The system will initiate a DDR request to the operator upon detection of a permanent error.

Alternate Path Retry (APR) automatically retries input/output operations in error and marks offline those data paths that are unusable. APR is automatically included when optional channel paths are specified.

The operator may vary paths online and offline by using the VARY path command. He may not vary the last remaining path to a device offline, nor may he vary teleprocessing paths or paths to shared DASDs.

The Missing Interrupt Checker support provides a function which performs polling of active units to assure that device and channel end interrupts are received within a specified time interval. The operator will be notified if any mounts or device and channel end interrupts that are left pending for longer than specified time interval. The operator may have to take specific actions depending upon the conditions encountered.

The Machine Check Handler, Channel Check Handler, Dynamic Device Reconfiguration and Interrupt Checker are standard parts of the VS2 control program. They reside in the control program area of virtual storage and operate in the unpaged section of processor storage except for part of DDR which resides in pageable LPA. Alternate Path Retry is an optional extension to the Input/Output Supervisor.

MVS RECOVERY MANAGEMENT SUPPORT

The Machine Check Handler (MCH) records, via recovery management, all machine checks and determines if recovery from a malfunction was made by the Instruction Retry or Error Correction Code facilities of the S/370 Processor. If the malfunction is not corrected by the machine facilities, MCH performs certain analyses and provides a record of the analysis to the Recovery Termination Manager. The appropriate software recovery routines are then invoked. In a tightly-coupled multiprocessing (MP) environment, if MCH processing is unsuccessful in a failing Processor, or if a Processor enters a check-stopped state, MCH will attempt to initiate recovery processing by marking the failing Processor offline and invoking the Recovery Termination Manager in the non-failing Processor.

The Channel Check Handler (CCH) analyzes information that results from channel data checks, channel control checks, and interface control checks. CCH attempts to have the error corrected by passing error information to the error recovery procedure. The Channel Check Handler formats appropriate error records which are recorded. In MVS,

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when an error affects the entire channel, MVS will attempt to recover any active I/O on the failing channel.

Dynamic Device Reconfiguration (DDR) allows a demountable volume not marked permanently resident to be moved from one device to another. The request to move a volume may be initiated by the system or by the operator. The system will initiate a DDR request to the operator upon detection of a permanent error. In MVS, DDR is also available for volumes containing data sets used for paging.

Alternate Path Retry (APR) ensures that an alternate path to a device is tried (whenever possible) when a failing path is detected. MVS always includes APR.

The operator may vary paths to a device online or offline by means of the VARY PATH command. In MVS, he can vary offline all paths except those to shared direct access storage devices which have an outstanding RESERVE.

The Missing Interrupt Checker (MIC) is a standard facility of VS2 that notifies the operator if a device-end, channel-end, DDR exchange, or mount interruption is not received within a specified period of time. The absence of such interruptions may mean that a mount message has not been satisfied or that a device has malfunctioned. Specific actions an operator may have to take depend upon the conditions he encounters. He may be required to ready a device on which a volume has been mounted, examine indicator lights on the device for abnormal signs, or terminate the job. In the case of channel end interruptions, MIC will invoke I/O restart to attempt to retry. Additionally, MIC will record via recovery management when device-end or channel-end interruptions are not received.

Alternate Processor Recovery (ACR) processing is invoked when a Processor in a tightly-coupled multiprocessing (MP) environment can no longer function. ACR processing is invoked by a signal that is sent by the failing Processor before it enters a permanent wait or stopped state. This signal is either a hardware-generated malfunction alert (MFA) or a software-generated emergency signal (EMS). When ACR processing is invoked on the non-failing Processor, it monitors the recovery processing of tasks and I/O on the failing Processor in an attempt to recover those activities which were on the failing Processor and continue system operations.

Any common pageable system areas (e.g., Link Pack Area) will be written to two separate paging data sets which may be on two separate devices. The additional copy will be utilized if on the first attempt to access the information, an I/O failure occurs.

MULTIPROCESSING WITH SHARED REAL STORAGE (MVS)

Multiprocessing (MP) is an extension of the MVS control program that supports two tightly-coupled Processor with shared real storage. Available with MVS, MP is an integral part of the system control programming. The two Processors are treated as system resources and are assigned by the resource manager to process any task. (Programs can also be designated by the installation to run on a particular Processor). Multiprocessing is designed to provide more efficient and more flexible allocation of execution time, I/O units, and main storage for a single job stream than uniprocessing with two separate Processor. Availability is extended by:

Recovery management support that reduces the impact of software and solid hardware failures.

Real storage reconfiguration that bypasses failing storage components in 4K blocks and terminates only affected tasks.

Alternate Processor Recovery (ACR) processing that allows the non-failing Processor to attempt recovery of tasks and I/O in progress on a failing processor.

In MVS Release 3, an additional availability improvement is included for the 168 Multiprocessing System. (Channel Reconfiguration Hardware support - CRH.) This facility permits the channels attached to a stopped Processor to be accessed via the Channel 6 interface of the still running Processor. It also allows a channel to be varied online for use by the system while the attached Processor is in an offline state. CRH is activated by either an ACR condition or by operator intervention with the **DIAGNOSE** instruction used to switch between the Channel 6 interface of the running Processor and the remote channels of the stopped Processor. With CRH, all channels in both the running and the stopped processor remain accessible for I/O. It should be noted that CRH cannot be activated when DSS is active in the system.

A new locking structure providing a number of locks in the control program allows more parallelism over systems having only one lock. With the use of separate address spaces for jobs and subsystems, queues and control blocks associated with only one virtual address space can be manipulated without preventing the other Processor from performing similar control program functions in other address spaces.

TIMESHARING OPTION - TSO (SVS and MVS)

An extension which provides VS2 users general purpose timesharing capability in a compatible VS2 environment. Terminal users share remote access to the powerful facilities of OS/VS2 for conversational interaction -- preparation, syntax checking, execution, updating of programs and data -- concurrently with normal background VS2 operations. A comprehensive easy-to-use conversational command language is provided for the terminal user to communicate with the system. TSO provides conversational remote access to the VS2 environment for both the experienced professional programmer and the individual with little or no experience with computers.

Features

- General purpose time sharing capability operating concurrently with VS2 background operation within one operating system.
- Data sets can be dynamically allocated in the time sharing region.

  In MVS, devices can also be dynamically allocated.
- Real storage utilization reflects the actual requirements to execute the program in the time shared region as compared to a fixed requirement in OS/MVT.
- In SVS, multiple timesharing users share a timesharing region and their active pages (working set) are swapped (block paged) to the paging data sets.
- In MVS, each timesharing user is assigned to an individual virtual address space.
- Time sharing provides an environment for creating and executing conversational programs. A device-independent BSAM/QSAM interface to terminals is provided for ease of development and installation of terminal-oriented application programs.
- Programming languages and data management are compatible between conventional (batch) programs and programs developed at the terminal. Batch or terminal-developed programs can be stored, retrieved and executed locally (at the computer center) or from the remote terminal allowing the use of data sets by time shared or other regions/address spaces.
- Use of TCAM to handle timesharing terminal types (see Terminals Supported in this section) allows the same terminal and/or communications lines to be used for timesharing or other TCAM applications.
- Terminal-users may use any IBM language processors supported on VS2.
- The debugging command, **TEST**, allows system programmers and assembler language programmers to control the execution of a program, interrupting it at dynamically specified points.
- In MVS, The Interactive Problem Control System may be used to provide interactive examination and analysis of any MVS (Release 3.7 with SU7) high-speed stand-alone, SVC, or SYSMDUMP (produced by SU33) dump.
- In MVS, the **ACCOUNT** facility may be executed in a background environment.
- In MVS, the installation may specify a time interval which establishes a period that will permit a timesharing user to reconnect to the system in the event of a line disconnect. Should the interval lapse prior to the user reconnecting to the system, then the system will automatically save any data set which the user was in the process of editing.

TSO offers comprehensive language support for online development, debugging and execution of programs in COBOL, FORTRAN, PL/I, BASIC and Assembler.

Language facilities available to the terminal user include: Compilation, usually invoked with a single command ... Linkage editing or loading ... Program execution with terminal I/O capabilities for interactive application ... Interactive debugging, using the data names and labels of the source program, of a program in execution for rapid program checkout.

In MVS Release 3, Expanded Command Procedure allows the user to specify compiler type functions to control execution of his CLISTs, with control options to handle error exiting, including nesting of CLISTs, If/Then/Else and Do While/End Syntax, Read/Write to/from CLIST, extensions of local and global options, external file - I/O and enhanced symbolic substitution. Also, a number of EDIT improvements have been added in MVS Release 3. In MVS Release 3, the use of VTAM allows the use of some SDLC terminal types (see *TSO Terminals Supported* in this section).

For more detailed descriptions of the language products designed for use under TSO, see the program product section of the sales manual.

TSO TERMINALS SUPPORTED

TSO supports the following terminals, programmable features, transmission control units, and communications controllers. Programmable features which change the control or transmission characteristics and which are not shown are not supported. Attempts to use TSO with unsupported features can cause unpredictable results.

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The access methods that support TSO are TCAM (through the TCAM Message Control Program provided) and VTAM. The access method shown in parenthesis after each terminal/feature is the one providing support for that terminal/feature.

The user should be aware that many terminal and control unit special features are transparent to programming, and are therefore readily usable even though not specifically identified. Note that the appropriate line adapters and hardware attachment features must be included in the system configuration.

Terminals that are functionally equivalent to those specifically supported by TSO may also function satisfactorily with TSO; the customer is responsible for establishing equivalency. IBM assumes no responsibility for the impact that any changes to the IBM-supplied programs or products may have on such terminals.

Start/Stop Lines

1050 Data Communication System on switched or point-to-point nonswitched lines: (TCAM)
- 1051 Control Unit (mdls 1,2):
  - Required: Attachment of 1052
  - Recommended: #1313 - Automatic EOB (or RPQ E28235)
    #6100 - Receive Interrupt
    #9698 - Text Time-Out Suppression
    #9700 - Transmit Interrupt
- 1052 Printer-Keyboard (mdls 1,2):
  - Recommended: #1313 - Automatic EOB
    #9571,#9591 - PTTC/EBCD Code

2741 Communication Terminal on switched or point-to-point nonswitched lines: (TCAM)
- Recommended: #4708 - Receive Interrupt
  #5501 - Print Inhibit
  #7900 - Transmit Interrupt
  #9571 - PTTC/EBCD Print Element (P/N 1167963)
- Supported: **#9567** - PTTC/BCD (P/N 1167938)
  #9812 - Correspondence (P/N 1167043)
- Not Supported: If 2741 is attached to a 2701:
  #4708 - Receive Interrupt
  #7900 - Transmit Interrupt

2845 Display Control (mdl 1) on nonswitched lines: (TCAM)
- Required: Attachment of 2265
  If 2845 is attached to a 2701:
  #4646,#4657 - IBM Terminal Adapter Type III
- Recommended: #3301 - Destructive Cursor
- Not Supported: Attachment of 1053
  #4801 - Line Addressing
  #7801 - Tab
- 2265 Display Station (mdl 1):
  - Required: #4766 - Alphameric Keyboard

2848 Display Control (mdls 1,2,3) on nonswitched lines: (TCAM)
- Required: Attachment of 2260
- Recommended: #3901 - Extended Cursor Control
  #5340 - Non-Destructive Cursor
  #5341 - Non-Destructive Cursor Adapter
- Not Supported: Attachment of 1053
  #4787 - Line Addressing
- 2260 Display Station (mdls 1,2):
  - Required: #4766 - Alphameric Keyboard
  - Recommended: #3606 - Extended Cursor Control, Alphameric Keyboard
  - Not Supported: Tab feature of 3606

3101 Display Terminal (mdls 10, 12, 13, 20, 23) on switched lines 110-1200 bps: (TCAM, VTAM)

3232 Keyboard Printer (mdl 51) on switched or nonswitched lines (VTAM, TCAM). On switched lines supported as a CPT-TWX 33/35 (BTAM)

3767 Communication Terminal (mdls 1,2) (supported as a 2741) on switched or nonswitched lines: (TCAM)
- Required: #7113 - 2741 Start/Stop (which provides PTTC/EBCD and Correspondence Codes)

5100/5110 Computer Systems (supported as a 2741) on switched or nonswitched lines: (TCAM)
- Required: #1525 - Communications Adapter

CPT-TWX (mdl 33/35) Line Control Type on switched lines: (TCAM)
- Supported: Data Interchange Code (8-level) at 110 bps even or forced parity

6733 Typewriter Communication Module (supported as a CPT-TWX 33/35) on switched and nonswitched lines at 110, 150, 300, and 1200 bps (BTAM, ACF/TCAM, ACF/VTAM)

Binary Synchronous Lines

**3270 Information Display System on nonswitched lines: (TCAM, VTAM)
- 3271 Control Unit (mdls 1,2):
  - Required: Attachment of 3277
  - Supported: **#9761** - EBCDIC Code
  - Not Supported: Attachment of 3284, 3286, 3287(as a 3284/3286) or 3288
    #1550 - Copy
- 3274 (mdl 1C) (Supported as a 3271):
  - Required: Attachment of 3278
  - Supported: Attachment of 3277
  - Not Supported: Attachment of 3268, 3284, 3286, 3287, 3288 or 3289
- 3275 Display Station (mdls 1,2):
  - Supported: **#9089** - EBCDIC Character Set
    #9761 - EBCDIC Code
  - *User Supported: #4600 - Operator Identification Card Reader
    #6350 - Selector Light-Pen
    Program function keys
    Additional flexibility in controlling screen formats
  - Not Supported: Attachment of 3284
- 3276 Control Unit Display Station (mdls 1, 2, 3, 4) (Supported as a 3271)
  - Supported: Attachment of 3278
  - Not Supported: Attachment of 3268, 3287
- 3277 Display Station (mdls 1,2):
  - Supported: **#9089** - EBCDIC Character Set
  - *User Supported: #4600 - Operator Identification Card Reader
    6350 - Selector Light-Pen
    Program function keys
    Additional flexibility in controlling screen formats
- 3278 Display Station (mdls 1, 2, 3, 4) (Supported as a 3277)
  - Supported: **#9082** - EBCDIC Character Set

5280 Distributed Data System on nonswitched lines (supported as a 3271-2) (BTAM, TCAM, VTAM):
- 5285 and 5288 controllers
  - Required: Refer to appropriate pages for required features and programming

8100 Information System on nonswitched lines (BTAM, TCAM, VTAM) [Supported as a 3271]:
- Required: Refer to 8100 pages for required features and programming for communication as a 3271. In particular, refer to 8100/DPPX 3270 Data Stream Compatibility licensed program or the DPPX/SP 3270 Data Stream Compatibility component.
- Supported: Use of 3277 and 3278
- Not Supported: Use of 8100/DPPX or 8100/DPPX/SP printers and copy function

System/34 on nonswitched lines (BTAM, VTAM) (supported as a 3271):
- 5340 System Unit:
  - Required: #2500, #3500 or #4500 Adapter Feature
    #4900 or #4901 Workstation Control Expansion A or B

System/36 on nonswitched lines (BTAM, VTAM) (supported as a 3271):
- 5360 System Unit:
  - Required: #2500 or #4500 Communications Adapter feature
    #4900 Workstation Control feature

System/38 (supported as a 3271 mdl 2) on a nonswitched line (BTAM, TCAM, VTAM):
- 5381 System Unit:
  - Required: #1501, #1502 Communications Attachment
    #2001, #2003 Communications Control

SDLC Terminals

3232-1 Keyboard Printer Terminal on switched or nonswitched lines (VTAM, TCAM).

**3270 Information Display System on nonswitched lines: (VTAM)
- 3271 Control Unit (mdls 11,12):
  - Required: Attachment of 3277
  - Supported: **#9761** - EBCDIC Code

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Not Supported: Attachment of 3284, 3286, 3287 (as a 3284/3286), 3288
#1550 - Copy

3275 Display Station (mdls 11,12):
Supported: **#9089** - EBCDIC Character Set
#9761 - EBCDIC Code
*User Supported: #4600 - Operator Identification Card Reader
#6350 - Selector Light-Pen
Program function keys
Additional flexibility in controlling screen formats
Not Supported: Attachment of 3284

3277 Display Station (mdls 1,2):
Supported: **#9089** - EBCDIC Character Set
*User Supported: #4600 - Operator Identification Card Reader
#6350 - Selector Light-Pen
Program function keys
Additional flexibility in controlling screen formats

3270 Information Display System on switched and nonswitched lines (VTAM) and on nonswitched lines only (TCAM/NCP Direct)
3276 Control Unit Display Station (mdls 11-14)
Supported: Attachment of 3278-2
Not Supported: Attachment of 3268, 3287
3278 Display Station (mdls 1-4)
Supported: **#9082** - EBCDIC Character Set

3767 Communication Terminal (mdls 1, 2, 3) on switched or non-switched lines: (VTAM)
Supported: SDLC adapter provided unless one of the Start/Stop features are are specified
#1201 - ASCII Code

3770 Data Communication System on switched or nonswitched lines: (VTAM)
3771 Communication Terminal (mdls 1,2,3):
Required: #1460 - SDLC/BSC, Switch Control, or
#1470 - SDLC
Supported: #1201 - ASCII Code
3773 Communication Terminal (mdls 1, 2, 3, P1, P2, P3):
Required: #1460 - SDLC/BSC, Switch Control, or
#1470 - SDLC
Supported: #1201 - ASCII Code
3774 Communication Terminal (mdls 1,2,P1,P2):
Required: #1460 - SDLC/BSC, Switch Control, or
#1470 - SDLC
Supported: #1201 - ASCII Code
3775 Communication Terminal (mdl 1, P1):
Required: #1460 - SDLC/BSC, Switch Control, or
#1470 - SDLC
Supported: #1201 - ASCII Code

3790 Communication System on switched and nonswitched lines: (VTAM, TCAM/NCP). TSO terminal sessions use the 3270 Data Stream Compatibility (DSC) mode
3791 Communication Controller
Required: 3791 Configuration feature code **#9165** for TSO/TCAM support
3791 Configuration Code **#9169** for TSO/VTAM or TSO/TCAM support
3277 mdl 1, 2, and/or
3276 mdl 2-4, 12-14 and/or
3278 mdl 2

5280 Distributed Data System on switched or nonswitched lines (supported as a 3274-1C) (VTAM):
5285 and 5288 controllers
Required: Refer to machine pages for required features and programming

8100 Information System with DPCX on switched or nonswitched lines: (VTAM, TCAM/NCP). TSO terminal sessions use the 3270 Data Stream Compatibility (DSC) mode.
8130 Information Processor (mdls A21, A23)
8140 Information Processor (Mdls A31, A33, A51, A53)
Required: Distributed Processing Communications Executive (DPCX)
3277 mdl 1, 2 and/or
3276 mdl 2, 3, 4, 12, 13, 14 and/or
3278 mdl 2

8100 Information System under DPPX with 3270 Data Stream Compatibility on switched and nonswitched lines (VTAM) and on nonswitched lines only (TCAM) [supported as a 3276]
Required: Refer to 8100 sales pages for required features. In particular, refer to 8100/DPPX 3270 Data Stream Compatibility Licensed Program.
Supported: Use of 3277 and 3278
Not Supported: Use of 8100/DPPX printers and copy function.

System/34 on nonswitched lines (VTAM) (supported as a 3274):
5340 System Unit:
Required: #2500, #3500 or #4500 Communications Adapter feature
#4900 or 4901 Workstation Control Expansion A or B

System/36 on nonswitched lines (VTAM) (supported as a 3274):
5360 System Unit:
Required: #2500 or #4500 Communications Adapter feature
#4900 Workstation Control feature

System/38 (supported as a 3274) on switched or nonswitched line (VTAM, TCAM):
5381 System Unit:
Required: #1501 or #1502 Communications Attachment feature
#2000, #2001, #2002 or #2003 Communications Control feature
#3200 Line Base feature

Local Channel Attachment

Local Terminals

2848 Display Control (mdls 1,2,3) on a local channel: (TCAM)
Required: Attachment of 2260
Recommended: #3901 - Extended Cursor Control
#5340 - Non-Destructive Cursor
#5341 - Non-Destructive Cursor Adapter
Not Supported: Attachment of 1053
#4787 - Line Addressing
2260 Display Station (mdls 1,2):
Required: #4766 - Alphameric Keyboard
Recommended: #3606 - Extended Cursor Control, Alphameric Keyboard
Not Supported: Tab feature of 3606

**3270 Information Display System on a local channel: (TCAM,VTAM)

3272 Control Unit (mdls 1,2):
Required: Attachment of 3277
Not Supported: Attachment of 3284, 3286, 3287 (as a 3284/3286) or 3288

3274 (mdl 1B) (Supported as a 3272)
Required: Attachment of 3278
Supported: Attachment of 3277
Not Supported: Attachment of 3268, 3284, 3286, 3287 3288 or 3289

3277 Display Station (mdls 1,2):
Supported: **#9089** - EBCDIC Character Set
*User Supported: #4600 - Operator Identification Card Reader
#6350 - Selector Light-Pen
Program function keys
Additional flexibility in controlling screen formats

3278 Display Station (mdls 1, 2, 3, 4)(Supported as a 3277)
Supported: **#9082** EBCDIC Character Set

3270 Information Control System on a local channel: (VTAM, TCAM through VTAM)

3272 Control Unit (mdls 1,2):
Required: Attachment of 3277
Not Supported: Attachment of 3284, 3286 or 3288

3274 Control Unit (mdl 1A)
Required: Attachment of 3278
Supported: Attachment of 3277
Not Supported: Attachment of 3268, 3284, 3286, 3287 3288 or 3289

3277 Display Station (mdls 1, 2)
Supported: #6350 - Selector Light-Pen
#9089 - EBCDIC Character Set

3278 Display Station (mdls 1, 2, 3, 4)
Supported: #6350 - Selector Light-Pen
#9082 - EBCDIC Character Set

* Can be supported in user-written TSO Command Processors and TSO Application Programs using the **TGET/TPUT ASIS** macro instructions.

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** TSO support of the 3270 utilizes brightness control to differentiate system-generated output (brightened intensity) from user input (normal intensity), and suppresses display of information entered in response to system prompt for password.

3790 Communication System on local channel: (VTAM, TCAM/NCP). TSO terminal session uses the 3270 Data Stream Compatibility (DSC) mode.

3791 Communication Controller

Required: 3791 Feature Code **#9165** for TSO/TCAM
Feature Code **#9169** for TSO via TCAM or VTAM
3277 mdl 1, 2 and/or
3276 mdl 2-4, 12-14 and/or
3278 mdl 2

Transmission Control Units and Communication Controllers

2701 Data Adapter Unit on a local channel: (TCAM)

Required: #4640 - IBM Terminal Adapter Type I and/or
#4656, 4657 - IBM Terminal Adapter Type III and/or
#7860-7862 - Telegraph Adapter Type I and/or
#7885 - Telegraph Adapter Type II

2702 Transmission Control Unit on a local channel: (TCAM)

Required: #4615 - IBM Terminal Control Type I and/or
#7912 - Telegraph Terminal Control Type II
#8200 - Type I Terminal Interrupt (necessary to support the 2741 and 1050 Transmit Interrupt and/or Receive Interrupt)

2703 Transmission Control Unit on a local channel: (TCAM)

Required: #4696 - IBM Terminal Control Type I and/or
#7912 - Telegraph Terminal Control Type II
#8200 - Type I Terminal Interrupt (necessary to support the 2741 and 1050 Transmit Interrupt and/or Receive Interrupt)

3704/3705-I/3705-II Communications Controller on a local channel:

Required: EP/VS (TCAM) or
NCP/VS (TCAM,VTAM)

DATA MANAGEMENT (SVS and MVS)

Data management controls all operations associated with input/ output devices, such as allocation of space on volumes, storing, naming, and cataloging data sets, and movement of data between real and auxiliary storage.

Virtual Storage Access Method - VSAM: VSAM is an access method designed to operate with direct access devices and to support both direct and sequential processing by means of either an index key (keyed accessing) or by means of relative byte address (addressed accessing). (Relative byte address refers to the displacement of a stored record, or control interval, from the beginning of the storage space allocated to the data set to which it belongs.)

Three types of data sets are provided: key-sequenced data sets, which are ordered by a key field in the data record, entry-sequenced data sets, which are ordered by the sequence in which the records were loaded, and relative record data sets which are ordered by record number. Keyed accessing is used to access key-sequenced or relative record data sets, and addressed accessing is used to access both key-sequenced and entry-sequenced data sets. Key-sequenced and entry-sequenced data sets may be either fixed or variable length records, relative record data sets are fixed length records only.

VSAM is composed of two major elements: A data organization which minimizes data movement and which is suitable for data base applications; and routines for creating data sets in the VSAM organization, adding and deleting records, and performing other data management functions. The data management functions supplied by VSAM are:

- Opening data sets
- Processing records by index key
- Processing records by address
- Closing data sets
- End-of-volume processing
- Cataloging VSAM data sets
- Data set password protection
- Allocating space
- Checkpoint/restart processing

Sequential Access Methods: In the Basic Sequential Access Method (BSAM) data is sequentially organized and physical blocks of data are stored or retrieved. The **READ/WRITE** macro instruction causes the initiation of an input/output operation. The completion of these operations is tested by using synchronization macro instructions. Automatic translation between EBCDIC and ASCII codes is provided for magnetic tape labels and record formats.

In the Queued Sequential Access Method (QSAM) logical records are retrieved or stored as requested. The access method anticipates the need for records based on their sequential order, and normally will have the desired record in virtual storage, ready for use, before the request for retrieval. When writing data, the program normally will continue as if the record had been written immediately, although the access method routines may block it with other logical records and defer the actual writing until the output buffer has been filled. As with BSAM, automatic translation between EBCDIC and ASCII codes is provided for magnetic tape labels and record formats.

Basic Partitioned Access Method - BPAM: This access method, when used in conjunction with BSAM, is designed for efficient storage and retrieval of discrete sequences of data (members) belonging to the same data set on a Direct Access device. The data set includes a directory that relates the member name with the address where the sequence begins. Each member has a simple name. Members may be added to a partitioned data set as long as space is available in the directory and the data set. Other than directory manipulation, all I/O is performed by BSAM.

Basic Direct Access Method - BDAM: In the Basic Direct Access Method (BDAM), records within a data set are organized on direct access volumes in any manner chosen by the programmer. Storage and retrieval of a record is by actual or relative address within the data set. This address can be that of the desired record or a starting point within the data set where a search for the record, based on a key furnished by the programmer, begins. Addresses are also used by BDAM as a starting point for searching for available space for new records.

Indexed Sequential Access Methods: Sequential and direct processing are provided by the Indexed Sequential Access Methods (ISAM). Records are maintained in control field sequence by key. A multilevel index structure is system maintained, allowing retrieval of any record by its key. Additions can be made to an existing ISAM data set without rewriting the data set.

The Basic Indexed Sequential Access Method (BISAM) stores and retrieves records randomly from an indexed sequential data set. Selective reading is performed using the **READ** macro instruction, and specifying the key of the logical record to be retrieved. Individual records can be replaced or new records added randomly.

The Queued Indexed Sequential Access Method (QISAM) is used to create an indexed sequential data set or to retrieve and update records sequentially from such a data set. Synchronization of the program with the completion of input/output transfer, and record blocking/deblocking are automatic. QISAM is also used to reorganize an existing data set.

VECTOR PROCESSING SUBSYSTEM - VPSS: The Vector Processing Subsystem (VPSS) is an access method designed to operate with the 3838 Array Processor. It provides a call level interface between the user program and the 3838 Array Processor. The user will, via CALL statements from FORTRAN or Assembler, be able to request that array calculations be performed by the 3838. VPSS is also available to the PL/1 program via PL/1's interlanguage communication facility.

Through the CALL statement procedure, the user establishes the processing sequence to be performed on the data. The 3838 capability is viewed as a set of vector arithmetic and logic instructions which include comparisons and conditional branches. By appropriately concatenating the instructions, in whatever sequence is desired, the user should be able to program complex processing functions unique to the installation.

Virtual I/O (MVS): The virtual I/O facility is available in MVS. It uses the system paging mechanism to transfer data set blocks between external page storage and real storage. The user can specify virtual I/O processing for system-named temporary data sets accessed through BDAM, BPAM, BSAM, QSAM, EXCP and XDAP interfaces. Virtual I/O processing for system-named temporary data sets is established at system generation time.

Page-size (4K bytes) physical blocks are dynamically allocated in external page storage as a virtual I/O data set is created. These blocks are not necessarily contiguous and the virtual I/O data set may span several volumes of external page storage. The blocks are released when the data set is deleted and the space is immediately made available for other paging needs.

Implementation of virtual I/O processing is compatible with the BDAM, BPAM, BSAM, QSAM, EXCP and XDAP macro interfaces to a DASD data set, and requires no change to user-written code or JCL. When a request is made for accessing a virtual I/O data set, the channel programs are intercepted and interpreted and the page table entries are manipulated if necessary, so that the desired data will be paged in or

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out of real storage as requested. For example, the control program reads a virtual I/O data set record into a virtual address space by modifying page table entries so that the 4K byte block(s) containing the record are identified as part of the virtual address space from which the request was made.

Restart processing currently available for temporary data sets is provided for virtual I/O data sets. Checkpoint and automatic step restart are provided for job failures. Checkpoint, step and job restart through the Job Entry Subsystem and automatic step restart are provided for system restart processing.

Some of the advantages of virtual I/O are: Centralized direct access storage device management ... Elimination of channel program translation and page fixing requirements ... Use of the I/O balancing of the paging mechanism ... Elimination of normal I/O device allocation and DADSM overhead for temporary data sets ... Compatibility at the object code and JCL level.

3850 MASS STORAGE SYSTEM - MSS (SVS and MVS)

SVS and MVS support attachment of a single 3850 Mass Storage System (MSS) (up to two A mdl 3851s).

The 3850 Mass Storage System (MSS) programming support includes an MSC (Mass Storage Control) Table Create program, Access Method Services functions to aid in mass storage volume management, and a Mass Storage System Communicator (MSSC) which communicates the Staging/Destaging commands to the MSC and contains Mass Storage Volume Control (MSVC) functions to assist in volume management. In addition, most of the facilities available for the control and management of real 3333/3330 Disk Storage drives and the data sets contained on 3336 Model 1 and 11 Disk Packs are applicable to virtual 3333/3330 addresses and the data sets contained on mass storage volumes. For SVS the 3350 devices may be attached to the 3830-3 or the ISC with staging adapter as a real device in native mode only. Brief descriptions of the significant areas of support follow. More detailed information can be found in the publication *OS/VS Mass Storage System (MSS) Planning Guide.*

MSC Table Create: Creates and initializes the tables required by the Mass Storage Control (MSC). The tables are of four types:

Configuration Information: describes the hardware present in the 3850 Mass Storage System and the interconnections between the various hardware components.

Cartridge Information: describes the locations and volume serial numbers of the mass storage volumes in the 3851 MSF.

Activity Information: describes the status of staging and destaging of data.

Control Information: contains information required to locate all the above tables and also the basic information required to start the MSC initial microprogram load.

This program must be run at the initial installation of the 3850 MSS and whenever the configuration changes. It must be run prior to a VS2 System Generation, if the 3851 **IODEVICE** macros are being changed, because it generates **IODEVICE** and **UNITNAME** card images to be used in Stage I of SYSGEN.

VS2 System Generation: The 3851 Mass Storage Facility is a new device type for which an **IODEVICE** macro must be included. The expanded addressing capability of the 3830 mdl 3 Storage Control and the Integrated Storage Controls (4650) with Staging Adapter special feature (#7220) on S/370 mdls 158 and 168 is identified to the system generation process as virtual 3333/3330 units. The number of virtual 3333/3330 addresses will be limited by the VS2 UCB limit (see *OS/VS2 System Generation Reference)* and by the available subchannels (see appropriate Processor or channel functional characteristics manual). An **IODEVICE** macro for each virtual 3333/3330 address is required. Certain system data sets must reside on real direct access units known to VS2. The four real unit addresses 0, 1, 8 and 9 on Staging Adapter 0 and Staging Adapter 1 are reserved for direct access to the MSC tables. If the only direct access units in an installation are the 3333/3330 Disk Storage drives included in the 3850 MSS, then one or more of these 3333/3330 drives must be assigned addresses that have been identified to VS2 as real 3333/3330 units. These 3333/3330 drives can then be used for the system data sets. For further information on system generation, refer to the publications *OS/VS System Generation Introduction* (GC26-3790) and *OS/VS2 System Generation Reference.*

Staging/Destaging Initiation: Staging and destaging is based upon Job Control Language (JCL) Data Definition (DD) statement parameters. **UNIT 3330V** indicates that the data set defined by DSNAME resides on a mass storage volume whose serial number is identified either by the **VOLUME** parameter or in the catalog. This mass storage volume is "mounted", i.e. made active, by the Mass Storage Control at job step initiation. If **DISP=OLD, SHR,** or **MOD** is specified, the staging of the data set is initiated when the data set is **OPEN**ed. Staging will be initiated for new data sets only when the space request is not on a cylinder boundary. Destaging of new data sets for which **DISP=KEEP** or **CATALOG** and the portions of old data sets that were modified is initiated when the mass storage volume is demounted.

Mass Storage System Communicator (MSSC): The MSSC includes **Mass Storage Volume Control** (MSVC) functions to assist users of the 3850 MSS to control and manage the use of mass storage volumes. MSVC centers around a new system data set, **Usercat.MSVI,** which is a keyed sequential VSAM data set containing space and activity information about mass storage volumes and groups of mass storage volumes. It is created, initialized, and maintained by the user via the Access Method Services functions for creating a VSAM data set and for the manipulation of mass storage volumes. **Usercat.MSVI** is used by MVS for the allocation of mass storage volumes to satisfy non-specific volume requests for new data sets. An Access Method Services function which produces a report of the status of mass storage volumes and groups of mass storage volumes is available. Access Method Services also list information concerning cartridges similar to the information listed concerning volumes. Included are two commands which enable the user to list or scratch and uncatalog non-VSAM data sets according to his specified criteria (e.g., creation date, expiration date or name qualifier). It is an installation responsibility to analyze these reports to determine the extent of space utilization on mass storage volumes and then to initiate the appropriate utility functions to scratch or copy inactive data sets.

Data Management Support: BSAM, QSAM, BPAM, BDAM, VSAM, EXCP, and XDAP may be used for data sets contained on mass storage volumes. The staging of such data sets is initiated at **OPEN**. ISAM data sets can be contained on mass storage volumes. However, staging for ISAM data sets is not initiated at **OPEN,** but rather, at the time a data record is accessed. One cylinder at a time is staged as requested by the "cylinder fault" mode of operation. The Direct Access Device Space Management (DADSM) facilities are applicable to mass storage volumes as well as to real direct access volumes. All of the catalog facilities of VS2 can be used for data sets contained on mass storage volumes.

Data Sharing: The components of the 3850 MSS can be shared by a maximum of four S/370s and 3033 Processor complexes. The catalog, user program libraries, and user data sets can be accessed by any Processor. If 3333s are shared between hosts, the 3330V devices with paths to the shared 3330 drives may be SYSGENed as shared or unshared at user option.

Data Security: The password protection data security facilities of VS2 can be used to control access to MSC tables and data sets contained on mass storage volumes.

Data Set Utility Programs: All non-stand-alone VS2 Data Set Utilities can be used with data sets contained on mass storage volumes.

System Utility Programs: All non-stand-alone VS2 System Utility Programs except IEHDASDR and IEHATLAS can be used on mass storage volumes.

IEHDASDR Utility Function: VS2 System Utility Program IEHDASDR provides support for formatting the DASD volumes as staging volumes. This utility function can only be performed external to the MSS.

Access Method Services Functions: Access Method Services provides mass storage volume commands which allow a user to initialize, modify, copy, and scratch mass storage volumes, to add and remove mass storage volumes from the 3850 MSS, and to convert real 3336 mdl 1 and 11 Disk Packs to mass storage volumes and back again. There are commands which allow a user to create, modify and scratch groups of mass storage volumes in **usercat.MSVI,** and to list the contents of **usercat.MSVI.**

Additional commands allow the user to copy, swap and compare his Mass Storage tables, to dump portions of the MSC or Staging Adapter storage, to dump the MSC tables, to audit cartridge locations within the Mass Storage Facility and to check the consistency of the MSC tables, Staging Adapter tables and Mass Storage Volume Inventory data set.

JES3: JES3 data and device management of the 3850 MSS is available in JES 3 Release 3. This support is described in the JES3 section under *Device, Volume and Data Set Management.*

VIRTUAL TELECOMMUNICATIONS ACCESS METHOD - VTAM

(SVS Release 1.7 and MVS Release 3) (Also refer to the Program Products section for licensed options provided for VTAM).

A functionally superior alternative to BTAM, VTAM provides telecommunications support for the 3704/3705 in network control mode and for locally attached 3270s, 3730s and 3790s. In addition, VTAM controls the sharing of telecommunication resources between application programs and supports the concurrent execution of multiple teleprocessing applications.

VTAM is supported in SVS Release 1.7, but is not supported in SVS Release 1.0 or 1.6. VTAM is supported in MVS Release 3 and all subsequent MVS releases, but is not supported in MVS Release 2.

VTAM provides for the direct transmission of messages between application programs and terminals. Using NCP/VS, it makes the lines

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and communications controllers transparent to the application program; thus, the application program need only be responsible for device control characters in data streams.

The expanded interface for application programs allows the user to control connections between application programs and terminals, as well as to request data transfer. A single request for connection or input can be directed simultaneously to more than one terminal.

For SS and BSC terminals, VTAM supports switched networks as point-to-point, manual dial, automatic dial, and automatic answer. Nonswitched networks are supported as point-to-point or multipoint, as appropriate for the device.

For SDLC terminals, VTAM initially supports switched and nonswitched lines. A switched line connection requires system operator assistance. Manual dial service is supported. Nonswitched networks are supported as point-to-point or multipoint, as appropriate for the device. VTAM subsequently supports SDLC terminals in switched networks as point-to-point, manual dial, automatic dial, and automatic answer. Each station has a unique transmission identification within the network, as defined by the installation.

The VTAM application program interface is upward compatible for the three virtual storage operating systems (DOS/VS, OS/VS1 and OS/VS2). It is designed for long-term stability and to aid user teleprocessing growth.

VTAM and VSAM are companion access methods on which to build customer DB/DC systems. In MVS Release 3, TCAM application programs can use certain VTAM facilities through the TCAM Message Control Program.

Network operator control facilities are provided, enabling the user to monitor and reconfigure his network to meet fluctuating requirements.

The program operator facility allows an authorized user-written application program to enter VTAM Network operator commands and receive VTAM Network operator messages.

Configuration Restart Facilities allow the VTAM Network to be reinstated after a failure or a normal deactivation occurs. Manual switching support to a backup Processor or 3704/3705 is provided.

VTAM's modular design and use of tailored VS2 RAS facilities provide a reliable telecommunications system and assist in maintenance.

A 3790-SNA System Installation Package, consisting of a 3790 Sample Installation test program with appropriate supporting code and control statements, and a 3790 Installation Guide, is provided to facilitate installation of 3790 Communication Systems and the host communications subsystem. The 3790-SNA System Installation package supports the 8100/DPCX Information System.

To aid in installing the 8100 Information System with DPPX or DPPX/SP, the Host Command Facility licensed program, with a 3270 display station running under VTAM or TCAM, can be used to:

- Remotely operate an 8100/DPPX or 8100/DPPX/SP system from a 3270 display station.
- Run 8100/DPPX or 8100/DPPX/SP checkout routines remotely.
- Verify the operation of a connection between S/370 and 8100/DPPX or 8100/DPPX/SP.
- Modify DPPX or DPPX/SP network profiles.

Teleprocessing Online Test Executive Program - TOLTEP: TOLTEP is a component of VTAM and is designed to control the selection, loading and execution of teleprocessing online terminal tests (OLTTs) for all control units and terminals in a VTAM network. It uses VTAM capabilities for line sharing, remote reporting, and remote test requests. TOLTEP performs control services, device accessing, and configuration-update functions for teleprocessing OLTTs of devices supported by VTAM.

TOLTEP allows the operator or IBM representative to run teleprocessing OLTTs concurrently with other processing programs, with VTAM and with the operating system. TOLTEP is automatically included in a system when VTAM is generated. It is initiated when VTAM is initiated and stopped when VTAM is stopped.

TOLTEP does not support the dedicated testing of a locally attached 3704/3705 Communications Controller. Dedicated testing of the local 3704/3705 is handled by OLTEP.

Although TOLTEP provides testing facilities for the VTAM network, TOTE and OLTEP are still required for testing appropriate non-VTAM networks.

TOLTEP requires the configuration data set (CDS) and the OLTT data set.

VTAM System Requirements: VTAM operates on all S/370 models supported by SVS Release 1.7 or MVS Release 3.

See *VTAM, TCAM and BTAM Terminals Supported* for a list of devices supported by VTAM with VS2.

TELECOMMUNICATIONS ACCESS METHOD - TCAM

(Also refer to the Program Products section for licensed options provided for NCP/VS).

The Telecommunications Access Method (TCAM) is a teleprocessing support program which may execute in conjunction with VTAM or as a separate access method. It provides:

- A regionalized, general-purpose TP access method providing facilities that permit exchange of data between a central S/370 and remote terminals.
- A control program designed to optimize the allocation and scheduling of a computer's resources in a real-time teleprocessing environment. Resources optimized include Processor time, real-storage space and I/O paths (lines and channels).
- A high-level language composed of macro instructions designed specifically to facilitate the construction of a TP message control program.

Please refer to the *Terminal Support Chart(s)* in this section for specific terminals and how supported.

TCAM provides unified management of terminal devices, local and remote, including BSC and SDLC devices, through a single Message Control Program. The TCAM application-program interface has been defined to provide maximum compatibility with BSAM (**READ/WRITE** level) and QSAM (**GET/PUT** level), yet provide the ability to identify or specify source and destination of terminal I/O. Network control functions may be provided in an application program able to issue TCAM operator control commands.

Teleprocessing applications using TCAM are constructed by providing a Message Control Program and one or more TCAM application programs.

TCAM does not provide emulation of the QTAM interface.

TCAM Message Control Program: The TCAM Message Control Program (MCP) serves as an interface between remote terminals, user-written application programs and secondary storage devices on which messages are queued until their destinations are available to receive them. The MCP's job is to control the flow of messages to and from these terminals, application programs, and queuing media, in a manner that optimizes allocation and scheduling of the computer's resources.

By handling all line control and scheduling of I/O operations for remote terminals, the TCAM MCP insulates user-written application programs from the complex device-dependent considerations inherent in a TP environment.

In TCAM, messages entered by remote terminals or application programs are queued by destination. Queuing by destination permits overlap of line usage in I/O operations; messages having a common destination may be received simultaneously from more than one source, even while the destination itself is busy sending or receiving a message. Disk queuing permits a high volume of concurrent terminal operations to proceed without requiring excessive real storage for buffering. TCAM destination queues may be located in main storage or on disk.

A TCAM MCP contains one or more message handlers. These are user-coded sets of routines that process messages as they enter and leave the TCAM MCP. Message handler functions are included by the selection and coding of TCAM supplied macros; among these functions are the following: message editing ... validity checking ... message routing ... record keeping ... error handling ... system control.

Special message-handler facilities are furnished for inquiry and conversational applications. The path of a message through a message handler may be varied dynamically based on the source or destination of the message, or on the presence or absence of certain character strings in the message header. To supplement TCAM-provided functions, the user may code open or closed subroutines consisting of assembler and macro instructions and include these in his message handlers. The TCAM MCP is just another problem program to the operating system. Assembly, linkage-editing, and execution of the MCP is similar to that for any other problem program. For performance reasons, the MCP is usually executed as the highest priority user task in the system, but this is not a requirement.

TCAM Application Programs: TCAM permits the user to code one or more application programs and interface these with the MCP. Application programmers are insulated from the TP environment; they issue ordinary **GET**s and **PUT**s or **READ**s and **WRITE**s to move data between the MCP and application program work areas.

TCAM application programs can be SAM compatible, and may be debugged in a non-TP environment using BSAM or QSAM as the access method, and a tape, card-reader, disk, card punch, printer, etc., as I/O devices. Once debugged, many application programs can be plugged into TCAM without reassembly by changing a single job-control statement. The user can specify that either messages or user-defined records be transferred when he issues his **GET/READ** or **PUT/WRITE** macros.

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TCAM application programs can be attached dynamically during execution by the MCP.

TCAM Service Facilities: TCAM offers an extensive set of service facilities. Among these are:

- A set of operator commands allowing the user to determine the status of his TP system and alter, activate, or deactivate portions of that system by entering appropriate commands from the system console, remote terminals, or application programs. An MCP may be referred to by its MCP name, and SNA entities are allowed as operands where applicable.
- A checkpoint/restart facility which allows the user to specify that his MCP environment be restored following system failure or closedown.
- A facility for selectively logging incoming or outgoing messages or message segments.
- Comprehensive debugging aids, including error-recovery and event-recording facilities, and utilities which permit debugging information to be dumped to tape or disk and then printed out.
- An online test facility (TOTE) that allows the user to test transmission control units (270X and 3704/3705) and remote terminals without closing down the MCP or deallocating the device being tested. In MVS Release 3 when TCAM uses VTAM, TOLTEP provides testing facilities for the VTAM network.

TCAM MFT, MVT/VS Compatibility: OS TCAM Message Control Programs must be reassembled to run in the OS/VS environment. This reassembly allows the MCPs to benefit from the virtual storage capability of OS/VS. Under OS/VS, TCAM runs as a subsystem in a virtual region. Certain TCAM elements, such as the buffer pool, I/O appendages, control blocks, and tables are fixed in main storage for the duration of the TCAM task.

TCAM/VTAM Relationship in MVS: TCAM users may elect to use VTAM to control the portion of their communications network attached to 3704/3705 operating with the Network Control Program/Virtual Storage (NCP/VS). When this option is chosen, VTAM controls the telecommunications environment that includes 3704/3705s in network control mode and, optionally for TCAM, locally attached 3270s. VTAM permits sharing of this telecommunications network among different applications including those applications which used TCAM 3704/3705 NCP/VS support in previous releases of the operating system. When the TCAM Message Control Program schedules a read or write operation for a station in the TCAM/VTAM network, the I/O request is routed to VTAM. To the TCAM applications, the message looks as if it were handled only by TCAM.

If a TCAM application program or a TCAM terminal operator issues TCAM 3704/3705 control commands, a unique return code and a response message is provided. This code and message indicate the command has been intercepted and cannot be executed. TCAM now shares this network with VTAM and is no longer the sole "owner" of the telecommunications network.

The installation can provide an interface to the terminal user similar to the TCAM interface by using the "simulated logon" capability of VTAM. However, to use the full sharing capabilities of VTAM, the installation instructs the terminal user to enter an installation-defined sequence requesting logon to TCAM and includes in the system the VTAM facility to monitor logons. This facility provides the capability to interpret the sequence entered by the terminal user and to route the interpreted logon request to the appropriate VTAM application (e.g., TCAM).

BASIC TELECOMMUNICATIONS ACCESS METHOD - BTAM

The facilities of the Basic Telecommunications Access Method (BTAM) are designed chiefly to provide the basic tools required to write a telecommunications program. These include facilities for creating terminal lists and for performing the following operations: Initiating and answering calls to and from terminals on switched networks ... Polling and addressing terminals on nonswitched multipoint lines ... Changing the status of terminal lists ... Transmitting and receiving messages ... Code translation ... Retransmitting messages which are received with detected errors ... Providing online terminal test facilities ... Keeping error statistics.

The support of Binary Synchronous Communications combined with that of the various start/stop devices gives BTAM a wide range of applicability and flexibility. BTAM supports low, medium, and high speed devices.

BTAM supports Binary Synchronous Communication over nonswitched (leased or private direct connection) and switched (dial) networks in a S/360 to S/370 and S/370 to terminal communication.

All terminals (except Binary Synchronous Communication) on a multipoint nonswitched line must be the same type. Terminals may be mixed within the same problem program.

Further information on terminal support is provided by Terminal Support Charts 1 and 2.

Optional communication serviceability facilities are available in BTAM including error recovery procedures, diagnostic error information, error counts and online terminal tests. It is strongly recommended that these facilities be included since they increase system availability.

VS2 BTAM supports the same functions as OS BTAM and, therefore, requires no additional programmer training. The user is cautioned regarding any internal changes that he may have made to OS BTAM.

Graphic Programming Services: Graphic Programming Services consists of the functions necessary to handle graphic input/output, and a set of macro instructions and problem oriented routines that can be used as building blocks in the construction of graphic processing programs. These services support the 3250 Graphic Display System, the 2250 Display Unit mdls 1 and 3, and the 2260 direct attachment (local). This access method includes: Macro instructions ... Data handling aids ... Problem oriented routines ... Graphic Data Generation Subroutine to generate data ... Light-Pen Tracking Subroutine ... The Graphics Access Method (GAM) includes: Read/Write level macro instructions ... buffer management facilities ... optional routines that facilitate man-machine communication ... Graphic Subroutine Package.

Graphic Subroutine Package: The Graphics Subroutine Package provides support for graphic programs written in Assembler Language or for the following compilers:

FORTRAN IV E, G or H
PL/I (F)
FORTRAN IV H - Extended or G1 (program products)
PL/I Optimizing or Checkout Compilers (program products)

These services consist of subroutines and functions that enable a programmer to create a display on one or more 3251 Display Stations or 2250 Display Units (mdls 1 and 3) under OS/VS2. The displays produced consist of any figures that can be constructed with points, lines, or characters, including charts, circles, arcs, rectangles etc. The subroutines are requested through the use of CALL statements in a sequence that produces desired characters or graphic forms on the 3251 or 2250 screen, and that provides two-way communication between the user's program and the 3250 or 2250 operator (if desired). In producing the desired displays, the subroutines automatically:

- Generate the necessary display buffer orders and data for the displays.
- Transfer the generated orders and data to the 3255 or 2840 display buffer for execution, relocating them as necessary.
- Allocate, control, and protect sections of virtual storage and of the 3255 or 2840 display buffer as required by the user's application program.
- Diagnose asynchronous errors and accomplish necessary error handling.

Highlights include:

- Two levels of display buffer order and data grouping each of which can be referenced as an entity: (1) an element - all orders and data produced as one call to a GSP subroutine, and (2) sequences of orders and data produced by several calls to GSP subroutines.
- Acceptance of input data in any two-dimensional rectangular coordinate system; the data is scaled as appropriate for use by the graphic subroutine package.
- Provision for temporarily removing an image from a display while retaining its associated orders and data in the display buffer, and later redisplaying the image.
- Modification of display buffer orders and data produced by a single call wherever they are located (in S/370 virtual storage or in a display buffer) by another call to the same subroutine.
- Display of alphameric characters using either the character generator or the 3250 or 2250 or, a series of lines called strokes.
- Capability to read information from the display buffer into S/370 virtual storage.
- Capability to locate the position of the light pen on the screen even if the light pen is pointed at a blank portion of that screen.
- Capability to place a tracking symbol on the screen and follow its motion as it is moved by a 3250 or 2250 operator with the light pen (restricted to 3250, or 2250 mdl 3).
- Allowance for display buffer subroutines that can be repeatedly invoked through display buffer order linkage, without recourse to the S/370 (restricted to 3250, or 2250 mdl 3).
- Ability to check the status of the program while it is being processed.
- Single and multiple queuing of attention information, and in-line processing of that information
- Access to the enhanced features of the 3250 Graphics Display System, including: 4 character sizes, character-string rotation

OS/VS2 (5752-VS2) (cont'd)

through 90 degrees counterclockwise, 4 line types, 8 intensity levels, and entity blinking.

Shared DASD: A pool of direct access storage devices may be shared by up to four S/370 Processors. Devices supported are 2314/2319, 3330/3333, 3340, 3344, 3375, 3380 and 3350. Two Processors may share a pool of 2305 direct access storage devices. The catalog, program libraries, and user data sets may be accessed by any Processor. Advantages are reduced file maintenance, improved operational flexibility, and reduced disk space requirements. Exclusive access for all other data sets can be controlled by using the **RESERVE** and **DEQ** macro instructions. VSAM user catalogs may be shared among OS/VS1, SVS, and MVS. OS control volume catalogs may be shared among the above plus the OS/MFT and OS/MVT systems. While VSAM user catalogs may be shared, reference to specific entry types (e.g., GDG) created by MVS may be accessed only by MVS. The master catalog cannot be shared. Program libraries and other system or user data sets may be shared on a read-only basis. The system does not automatically provide exclusive control of records, or prevent concurrent update or extensions to these data sets. Such data sets should be shared on a read-only basis until safeguards are instituted by each installation.

SYSTEM SUPPORT PROGRAMS

Linkage Editor: The Linkage Editor combines separately compiled or assembled object modules into one or more load modules that are in a format suitable for loading by the control program and for subsequent execution. It also combines previously edited load modules with each other or with object modules.

Features: Although linking or combining of program modules is its primary function, the linkage editor also:

- Provides CSECT ordering and page boundary. alignment facilities to allow the user to improve paging characteristics of his programs.
- Incorporates modules from data sets other than those in its primary input, either automatically or upon request.
- Aids program modification by replacing and deleting control sections as directed by linkage editor control statements.
- Defines the storage requirements for the common control sections generated by the assembler and by FORTRAN compilers, and the static external areas generated by PL/I compilers.
- Provides processing options and logs diagnostic error messages.
- Maintains an audit trail of compilation, linkage editing dates and levels and modifications on a CSECT basis within a load module via the identification record (IDR).
- Provides a service aid feature to allow for expansion of modules to provide maintenance space.
- Processes a control card and parameter permitting the user to supply his authorization level for APF.

Loader: The Loader provides improved performance in a compile-load-go environment, compared to a normal compile link-edit, execution sequence. The Loader combines the basic editing and loading functions of the linkage editor with program loading (fetch) in the job step. It loads object modules provided by the compilers and load modules produced by the linkage editor directly into virtual storage.

VS2 Assembler: The VS2 Assembler allows users to write programs in S/370 Assembler Language. Assembler Language gives the user access to equipment functions and permits the user to obtain a balance between real storage usage and execution time of his program. Programs written in Assembler language normally require more coding effort than if written in a higher level language. The Assembler allows the user to generate and maintain VS2. Among the features supported by this assembler are:

- Macro instructions - The macro capability provided by the assembler is a powerful programming tool providing interfaces to the VS2 Input/Output Supervisor by means of Data Management macros, access to the complete VS2 capabilities through the use of Supervisor macros, and the ability to include programmer defined macros in assembler programs for special applications.
- Conditional Assembly Statements - Conditional assembly statements are used to alter the sequence in which statements are processed, or to specify selective assembly of instructions. The conditional assembler mechanism is a key element in the macro feature.
- Private Libraries - A private library may contain assembler language statements. These can be macro definitions or code that is to be inserted into the program by the **COPY** statement.
- Dynamic Work Areas - The assembler provides a mechanism for establishing addressability to independently allocated storage areas.

The VS2 Assembler is a compatible subset of the Assembler H Program Product, 5734-AS1, which is available under VS2.

Assembler System Requirements: The VS2 System Assembler uses the S/370 Standard Instruction Set. This assembler is designed to run more efficiently in 128K of virtual storage, and requires a minimum of 64K bytes of virtual storage. In addition to the standard VS2 requirements, the System Assembler requires space in auxiliary storage for system input data sets and three intermediate data sets for work storage. In MVS, virtual I/O may be used.

Depending on program requirements, additional data sets may be needed for Macro Definition library, print output, object module output, and punch output.

The VS2 Assembler provides extensions not found in OS/360 Assembler F such as: ... **SETC** values and character relation terms may be up to 255 characters in length (the old limit was 8 characters) ... Relaxed restrictions and extended functions for conditional assembler statements ... Three additional system variable symbols (**&SYSPARM**, **&SYSTIME**, and **&SYSDATE**) ... Extended mnemonics for RR-type branch instructions ... Improved diagnostics and debugging facilities ... Mnemonics for relocate and multiprocessing instructions.

System Utilities: These programs are used to maintain system control data at an organizational or system level to operate in pageable storage. The following functions are performed by the system utility programs.

IEHPROGM - modifies system control data and maintains data sets at an organizational level, scratch, rename, catalog data, etc.†

IEHMOVE - moves or copies logical collections of data.†

IEHLIST - lists system control data such as directory entries of partitioned data sets and VTOC entries.†

IEHDASDR - Initializes direct access volumes for use with the operating system and dumps data from and restores data to these volumes. Central and local service were discontinued January 22, 1981.

IEHINITT - Writes volume label sets in EBCDIC, in BCD, or in ASCII code on magnetic tapes.

IEHATLAS - Locates and assigns an alternate track to replace a defective track and copies usage records from the defective track to alternate track.

IFHSTATR - Selects, formats, and writes information from Type 21 (error statistics by volume) records.

Device Support Facilities - Initializes direct access storage volumes for use with the operating system, inspects count-key data DASD volumes for defective tracks, conditionally reclaims tracks previously flagged defective, and analyzes the operational status of the 3350, 3375, 3380 and 3344 drives and the data and control paths. For the IBM 3340, 3344, 3350, 3375 and 3380, Device Support Facilities utilizes the skip displacement bytes in an attempt to recover a defective track before assigning an alternate. This aids the user in determining whether an error situation is drive or media related so the appropriate recovery procedures can be initiated. This utility is used to create a VTOC index when a volume is initialized on count-key-data devices. The building of an index over existing VTOCs may be done via this utility on systems that have the Data Facility/Device Support program product installed.

† Because the SVS system catalog is replaced by a VSAM master catalog in MVS, some IEHPROGM, IEHMOVE, and IEHLIST functions are replaced by Access Method Services or no longer supported.

With MVS, IEHUCAT provides the capability of updating an OS/MFT, MVT, VS1 and SVS catalog from a record of changes made to the MVS catalog. This program may be executed under SVS, OS/MVT, OS/MFT or VS1.

Access Method Services - The access method services multifunction service program for VSAM data sets is used to: Define a VSAM data set or catalog ... Convert a sequential or an indexed sequential data set to the VSAM format ... List VSAM catalog entries or records of a data set ... Copy a data set for reorganization ... Create a backup copy of a data set ... Make a data set portable from one operating system to another.

It can be invoked through an input job stream containing an Access Method Services command, by a processing program that passes it a command statement, or from a timesharing terminal.

In MVS, Access Method Services provides additional functions. It is also used to: Define and delete aliases for catalog names and non-VSAM data set names ... Support generation data groups (GDGs) ... Define and format paging data sets ... Convert an OS/MFT, MVT, VS1 and SVS catalog to an MVS catalog ... Move or copy a VSAM catalog ... Create the pointers in the master catalog to the OS control volume catalogs.

System Data Set Utilities: These programs reorganize, change or compare data at the data set and/or record level, and are required for the proper generation and maintenance of the system control program. The following general functions are performed by these utilities for non-VSAM data sets:

OS/VS2 (5752-VS2) (cont'd)

IEBCOPY - Copies, compresses, merges, loads, and unloads partitioned data sets.

IEBGENER - Copies a sequential data set or members of a partitioned data set, or converts a data set from sequential to partitioned organization.

IEBPTPCH - Prints or punches records residing in a sequential or partitioned data set.

IEBUPDTE - Updates a symbolic library

IEBEDIT - Produces an edited input job-stream data set from a master input job-stream data set

IEBTCRIN - Constructs records from input read from the 2495 Tape Cartridge Reader. Generation of a 2495 is required for the inclusion of the IEBTCRIN utility into the operating system.

IEBDG - Can create output data sets either with internally generated test data or externally supplied input. These data sets can be sequential, indexed sequential, or partitioned.

IEBCOMPR - Compares two identically organized sequential or partitioned data sets at the logical record level.

IEBISAM - Can copy, print, reorganize, load, or unload an indexed sequential data set.

IEBIMAGE - New 3800 Utility provides means for the user to create or modify and to store in **SYS1.IMAGELIB** Forms Control Buffer records, Copy Modification records, Graphic Character Modification Records, and Character Arrangement tables. Input to the Utility consists of simple control statements. User can specify for FCB records forms sizes, number of lines at each vertical spacing, and line positions for simulated channel control punches. For Copy Modification, control statements include the text and its position within each copy of the pages of a data set. Existing Copy Modification records can also be modified. Graphic Character Modification statements provide means for combining and naming groups of graphic characters, including any characters already in **SYS1.IMAGELIB**, and to assist in storing in the system new graphic characters of user's own design. Character Arrangement tables can be created or modified to print with different character sets, to include Graphic Character Modifications, and to assign data codes to graphics or to change existing assignments.

Independent Utilities: The following independent utilities do not operate with the VS2 control program, but they support VS2 with the following services:

IBCDASDI - Initializes Direct Access Volumes for use with VS2. Central and local service were discontinued on January 22, 1981.

ICAPRTBL - Performs stand-alone buffer loading for the IBM 3211 printer.

IBCDMPRS - Performs unloading and loading of data between DASD and a removable volume.

Device Support Facilities - Initializes direct access storage volumes for use with the operating system, inspects count-key data DASD volumes for defective tracks, conditionally reclaims tracks previously flagged defective, and analyzes the operational status of the 3344, 3350, 3375 and 3380 drives and the data and control paths. For the IBM 3340, 3344, 3375 and 3380, Device Support Facilities utilizes the skip displacement bytes in an attempt to recover a defective track before assigning an alternate. This utility is used to create a VTOC index when a volume is initialized on count-key-data devices. Device Support Facilities will utilize the SKIP Displacement bytes in an attempt to recover a defective track before assigning an alternate track for the IBM 3375 and IBM 3380 users. The MSS 3330 virtual volumes are supported by the BUILDIX command.

These independent utilities are not supported for the 3066 console.

Online Test Executive Program - OLTEP: The Online Test Executive Program (OLTEP) is a function designed to direct the selection, loading, and execution of the Online Test sections (OLT's) within the VS2 environment.

OLTEP with the related OLTs is designed to allow the testing of Input/Output Hardware components of a system, concurrent with the running of customer jobs.

The OLTEP/OLT system is designed for: Providing an interface with RETAIN/370 ... Diagnosing I/O errors ... Verifying I/O hardware repairs and Engineering Changes ... Exercising a device requiring dynamic adjustments ... Checking I/O hardware ... Preserving integrity of customer data while testing.

As a job under VS2, it is called by standard Job Control Language and is under the control of the operating system at all times. It uses the facilities of VS2 to accomplish the testing and competes with other jobs in the system for use of these facilities when running in a multiprogramming environment.

Definition of test to be run can be entered via console or non-console devices.

Field Engineering supplies the OLTs and device configuration information to the customer on magnetic tape or cards. The Field Engineer reformats and link edits the OLTs into a partitioned data set so that they can be used under the operating system. Device configuration information is required for each device to be tested by OLTEP/OLTs.

The OLTEP interface to RETAIN/370 provides the ability to transfer Diagnostic Test results to the RETAIN/370 center and allows the RETAIN/370 center to modify Diagnostic Test requests and options. The RETAIN/370 interface is provided in OLTEP via the console.

OLTEP must normally be executed as a V=R job The Logout Analysis program operates in virtual storage. Since use of OLTEP is now restricted by APF, all OLTEP programs must be online in protected system libraries.

OLTEP must normally be executed in a minimum of 76K bytes in MVS and 64K bytes in SVS as a V=R job. The logout analysis program will operate in the paged virtual storage.

Teleprocessing Online Test Executive Program - TOLTEP: (MVS Release 3)

An online test facility is provided for telecommunications networks under VTAM. See description in sales manual pages of the Virtual Telecommunications Access Method (VTAM) for information on TOLTEP.

SERVICE AIDS

Dynamic Support System (DSS) is no longer supported on OS/VS2 MVS and is deleted from the OS/VS2 MVS Release 3.8 distribution libraries.

Generalized Trace Facility (GTF) is a standard feature in the VS2 system. It is a program service that assists users in performing problem determination and diagnosis by tracing system events, user events, or both. GTF consists of two major functions, the Generalized Trace function and the Trace Edit function.

The Generalized Trace function is a system service that can be optionally started from the master console. It executes as a system task in a region. When the Generalized Trace function is started, the user also has the option of tracing internally in the GTF region or externally to a data set on an auxiliary device.

The GTF internal trace mode has been enhanced in MVS to include the full tracing selectivity and capability that previously existed only for external trace mode. Additionally, all GTF records may now be optionally formatted as part of an ABEND/SNAP dump. Dumps produced by AMDSADMP or other system dumping facilities also contain GTF trace data. Several types of system trace records have been added to support function in MVS.

The Trade Edit function is a feature of the AMDPRDMP service aid and provides the user with a selective data reduction capability for the trace data set or formats GTF trace data from a storage dump produced by AMDSADMP or the **SYS1.DUMP** data set. It runs as a problem program and can be invoked via JCL.

AMAPTFLE - This program aids in the application of a PTF to the system by producing the JCL statements that are required for the proper application of the temporary fix. When a PTF is to be applied to a module, the user supplies distribution library module name and status and level information for each CSECT being modified. The program then either produces the necessary Job Control Language statements for application of the PTF; or, if specified, dynamically invokes the linkage editor to update the operating system. The program executes in the paged section of processor storage.

AMBLIST - This Linkage Editor service aid program produces various formatted listings which may be used for system serviceability and diagnostic purposes. Depending on options specified on AMBLIST control statements, the following listings may be produced:

- Formatted load module listings.
- Formatted object module listing.
- Map of System link pack area.
- Load module map and cross-reference listings.
- Map and cross-reference listings of the system nucleus.
- The data stored in the CSECT Identification records of load modules.
- Load module map and cross-reference listings showing addresses relocated relative to a user-supplied address.
- Load module summary data including entry point address, APF access code, module attributes, and the contents of the module's System Status Index.
- Program modifications to a load module library.

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The minimum virtual storage requirement for AMBLIST is 64K bytes.

AMASPZAP - This service aid program assists authorized personnel to:

Inspect and modify instructions and data in any load module that exists as a member of a partitioned data set.

Inspect and modify data in a specific data record that exists in a direct access data set.

Dump an entire data set, a specific member of a partitioned data set, or any portion of a data set residing on a direct access device.

AMDSADMP - This service aid is a macro instruction that allows the user to generate a stand-alone dump program that is specifically tailored to his needs. AMDSADMP can generate two types of dump programs: one high-speed, the other low-speed. The high-speed version can write the control registers, contents of real storage, and selected portions of paged out storage onto a tape volume in large blocks. The low-speed version can write the control registers and the contents of real storage to a printer or tape volume in unblocked, printable format.

AMDPRDMP - This service aid program formats and prints dump data sets produced by AMDSADMP and other system programs. The dump data sets may contain dumped real or virtual storage.

Selective printing and formatting of the dump data sets is completely controlled by the user of AMDPRDMP via control statements. The **SUMMARY** control statement in MVS may be used to obtain the following: A synopsis of the storage ranges contained in the dump data set ... A summary of the status of the system as the dump data set shows it.

The user may use this information to determine what further formatting is required and he proceeds to get the required formatting by selecting the proper AMDPRDMP control statements.

An interface is provided whereby the user may write formatting modules to do additional (user tailored) formatting during AMDPRDMP execution.

In MVS Release 3, the Fast Dump Scan facility is added which allows the user to scan a storage dump (SVC Dump or Standalone Dump) from any TSO terminal (via the **CALL** subcommand) or the master console.

To use fast dump scan, the user executes AMDPRDMP. A new verb, **DISPLAY** (and subverbs **LIST, HARDCOPY, EQUATE, COMMENT, RETURN**), is used to display up to 256 storage locations starting at a specified hex or symbolic virtual storage address.

IMCOSJQD - This service aid produces a formatted copy of the contents of the job queue data set. This program operates as a problem program under the SVS control program. It is not supported in MVS. The stand-alone job queue dump program (IMCJQDMP) is not supported in VS2.

IFCEREPO - Edits and lists error environment records including software records with MVS.

IFCDIPOO - Reinitializes the system data set, **SYS1.LOGREC**.

HMASMP - This program is used for the application of Program Temporary Fixes (PTFs) prepared in the new Systems Modification Program format. It is designed to improve the quality and reliability of the support process by recording the status of the system so that modifications will not be applied where inappropriate. Also, updating will be easier since libraries, modules, macros, and PTFs can all be updated and applied via one programming procedure.

Analysis Program-1 (AP-1) aids the operator in analyzing 3350 or 3344 DASD error situations and in isolating such errors into hardware or media related areas.

AP-1 may be directed to test for hardware errors only or hardware and media errors. Simple result messages appear on the operator console. Detailed error related data are directed to SYSPRINT.

AP-1 will only analyze errors associated with 3350 or 3344 devices and requires that one of these devices be on the system. Central and local service were discontinued on January 22, 1981.

Display Exception Monitoring Facility: The Display Exception Monitoring Facility (DEMF), Selectable Unit (SU) 68 for MVS, component release UY99958 for SVS, is a serviceability aid which offers users of 3270 Information Display System in local or BSC mode assistance in locating a hardware problem in a communication network. In remote mode, the 3270 must communicate through a 270X or 370X in EP mode.

DEMF is logically composed of two tasks: a logging function and a display function. The logging function runs as a system task under SVS or MVS. It is passed communication error records created for the SYS1.LOGREC data set. The display function is a component that runs under TCAM, CICS/VS, or IMS/VS. It presents a structured display of errors accumulated by the logging function at the user request.

Program Products: There are a large number of program products which may be ordered to support OS/VS. The program product section of the sales manual should be referenced for more information and ordering instructions.

Current System Programs (CSP) Under OS/VS: Type I CSPs, such as Sort and the Language Compilers, are not distributed as part of the OS/VS SCP. Those wishing to continue using them may transfer them over from their OS Release 21.8 or later system. If the CSP is on a DASD device accessible to a VS system, then the VS systems SYS1.PROCLIB need only be updated to include the CSPs cataloged procedures. These procedures should contain a JOBLIB or STEPLIB DD card referencing the data set containing the CSP. If the CSPs reside on a DASD device not accessible to VS, then they should be copied to one with the IBM Utility IEBCOPY. The VS System's SYS1.PROCLIB should be updated accordingly.

Those customers not on OS Release 21.8 must order this or a later release of the OS DLIBs. They would then perform a processor only SYSGEN as described in the *OS System Generation Guide* (GC28-6554). In so doing, the CSP target library and the procedural library should be one accessible by the VS system.

Ordering instructions for the Release 21.8 DLIBs are the same as for Release 21.7, which are available in the Release 21.7 Guide (GC28-6730)

Please note that the following programs and program products which were announced for SVS are not supported on MVS (i.e., APARS against these programs running on MVS will not be accepted).

Program Name	Program Number
	360A-CX-42X,
CALL/OS	44X,45X,46X
COBOL F	360S-CB-524
COBOL F Library	360S-LM-525
Full ANS COBOL V2	360S-CB-545
Full ANS COBOL V2 Library	360S-LM-546
FORTRAN G	360S-FO-520
FORTRAN H	360S-FO-500
FORTRAN G & H Library	360S-LM-501
PL/I F	360S-NL-511
PL/I F Library	360S-LM-512
PL/I F Syntax Checker	360S-PL-552
Sort/Merge	360S-SM-023

Even though the above Type I language compilers are not supported under MVS, generated object code for customers programs using any of these higher-level Type I languages, together with the relevant library modules, will operate on the current release of MVS subject to the constraints outlined in the *Introduction to OS/VS2 Release 2* (GC28-0661). Further, if that object code (with relevant object modules) runs on MVT Release 21.8 or a previous release of VS2 but does not function with the current release of MVS, an APAR will be accepted against MVS. Verification of the defect is the responsibility of the local CE programming systems representative, who will submit the APAR to the SCP location.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

System Configuration: SVS supports S/370 mdls 145, 158, 168, 155II, and 165II and the 3031, 3032 and 3033 Processors. The 158MP and 168MP processors are supported in uniprocessor mode (8 megabyte maximum). Real storage requirements for SVS are:

384K	Minimum concurrent batch and reader/writer.
512K	Minimum concurrent batch, reader/writer, and TSO or Minimum ASP Support Processor.
768K	Normally considered for concurrent batch, TSO, HASP.
1,024K	Normally considered for ASP Support Processor with local main.

MVS supports S/370 mdls 145, 158, 168, 155II, 165II, 158AP, 168AP, 158MP, and 168MP and the 3031, 3031AP, 3032 and 3033 Processors. Real storage requirements for MVS are:

768K	JES2 design entry - not a production system.
1,024K	JES3 design entry - not a production system.
2,048K	Normally considered for a batch production system.
3,072K	Normally considered for a batch and TSO or batch and IMS/VS production system.
4,096K	Normally considered for a batch, TSO and IMS/VS production system.

The recommended storage requirements for MVS production systems are guidelines only. Benchmarks or customer performance evaluation runs should be utilized as required.

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MINIMUM VS2 CONFIGURATION

The minimum configuration required for VS2 operation or SYSGEN is:

- S/370 3145, 3155II, 3158, 3158AP, 3158MP, 3165II, 3168, 3168AP, 3168MP, 3031, 3031AP, 3032, or 3033 Processor. The 3145 requires the clock comparator and Processor timer feature (#2001), the advanced control program support feature (#001) and floating point feature (#3910).
- 384K bytes of available real storage for SVS or 768K bytes of available real storage for MVS.
- A multiplexer channel.
- A selector or byte multiplexer channel.
- SVS; Three 3330/3333, three 3340, (with 3348 mdl 70 Data Modules) or four 3340 (with 3348 mdl 35 Data Modules) DASD spindles plus any additional online DASD capacity necessary to meet customers operational needs.
- MVS; Five 3340 (with mdl 70 Data Modules) or four 3330/3333 DASD spindles plus any additional online DASD capacity necessary to meet customers operational needs. The minimum spindle requirement for 3330/3333 mdl 11 is four. The 3340 requirements may be satisfied by 3344 volumes if the starter system address requirements are met. The 3330/3333 requirements (all models) may be satisfied by 3350 spindles in the equivalent compatibility mode. Starter system and library tapes which restore to the 3350 in native mode or 2314 are not provided. The user with 3350 DASD only must satisfy the 3330/3333 requirements above with 3350 spindles in 3330 compatibility mode with one exception. The target device for the new system being generated may be a 3350 in native mode if the starter system address requirement for 3350 is met.
- A SYSIN device (card reader or tape).
- A SYSOUT printer (printer or tape).
- A SYSOUT punch (punch or tape).
- A console
- A 9-track 1600 bpi tape drive.*

* Distribution of the SCP, component releases, emulator SCPs and PTFs are made on a 9-track 1600 bpi tape; therefore, a 9-track tape on the system or access to another system meeting the minimum configuration requirements and having a 9-track tape at the customer installation is required for system generation and maintenance. Note - a tape drive is also recommended for the output from a high speed stand-alone dump program (AMDSADMP). This may be the same drive used for generation and maintenance.

If TCAM/VTAM/BTAM is specified, at least one transmission control unit or communications controller is required for operation of remote terminals (VTAM requires a 3704/3705-I/3705-II in network control mode).

SYSTEM GENERATION

This is the process of preparing a specially tailored operating system to match the machine configuration and operating system options selected by the user. This process uses either the VS2 starter system or the user's current operational VS2 system (assuming the system generation is for the same release as the operational VS2 system) and requires the following programs: Control Program ... Data Management, Date Set Control, BSAM, QSAM, BPAM ... Assembler ... Linkage Editor ... Utilities.

PID distributes on 9-track 1600 bpi tape for 2314/2319 (Not available for MVS) or 3330/3333 mdl 11, or 3340 residence the required libraries (Partitioned Data Sets) which contain the Operating System modules the system generation macro instructions need for the system generation process when VS2 is ordered. The inclusion of JES into VS2 is accomplished via an additional generation phase which requires a card reader. The same system requirements are required for maintenance as for generation since some changes may require a full or partial system generation.

Tables showing the device supported, the system functions for which they may be used, and the three character address assigned to each of the units for the Starter System can be found in:

OS/VS2 System Generation Reference GC26-3792
OS/VS2 Release 2 Guide GC28-0671

Feature Support: The following features are supported by VS2. Other features, not listed, have no specific programming support; their existence is ignored by the control program. Attempts to use VS2 with unsupported features may cause unpredictable results. For brevity this list does not include those basic features or control units which are required to connect a supported device.

OPTIONAL PROCESSOR FEATURES SUPPORTED

S/370

Feature	145	148	155II	158	165II	168
Advanced Control Program Support	1001	STD	STD	STD	STD	STD
Conditional Swapping	1051	**	STD	STD	STD	STD
Block Multiplexer Channel	1421-4	STD	1433-5	1433-5	N/A	N/A
Buffer Expansion	N/A	N/A	N/A	N/A	1432	1435
Channel-to-Channel	1850	1850	1850	1850	N/A	N/A
Clock Comparator and processor Timer	2001	STD	STD	STD	STD	STD
Direct Control	3274	3274	3274	3274	N/A	N/A
Extended Precision Floating Point	3910	STD	3700	3700	STD	STD
Extended Channels	N/A	N/A	N/A	N/A	3850	3855
1401/1440/1460 Compatibility	4457	4457	3950	3950	N/A	N/A
1401,1410/7010 Compatibility	4458	4458	3950	3950	N/A	N/A
High Speed Multiply	N/A	N/A	N/A	N/A	4520	4525
Integrated Storage Controls	4660*†	4660	N/A	4650	N/A	4650
Multiplexer Subchannels, Additional	4951-4	4953	N/A	N/A	N/A	N/A
2nd Byte Multiplexer Channel	N/A	N/A	4990	4990	N/A	N/A
OS/DOS Compatibility	STD	STD	5450	5450	N/A	N/A
Selector Channel	6982-4	N/A	N/A	N/A	N/A	N/A
7070/7074 Compatibility	N/A	N/A	7117	7117	7117	7127
7080 Compatibility	N/A	N/A	N/A	N/A	7118	7128
709/7090/7094II Compatibility	N/A	N/A	N/A	N/A	7119	7129
Staging Adapter for ISC	N/A	N/A	N/A	7220	N/A	7220
3213 Printer Attachment	N/A	N/A	N/A	7840	N/A	N/A
3210 Adapter	7844-5	N/A	7844-5	N/A	N/A	N/A
3215 Adapter	7855	N/A	7855	N/A	N/A	N/A
Two Channel Switch for ISC	8100*	8100	N/A	7905	N/A	7905
Word Buffer	8810	STD	N/A	N/A	N/A	N/A

* 3345 mdls 3, 4, 5 available on the 145.

** This instruction is part of Advanced Program Control Support.

† Supported only with SVS.

3031, 3032 and 3033 Processors

Feature	3031	3032	3033
Block Multiplexer Channel	STD	STD	STD
Extended Precision Floating Point	STD	STD	STD
Multiplexor Subchannels	STD	STD	STD
Two-byte Interface	N/A	7850	7850
Extended Channels	N/A	3850	3850*
Channel-to Channel (First)	1850	1850	1850
Clock Comparator	STD	STD	STD
Adv. Control Processor Support	STD	STD	STD

* 3851 on 3033 Processor Model Group N and 3033 Processor Model Group S

I/O FEATURES

1052 Printer - Keyboard (see VTAM, TCAM and BTAM Terminals Supported)

1275 Optical Reader Sorter (mdls 1, 2, 4):
Required: #2925 - Expanded Capability
#9185 - Dual Address

1287 Optical Reader (mdls 1,2,3,4,5):
Supported: #3850 - Expanded Symbol Set
#3945 - Farrington 7B Font
#4470 - 1428 and ANSCS OCR Font
#5300 - NCR Optical Type Font (mdls 2, 4 only)

OS/VS2 (5752-VS2) (cont'd)

#5370 - Numeric Handwriting
#5479 - Optical Mark Reading

1288 Optical Page Reader (mdl 1):
Supported: #5370 - Numeric Handwriting
#5479 - Optical Mark Reading

1403 Printer (mdls 2,3,7,N1):
Supported: #8640 - Universal Character Set
#8641 - Universal Character Set

1419 Magnetic Character Reader (mdl 1):
Supported: #1445 - Batch Numbering (requires 3800 Expanded Capability and 7730 Dual Address)
#5739,5741 - Program Control for Pocket Lights

1443 Printer (mdl N1):
Supported: #5558 - 24 Additional Print Positions.

2150 Console

2250 Display Unit (mdls 1, 3)

2260 Display Station (see VTAM, TCAM and BTAM Terminals Supported)

2305 Fixed Head Storage (mdls 1,2):
Required: #2835 Storage Control

2314 Direct Access Storage Facility (mdl A1):
Supported: #8170 - Two-Channel Switch

2319 Disk Storage

2400 Magnetic Tape Unit and Control:
Required: #2803 Tape Control (mdl 2)
Supported: #3471, 3472 - Dual Density (800 - 1600 bpi)

2401 Magnetic Tape Unit (mdls 1,2,3,4,5,6)

2420 Magnetic Tape Unit (mdls 5,7)

2495 Tape Cartridge Reader

2501 Card Reader (mdls B1,B2):
Supported: #1531 - Card Image

2520 Card Read Punch (mdls A1,B1):
Supported: #1531 - Card Image

2520 Card Punch (mdls A2,A3,B2,B3):
Supported: #1531 - Card Image

2540 Card Read Punch (mdl 1):
Supported: #1531 - Card Image

2671 Paper Tape Reader

2803 Tape Control (mdls 1, 2, 3):
Required: #3228 - Data Conversion (for all 7-track tapes that record binary data such as variable length, format V records and abnormal end dumps. Inclusion of 7-track tapes without this feature is not recommended)
Supported: #7125,7127,7135 - 7-track Compatibility
#7185 - 16 Drive Addressing
#7900 - 2420 Attachment (2803 mdl 2 only)

2804 Tape Control (mdls 1, 2, 3):
Required: #3236 - Data Conversion (for all 7-track tapes that record binary data such as variable length, format V records and abnormal end dumps. Inclusion of 7-track tapes without this feature is not recommended)
Supported: #7126,7128,7136 - 7-track compatibility

2816 Switching Unit (mdl 1):
Supported: 1050-1052,1055,2285,2286, 4455,6392,6393 - Additional Switching

2821 Control Unit (mdls 1,2,3,5,6):
Supported: #1990 - Column Binary (for problem program use only)
#8637-#8639 - Universal Character Set Adapter

2844 Auxiliary Storage Control:
Supported: #8171 - Two Channel Switch
Not Supported: More than 2 paths to a device from one Processor with MVS Release 2.

2860 Selector Channel (mdls 1,2,3):
Supported: #1850 - Channel-to-Channel Adapter (Available with MVS; for SVS support, see ASP)

2870 Multiplexer Channel:
Not Supported: Burst devices (including byte devices with burst mode options operating in burst mode) on a multiplexer subchannel. Magnetic tapes are supported on the selector subchannels.
Cross channel devices (2804 Tape Control, 2816 Switching Unit, 3803 Tape Control with communicator feature and either 2-control switch 3-control switch or 4-control switch, 3803 Tape Control with 8100 Two-Channel Switch) attached between any 2780 selector subchannel and any other selector channel or between any 2780 selector subchannel and a selector subchannel of a different 2870.

2880 Block Multiplexer Channel (mdls 1, 2):
Supported: #7850, #7851 - Two-Byte Interface

3036 Console

3066 System Console (mdl 1)

3088 Multisystem Channel Communication Unit (mdls 1, 2)

3158 Console Function

3210 Console Function

3211 Printer (mdl 1):
Required: 3811 Printer Control Unit
Supported: #5554 - 18 Additional Print Positions

3213 Console Printer

3215 Console Printer-Keyboard

3275 Display Station (mdls 1, 2) *(See VTAM, TCAM and BTAM Terminals Supported)*

3284 Printer (mdls 1, 2)

3286 Printer (mdls 1, 2)

3288 Printer (mdl 2) (supported as a 3286-2)

3277 Display Station (mdls 1, 2) *(see VTAM, TCAM and BTAM Terminals Supported)*

3330 Disk Storage (mdls 1,2,11):
Required: 3333 Disk Storage and Control, or 3830 Storage Control

3333 Disk Storage and Control (mdls 1,11):
Supported: #8150 - String Switch

3340 Direct Access Storage (mdls A2,B1,B2):
Required: 3340 mdl A2
Supported: #6201,6202 - Rotational Position Sensing
#8150 - String Switch

3344 Direct Access Storage (mdls B2,B2F)

3350 Direct Access Storage Facility (mdls A2,A2F,B2,B2F,C2,C2F):
Supported: #8150 - String Switch

3375 Direct Access Storage (mdls A1, B1)
Supported: #8150 - String Switch
Required: 3880 Storage Control mdl 1 or 2

3380 Direct Access Storage (mdls A4,AA4,and B4.
Supported: #8150 - String Switch
Required: 3880 Storage Control mdl 2 or 3

3410 Magnetic Tape Unit (mdls 1,2,3):
Supported: #3211 - Single Density
#3221 - Dual Density
#6550 - Seven-Track Tape Unit
#7360 - S/360/370 Attachment

3411 Magnetic Tape Unit and Control (mdls 1,2,3):
Supported: #3211 - Single Density
#3221 - Dual Density
#6550 - Seven-Track Tape Unit
#7360 - S/370 Attachment

3420 Magnetic Tape Unit (mdls 3,5,7):

OS/VS2 (5752-VS2) (cont'd)

Supported: #3550 - Dual Density
#6407 - 7-track
#6631 - Single Density

3420 Magnetic Tape Unit (mdls 4,6,8):
Supported: #6420 - 6250 Density
#6425 - 6250/1600 Density

3505 Card Reader (mdls B1,B2):
Supported: #5450 - Optical Mark Read
#6555 - Selective Stacker

3525 Card Punch (mdls P1,P2,P3):
Supported: #1533 - Card Read
#5272 - Multiple Card Print
#8338 - Two-Line Card Print

3540 Diskette Input/Output Unit (mdls B1, B2)

3800 Printing Subsystem (mdl 1):
Supported: #1490 - Burster-TrimmerStacker
#5401 - 127 Character Generation Storage Positions
#8170 - Two Channel Switch

3803 Tape Control (mdl 1):
Supported: #1792 - Two-Control Switch
#1793 - Three-Control Switch
#1794 - Four-Control Switch
#3551 - Dual Density
#6408 - Seven-Track
#9071 - Communicator 1-2
#9073 - Communicator 3-4

3803 Tape Control (mdl 2):
Supported: #1792 - Two-Control Switch
#1793 - Three-Control Switch
#1794 - Four-Control Switch
#5310 - Nine-Track NRZI
#6320 - Seven-Track NRZI
#8100 - Two-Channel Switch
#9071 - Communicator 1-2
#9073 - Communicator 3-4

3811 Printer Control Unit (mdls 1,2):
Supported: #5553 - Additional (18) Print Positions

3830 Storage Control (mdls 1,2):
Supported: #8170 - Two-Channel Switch
#8171 - Two-Channel Switch, Additional
Not Supported: More than 2 paths to a device from one Processor with MVS Release 2

3830 Storage Control (mdl 3):
Supported: #8170 - Two-Channel Switch
#8171 - Two-Channel Switch, Additional

3851 Mass Storage Facility (mdls A1,A2,A3,A4,B1,B2,B3,B4):
Supported: #8171,8172 - Two Channel switch, additional
#4901,4902 - MSC Port

3880 Storage Control (mdls 1, 2, 3)
Supported: #8170 - Two-Channel Switch Pair
#8171 - Two-Channel Switch Pair, Additional
#8172 - Eight-Channel Switch feature (requires #8170 and #8171)
#6550 - Speed Matching Buffer for 3380
#6560 - Speed Matching Buffer for 3375
Not Supported: More than 2 paths to a device from one Processor with MVS Release 2.

3880 Storage Control (mdls B13, D13)
Supported: #8170 - Two-Channel Switch Pair
#8171 - Two-Channel Switch Pair, Additional

3880 Storage Control (mdl D11)
Supported: #8170 - Two-Channel Switch Pair
#8171 - Two-Channel Switch Pair, Additional

3886 Optical Character Reader (mdl 1):
Supported: #3210 - Additional Data Storage
#4610 - Additional Instruction Storage
#4720 - Line Marking
#5360 - Numeric Handprinting
#6450 - Serial Numbering
Not Supported: The 3886 is not supported by SVS.

3890 Document Processor (mdls A1,A2,A3,A4,A5,A6):
Supported: #5111 - Microfilming
#4666 - Item Number/Endorsing

4245 Printer mdl 1

SVS DEVICE SUPPORT

The *SVS Device Support Chart* shows all devices that are supported by SVS for systems functions and/or non-TP access methods. (For other telecommunications devices see *VTAM, TCAM and BTAM Terminals Supported).* The chart shows for each device the relevant functions supported.

Devices which are not shown in this chart have no specific programming support under SVS and their existence is not recognized by the control program.

Notes:

1) BSAM (device-dependent only).
2) QSAM (device-dependent only) for journal tapes; BSAM (device-dependent only) for cut-form documents.
3) The Selective Tape Listing feature is not supported.
4) A console must consist of a printer-keyboard, or a card reader and printer to simulate the actions of a printer-keyboard (composite console).
5) DIDOCS supported.
6) Multiple Requesting supported.
7) File Scan not supported.
8) Rotational Position Sensing support (optional feature on 3340).
9) For message queues under TCAM.
10) A Data Set Utility (IEBTCRIN) is provided to read data from the 2495 and create a sequentially organized data set.
11) Supported for read or punch, but not both simultaneously.
12) For use with the VS2 Output Writer; not for system messages.
13) Punch Feed Read is not supported.
14) The 3540 is supported by the VS2 Diskette Copy Programming Support.
15) QSAM (device-dependent only).

Legend:

C = Console
G = Graphic Programming Support
S = Sequential Access Method
I = Indexed Sequential Access Method
P = Basic Partitioned Access Method
D = Basic Direct Access Method
A = Virtual Storage Access Method
X = Function Supported

OS/VS2 (5752-VS2) (cont'd)

SVS DEVICE SUPPORT CHART

I/O Unit Support: The following units to a maximum of 768 devices are supported at the SVS Release 1.7 level by the Operating System, for the indicated function:

Input/Output Units	Input Job Stream	In/Out Work Queue	System Output	Primary SYSRES	Program Libraries	C	G	S	I,P,D,A
1052 Printer-Keyboard	X		X			X			
1275 Optical Reader								X1	
1287 Optical Reader								X2	
1288 Optical Page Reader								X1	
1403 Printer			X3			X4		X3	
1419 Magnetic Character Reader								X1	
1443 Printer						X4		X	
2150 Console						X			
2250 Display Unit						X5	X		
2260 Display Station						X5	X		
2305 Fixed Head Storage (Notes 6,7)	X8	X8		X	X8			X8	X8
2314 Direct Access Storage Facility (Notes 7,9)	X	X		X	X			X	X
2319 Disk Storage (Notes 7,9)	X	X		X	X			X	X
2401 Magnetic Tape Unit	X		X					X	
2402 Magnetic Tape Unit	X		X					X	
2403 Magnetic Tape Unit and Control	X		X					X	
2420 Magnetic Tape Unit	X		X					X	
2495 Tape Cartridge Reader								X10	
2501 Card Reader	X		X			X4		X	
2520 Card Read Punch	X11		X11,12			X4		X11	
2520 Card Punch			X12			X4		X	
2540 Card Read Punch	X13		X12,13			X4		X	
2671 Paper Tape Reader								X	
3036 Console (Note 20)									
3066 System Console (Note 20)						X5		X5	
3158 Console Function						X5			
3210 Console Printer-Keyboard						X			
3211 Printer			X			X4		X	
3213 Console Printer						X			
3215 Console Printer-Keyboard						X			
3275 Display Station	X					X3			
3276 (Supported as a 3277)	X					X3			
3277 Display Station	X					X3			
3278 (Supported as a 3277)	X					X3			
3284 Printer						X4			
3286 Printer						X4			
3288 Printer						X4			
3330 Disk Storage (Notes 7,9)	X8	X8		X8	X			X8	X8
3333 Disk Storage and Control (Notes 7,9)	X8	X8		X8	X			X8	X8
3340 Direct Access Storage Facility (Notes 7,9)	X8	X8		X8	X8			X8	X8
3344 Disk Storage (Notes 7,9)	X8	X8		X8	X8			X8	X8
3350 Direct Access Storage Facility (Notes 7,9)	X8	X8		X8	X8			X8	X8
3410 Magnetic Tape Unit	X		X						
3411 Magnetic Tape Unit and Control	X		X						
3420 Magnetic Tape Unit	X		X					X	
3505 Card Reader	X					X4		X	
3525 Card Punch	X11		X11,12			X4		X	
3540 Diskette I/O Unit (Note 14)	X14		X14						
3800 Printing Subsystem			X					X	
3890 Document Processor								X15	

OS/VS2 (5752-VS2) (cont'd)

MVS DEVICE SUPPORT CHART

I/O Unit Support: The following units to a maximum of 1,023 devices are supported at the MVS Release 3.7 level and a maximum or 1,917 devices are supported at the MVS Release 3.8 level by the Operating System, for the indicated function:

Input/Output Units	Input Job Stream	In/Out Work Queue	System Output	Primary SYSRES	Program Libraries	C	G	S	I,P,D,A
1275 Optical Reader								X1	
1287 Optical Reader								X2	
1288 Optical Page Reader								X1	
1403 Printer			X3			X4		X3	
1419 Magnetic Character Reader								X1	
1443 Printer						X4		X	
2305-1 Fixed Head Storage (Notes 6, 7, 20)	X8	X8,9		X	X8			X8	X8
2305-2 Fixed Head Storage (Notes 6,7)	X8	X8,9		X	X8			X8	X8
2314 Direct Access Storage Facility (Notes 7,10)	X	X		X	X			X	X
2401 Magnetic Tape Unit	X		X					X	
2402 Magnetic Tape Unit	X		X					X	
2403 Magnetic Tape Unit and Control	X		X					X	
2420 Magnetic Tape Unit	X		X					X	
2501 Card Reader	X					X4		X	
2520 Card Read Punch	X12		X12,13			X4		X12	
2520 Card Punch			X13			X4		X	
2540 Card Read Punch	X14		X13,14			X4		X	
3036 Console						X5			
3066 System Console						X5			
3158 Console Function						X5			
3203-5 Printer (Note 21)			X			X4		X	
3210 Console Printer-Keyboard						X			
3211 Printer			X			X4		X	
3213 Console Printer						X			
3215 Console Printer-Keyboard						X			
3251 Display Station (Note 24)						X5	X		
3275 Display Station	X					X5			
3276 (Supported as a 3277)	X					X5			
3277 Display Station	X					X5			
3278 (Supported as a 3277)	X					X5			
3284 Printer						X4			
3286 Printer						X4			
3288 Line Printer						X4			
3330 Disk Storage (Notes 7,10)	X8	X8		X8	X			X8	X8
3333 Disk Storage and Control (Notes 7,10)	X8	X8		X8	X			X8	X8
3340 Direct Access Storage Facility (Notes 7,10)	X8	X8		X8	X8			X8	X8
3344 Direct AccessStorage (Notes 7,10)	X8	X8		X8	X8			X8	X8
3350 Direct Access Storage (Notes 7,10)	X8	X8		X8	X8			X8	X8
3375 Direct Access Storage (Notes 7, 22, 23)	X8	X8		X8	X8			X8	X8
3380 Direct Access Storage (Notes 7, 22, 23)	X8	X8		X8	X8			X8	X8
3410 Magnetic Tape Unit	X		X						
3411 Magnetic Tape Unit and Control	X		X						
3420 Magnetic Tape Unit	X		X					X	
3505 Card Reader	X					X4		X	
3525 Card Punch	X12		X12,13			X4		X	
3800 Printing Subsystem			X					X	
3838 Array Processor (Note 25)		X							
3851 Mass Storage Facility (Note 16)	X17				X17,18			X17	X17
3886 Optical Character Reader								X1	
3890 Document Processor								X19	
4245 Printer			X			X4		X	

OS/VS2 (5752-VS2) (cont'd)

MVS Device Support: The *MVS Device Support Chart* shows all devices that are supported by MVS for systems functions and/or non-TP access methods. For additional devices supported for system functions and/or non-TP access methods, see MVS/370 Data Facility Product (5665-295) program product. (For other telecommunications devices see *VTAM, TCAM and BTAM Terminals Supported).* The chart shows for each device the relevant functions supported.

Devices which are not shown in this chart have no specific programming support under MVS and their existence is not recognized by the control program.

Notes

1) BSAM (device-dependent only).
2) QSAM (device-dependent only) for journal tapes; BSAM (device-dependent only) for cut-form documents.
3) The Selective Tape Listing feature is not supported.
4) A console must consist of a printer-keyboard, or a card reader and printer to simulate the actions of a printer-keyboard (composite console).
5) DIDOCS supported.
6) Multiple Requesting supported.
7) File Scan not supported.
8) Rotational Position Sensing support (optional feature on 3340).
9) Not supported by JES3.
10) For message queues under TCAM.
11) A Data Set Utility (IEBTCRIN) is provided to read data from the 2495 and create a sequentially organized data set.
12) Supported for read or punch, but not both simultaneously.
13) For use with the VS2 Output Writer; not for system messages.
14) Punch Feed Read is not supported.
15) The 3540 is supported by the VS2 Diskette Copy Programming Support. SYSIN/SYSOUT support is provided by the Diskette Reader program and Diskette Writer program with JES2/JES3.
16) Support shown is for 3330s or 3333s as virtual device types. If real 3330/3333s are included as part of 3851, see the 3330/3333 lines above.
17) With 3330/3333 as staging device, Rotational Position Sensing supported.
18) User Program Libraries only.
19) QSAM (device-dependent only).
20) Supported on Models 165II, 168 and the 3033 Processor only.
21) Supported on Release 3.8.
22) Requires OS/VS2 MVS Data Facility/Device Support program product (5740-AM7).
23) For message queues under TCAM, requires the ACF/TCAM Version 2 Release 3 program product (5735-RC3).
24) Must be SYSGENed as 2250-3.
25) Requires Vector Processing Subsystem (VPSS) (5744-CK1).

Legend:

C = Console
G = Graphic Programming Support
S = Sequential Access Method
I = Indexed Sequential Access Method
P = Basic Partitioned Access Method
D = Basic Direct Access Method
A = Virtual Storage Access Method
X = Function Supported

VTAM, TCAM and BTAM TERMINALS SUPPORTED

VTAM, TCAM and BTAM telecommunications access methods support the following terminals, programmable features, transmission control units, and communications controllers. Programmable features which change the control or transmission characteristics and which are not shown are not supported. Attempts to use VTAM, TCAM or BTAM with unsupported features can cause unpredictable results. If the terminal/feature is not supported by all three access methods, the access method(s) which does(do) support the terminal/feature is(are) shown in parenthesis.

The user should be aware that many terminal and control unit special features are transparent to programming, and are therefore readily usable even though not specifically identified. Note that the appropriate line adapters and hardware attachment features must be included in the system configuration.

Terminals that are functionally equivalent to those specifically supported by VTAM, TCAM or BTAM may also function satisfactorily with VTAM, TCAM or BTAM; the customer is responsible for establishing equivalency. IBM assumes no responsibility for the impact that any changes to the IBM-supplied programs or products may have on such terminals.

REMOTE ATTACHMENT

Terminals and Terminal Features

SS LINES:

IBM TERMINALS

1030 Data Collection System on nonswitched lines: (TCAM,BTAM)
- 1031 Input Station (mdls A1,A2,A3,A4,A5,A6,A7):
  - Supported: Attachment of 1031,1033,1034, 1035
- 1031 Input Station (mdls B1,B2,B3,B4,B5,B6,B7):
  - Supported: Attachment of 1035
- 1035 Badge Reader
- 1033 Printer
- 1034 Card Punch
- 1035 Badge Reader

1050 Data Communication System on switched or nonswitched lines:
- 1051 Control Unit (mdls 1,2):
  - Supported: Attachment of 1052,1053,1054, 1055,1056,1057,1058,1092, 1093
  - #1313 - Automatic EOB
  - #4795 - Line Correction
  - #4796 - Line Correction Release
  - #5465 - Open Line Detection
  - #6100 - Receive Interrupt
  - **#9698** - Text Time-Out Suppression
  - **#9700** - Transmit Interrupt
- 1052 Printer-Keyboard (mdls 1,2):
  - Supported: #1313 - Automatic EOB
  - **9567,9597** - PTTC/BCD Code
  - **#9571,#9591** - PTTC/EBCD Code
- 1053 Printer (mdl 1):
  - Supported: **#9567,9597** - PTTC/BCD Code
  - **#9571,9591** - PTTC/EBCD Code
- 1054 Paper Tape Reader (mdl 1)
- 1055 Paper Tape Punch (mdl 1)
- 1056 Card Reader (mdls 1,3)
- 1057 Card Punch (mdl 1)
- 1058 Printing Card Punch (mdls 1,2)

2848 Display Control (mdls 1,2,3) on nonswitched lines: (TCAM,BTAM)
- Supported: Attachment of 2260,1053
- #3901 - Extended Cursor Control
- #4787 - Line Addressing
- #5340 - Non-Destructive Cursor
- #5341 - Non-Destructive Cursor Adapter
- Not Supported: Attachment of 1053 (TCAM)
- 2260 Display Station (mdls 1,2):
  - Supported: #3606 - Extended Cursor Control Alphameric Keyboard
  - #4766 - Alphameric Keyboard
  - Not Supported: Tab feature of 3606
- 1053 Printer (mdl 4): (BTAM)
  - Supported: **#9567,#9597** - PTTC/BCD Code
  - **#9571,#9591** - PTTC/EBCD Code

2845 Display Control (mdl 1) on nonswitched lines: (TCAM,BTAM)
- Supported: Attachment of 2265,1053
- #3301 - Destructive Cursor
- #4801 - Line Addressing
- Not Supported Attachment of 1053 (TCAM)
- #7801 - Tab
- 2265 Display Station (mdl 1):
  - Supported: #4766 - Alphameric Keyboard
- 1053 Printer (mdl 4): (BTAM)
  - Supported: **#9567,#9597** - PTTC/BCD Code
  - **#9571,#9591** - PTTC/EBCD Code

2740 Communication Terminal (mdl 1) on switched or nonswitched lines:
- Supported: #3255 - Dial Up
- #6114 - Record Checking
- #7479 - Station Control
- #8028 - Transmit Control
- #8301 - 2760 Attachment (TCAM, BTAM)
- **#9567,#9597** - PTTC/BCD Code
- **#9571,9591** - PTTC/EBCD Code Correspondence Code

OS/VS2 (5752-VS2) (cont'd)

2740 Communication Terminal (mdl 2) on nonswitched lines:
Supported: #1495,1496 - Buffer Expansion
#1499 - Buffer Receive
#6114 - Record Checking
#9571,#9591 - PTTC/EBCD Code

2741 Communication Terminal (mdl 1) on switched or nonswitched lines:
Supported: #3255 - Dial Up
#4708 - Receive Interrupt
#7900 - Transmit Interrupt
#9567,#9597 - PTTC/BCD Code
#9571,#9591 - PTTC/EBCD Code Correspondence Code

2760 Optical Image Unit (mdl 1) on switched or nonswitched lines (TCAM,BTAM)
Required: In the 2740-1: #6114 Record Checking and 8301 - 2760 Attachment

3100 Display Terminal (mdls 10, 12, 13, 20, 23) on switched lines 110-1200 bps: (TCAM, VTAM)

3232 Keyboard Printer (mdl 51) on switched or nonswitched lines.

3767 Communication Terminal (mdls 1,2) (supported as a 2740-1) on switched or nonswitched lines:
Required: #7111 - 2740-1 Start/Stop
Supported: **#9560** - Station Control

3767 Communication Terminal (mdls 1,2,3) (supported as a 2740-2) on nonswitched lines:
Required: #7112 - 2740-2 Start/Stop

3767 Communication Terminal (mdls 1,2) (supported as a 2741) on switched or nonswitched lines:
Required: #7113 - 2741 Start/Stop

5100/5110 Computer Systems (supported as a 2741) on switched or nonswitched lines:
Required: #1525 - Communications Adapter

6733 Typewriter Communication Module (supported as a CPT-TWX 33/35) on switched and nonswitched lines at 110, 150, 300, and 1200 bps (BTAM, ACF/TCAM, ACF/VTAM)

CMCST (Communicating Magnetic Card Selectric® Typewriter) (supported as a 2741 with Correspondence Code) on switched lines:
Supported: The CMCST is functionally equivalent to a 2741 with Dial UP, Receive Interrupt and Transmit Interrupt

IBM PROCESSORS AS TERMINALS

(For details of programming support provided within the Processor when acting as a terminal, see appropriate programming sales manual pages)

System/7 (supported as a 2740-1 with checking) on switched or nonswitched lines:
Required: #1610 - Asynchronous Communication Control

Non-IBM TERMINALS

AT&T 83B3 Line Control Type on nonswitched lines

CPT-TWX (mdl 33/35) Line Control Type on switched lines

World Trade Telegraph on nonswitched lines

WU 115A Line Control Type on nonswitched lines

BSC LINES:

IBM TERMINALS

2790 Data Communication System on switched or nonswitched lines: (TCAM,BTAM)
2715 Transmission Control Unit (mdl 1 and 2):
Required: 2740
Supported: Attachment of 2798,1035,1053, 2740
#3801 - Expanded Capability
#4850 - Local 2740 Adapter
#9401 - Point-to-point Nonswitched
#9402 - Point-to-point Switched
#9403 - Multipoint Nonswitched
2740 Communication Terminal (mdl 1)
2798 Guidance Display Unit (mdl 1)
1035 Badge Reader (mdl 1)
1053 Printer (mdl 1)

2770 Data Communication System on switched or nonswitched lines:
2772 Multipurpose Control Unit:
Required: #5010 - Multipoint Data Link Control (VTAM)
Supported: Attachment of 0050,0545,1017, 1018,1053,1255,2203,2213, 2265,-2502,5496
#1340 - Automatic Answering
#1490 - Buffer Expansion (256 bytes)
#1491 - Buffer Expansion Additional (512 bytes)
#1910 - Conversational Mode
#3250 - Display Format Control
#3650 - EBCDIC Transparency
#3860 - 144 Character Print Line
#4610 - Identification
#4690 - Keyboard Correction
#5010 - Multipoint Data Link Control (TCAM,BTAM)
#5890 - Horizontal Format Control
#6555 - Space Compression/Expansion
#7705 - Synchronous Clock
#7950 - Transmit-Receive-MonitorPrint
#9140 - Extended Re-Entry
#9402 - Line Termination - 2-wire
#9761 - Transmission Code EBCDIC
#9762 - Transmission Code ASCII
#9936 - Immediate WACK
0050 Magnetic Data Inscriber
0545 Output Punch (mdls 3,4)
1017 Paper Tape Reader (mdls 1,2)
1018 Paper Tape Punch (mdl 1)
1053 Printer (mdl 1)
1255 Magnetic Character Reader
2203 Printer (mdls A1,A2):
Supported: #5558 - Print Positions, 24 Additional
2213 Printer (mdls 1,2)
2265 Display Station (mdl 2)
2502 Card Reader (mdls A1,A2)
5496 Data Recorder

2780 Data Transmission Terminal on switched or nonswitched lines:
Supported: #1340 - Automatic Answering
#1350 - Automatic Turnaround
#3401 - Dual Communication Interface
#5010 - Multiple Record Transmission
#5020 - Multipoint Line Control
#5820 - 120 Character Print Line
#5821 - 144 Character Print Line
#6400 - Selective Character Set
#7850 - Terminal Identification
#8030 - EBCDIC Transparency
#9150 - Extended Retry Transmission
#9761 - ASCII Transmission Code
#9762 - EBCDIC Transmission Code

2980 General Banking System on nonswitched lines:
2972 Station Control Unit (mdl 8 - RPQ 858160, mdl 11 - RPQ 858231)
Supported: Attachment of 2980,2971
RPQ 835503 - Buffer Expansion
RPQ 858165,858182 - 96-Character Buffer
2980 Teller Station (mdl 1 - RPQ 835504, mdl 4 - RPQ 858147)
2980 Administrative Station (mdl 2 - RPQ 835505)
2971 Remote Control Unit (mdl 3 - RPQ 858144)

3270 Information Display System on nonswitched lines:
3271 Control Unit (mdls 1,2):
Supported: Attachment of 3277,3284,3286,3287 3288
#1550 - Copy
#9761 - EBCDIC Code
3274 Control Unit (mdl 1C) (Supported as a 3271)
Supported: Attachment of 3268, 3277, 3278, 3284, 3286, 3287, 3288, 3289

OS/VS2 (5752-VS2) (cont'd)

3276 Control Unit Display Station (mdls 1,2,3,4) (Supported as a 3271)
- Supported: Attachment of 3268, 3278, 3287
  #6350 - Selector Light-Pen
  #9082 - EBCDIC Character Set

3277 Display Station (mdls 1,2):
- Supported: #6350 - Selector Light-Pen
  #9089 - EBCDIC Character Set

3278 Display Station (mdls 1, 2, 3, 4) (Supported as a 3277)
- Supported: #6350 Selector Light-Pen
  #9082 - EBCDIC Character Set

3268 Printer (mdl 2) [Supported as a 3286-2]

3284 Printer (mdls 1,2):
- Supported: **#9089** - EBCDIC Character Set

3286 Printer (mdls 1,2):
- Supported: **#9089** - EBCDIC Character Set

3287 Printer (mdls 1, 2) (Supported as a 3284 or 3286 attached to a 3271-1 or -2)
- Supported: **#9082** - EBCDIC Character Set

3288 Printer (mdl 2) (supported as a 3286-2):
- Supported: **#9089** - EBCDIC Character Set

3289 Printer (mdls 1,2) (Supported as 3286-2)

3270 Information Display System on switched lines (BTAM) or nonswitched lines: (VTAM,TCAM,BTAM)

3275 Display Station (mdls 1,2):
- Supported: Attachment of 3284
  #6350 - Selector Light-Pen
  #9089 - EBCDIC Character Set
  #9761 - EBCDIC Code

3284 Printer (mdl 3):
- Supported: **#9089** - EBCDIC Character Set

3624 Consumer Transaction Facility (mdls 1, 2, 11, 12) (supported as a 2772) (BTAM):
- Supported: Attached to a 3704/3705 via nonswitched lines only

3650 Programmable Store System (Supported as a System/3) on switched lines: (BTAM)

3651 Store Controller (mdls A25, B25, A75, B75, C75, D75
- Supported: Attachment of 3275, 3657, 3659,3663, 3669 3683, 3784

3653 Point of Sale Terminal (mdl 1 and 1P)

3683 Point of Sale Terminal (all models)

3657 Ticker Unit (Not available on 3651 mdl A25 and B25)

3663 Supermarket Terminal (mdls 1P, 2 and 3P)

3275 Display Station (mdl 3)
- Supported: Attachment of 3284

3284 Printer (mdl 3)

3659 Remote Communication Unit (mdl 1)
- Required: 2400 bps nonswitched line (Not available on 3651 mdls A25 and B25)

3784 Printer (mdl 1) Not Available on 3651 mdls A25 and B25

3669 Remote Communication Unit (mdl 1) Not Available on 3651 mdls A25 and B25

3660 Supermarket Scanning System (supported as a System/3) on switched lines: (BTAM)

3651 Store Controller (mdls A60,B60):
- Supported: Attachment of 3663,3669

3663 Supermarket Terminal (mdls 1,2):
- Supported: Attachment of 3666

3666 Checkout Scanner (mdl 1)

3669 Store Communications Unit (mdl 1)

3660 Supermarket Key-Entry System (supported as a System/3) on switched lines: (BTAM)

3661 Store Controller:
- Supported: Attachment of 3663

3663 Supermarket Terminal (mdls 1,2)

3670 Brokerage Communication System on nonswitched lines: (TCAM)

3671 Shared Terminal Control Unit (mdl 1):
- Supported: Attachment of 3672,3673, 3674
  #3250 - Display Expansion

3672 Executive Console (mdl 1)

3673 Data Display (mdl 1)

3674 Printer-Keyboard (mdl 1)

3680 Programmable Store System supported on switched and nonswitched lines: (BTAM)

3684 Point of Sale - Control Unit (mdls 1, 2)
- Supported: 3684 mdl 2: Attachment of 3683 Point of Sale Terminal

3683 Point of Sale Terminal

3735 Programmable Buffered Terminal (mdl 1) on switched or nonswitched lines:
- Supported: Attachment of 5496,3286
  #5010 - Multipoint Data Link Control
  #9761 - EBCDIC Code
  #9762 - ASCII Code

5496 Data Recorder (mdl 1)

3286 Printer (mdl 3)

3741 Data Station (mdl 2) on switched or nonswitched lines:
- Supported: Attachment of 0129,3713,3715, 3717
  #1680 - Expanded Communications
  #1685 - Expanded Communications/ Multipoint Data Link Control
  #5450 - Operator Identification Card Reader
  #7850 - Terminal Identification

0129 Card Data Recorder (mdl 2)

3713 Printer (mdl 1)

3715 Printer (mdls 1,2)

3717 Printer (mdl 1)

3741 Programmable Workstation (mdl 4) on switched or nonswitched lines:
- Supported: Attachment of 0129,3713, 3715
  #1680 - Expanded Communications
  #1685 - Expanded Communications/ Multipoint Data Link Control
  #5450 - Operator Identification Card Reader
  #7850 - Terminal Identification

0129 Card Data Recorder (mdl 2)

3713 Printer (mdl 1)

3715 Printer (mdls 1,2)

3747 Data Converter (mdl 1) on switched or nonswitched lines:
- Supported: #1660 - Communications Adapter

3770 Data Communication System (supported as a 2770) on switched or nonswitched lines:

3771 Communication Terminal (mdls 1,2,3):
- Required: #1460 - SDLC/BSC, Switch Control, or
  #1461 - BSC Point-to-point, or
  #1462 - BSC Multipoint
- Supported: #1201 - ASCII Code

3773 Communication Terminal (mdls 1,2,3,P1,P2,P3):
- Required: #1460 - SDLC/BSC, Switch Control, or
  #1461 - BSC Point-to-point, or
  #1462 - BSC Multipoint
- Supported: #1201 - ASCII Code

3774 Communication Terminal (mdls 1,2,P1,P2):
- Required: #1460 - SDLC/BSC, Switch Control, or
  #1461 - BSC Point-to-point, or
  #1462 - BSC Multipoint
- Supported: #1201 - ASCII Code

3775 Communication Terminal (mdls 1,P1):
- Required: #1460 - SDLC/BSC, Switch Control, or
  #1461 - BSC Point-to-point, or
  #1462 - BSC Multipoint
- Supported: #1201 - ASCII Code

3776 Communication Terminal (mdls 1,2) (supported as a 2772/3780):
- Required: #1460 - SDLC/BSC, Switch Control, or
  #1461 - BSC Point-to-point, or
  #1462 - BSC Multipoint
- Supported: #1201 - ASCII Code

3777 Communication Terminal (mdl 1) (supported as a 2772/3780):
- Required: #1460 - SDLC/BSC, Switch Control, or
  #1461 - BSC Point-to-point, or
  #1462 - BSC Multipoint
- Supported: #1201 - ASCII Code

3777 Communication Terminal (mdl 2) (supported as a S/360-20 MULTI-LEAVING Workstation):
- Required: #3701 - EIA Interface

OS/VS2 (5752-VS2) (cont'd)

3780 Data Communications Terminal (mdl 1) (supported as a 2772 without component select) on switched or nonswitched lines:
Supported: #3601 - EBCDIC Transparency
#5010 - Multipoint Data Link Control
#5701 - Print Positions, Additional
#9761 - EBCDIC Code
#9762 - ASCII Code

5110 Computer (supported as a 2772) on switched or nonswitched lines:
Required: 2074 BSCA
Supported: Attachment of a 5103 Printer, 5106 Tape Cartridge and 5114 Diskette Unit.
The 5110 emulates the following 2772 features:
Auto Answer, Buffer expansion additional (512), EBCDIC transparency, 144 character print line, identification, Multipoint Data Link Control (TCAM, BTAM), Horizontal Format Control, Space Compression/ expansion, Synchronous clock, Transmission code EBCDIC.

5265 Retail Communicating mdl (supported as 3741) point-to-point operation. (TCAM,BTAM).
Required: #5500 - 1200 BPS Integrated Nonswitched Modem or
#5501 -1200 BPS Integrated Switched Modem or
#3701 - EIA/CCITT Interface

5275 Direct Numerical Control Station (supported as a 3275 with EBCDIC code and EBCDIC Character Set) on switched lines (BTAM) or nonswitched lines (VTAM, TCAM, BTAM).

IBM PROCESSORS AS TERMINALS

(For details of programming support provided within the Processor when acting as a terminal, see appropriate programming sales manual pages)

1130 Computing System on switched or nonswitched lines: (TCAM,BTAM)
1131 Central Processing Unit:
Required: #7690 - Synchronous Communications Adapter

1800 Data Acquisition and Control System on switched or nonswitched lines: (TCAM,BTAM)
1826 Data Adapter Unit:
Required: #7550 - Communication Adapter

5280 Distributed Data System (supported as a 3271-2) on a nonswitched line:
5285 and 5288 controllers:
Required: Refer appropriate pages for required features and related programming

5280 Distributed Data System (supported as a 3741 or S/3 MRJE) on switched or nonswitched line:
5285 and 5288 Processor Units:
Required: #2500 Communications Adapter

Series/1 (Supported as a S/3 on switched or nonswitched lines:) (BTAM)
4953 or 4955 Processor
Required: #2074, 2075 or 2094 Binary Synchronous Communications Adapter

System/3 on switched or nonswitched lines:
5404, 5406, 5408, 5410, 5412 or 5415 Processing Unit:
Required: #2074 - Binary Synchronous Communications Adapter

System/7 (supported as a System/3) on switched or nonswitched lines:
5010 Processor Module:
Required: #2074 - Binary Synchronous Communications Adapter

System/32 (supported as a System/3) on switched or nonswitched lines:
5320 System Unit:
Required: #2074 - Binary Synchronous Communications Adapter

System/34 (supported as a System/3) on switched or nonswitched lines: 5340 System Unit:
Required: #2500, #3500 or #4500 Communications Adapter feature

System/34 (supported as a 3271 mdl 2) on a nonswitched line:
5340 System Unit:
Required: #2500, #3500, #4500 Communication Adapter feature
#4900 or #4901 Workstation Control Expansion A or B

System/36 (supported as a System/3) on switched or nonswitched lines:
5360 System Unit:
Required: #2500 or #4500 Communications Adapter feature

System/36 (supported as a S/360 mdl 25 and up) on switched or nonswitched lines:
5360 System Unit:
Required: #2500 or #4500 Communication Adapter feature

System/36 (supported as a 3271 mdl 2) on nonswitched lines:
5360 System Unit:
Required: #2500 or #4500 Communication Adapter feature
#4900 Workstation Control feature

System/38 (supported as a System/3) on switched or nonswitched lines:
5381 System Unit:
Required: #1501 or #1502 Communications Attachment Feature
#2001 or #2003 Communications Control Feature
#3200 Line Base Feature

S/38 (supported as a 3271 mdl 2) on a nonswitched line:
5381 System Unit:
Required: #1501, #1502 Communications Attachment
#2001, #2003 Communications Control

S/360 mdl 20 on switched or nonswitched lines: (TCAM,BTAM)
2020 Processing Unit:
Required: #2074 - Binary Synchronous Communications Adapter

S/360 mdls 25,30,40,50,65,65MP,67(65mode),75,85,91,195 on switched or nonswitched lines: (TCAM,BTAM)
Processing Unit:
Required: #4580 - Integrated Communications Attachment, or
2701 Data Adapter Unit, or
2703 Transmission Control, or
3704 Communications Controller in emulation mode, or
3705-I Communications Controller in emulation mode, or
3705-II Communications Controller in emulation mode

All virtual storage S/370 Processors on switched or nonswitched lines:
Processing Unit:
Required: #4640 - Integrated Communications Adapter, or
2701 Data Adapter Unit, or
2703 Transmission Control, or
3704 Communications Controller in network control or emulation mode, or
3705-I Communications Controller in network control or emulation mode, or
3705-II Communications Controller in network control or emulation mode

8100 with DPPX on nonswitched lines: (BTAM, TCAM, VTAM)

OS/VS2 (5752-VS2) (cont'd)

Required: Refer to 8100 pages for required features and for licensed programs supported.

8100 with DPPX/SP on nonswitched lines: (BTAM, TCAM, VTAM)
Required: Refer to 8100 pages for required features and for licensed programs supported.

SDLC LINES:

COMMUNICATIONS CONTROLLERS

3704 Communications Controller in network control mode (VTAM,TCAM)

3705 Communications Controller in network control mode (VTAM,TCAM)

IBM TERMINALS

3232-1 Keyboard Printer Terminal on switched or nonswitched lines (VTAM, TCAM).

3270 Information Display System on nonswitched lines: (VTAM,TCAM)
- 3271 Control Unit (mdls 11,12):
  - Supported: Attachment of 3277,3284,3286, 3287,3288
  - #1200 - ASCII Code
  - #1550 - Copy
  - **#9761** - EBCDIC Code
- 3275 Display Station (mdls 11,12):
  - Supported: Attachment of 3284
  - #1200 - ASCII Code
  - #6350 - Selector Light-Pen
  - **#9089** - EBCDIC Character Set
  - **#9761** - EBCDIC Code
- 3277 Display Station (mdls 1,2):
  - Supported: #6350 - Selector Light-Pen
  - **#9089** - EBCDIC Character Set
- 3284 Printer (mdls 1,2):
  - Supported: **#9089** - EBCDIC Character Set
- 3284 Printer (mdl 3):
  - Supported: **#9089** - EBCDIC Character Set
- 3286 Printer (mdls 1,2):
  - Supported: **#9089** - EBCDIC Character Set
- 3287 Printer (mdls 1, 2) (Supported as a 3284 or 3286 attached to a 3271-11 or -12)
  - Supported: **#9082** - EBCDIC Character Set
- 3288 Printer (mdl 2) (supported as a 3286-2):
  - Supported: **#9089** - EBCDIC Character Set

3270 Information Display System on switched and nonswitched lines (VTAM) and on nonswitched lines only (TCAM/NCP Direct) (Supported as a 3790 with Configuration Support 9165).
- 3276 Control Unit Display Station (mdls 11,12,13,14)
  - Supported: Attachment of 3268, 3278, 3287
  - #6350 - Selector Light-Pen
  - **#9082** - EBCDIC Character Set
- 3278 Display Station (mdls 1,2,3,4) (Supported as a 3277)
  - Supported: #6350 - Selector Light-Pen
  - **#9082** - EBCDIC Character Set
- 3268 Printer (mdl 2) [Supported as a 3286-2]
- 3287 Printer (mdls 1,2) (Supported as a 3284 or 3286)
  - Supported: **#9082** - EBCDIC Character Set

3600 Finance Communication System on switched or nonswitched lines: (VTAM, TCAM)
- 3601 Controller (mdls 1,2A,2B,3A,3B):
  - Supported: Attachment of 3603,3604,3606, 3608,3610,3611,3612,3614, 3615, 3616,3618
- 3602 Controller (mdls 1A and 1B)
- 3603 Terminal Attachment Unit (mdls 1,2):
  - Supported: 3600 loop attachable devices.
- 3604 Keyboard Display (mdls 1,2,3,4,5,6,7)
- 3606 Financial Services Terminal (mdls 1,2)
- 3608 Printing Financial Services Terminal (mdls 1,2)
- 3610 Document Printer (mdls 1,2,3,4)
- 3611 Passbook Printer (mdls 1,2)
- 3612 Passbook and Document Printer (mdls 1,2,3)
- 3614 Consumer Transaction Facility (mdls 1,2,11,12):
  - Required: When attached to a 3601 or 3602, 3601 or 3602 application programs
  - Supported: Attachment to a 3704/3705 (via nonswitched lines only) or a 3601,-3602.
- 3616 Passbook and Document Printer (mdl 1)
- 3618 Administrative Line Printer (mdl 1)
- 3615 Administrative Terminal Printer (mdls 1,2)
- 3694 Document Processing System

3630 Plant Communication System on switched or nonswitched lines (VTAM, TCAM)
- 3631 Controller (mdls 1A, 1B)
  - Supported: Attachment of 3604, 3641, 3642 3643, 3644, 3646, 3842, 7430 (RPQ)
- 3632 Controller (mdls 1A, 1B)
  - Supported: Attachment of 3604, 3641, 3642 3643, 3644, 3646, 3842, 7430 (RPQ)
- 3604 Keyboard Display (mdl 6)
- 3641 Reporting Terminal (mdls 1, 2)
- 3642 Encoder Printer (mdls 1, 2)
- 3643 Keyboard Display mdls 2, 3, 4
- 3644 Automatic Data Unit (mdl 1)
- 3646 Scanner Control Unit (mdl 1)
- 3647 Time and Attendance Terminal (mdl 1)
- 3842 Loop Control Unit (mdl 1)
- 7430 Document Printer (RPQ)

3650 Programmable Store System on switched or nonswitched lines: (VTAM, ACF/VTAM)
- 3651 Store Controller (mdls A25, B25, A75, B75, C75, D75)
  - Supported: Attachment of 3275, 3653, 3657, 3659, 3663, 3669, 3683, 3784
- 3653 Point of Sale Terminal (mdl 1 and 1P)
- 3683 Point Of Sale Terminal (all models)
- 3663 Supermarket Terminal (mdl 1P, 2 and 3P
- 3657 Ticket Unit (Not available on 3651 mdls A25 and B25)
- 3275 Display Station (mdl 3)
  - Supported: Attachment of 3284
- 3284 Printer (mdl 3)
- 3659 Remote Communications Unit (mdl 1)
  - Required: 2400 bps nonswitched line
- 3784 Printer (mdl 1) [not available on 3651 mdls A25 and B25]
- 3669 Remote Communication Unit (mdl 1) Not available on 3651 mdl A25 and B25.

3650 Retail Store System on switched or nonswitched lines: (VTAM,ACF/VTAM)
- 3651 Store Controller (mdls A50,B50):
  - Supported: Attachment of 3653,3657,3275, 3659,3784
- 3653 Point of Sale Terminal (mdl 1 and 1P)
- 3657 Ticket Unit
- 3275 Display Station (mdl 3):
  - Supported: Attachment of 3284
- 3284 Printer (mdl 3)
- 3659 Remote Communications Unit (mdl 1)
- 3784 Printer (mdl 1)

3660 Supermarket Scanning System on switched lines: (VTAM)
- 3651 Store Controller (mdls A60,B60):
  - Supported: Attachment of 3663,3669
- 3663 Supermarket Terminal (mdls 1,2):
  - Supported: Attachment of 3666
- 3666 Checkout Scanner
- 3669 Store Communication Unit (mdl 1)

3660 Supermarket Key-Entry System on switched lines: (VTAM)
- 3661 Store Controller:
  - Supported: Attachment of 3663
- 3663 Supermarket Terminal (mdls 1,2)

3730 Distributed Office Communication System on switched or nonswitched lines (VTAM and TCAM/NCP Direct)
- 3791 Controller, mdl 11C, 12A, or 12B with SDLC with Clock (#6301) or SDLC without Clock (#6302 or #6303), and required modem
- 3732 Text Display Station
- 3736 Printer

3680 Programmable Store System supported on switched and nonswitched lines: (VTAM)
- 3684 Point of Sale - Control Unit (mdls 1, 2)
  - Supported: 3684 mdl 2: Attachment of 3683 Point of Sale Terminal

OS/VS2 (5752-VS2) (cont'd)

3767 Communication Terminal (mdls 1,2,3) on switched or non-switched lines: (VTAM,TCAM)
- Supported: SDLC adapter provided unless one of the Start/Stop features are specified
- #1201 - ASCII Code

3770 Data Communication System on switched or nonswitched lines: (VTAM,TCAM)

3771 Communication Terminal (mdls 1,2,3):
- Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
- Supported: #1201 - ASCII Code

3773 Communication Terminal (mdls 1,2,3,P1,P2,P3):
- Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
- Supported: #1201 - ASCII Code

3774 Communication Terminal (mdls 1,2,P1,P2):
- Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
- Supported: #1201 - ASCII Code

3775 Communication Terminal (mdls 1,P1):
- Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
- Supported: #1201 - ASCII Code

3776 Communication Terminal (mdls 1,2):
- Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
- Supported: #1201 - ASCII Code

3776 Communication Terminal (mdl 3,4) (VTAM):
- Supported: #1201 - ASCII Code

3777 Communication Terminal (mdl 1):
- Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
- Supported: #1201 - ASCII Code

3777 Communication Terminal (mdl 3) (VTAM):
- Supported: #1201 - ASCII Code

3790 Communication System on switched or nonswitched lines: (VTAM,TCAM)

4730 Personal Banking Machine on nonswitched lines: (VTAM, ACF/VTAM, TCAM)

6670 Information Distributor on switched or nonswitched lines (ACF/VTAM, ACF/TCAM V2 R2)

8100/DPCX Information System on switched and nonswitched lines: (VTAM, TCAM)

8815 Scanmaster I on switched or nonswitched lines (VTAM)

IBM PROCESSORS AS TERMINALS

5280 Distributed Data System (supported as a 3274-1C) on switched and nonswitched lines (TCAM, VTAM):

5285 and 5288 Controllers:
- Required: Refer to sales manual for required features and related programming

5280 Distributed Data System (supported as a 3770) on switched or nonswitched lines:

5285 and 5288 Processor Units:
- Required: #2500 Communications Adapter

System/32 (supported as a 3770) on switched or nonswitched lines: (VTAM,TCAM)

5320 System Unit:
- Required: #1005 - Additional Storage (minimum of one)
- #6301 - Synchronous Data Link Control

System/34 (supported as a 3770 or 3791) on switched or nonswitched lines (VTAM, TCAM):

5340 System Unit:
- Required: #2500, #3500, or #4500 Communications Adapter feature

System/34 (supported as a 3274 mdl 1C) on a nonswitched line (VTAM):

5340 System Unit
- Required: #2500, #3500 or #4500 Communications Adapter feature
- #4900 or #4901 Workstation Control Expansion A or B

System/36 (supported as a 3770 or 3791) on switched or nonswitched lines:

5360 System Unit:
- Required: #2500 or #4500 Communications Adapter feature

System/36 (supported as a 3274 mdl 1C) on switched or nonswitched lines:

5360 System Unit
- Required: #2500 or #4500 Communications Adapter feature
- #4900 Workstation Control feature

System/36 on nonswitched lines (VTAM) (supported as a 3274):

5360 System Unit:
- Required: #2500 or #4500 Communications Adapter feature
- #4900 Workstation Control feature

System/38 (supported as a 3770) on switched or nonswitched line:

5381 System Unit:
- Required: #1501 or #1502 Communications Attachment feature
- #2000, #2001, #2002, or #2003 Communications Control feature
- #3200 Line Base feature

System/38 (supported as a 3274) on switched or nonswitched line (VTAM, TCAM):

5381 System Unit:
- Required: #1501 or #1502 Communications Attachment feature
- #2000, #2001, #2002 or #2003 Communications Control feature
- #3200 Line Base feature

8100 with DPPX on switched or nonswitched lines: (TCAM, VTAM)
- Required: Refer to 8100 pages for required programs and for Licensed Programs supported.

8100 with DPPX/SP on switched or nonswitched lines: (TCAM, VTAM)
- Required: Refer to 8100 sales pages for required programs and for licensed programs supported.

LOCAL ATTACHMENT

Transmission Control Units and Communications Controllers

2701 Data Adapter Unit on local channel: (TCAM,BTAM)
- Supported: #1302, #1303, #1314 - Autocall
- #3455 - Dual Code
- #3463-3465 - Dual Communication Interface
- #8029 - Transparency
- **#9060** - EBCDIC Code
- **#9061** - ASCII Code
- **#9062** - 6-bit Transcode

2702 Transmission Control Unit on local channel: (TCAM,BTAM)
- Supported: #1290 - Autocall
- #1319 - Autopoll
- #8055 - 2741 Break

2703 Transmission Control Unit on local channel: (TCAM,BTAM)
- Supported: #1340,1341 - Autocall
- #7715 - EBCDIC Code
- #7716 - ASCII Code
- #7717 - 6-bit Transcode
- #8055 - 2741 Break
- **#9100** - Transparency for ASCII

2715 Transmission Control Unit (mdl 1) on local channel: (TCAM,BTAM)
- Supported: See "2790" under *Local Terminals*

3704/3705-I/3705-II Communications Controller on local channel:

OS/VS2 (5752-VS2) (cont'd)

Supported: EBCDIC Code, ASCII Code, Autopoll and EBCDIC Transparency do not have special feature codes in the 3704/3705
EP/VS (TCAM,BTAM)
NCP/VS (VTAM,TCAM)
PEP
#8002 - Two-Channel Switch (VTAM,TCAM)

LOCAL TERMINALS

2848 Display Control (mdls 1,2,3) on local channel: (TCAM)
Supported: Attachment of 2260, 1053
#3901 - Extended Cursor Control
#4787 - Line Addressing
#5340 - Non-Destructive Cursor
#5341 - Non-Destructive Cursor Adapter
Not Supported: Attachment of 1053
2260 Display Station (mdls 1,2):
Supported: 3606 - Extended Cursor Control, Alphameric Keyboard
Not Supported: Tab feature of 3606

2790 Data Communication System on local channel: (TCAM,BTAM)
2715 Transmission Control Unit (mdl 1):
Supported: Attachment of 2740, 2791, 2793
#3801 - Expanded Capability
#4850 - Local 2740 Adapter
Not Supported: #8110 - Two Processor Switch
2740 Communication Terminal (mdl 1)
2791 Area Station (mdls 1,2):
Supported: Attachment of 1035, 2795, 2796, 2797, 2798, 1053
1035 Badge Reader (mdl 1)
2795 Data Entry Unit (mdl 1)
2796 Data Entry Unit (mdl 1)
2797 Data Entry Unit (mdl 1)
2798 Guidance Display Unit (mdl 1)
1053 Printer (mdl 1)
2793 Area Station (mdl 1):
Supported: Attachment of 2795, 2796, 2797, 2798, 1053
2795 Data Entry Unit (mdl 1)
2796 Data Entry Unit (mdl 1)
2797 Data Entry Unit (mdl 1)
2798 Guidance Display Unit (mdl 1)
1053 Printer (mdl 1)

3270 Information Display System on local channel:
3272 Control Unit (mdls 1,2):
Supported: Attachment of 3277, 3284, 3286, 3287, 3288
3277 Display Station (mdls 1,2):
Supported: #6350 - Selector Light-Pen
#9089 - EBCDIC Character Set
3284 Printer (mdls 1,2):
Supported: **#9089** - EBCDIC Character Set
3286 Printer (mdls 1,2):
Supported: **#9089** - EBCDIC Character Set
3287 Printer (mdls 1, 2) (Supported as a 3284 or 3286 attached to 3272-1 or -2)
Supported: **#9082** - EBCDIC Character Set
3288 Printer (mdl 2) (supported as a 3286-2):
Supported: **#9089** - EBCDIC Character Set

3270 Information Display System on Local Channel: (Supported as a 3272)
3274 Control Unit (mdl 1B)
Supported: Attachment of 3268, 3277, 3278, 3284, 3286, 3287, 3288, 3289
3277 Display Station mdls 1,2)
Supported: #6350 - Selector Light-Pen
#9089 - EBCDIC Character Set
3278 Display Station (mdls 1, 2, 3, 4) (Supported as a 3277)
Supported: #6350 - Selector Light-Pen
#9082 - EBCDIC Character Set
3268 Printer (mdl 2) [Supported as a 3286-2]
3284 Printer (mdls 1, 2)
Supported: **#9089** - EBCDIC Character Set
3286 Printer (mdls 1, 2)
Supported: **#9089** - EBCDIC Character Set
3287 Printer (mdls 1,2)(Supported as a 3284 or 3286)
Supported: **#9082** - EBCDIC Character Set
3288 Printer (mdl 2) (Supported as a 3286-2)
Supported: **#9089** - EBCDIC Character Set
3289 Printer (mdls 1,2)(Supported as a 3286-2)

3270 Information Display System on Local Channel: (VTAM, TCAM through VTAM) (Supported as a 3790 with Configuration Support)
3274 Control Unit (mdl 1A)
Supported: Attachment of 3268, 3277, 3278, 3284, 3286, 3287, 3288, 3289
3277 Display Station (mdls 1,2)
Supported: #6350 - Selector Light-Pen
#9089 - EBCDIC Character Set
3278 Display Station (mdls 1,2,3,4)
Supported: #6350 - Selector Light-Pen
#9082 - EBCDIC Character Set
3268 Printer (mdl 2) [Supported as 3286-2]
3284 Printer (mdls 1,2)
Supported: **#9089** - EBCDIC Character Set
3286 Printer (mdls 1,2)
Supported: **#9089** - EBCDIC Character Set
3287 Printer (mdls 1,2)(Supported as a 3284 or 3286)
Supported: **#9082** - EBCDIC Character Set
3288 Printer (mdl 2)(Supported as a 3286-2)
Supported: **#9089** - EBCDIC Character Set
3289 Printer (mdls 1,2)(Supported as a 3286-2)

3730 Office Communication System on local channel (VTAM)
3791 Controller, mdl 11C, 12A or 12B with: Local Channel Attachment (#1515)
3732 Text Display Station
3736 Printer

3790 Communication System on local channel: (VTAM,TCAM through VTAM) See appropriate sales pages for description of configuration and access methods supported.

7770 Audio Response Unit (mdl 3) on local channel (TCAM)

Legend:

(VTAM) = VTAM only
(TCAM) = TCAM only
(BTAM) = BTAM only

OS/VS2 (5752-VS2) (cont'd)

SVS TERMINAL SUPPORT CHART 1

Remote Attach (a)	VTAM via NCP/VS	TCAM via NCP/VS	TCAM or BTAM via EP/VS (d)	TCAM or BTAM via 270X (e)	TSO via TCAM, NCP/VS	TSO via TCAM, EP/VS
SS Lines:						
1031			X	1,2,3		
1051	X	X	X	1,2,3	X	X
2260			X	1		X
2265			X	1		X
2740-1,-2	X	X	X	1,2,3		
2741	X	X	X	1,2,3	X	X
2760			X	1,2,3		
3101	X	X	X		X	X
3232-51	X	X	X		X	X
3767-1,-2 (2740-1)	X	X	X			
3767-1,-2,-3 (2740-2)	X	X	X	1		
3767-1,-2 (2741)	X	X	X		X	X
5100 (2741)	X	X	X		X	X
CMCST (2741)	X	X	X	1,2,3		
System/7 (2740-1)	X	X	X	1,2,3		
AT&T 83B3 or WU 115A Line Control Type	X	X	X	1,2,3		
CPT-TWX (M33/35)	X	X	X	1,2,3	X	X
WT Telegraph	X	X	X	1,2,3		
6733 (CPT-TWX 33/35)	X	X	X	-	X	X
BSC Lines:						
2715-2		X	X	1,3		
2772	X	X	X	1,3		
2780	X	X	X	1,3		
2972-8,-11	X	X	X (B)	1,3 (B)		
3271-1,-2	X	X	X	1,3	X	X
3274-1C (3271-1,2)	X	X	X	1,3	X	X
3275-1,-2	X	X	X	1,3	X	X
3276 (3271-1,2)	X	X	X	1,3	X	X
3651-A60,-B60 (S/3)			X (B)			
3661 (System/3)			X (B)			
3670			X (T)	1,3 (T)		
3684			X			
3735	X	X	X	1,3		
3741-2,4	X	X	X	1,3		
3747	X	X	X	1,3		
3771-1,-2,-3 (2772)	X	X	X	1		
3773-1,-2,-3,-P1, -P2,-P3 (2772)	X	X	X	1		
3774-1,-2,-P1,-P2, (2772)	X	X	X	1		
3775-1,-P1, (2772)	X	X	X	1		
3776-1,-2 (2772/3780)	X	X	X	1		
3777-1 (2772/3780)	X	X	X	1		
3780 (2772)	X	X	X	1,3		
1131		X	X	1,3		
1826		X	X (B)	1,3 (B)		
System/3	X	X	X	1,3		
System/7 (System/3)	X	X	X	1,3		
System/32 (System/3)	X	X	X	1,3		
System/34 (System/3)	X	X	X	1,3		
System/34 (3271)	X		X (B)	1,3 (B)		
System/36 (System/3)	X	X	X	1,3		
System/36 (S/360 (b)) (mdls 25 and up)		X	X	1,3		
System/36 (3271)	X		X (B)	1,3 (B)		
System/38 (3271)	X	X		1,3 (B)		
System/38 (3770)	X	X	X	1,3		
S/360-20		X	X	1,3		
S/360 (b)		X	X	1,3		
S/370 (b)	X	X	X	1,3		
5265 (3741)		X	X			

OS/VS2 (5752-VS2) (cont'd)

SVS Terminal Support Chart 1 - cont'd

	VTAM via NCP/VS	TCAM via NCP/VS
SDLC Lines:		
3271-11,-12	X	X
3274-1C(3271-1,2)	X	X
3275-11,-12	X	X
3276(3791)	X	X
3601	X	X
3602	X	X
3614	X	X
3624	X	
3631	X	X
3632	X	X
3684	X	
3767-1,-2,-3	X	X
3771-1,-2,-3	X	X
3773-1,-2,-3	X	X
3773-P1,-P2,-P3	X	X
3774-1,-2,-P1,-P2	X	X
3775-1,-P1	X	X
3776-1,-2	X	X
3776-3,-4	X	
3777-1	X	X
3777-3	X	
3791	X	X(f)
8130 DPCX-A21,-A23	X	X
8140 DPCX-A31, -A33,-A51,-A53	X	X
S/32 (3770)	X	
S/34 (3770)	X	
S/34 (3791)	X	
S/34 (3274)	X	
S/36 (3770)	X	
S/36 (3790)	X	
S/36 (3274)	X	
S/38 (3770)	X	

Local Channel Attach	VTAM	TCAM	BTAM	TSO via TCAM
TCUs, Local Communications Controllers:				
2701		X	X	
2702		X	X	
2703		X	X	
2715-1		X	X	
3704 (EP/VS)		X	X	
3704 (NCP/VS)	X	X		
3705-1 (EP/VS)		X	X	
3705-I (NCP/VS)	X	X		
3705-II (EP/VS)		X	X	
3705-II (NCP/VS)	X	X		
Local Terminals:				
2260		X		
3272-1,-2	X	X	X	X
3274-1A(3791)	X			
3274-1B(3272-2)	X	X	X	X
3791	X(c)			
7770-3		X		

Legend:

SS	=	Start/Stop
BSC	=	Binary Synchronous Communication
SDLC	=	Synchronous Data Link Control
X	=	supported now
(date)	=	date when support will be available

Notes:

(B) BTAM only.

(T) TCAM only.

(a) If shown, the terminal type in parenthesis designates the programming support provided by SCPs. E.g., "System/7 (2740-1)" means "the System/7 is supported as a 2740-1".

(b) S/360 mdls 25, 30, 40, 50, 65, 65MP, 67 (65 mode), 75, 85, 91, 195 with either BOS, BPS, DOS, or OS. All virtual storage S/370 Processors with either BOS, BPS, DOS, OS, DOS/VS, OS/VS1, or OS/VS2.

(c) The ICR for Special Programming Support for Key Entry (SPS/KE) supports only the local 3791 with Data Entry Configuration using 3760s, and precludes concurrent operation of 3704/3705 or 3272 controllers through VTAM.

(d) 3704/3705 EP/VS, or the Partitioned Emulation Programming (PEP) extension to 3704/3705 NCP/VS, can be used to emulate the 270X.

(e) 270X = 2701, 2702, 2703; column shows last digit of 270X support. All support without a date is available now.

(f) Does not apply to versions earlier than Version 6 of the 3791 Controller.

OS/VS2 (5752-VS2) (cont'd)

MVS TERMINAL SUPPORT CHART 1

Remote Attach (a)	VTAM via NCP/VS (c)	TCAM via VTAM (c)	TCAM via NCP/VS (f)	TCAM or BTAM via EP/VS (g)	via 270X (h)	TSO via TCAM, NCP/VS	TSO via TCAM, EP/VS	TSO via VTAM	JES2 via RTAM	JES3 via RTAM
SS Lines:										
1031				X	1,2,3					
1051	X	X	X	X	1,2,3	X	X			
2260				X	1		X			
2265				X	1		X			
3101	X	-	X	X	1	X	X (o)			
2740-1,-2	X	X	X	X	1,2,3					
2741	X	X	X	X	1,2,3	X	X			
2760				X	1,2,3					
3232-51	X	X	X	X		X	X			
3767-1,-2 (2740-1)	X	X	X	X						
3767-1,-2,-3 (2740-2)	X	X	X	X	1					
3767-1,-2 (2741)	X	X	X	X		X	X			
5100 (2741)	X	X	X	X		X	X			
5110 (2741)	X	X	X	X		X				
CMCST (2741)	X	X	X	X	1,2,3					
S/7 (2740-1)	X	X	X	X	1,2,3					
AT&T 83B3 or WU 115A Line Control Type	X	X	X	X	1,2,3					
CPT-TWX (M33/35) Line Control Type	X	X	X	X	1,2,3	X	X			
WT Telegraph	X	X	X	X	1,2,3					
6733 (CPT-TWX 33/35)	X	X	X	X	-	X	X	X		
BSC Lines:										
2715-2			X	X	1,3					
2772	X	X	X	X	1,3				X	X
2780	X	X	X	X	1,3				X	X
2972-8,-11	X	X	X	X (B)	1,3 (B)					
3271-1,-2	X	X	X	X	1,3	X	X	X		
3274-1C(3271-1,2)	X	X	X	X	1,3	X	X	X		
3275-1,-2	X	X	X	X	1,3	X	X	X		
3276 (3271-1,2)	X	X	X	X	1,3	X	X	X		
3624-1,-2,-11,-12 (2772)				X(B)						
3651-A25,B25,A75 B75,C75,D75 (S/3)				X (B)						
3651-A60,-B60 (S/3)				X (B)						
3661 (S/3)				X (B)						
3670				X (T)	1,3 (T)					
3684				X (B)						
3735	X	X	X	X	1,3					
3741-2,-4	X	X	X	X	1,3					
3747	X	X	X	X	1,3					
3771-1,-2,-3 (2772)	X	X	X	X	1				X	X
3773-1,-2,-3 (2772)	X	X	X	X	1				X	X
3773-P1, -P2,P3 (2772)	X	X	X	X	1					
3774-1,2 (2772)	X	X	X	X	1				X	X
3774-P1,-P2 (2772)	X	X	X	X	1				X(k)	X
3775-1 (2772)	X	X	X	X	1				X	X
3775-P1 (2772)	X	X	X	X	1				X(k)	X
3776-1,-2 (2772/3780)	X	X	X	X	1				X	X
3777-1 (2772/3780)	X	X	X	X	1				X	X
3777-2 (S/360-20)									X	X
3780 (2772)	X	X	X	X	1,3				X	X
5110 (2772)			X	X		X	X			
5265 (3741)			X	X						
5275 (3275-1,-2)	X	X	X	X	1					
5285/5288 (3271)	X	X	X	X	1,3			X		
5285/5288 (3741)	X	X	X	X (B)	1,3(B)					
5285/5288 (S/3)									X	X
1131			X	X	1,3				X	X
1826			X	X (B)	1,3 (B)					

OS/VS2 (5752-VS2) (cont'd)

MVS Terminal Support Chart 1 - Cont'd. (1)

Remote Attach (a) SS Lines:	VTAM via NCP/VS (c)	TCAM via VTAM (c)	TCAM via NCP/VS (f)	TCAM or BTAM via EP/VS (g)	TCAM or BTAM via 270X (h)	TSO via TCAM, NCP/VS	TSO via TCAM, EP/VS	TSO via VTAM	JES2 via RTAM	JES3 via RTAM
Series/1				X (B)	1(B)					
System/3	X	X	X	X	1,3				X	X
System/7 (System/3)	X	X	X	X	1,3					
System/32 (System/3)	X	X	X	X	1,3				X	X
System/34 (System/3)	X	X	X	X	1,3				X	X
System/34 (3271)	X			X (B)	1,3 (B)			X		
System/36 (System/3)	X	X	X	X	1,3				X	X
System/36 (3271)	X			X (B)	1,3 (B)			X		
System/36 (S/360) (mdls 25 up)			X	X	1,3				X	X
System/38 (System/3)	X	X	X	X	1,3				X	X
System/38 (3271)	X		X		1,3 (B)			X		
S/360-20			X	X	1,3				X	X
S/360 (b)			X	X	1,3				X	X
S/370 (b)	X	X	X	X	1,3				X	X
8100/DPPX (j)	X		X	X	1,3	X	X	X	X	X
8100/DPPX/SP (j)	X		X	X	1,3	X	X	X	X	X

OS/VS2 (5752-VS2) (cont'd)

MVS Terminal Support Chart 1 - Cont'd. (2)

SDLC Lines:	VTAM via NCP/VS (c)	TCAM via VTAM (c)	TCAM via NCP/VS	TSO via VTAM	JES2 via VTAM	JES3 via VTAM
3232-1	X	X	X	X	X	-
3271-11,-12	X	X	X	X		
3274-1C(3791)	X	X	X	X		
3275-11,-12	X	X	X	X		
3276(3791)	X	X	X	X		
3601	X	X	X			
3602	X	X	X			
3614	X	X	X			
3624	X					
3631	X	X	X			
3632	X	X	X			
3651-A25,B25,A75 B75,C75,D75(S/3)		X	X			
3651-A50,-B50	X	X				
3651-A60,-B60	X					
3661	X					
3684	X					
3694	X	X	X	-	X (p)	X (p)
3767-1,-2,-3	X	X	X	X		
3771-1,-2,-3	X	X	X	X	X	X
3773-1,-2,-3	X	X	X	X	X	X
3773-P1,-P2,-P3	X	X	X			X
3774-1,-2	X	X	X	X	X	X
3774-P1,-P2	X	X	X			X
3775-1	X	X	X	X	X	X
3775-P1	X	X	X			X
3776-1,-2	X	X	X		X	X
3776-3,-4	X				X	X
3777-1	X	X	X		X	X
3777-3	X				X	X
3791	X	X (e)	X (e)		X	X
3791 (for 3730)	X		X		X (m)	X (m)
5285/5288 (3274-1C)	X	X	X	X		
5285/5288 (3770)	X		X		X	X
8130/DPCX-A21,-A23	X	X	X	X	X	X
8140/DPCX-A31, -A33,-A51,-A53	X	X	X	X	X	X
System/32 (3770)	X				X	
System/34 (3770)	X					
System/34 (3791)	X	X	X		X	X
System/34 (3274)	X				X	
System/36 (3770)	X					
System/36 (3791)	X	X	X		X	X
System/36 (3274)	X				X	
System/38 (3770)	X					
6670	X		X		X (n)	X (n)
8100/DPPX(j)	X		X	X	X	X
8100/DPPX/SP(j)	X		X	X	X	X

Local Channel Attach	VTAM (c)	TCAM via VTAM (c)	TCAM	BTAM	TSO via TCAM	TSO via VTAM	JES2 via VTAM	JES3 via VTAM
TCU's Local Communications Controllers:								
27011			X	X				
2702			X	X				
2703			X	X				
3704 (EP/VS)			X	X				
3704 (NCP/VS)	X	X	X					
3705-1 (EP/VS)			X	X				
3705-1 (NCP/VS)	X	X	X					
3705II (EP/VS)			X	X				
3705-II (NCP/VS)	X	X	X					
Local Terminals:								
2260			X					
2715-1			X	X				
3272-1,-2	X	X	X	X	X	X		
3274-1A(3791)	X	X						
3274-1B (3272-2)	X	X	X	X	X	X		
3791	X(d)	X(e)					X	X
3791 (for 3730)	X							
7770-3			X					

Legend:

SS	=	Start/Stop
BSC	=	Binary Synchronous Communication
SDLC	=	Synchronous Data Link Control
X	=	supported now
(date)	=	date when support will be available

Notes:

(B) BTAM only.
(T) TCAM only.

(a) If shown, the terminal type in parenthesis designates the programming support provided by SCPs. E.g., "S/7(2740-1)" means "the S/7 is supported as a 2740-1"
(b) S/360 mdls 25, 30, 40, 50, 65, 65MP, 67 (65 mode), 75, 85, 91, 195 with either BOS, BPS, DOS or OS. All virtual storage S/370 Processors with either BOS, BPS, DOS, OS, DOS/VS, OS/VS1 or OS/VS2.
(c) MVS Release 3.0 or later.

OS/VS2 (5752-VS2) (cont'd)

(d) The ICR for Special Programming Support for Key Entry (SPS/KE) supports only the local 3791 with Data Entry Configuration using 3760s. This support precludes concurrent operation of 3704/3705 or 3272 controllers through VTAM or TCAM through VTAM.

(e) Does not apply to versions earlier than Version 6 of the 3791 Controller.

(f) MVS Release 2.0 only.

(g) 3704/3705 EP/VS, or the Partitioned Emulation Programming (PEP) extension to 3704/3705 NCP/VS, can be used to emulate the 270X.

(h) 270X 2701, 2702, 2703; column shows last digit of 270X support. All support without a date is available now.

(j) Supported as a 2780.

(k) Support is for console printer and for data formatted as cards from diskette or keyboard (Logon).

(l) Dependent on SU 26 availability.

(m) Concurrent 3730-3790 systems only.

(n) Supported through the MVS/Information Distribution Workstation Support (program product 5740-AMA) with ACF/VTAM on 3/80, and with ACF/TCAM on 4/80.

(o) Installation of Network Terminal Option required.

(p) JES2 and JES3 support for the 3602 and 3694 is limited to users of program product CHX/3694 (5748-F53).

MVS TERMINAL SUPPORT CHART 2

	Communications Code EBCDIC		ASCII		Communication Network sw	nonsw	
	norm	trans	norm	tran	PTP	PTP	MP
SS Lines:							
1031	-	-	-	-	-	-	X
1051	-	-	-	-	X	-	X
2260	-	-	-	-	-	-	X
2265	-	-	-	-	-	-	X
2740-1	-	-	-	-	X	X	X
2740-2	-	-	-	-	-	-	X
2741	-	-	-	-	X	X	-
2760	-	-	-	-	X	X	-
3101	-	-	X	-	X	-	-
3232-51	-	-	X	-	X	X	-
3767-1,-2 (2740-1)	-	-	-	-	X	X	X
3767-1,-2,-3 (2740-2)	-	-	-	-	-	-	X
3767-1,-2 (2741)	-	-	-	-	X	X	-
5100 (2741)	-	-	-	-	X	X	-
5110 (2741)	-	-	-	-	X	X	-
CMCST (2741)	-	-	-	-	X	-	-
System/7 (2740-1)	-	-	-	-	X	X	X
AT&T 83B3, WU 115A	-	-	-	-	-	-	X
CPT-TWX (M33/35)	-	-	-	-	X	-	-
WT Telegraph	-	-	-	-	-	X	-
6733 (CPT-TWX 33/35)	-	-	X	-	X	X	-
BSC Lines:							
2715-2	-	X	-	-	S	X	M
2772	X	X	X	-	S	X	M
2780	X	X	X	-	S	X	M
2972-8,-11	X	-	-	-	-	-	M
3271-1,-2	X	-	X	-	-	-	M
3274-1C (3271-1,2)	X	-	X	-	-	-	M
3275-1,-2	X	-	X	-	S	-	M
3276 (3271-1,2)	X	-	X	-	-	-	M
3624-1,-2,-11,-12 (2772)	-	X	-	-	-	-	M
3651-A25,B25, A75,B75,C75, D75(System/3)		X			X		
3651-A60,-B60 (System/3)	-	X	-	-	X	-	-
3661 (System/3)	-	X	-	-	X	-	-
3670	X	-	-	-	-	-	M
3684		X			X		
3735	X	-	X	-	S	-	M
3741-2,-4	X	X	X	-	S(d)	X	-
3747	X	X	-	-	S(d)	X	-
3771,3773,3774, 3775 (2772)	X	X	X	-	S	X	M
3776, 3777-1 (2772/3780)	X	X	X	-	S	X	M
3777-2 (S/360-20)	X	X	X	X	S	X	M
3780 (2772)	X	X	X	-	S	X	M
5110 (2772)	X	X	-	-	S	X	M
5265 Communicating Model (3741)	X	-	-	-	X	X	-
5725 (3275-1,-2)	X	-	-	-	S(e)	-	M
1131	X	X	-	-	S	X	M
1826	X	X	X	-	S	X	M
5285/5288 (3271-2)	X	-	-	-	-	-	M
5285/5288 (3741)	X	X	X	-	S	X	M
5285/5288 (System/3)	X	X	X	-	S	X	-
System/3	X	X	X	-	S	X	M
System/7 (System/3)	X	X	X	-	X	X(f)	M
System/32 (System/3)	X	X	X	-	S	X	M
System/34 (System/3)	X	X	X	-	S	X	M
System/34 (3271)	X						M
System/36 (System/3)	X	X	X	-	S	X	M
System/36 (S/360(b))	X	X	X	-	S	X	M
System/36 (3271)	X						M
System/38 (System/3)	X	X	X	-	S	X	-
System/38 (3271)	X	-	-	-	-	-	M
S/360-20	X	X	X	X	S	X	M
S/360 (b)	X	X	X	X	S	X	-
S/370 (b)	X	X	X	X	S	X	-
5265 (3741)			X	X			
8100/DPPX DPPX/DSC	X					X	X
DPPX/RJE	X	X				X	
8100/DPPX/SP DPPX/SP/DSC	X					X	X
SDLC Lines:							
3232-1					X	X	N
3271-11,-12					-	-	N
3274-1C(3791)	SDLC is insensitive				-	X	X
3275-11,-12	to data interchange				-	-	N
3276(3791)	codes.				D	X	X
3601					X	X	N
3602					X	X	N

OS/VS2 (5752-VS2) (cont'd)

TERMINAL SUPPORT CHART 2 (cont'd)

	Communications Code				Communication Network		
	EBCDIC		ASCII		sw	nonsw	
	norm	trans	norm	tran	PTP	PTP	MP
3614					-	X	N
3624					-	X	N
3631					X	X	N
3632					X	X	N
3651-A25,B25,A75 B75,C75,D75					D(e)	X	N
3651-A50,-B50					D(e)	X	N
3651-A60,-B60					D	-	-
3661					D	-	-
3684					D	X	N
3694					X	X	X
3767-1,-2,-3					D	X	N
3771,3773,3774 3775,3776,3777-1,3					D	X	N
3791 (c)					D(e)	X	N
4730-F01,-F02,-R01,-R02					-	X	N
5285/5288 (3274-1C)					D	X	N
5285/5288 (3770)					D	X	N
6670					D	X	N
System/32 (3770)					D	X	N
System/34 (3770)					D	X	N
System/34 (3790)					D	X	N
System/34 (3274)					D	X	N
System/36 (3770)					D	X	N
System/36 (3790)					D	X	N
System/36 (3274)					D	X	N
System/38 (3274)					D	X	N
8130/DPCX-A21,-A23					D(e)	X	N
8140/DPCX-A31, -A33,-A51,-A53					D(e)	X	N
8815					D	X	N
SS Lines:							
Local Channel Attach:							
8100/DPPX					D	X	N
8100/DPPX/SP					D	X	N
2260	-	-	-	-			
2715-1	-	X	-	-			
3272-1,-2	X	-	-	-			
3274-1A(3791)	X	-	-	-			
3274-1B(3272-2)	X	-	-	-			
3791 (c)	3791 local attachment is code insensitive						
7770-3	-	-	-	-			

Legend:

SS = Start/Stop
BSC = Binary Synchronous Communication
SDLC = Synchronous Data Link Control
X = Supported
– = Not supported
D Group of terminals which can communicate over the public switched telephone network to the same SDLC line appearance on a 3704 or 3705 attached to a S/370. All DTEs so communicating must be operating with the same clocking source (either modem or business machine) and at the same transmission speed.
M Group of terminals which can operate on same BSC MP line and same line speed.
N Group of terminals which can operate on same SDLC MP line and same line speed.
S Group of terminals which can share the same phone number(s).

Notes:

(a) If shown, the terminal type in parenthesis designates the programming support provided by SCPs. E.g., "S/7 (2740-1)" means "the S/7 is supported as a 2740-1"
(b) S/360 mdls 25, 30, 40, 50, 65, 65MP, 67 (65 mode), 75, 85, 91, 195 with either BOS, BPS, DOS or OS. All virtual storage S/370 Processors with either BOS, BPS, DOS, OS, DOS/VS, OS/VS1 or OS/VS2.
(c) The 3791 Controller, as part of the 3790 Communication System/Data Entry Configuration, does not support ASCII code.
(d) The 3741/3747 can use the same switched network hardware at the 3704/3705 as other BSC terminals. However, NCP/VS requires that the port be configured for 3741/3747 when the port is to be used for 3741/3747. Two separate versions of NCP/VS must be maintained for the two separate configurations of the port, and the proper version loaded into the 3704/3705 for the way the port is to be used at the time.
(e) Terminal operates on switched line using manual dial/manual and/or auto answer procedures and nonswitched VTAM-NCP/VS programming support. The 3651-A50,-B50 uses manual answer and the 3791 uses manual or auto answer procedures. These manual dial procedures will not be required when switched VTAM-NCP/VS support is available.
(f) IPL of S/7 is not supported in this network configuration.
(g) 1750 BSCA does not support MODEM Autoanswer function.

OS/VS2 (5752-VS2) (cont'd)

ASP – ASYMMETRIC MULTIPROCESSING SYSTEM (360A-CX-15X)
For description, see IBM.

HASP-II VERSION 4 (370H-TX-001) (SVS)

HASP II Version 4 is not System Control Programming (SCP). It is optionally available to replace SVS readers and writers. It provides the remote job entry (RJE) support for SVS. Installation remains the responsibility of the user. Programming service classification is A.

The HASP System is an extension of SVS and provides support in the areas of job management, data management, task management, and remote job entry. HASP operates as a systems task and is formally interfaced to SVS. When HASP is used, it supplants the normal SVS functions of reader - printer - punch input/output services, SYSIN-SYSOUT spooling and job scheduling.

Features that may add to systems performance are a high performing SPOOL management routine and the HASP MULTI-LEAVING line manager. MULTI-LEAVING is employed with all Processor workstations and will tend to maximize line effectiveness and provide concurrent operation of all supported workstation devices.

HASP operation is a V=V mode. The minimal storage that must be fixed is 12K bytes. The requirement for fixed storage will be approximately 25% of the total storage generated for a HASP System.

The job input and output services provided for local peripheral devices along with a subset of the HASP operator commands capability are optionally extended to remote workstations, including both Processor and non-Processor terminals. Workstation programs for BSC S/360 mdl 20 or higher, BSC 1130, and BSC S/3 are generated as extensions to the central HASP System and operate in the workstation on a 'stand-alone' basis. The HASP RJE implementation for BSC Processor workstations is based upon the HASP MULTI-LEAVING philosophy which provides the capability for concurrent operation for all supported terminal job input, output, and console devices.

HASP Description: HASP is a specialized program which operates in the same Processor with SVS to perform the peripheral functions associated with batch job processing.

HASP is loaded as a systems task. Control of all online unit record devices is assumed, the designated intermediate storage direct access device(s) are initialized and job processing begins.

HASP has three major processing stages which relate to its three major external functions. These are:

1. **INPUT STAGE** – This stage reads jobs simultaneously from an essentially unlimited number of various types of online card readers, tapes and remote terminals into the system. These jobs are then entered into a priority queue by job class to await processing by the next stage.
2. **EXECUTION STAGE** – This stage removes jobs based upon priority and class from the queue established by the Input State and passes those jobs to SVS for processing. Input cards are supplied as required to the executing program and print and punch records are received and written onto HASP intermediate storage. This stage can simultaneously control an essentially unlimited number of jobs being processed by SVS. At the completion of a job, it is placed in a queue to await processing by the next stage.
3. **OUTPUT STAGE** – One purpose of this stage is to transcribe the printed output generated by jobs in the previous stage to printers. An essentially unlimited number of various types of printers and remote terminals can be operated simultaneously.
   The output stage also transcribes the punch output generated by jobs in the execution phase to punches. An essentially unlimited number of various types of punches and remote terminals can be operated simultaneously.

All of these processes are controlled by reenterable code so that no additional code is required to support multiple, simultaneous functions. Since all of the above functions can occur simultaneously and asynchronously, a continuous flow of jobs may pass through the system.

Following are some of the more significant algorithms employes by HASP to improve function and performance:

Specialized Direct Access Storage Allocation: HASP, through the use of an allocation bit map in main storage, dynamically allocates space for intermediate storage on a record basis, within definable track groups, for jobs. The use of this technique offers the following advantages:

1. Disk-arm motion and interference is minimize by dynamically allocating space based upon the position of the access mechanism.
2. Disk area fragmentation is automatically eliminated by allocation of the smallest possible increment of space.
3. The data for a single data set can be spread across multiple direct access volumes. In addition to further optimizing arm motion, this capability allows for the simultaneous use of multiple selector channels to increase the data rate for a given job.
4. Space is allocated as required minimizing the loss of space as a result of over-estimated output requirements.
5. The release of previously used space is accomplished by a simple algorithm which requires no I/O operations.

Unit Record Device Command Chaining: While operating any reader, printer or punch, rather than handling each record separately, HASP constructs a chained sequence of channel command words to pass to the channel. Thus, instead of the overhead of the EXCP and the ensuing interrupts for each record transmitted, only one EXCP and associated interrupt is required for a series of records. For example, when reading a job into the system, HASP might chain 40 commands together to instruct a card reader. This would cause the next 40 cards to be read into storage without requiring the execution of any Processor instructions.

Transparent Blocking: All input, print and punch for every job is automatically blocked by HASP to improve performance. Since all deblocking is also done by HASP, any program, even if designed to operate with unblocked records can benefit from the blocking. Also, because all blocking and deblocking is done by HASP, problem programs require buffers only the size of a single card or line. This can reduce a program's partition or region requirement by several thousand bytes over normal full track blocking.

Dynamic Buffer Pool: HASP maintains a dynamic area of storage which is allocated as required. This technique allows not only multiple data sets of a job but multiple jobs to share this area, thereby insuring optimum use of storage.

HASP Standard Features: The standard features of HASP are as follows:

Job input service provides for low overhead reading of job streams and storing of data on SPOOL volumes for later high speed retrieval for up to 99 concurrently active local card readers in any combination of devices as follows (one required): 2540 reader ... 2501 reader ... 3505 reader (80-column punched cards only).

Execution services provides for selection of jobs and execution monitoring for up to 63 concurrently executing jobs with services as follows: Selection of jobs based upon job class and initiator priority class list of up to 64 classes for each initiator ... automatic delaying of jobs with duplicate OS jobnames ... automatic deblocking and blocking of user SYSIN/SYSOUT data using the HASP dynamically shared buffer pool ... counting of lines, cards, and execution duration with optional operator notification and/or cancellation ... interface for SMF counting of SYSIN/SYSOUT data.

Execution services requires an OS Reader Interpreter to be active at all times.

Multiple SPOOL volume support provides for balanced utilization of up to 36 volumes for any combination of devices as follows (one required): 2314 ... 3330 ... 2305.

Warm start capability provides for checkpointing critical HASP information sufficient for: optionally restarting jobs which were executing ... restarting print at the last checkpoint ... restarting punch at the beginning of data set.

Job output print service provides for low overhead printing of job stream system message and user data print output for up to 99 concurrently active local printers in any combination of devices as follows (one required): 1403 Printer ... 3211 Printer.

Special forms feature provides for the routing of print (on a job or data set basis) and punch data (data set basis) to special forms output queues for output as directed by the operator.

Console Support provides for direct entry for HASP commands and HASP abbreviated reply to WTOR through SVS Operator Consoles.

HASP minimal System Message Block (SMB) output writer provides for retrieval of SMBs from the **SYS1.SYSJOBQUE** data set.

HASP interfaces directly with the SVS SMF writer.

HASP Optional Features: In addition to the standard features, the following optional features are available:

OS/VS2 (5752-VS2) (cont'd)

Internal Reader feature provides the ability for any nonswappable task within the system to submit jobs to HASP for batch execution as though entered from a HASP card reader.

Job output punching services provides for low overhead punching of job stream user punch output for up to 99 concurrently active local punches in any combination of devices as follows: 2520 punch ... 2540 punch ... 3525 punch.

Execution Batching feature provides the facility for passing jobs directly to a processing program such as a "one-step" monitor, reducing the overhead of OS scheduling and allocation of facilities for short running jobs requiring limited system facilities.

Priority aging feature provides for automatically increasing the HASP scheduling priority of jobs which have been in the system for extended periods of time.

Remote Job Entry feature provides for high speed communications with BSC batch workstations which may be used for job stream input and output as well as operator control of the devices and jobs associated with the remote (see HASP Remote Job Entry for features).

HASP RJE Features: Those features common to all HASP RJE configurations are listed as follows:

HASP RJE supports up to 99 remote workstations communicating over nonswitched (point-to-point) or switched lines.

HASP RJE provides for concurrent operations over up to 99 lines assigned to unique communication lines adapter addresses of the following types: SDA Type II on a 2701 for BSC ... Synchronous Base on a 2703 for BSC ... 3704/3705 providing 270X emulation.

Output routing control provides for print and punch output to be directed to the devices attached to the remote, to the central system, or to other remotes as designed by HASP generation parameters, by control card submitted with the job, or by operator command.

Remote operator control feature provides a subset of the HASP operator commands for display of information and control of jobs and devices associated with the remote.

Operator message output feature provides for transmission of messages and responses to remote operators with online MULTI-LEAVING workstations with consoles immediately and optionally saving of messages for all other remotes until the remote is online and has its primary printer available.

Workstation programs, when required, are supplied as extensions of HASP and are contained on the HASP distribution tape in source form.

Terminal support on the central system provides for communication with: 2770 (BSC) ... 2780 (BSC) ... 3780 (BSC) ... S/360 Models 20, 25, 30, 40, 50, 65, 75, 85, and 195 (MULTI-LEAVING) ... 1130 (MULTI-LEAVING) ... S/3 (MULTI-LEAVING) ... S/32 or S/34 (MULTI-LEAVING as a S/3).

The signon feature provides for remote identification and line security through line passwords.

Remote characteristics support utilizes the unique features on each remote as follows: full text transparency (required for object decks) ... text compression ... print line width ... buffer size and blocking capabilities.

Note: Multipoint or multidrop line features are prohibited.

Remote job priority adjustment provides for favoring or limiting the HASP scheduling priority of jobs submitted from each remote workstation.

Line restart feature provides for warm starting of print output after remote workstation or line failures.

Line error recovery provides for continuous retry until successful transmission.

HASP MULTI-LEAVING RJE Features: MULTI-LEAVING is a term which describes a computer-to-computer communication technique developed for use by the HASP System. In a gross sense, MULTI-LEAVING can be defined as the fully synchronized, pseudo-simultaneous, bi-directional transmission of a variable number of data streams between two or more computers utilizing binary synchronous communications facilities. Those features common to all HASP RJE configurations are provided with MULTI-LEAVING configurations with additional features as follows:

Concurrent device operation feature provides for all supported devices to operate concurrently in accordance with the device characteristics, line speed, and characteristics of the data streams.

Dual reader/punch device support provides for use as both reader and punch under automatic or operator control.

Unit record error recovery provides a minimum of operator intervention and continued operations using unaffected devices on operator console configurations.

HASP/2770 RJE Workstation: The 2770 is supported by the HASP RJE features as a BSC workstation for submission and control of jobs at the central HASP for OS processing and has the following features:

Device support of the 2772 provides for job stream input and output on the following devices: 2213 mdl 2 Printer ... 2203 Models A1 or A2 Printer ... 2502 Models A1 or A2 Card Reader ... 0545 mdls 3 or 4 Output Punch.

Note: The standard keyboard provided with the 2772 may be used as a 2502 reader for text which is compatible with card input. Such input is limited to entry of commands and extremely short job stream input (a job stream must fit entirely within the 2772 buffer).

Extended support provides for special features: Buffer expansion and buffer expansion additional ... EBCDIC or ASCII transmission code ... Full text transparency for EBCDIC ... Horizontal Format Control ... 144 character print line (2203 only, requires Buffer Expansion) ... Space Compression/Expansion.

The Terminal ID and Security ID features may be present but are not supported by HASP.

Note: Other features not prohibited by HASP RJE and transparent to programming are permitted.

HASP/2780 RJE Workstation: The 2780 is supported by the HASP RJE feature as a BSC workstation for submission and control of jobs at the central HASP for OS processing and has the following features:

Device support for job stream input and output on the following 2780 configurations: mdl 1 Printer and Reader ... mdl 2 Printer, Reader and Punch.

Extended support provides for special features: Multi-record transmission ... 120 and 144 character print line ... Horizontal Format Control ... EBCDIC or ASCII transmission codes ... Full text transparency for EBCDIC.

The Terminal ID and Security ID features may be present but will not be supported by HASP.

Note: Other features not prohibited by HASP RJE and transparent to programming are permitted.

HASP/3777-2 MULTI-LEAVING Workstation: The 3777 mdl 2 is supported as a S/360 mdl 20 Binary Synchronous MULTI-LEAVING Workstation for submission and control of jobs at the central HASP for OS processing and has the following features:

The RMTM20 Workstation program is generated by HASP remote generation procedures for a S/360-20 Submodel 5 with 12K of main storage.

Device support provides concurrent operations on each reader, printer, punch and console device: 3203-3 Printer (required) (specify 1403) ... 2502 Reader (required) (specify 2501) ... 3521 Punch (optional) (specify 1442) ... Console Display (optional) (specify 2152).

HASP/3780 RJE Workstation: The 3780 is supported by the HASP RJE features as a BSC workstation for submission and control of jobs at the central HASP for OS processing and has the following features:

Device support provides for job stream input and output on the following devices: Card Reader ... Line Printer.

Supported features are: 512 character buffer ... Variable length record ... Space Compression/ Expansion ... EBCDIC or ASCII transmission code ... Full text transparency for EBCDIC ... Print positions (additional) for 144 character print line ... Horizontal Format Control.

The Terminal ID and Security ID features may be present but are not be supported by HASP.

OS/VS2 (5752-VS2) (cont'd)

HASP/360-20 MULTI-LEAVING Workstation: The S/360 mdl 20 with BSC adapter and HASP provided workstation program is supported as a BSC MULTI-LEAVING workstation for submission of jobs to the central HASP for OS processing and has the following features:

The RMTM20 workstation program is generated by HASP remote generation procedures and requires a minimum of 8K main storage on a mdl 20 submodels 2, 4, 5, and 6. Larger core (up to 32K) may be used for additional buffer storage is available.

Device support provides concurrent operations on one of each reader, printer, punch and console device: 2203 Printer or 1403 Printer (one required) ... 2501, 2520 or 2560 Reader device (one required) ... 1442, 2520 or 2560 Punch device (optional) ... 2152 Console (optional).

Dual 2520 device support provides automatic determination of function as follows: Operator places blank cards in feed designating punch ... Operator places job stream in feed designating reader.

Dual 2560 device support provides selection of functions by feed hopper as follows: Prinmary feed assigned to reader ... Secondary feed assigned to punch.

Unit record data checks which require operator intervention may be corrected without stopping other functions when the 2152 console is available.

Communications adapter support on the workstation provides for EBCDIC code (transparency optional) over all available BSC line speeds; however, speeds requiring the high speed feature (19.2K baud and above) are not recommended for the submodels 2 or 4.

HASP/360 MULTI-LEAVING Workstation: The S/360 mdls 25, 30, 40, 50, 65, 75, 85 and 195 with BSC adapter and HASP provided workstation programs are supported as BSC MULTI-LEAVING workstations for submission of jobs to the central HASP for OS processing and have the following features:

The RMT360 workstation program is generated by HASP remote generation procedures and requires a minimum of 8K main storage to support single reader, printer, punch, and console device configurations. Larger storage (up to 32K) may be used as space for additional buffers and to support additional devices for up to seven readers, printers, punches (the number of printers when added to the number of punches must not exceed eight).

Device support provides for concurrent operations on each of the supported devices as follows: 2501 Reader ... 1442 Reader/Punch and Punch ... 2520 Reader/Punch and Punch ... 2540 Reader/Punch ... 1403 Printer ... 1052 Printer-Keyboard.

Notes: At least one reader and one printer along with the 1052 console required ... Each device (including communications adapter) must be on separate non-shared subchannels.

Dual reader/punch support for 1442 and 2520 provides for automatic determination of function as follows: Operator places blank cards in feed designating punch ... Operator places job stream in feed designating reader.

Note: 2540 reader/punch has two independent card paths which operate concurrently.

Communications adapter support on the workstation provides for EBCDIC transmission (transparency optional), via: SDA Type II on a 2701 ... Integrated BSC adapter on Model 25.

HASP/1130 MULTI-LEAVING Workstation: The 1130 Computing System with BSC adapter and HASP provided workstation program is supported as a BSC MUTLI-LEAVING workstation for submission of jobs to the central HASP for OS processing and has the following features:

The RTP1130 workstation program is generated by HASP remote generation procedures and requires a minimum of 8K main storage to operate all supported devices concurrently. Larger core (up to 32K) may be used for additional buffer storage.

Device support provides for concurrent operations on each of the supported devices as follows: 2501 Reader ... 1442 Reader/Punch or Punch ... 1132 Printer ... 1403 Printer ... Standard Printer-Keyboard.

Note: At least one reader required.

Dual reader/punch support for the 1442 provides for operator assignment of function.

Console output support provides for color-coded messages for separation of HASP messages from workstation messages and operator input.

Single 1403 printer configurations support 132 character lines (RPQ features required).

Note: This feature does not include support for UCS printers.

Communications adapter support on the workstation provides for EBCDIC code (transparency optional) at any speed available to the standard BSC adapter attachable to the 1131.

HASP/System/3 MULTI-LEAVING Workstation: The System/3 with BSC adapter and HASP provided workstation program is supported as a BSC MULTI-LEAVING workstation for submission of jobs to the central HASP for OS processing and has the following features:

The System/3 workstation program is generated by HASP remote generation procedures and requires a minimum of 8K main storage to operate all supported devices currently. Larger core is utilized when available.

Device support provides for concurrent operations on each of the supported devices as follows: 5424 Reader/Punch ... 1442 Reader/Punch ... 5203 Printer ... 1403 Printer ... 5471 Printer-Keyboard (console) ... 5475 Data Entry Keyboard (in lieu of 5471).

Note: At least a card reader and printer required.

Dual reader/punch support for 1442 and 5424 provides for automatic determination of each card path as follows: Operator places blank cards in feed to designate punch ... Operator places job stream in feed to designate reader.

Each 96-column card punched is interpreted.

Communications adapter support on the workstation provides for EBCDIC code (transparency optional) at any speed available to the BSC adapter.

Printer support provides for extra print positions and UCS images of LC and PN trains (PN recommended).

System/32 MULTI-LEAVING Workstation for HASP: The System/32 with Binary Synchronous Communications Adapter and its associated MRJE/WS System Utility Program is supported as a BSC MULTI-LEAVING workstation for submission of jobs to the central HASP for OS processing and has the following features:

For remote workstation support by HASP, the System/32 must be specified as a System/3. The System/32 MRJE/WS System Utility Program is supplied as a component of the System/32 SCP.

Device support provides for concurrent operations on each of the supported facilities of the 5320 System Unit: Disk storage simulation of card I/O and/or printer data streams ... Line or serial printing ... Keyboard/display (console).

Communications adapter support on the workstation provides for EBCDIC code (Text Transparency optional) at any speed available to the Binary Synchronous Communications Adapter.

System/34 MULTI-LEAVING Workstation for HASP: The System/34 with Communications Adapter in BSC mode and its associated MRJE System Utility Program is supported as a BSC MULTI-LEAVING workstation for submission of jobs to the central HASP for OS processing and has the following features:

For remote workstation support by HASP, the System/34 must be specified as System/3. The System/34 MRJE System Utility Program is supplied as a component of the System/34 SSP.

Device support provides for concurrent operations on each of the supported features of the 5340 System Unit: Disk storage simulation of card I/O and/or printer data streams ... line or serial printing ... keyboard/display (console).

Communication adapter support on the workstation provides for EBCDIC code (Text Transparency optional) at any speed available to the Communications Adapter.

System/38 MULTI-LEAVING Workstation for HASP : The System/38 with Communications Attachment and Communications Controls Features and its associated RJEF Licensed Program is

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supported as a Binary Synchronous MULTI-LEAVING workstation for submission of jobs to HASP for OS processing and has the following features:

For remote workstation support by HASP, the System/38 must be specified as a System/3 or as a S/360 Mdl 25 or greater when more than 3 readers/writers are to be supported. The System/38 Remote Job Entry Facility (RJEF) is supplied as a Licensed Program.

Device support provides for concurrent operations on each of the supported facilities of the 5381 system unit: Disk storage simulation of card I/O and/or printer data streams...line or serial printing...keyboard/display (console)...direct output to user application program.

Communications adapter support on the workstation provides for EBCDIC code (Text transparency optional) at any speed available to the Communications Adapter.

SCP PROGRAMMING SERVICES: Class 1 SCP Category B.