Bull DPS 7 Series

MANAGEMENT SUMMARY

UPDATE: *Bull announced three new models designed for the medium- to large-scale sectors of the DPS 7 range at the Hannover Fair in March. They are DPS 7/617 S, DPS 7/717 S, and DPS 7/817 S. These models have a memory capacity of up to 12MB and offer the same level of power as the DPS 7/617, DPS 7/717, and DPS 7/817. The new models use 256K MOS memory technology and the new MSU 1007 high-capacity disk units. The three additions to the DPS 7 range now raise the total number of models in the line to thirteen.*

The Bull DPS 7 Series has passed through several evolutionary stages since its introduction. The principal restructuring of the DPS 7 came in September 1984 when Bull renumbered eight systems from the older DPS 7 line and enhanced them with increased main memory capacities and other hardware changes. At that time, Bull also launched two new models for the series. With the current addition of three new models, the DPS 7 Series now offers wider power ranges than ever before.

Bull SA is divided into four groups: Bull Systèmes, responsible for mainframes, including the DPS 7 and DPS 8, and minicomputers such as the DPS 4 and DPS 6; Bull Sems, which deals with minicomputers such as the SPS 5, SPS 7, SPS 9, and Mitra; Bull Peripheriques, responsible for peripherals such as disks, printers, and magnetic tape units; and Bull Transac which produces the Micral microcomputer, Questar terminals, and office automation and banking equipment. Bull has approximately 26,000 employees worldwide in 75 countries. Sales rose in 1985 by 18.5 percent over 1984 to 16.1 billion FF, and net profits totalled 110.2 million FF, compared to a loss of 489 million FF in 1984.

The DPS 7 architecture provides multiprocessing capabilities and a high degree of simultaneity. In addition to 1, 2, or 4 central processors, a Bull DPS 7 system contains a

The DPS 7 Series of 13 compatible models contains single-, dual-, and quadri-processor systems divided into 4 subgroups, offering a high degree of reliability through redundancy. All models run under the GCOS 7 operating system. The series is suitable for the medium to large central user who needs distributed processing and networking capabilities.

MODELS: DPS 7/107 S, 7/307, 7/407, 7/507, 7/617, 7/617 S, 7/717, 7/717 S, 7/817, 7/817 S, 7/627, 7/727, 7/827.
CONFIGURATION: From 2 to 16 megabytes of main memory, and 2 to 32 I/O channels.
COMPETITION: IBM 4300 Series and equivalent ranges, IBM System 38, Hewlett-Packard HP 3000, and Digital Equipment Corporation VAXs.
PRICE: Purchase prices range from approximately 1.100.000 FF for the entry-level DPS 7/107 S, to over 14.000.000 FF.

CHARACTERISTICS

MANUFACTURER: Bull, 121 avenue Malakoff, 75116, Paris, France. Telephone (01) 4502 9090. Telex 614050 F.

COMPANY LOCATIONS: *Algeria:* Cii Honeywell Bull, 5 rue de Nîmes, B.P. 126, Ferhat-Boussad-Alger. Telephone (213) 63 11 21/22; *Argentina:* Bull Argentina S.A.C.I., Carlos Pellegrin 1363, 1041 Buenos Aires. Telephone (1) 394 50 04; *Austria:* Honeywell Bull AG, Linke Wienzeile 236, A-1150 Vienna 15. Telephone (222) 85 36 41; *Belgium:* Honeywell Bull SA, Avenue Marnix 28, 1050 Brussels. Telephone (02) 517 8411; *Brazil:* ABC Bull Telematic SA, Avenida Angelica 903, CEP 01227 Santa Cecilia, São Paulo. Telephone (1) 826 30 22; *Cameroon:* CII Honeywell Bull, Immeuble Viazzi et Aubriet, B.P. 2552, Bonanjo Douala. Telephone (237) 42 18 48; *China:* Bull Beijing Representative Office, Suite 2917, Minzu Hotel, Beijing, China. Tele-

The Bull DPS 7/X07 models are single-processor systems and include the 7/107 S, 7/307, 7/407, and 7/507.

Bull DPS 7 Series

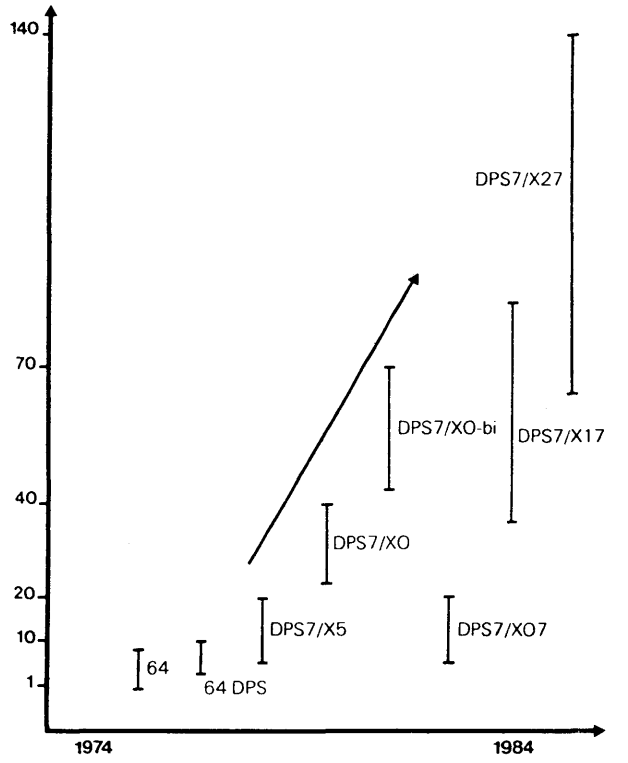

Figure 1. Bull DPS 7 evolution

number of other processors for specific functions, including the input/output processor, disk processor, magnetic tape processor, unit record processor, communications processor, and network processor.

Simultaneity is achieved at two basic levels: within the main processor and by concurrent operation with the main processor of peripheral and network processors. These ancillary processors all have intelligence and some memory and are autonomous within certain limits. The main processor also has a capability for carrying out a number of operations in parallel—such as fetching and decoding instructions, performing arithmetic/logical operations, and finding main memory addresses.

The network processor provides complete facilities for network control and can also be used as a terminal concentrator or as a switch. There are various models available for the different members of the DPS 7 Series. The Datanet 7130 communications processor, for example, supports up to 23 communications lines and terminals of different types. All Datanet processors support connection of the DPS system to public networks, such as Transpac, DATEX-P, and NPDN.

The DPS 7 Series is divided into subgroups which differ mainly in hardware configuration. The subgroups are the three single-processor DPS 7/X07 models; the 7/X17 and

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DISTRIBUTORS: Bull has agents in the following countries: Bolivia, Chile, Djibouti, Egypt, Finland, Guinea, India, Indonesia, Kuwait, Mauritius, New Caledonia, Paraguay, Peru, Tahiti, United Arab Emirates, and Venezuela.

MODELS: DPS 7/107 S, 7/307, 7/407, 7/507, 7/617, 7/617 S, 7/717, 7/717 S, 7/817, 7/817 S, 7/627, 7/727, 7/827.

DATE ANNOUNCED: 7/X07, 7/X17 models—September 1984; 7/X17 S models—March 1986.

FIRST DELIVERY: 7/X07—February 1985; 7/X17, 7/X27—April 1985; 7/X17 S—July 1986.

NUMBER INSTALLED TO DATE: About 2,000.

Bull DPS 7 Series

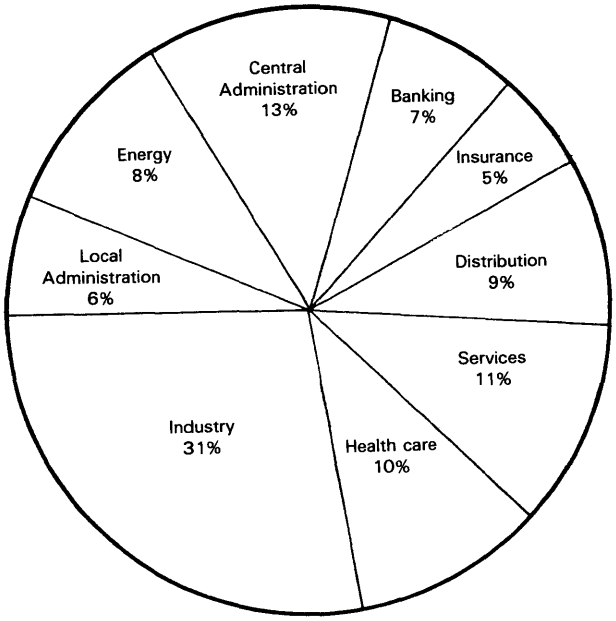

Figure 2. Bull DPS 7 principle applications

7/X17 S models; and the 7/X27 twin systems which are fault-tolerant versions of the 7/X17 models. The 7/X17, 7/X17 S, and 7/X27 models have input/output processors; the 7/X07 models do not. All DPS 7 models run the GCOS 7 operating system and offer complete compatibility

DATA FORMATS

BASIC UNIT: 8-bit byte plus one parity bit. Data paths are four bytes (32 bits) wide, while addresses and commands use an independent 28-bit path. Data can be interpreted as binary, decimal, hexadecimal, or alphanumeric. Data bits are interpreted in groups of four (packed decimal) or eight (alphanumeric EBCDIC), or in strings of 16 to 64 bits (binary digits). The strings can be interpreted as signed or fixed-point operands with single- (16-bit) or double- (32-bit) precision formats. The scientific instruction set, used for floating-point operations, provides the capability for 128-bit quad words.

FIXED-POINT OPERANDS: 1 to 16 bytes (1 to 31 digits plus sign) in packed decimal; one half word (15 bits plus sign) or full word (31 bits plus sign) in binary.

FLOATING-POINT OPERANDS: 1, 2, 3, or 4 words, consisting of a sign bit, a 7-bit exponent, and a 24-bit, 56-bit, or 112-bit fraction.

INSTRUCTIONS: The DPS 7 systems are microcoded machines that can serve as upgrades to Level 64 and 64/DPS systems through the execution of the appropriate instruction set.

INTERNAL CODE: EBCDIC.

MAIN STORAGE

Memory is organized into consecutively numbered byte locations. Four-byte blocks are always accessed regardless of operand size. Halfword (16-bit) operands must begin on even-numbered byte locations, and full-word (32-bit) and double-word (64-bit) operands must begin on byte locations divisible by 4.

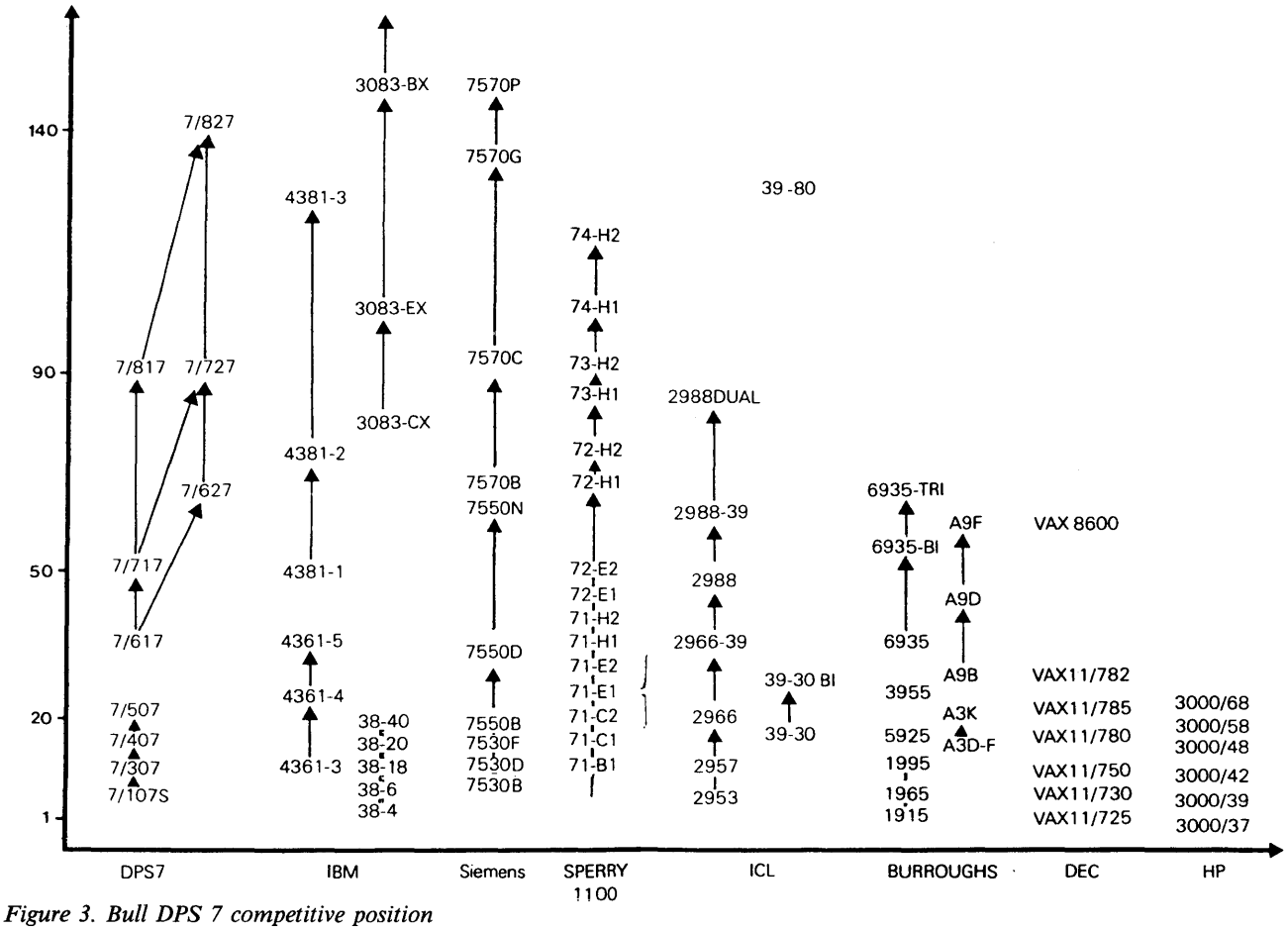

Figure 3. Bull DPS 7 competitive position

Bull DPS 7 Series

at the operating system level and at the networking level, where Bull offers networking software under the DSA label.

The 7/X07 group comprises the following four models: 7/107 S, 7/307, 7/407, and 7/507. The 7/107 S is an entry-level system, while the 7/307, 7/407, and 7/507 are based on the original 7/35, 7/45, and 7/55 models, respectively. Each model has a basic 2M bytes of main memory, expandable to 4M bytes on the 7/107 S and 7/307, to 6M bytes on the 7/407, and to 8M bytes on the 7/507. Peripherals are connected into the system through input/output channels, of which the 7/107S and 7/307 offer four, and the 7/407 and 7/507 provide eight. The 7/107 S differs from the other 7/X07 models in that it contains an integrated disk processor, which is optional on the other systems. All machines contain as standard a magnetic tape adaptor through which magnetic tape processors are connected, and one unit record device which supports card readers and diskette drives. All four 7/X07 models include two communications processors with a total of 12 lines, and with the exception of the 7/107 S, a network processor is also standard.

The 7/617, 7/717, and 7/817 models are broadly based on the upper range members of the original DPS 7 Series: 7/60P, 7/70, 7/80, and 7/82. The DPS 7/617 and 7/717 are both single-processor systems which comprise up to 8M bytes of main memory, one 16K-byte block of cache memory, four standard I/O processors, two network processors, and a number of disk, magnetic tape, and unit record

TYPE: 64K-bit MOS chips. Current Mode Logic (CML), a fast, low power, low heat technology is used. CML has a propagation time of one nanosecond per logic port. In addition, the DPS 7 uses a multilayer micropackaging technique that supports 10,000 to 15,000 functions per board. The CML technology used is the result of cooperation by Bull in Europe, Honeywell in the United States, and the Nippon Electric Company in Japan. Micropackaging is the result of research and development work at Bull Laboratories.

CYCLE TIME: See Characteristics Table.

CAPACITY: See Characteristics Table.

CHECKING: Each item of stored data is monitored by a Hamming code (one byte for every 8 data bytes) which corrects single-bit errors and detects double-bit errors. Parity checks are performed to ensure data integrity. All registers and calculation circuits include a key check.

Diagnostic microprograms are launched at each system initialization or at the operator's request by the main processors and by peripheral processors to verify their operation. The support system launches checkpoints when there is an irretrievable error or a power loss.

In the event of an error, a retry is activated. The retry can be initiated by firmware for a microinstruction or an instruction, or by software for a group of instructions or input/output commands. Retries can be initiated several times. Whenever an error is detected and a retry is attempted, the event is recorded in an error log. An error report, subsequently produced, indicates the origin of each error, speeds up diagnosis, and implements fast, corrective intervention.

STORAGE PROTECTION: In the GCOS 7 environment, to avoid artificial restrictions on the placement of segments

TABLE 1. CHARACTERISTICS OF THE BULL DPS 7 SERIES

Model	7/107S	7/307	7/407	7/507	7/617	7/717	7/817
Central processors	1	1	1	1	1	1	2
Cycle time, ns	390	360	240	140	150	107.5	107.5
Main memory							
Minimum, MB	2	2	2	2	2	4	6
Maximum, MB	4	4	6	8	8	8	10
Read cycle time, ns	355	355	355	355	NA	NA	NA
Write cycle time, ns	290	290	290	290	NA	NA	NA
Cache memory, KB	0	0	0	0	16	16	32
Input/Output							
I/O Channels (integrated & optional)	2+2	2+2	4+4	4+4	0	0	0
I/O Processors	0	0	0	0	4-12	4-16	8-16
Disk processors (DP)	2	2	4	4	0	0	0
Single-channel DPs	0	0	0	0	6	8	8
Dual-channel DPs	0	0	0	0	3	4	4
Disk drives, max.	8	18	36	36	54	72	72
Magnetic tape adapter	1	1	1	1	0	0	0
Single-access MTP	0	1	2	2	2	4	4
Dual-access MTP	0	0	1	1	1	2	2
Magnetic tapes, max.	4	12	20	20	16	32	32
Communications Processors (12 lines)	2	2	2	2	0	0	0
Network Processor	0	1	1	2	2	2	4
NP lines	0	64	128	128	128	256	512
Operating System							
GCOS 7-ES	Yes	Yes	Yes	No	No	No	No
GCOS 7-MS	No	Yes	Yes	Yes	Yes	No	No
GCOS 7-LS	No	No	No	No	Yes	Yes	Yes

NA—Not applicable.

Bull DPS 7 Series

TABLE 1. CHARACTERISTICS OF THE BULL DPS 7 SERIES (Continued)

Model	7/627	7/727	7/827	7/617S	7/717S	7/817S
Central processors	2	2	4	1	1	2
Cycle time, ns	150	107.5	107.5	950	107.5	107.5
Main memory						
Minimum, MB	4	8	12	4	8	8
Maximum, MB	16	16	16	12	12	12
Read cycle time, ns	NA	NA	NA	NA	NA	NA
Write cycle time, ns	NA	NA	NA	NA	NA	NA
Cache memory, KB	32	32	64	16	16	32
Input/Output						
I/O Channels (integrated & optional)	0	0	0	0	0	0
I/O Processors	8-24	8-32	16-32	7	8	11
Disk processors (DP)	0	0	0	0	0	0
Single-channel DPs	12	16	16	6	8	8
Dual-channel DPs	6	8	8	3	4	6
Disk drives, max.	81	108	108	54	72	108
Magnetic tape adapter	0	0	0	0	0	0
Single-access MTP	4	8	8	0	0	0
Dual-access MTP	2	4	4	1	1	2
Magnetic tapes, max.	32	64	64	18	8	16
Communications Processors (12 lines)	0	0	0	0	0	0
Network Processor	4	4	4	2	2	2
NP lines	128	256	512	128	256	256
Operating System						
GCOS 7-ES	No	No	No	No	No	No
GCOS 7-MS	No	No	No	Yes	No	No
GCOS 7-LS	Yes	Yes	Yes	Yes	Yes	Yes

NA—Not applicable.

processors. The dual-processor 7/817, in its basic configuration, comprises 6M bytes of main memory, two blocks of cache memory, eight I/O processors, and four network processors. Main memory can be expanded to 10M bytes. An additional eight I/O processors can be supported. Disk, magnetic tape, and unit record processors are available.

The 7/617 S, 7/717 S, and 7/817 S have the same architecture and the same level of power as the 7/617, 7/717, and 7/817. The 7/817 S is a dyadic system with main memory ranging from 4MB to 12MB. The principal characteristic of the 7/X17 models is that they can be upgraded on site to the 7/X27 redundant models.

The three 7/X27 models, the 7/627, 7/727, and 7/827, are fully redundant versions of the 7/617, 7/717, and 7/817

in memory, the DPS 7 protects every segment individually with an automatic system of rings and protection levels. This protection system, implemented by hardware and firmware, protects segments on the basis of the information they contain rather than by their physical locations.

The main processor, while executing a process, can be at one of 4 levels of privilege, called rings. The rings are numbered from 0 to 3, with 0 being the most privileged. A ring number is allocated to each segment when it is created; when the process is entered, the main processor adopts this ring number. Each segment is allocated 3 protection levels, one for each possible use. Each level can be anywhere within the range of 0 to 3. At every reference to an address in a segment, the protection level for the relevant type of use is checked against the current ring number of the main processor. Access is allowed only under the following conditions: for read and write access, the ring number is less than or equal to the protection level; for execute access, the ring

TABLE 2. MASS STORAGE

Model	MSU 0395	MSU 0555	MSU 1007
Type	Removable	Fixed	Fixed
Number of spindles per unit	1	2	2
Capacity	300MB	2 x 635MB	2 x 500MB
Tracks per surface	808	1,676	1,422
Surfaces per pack/spindle	19	20	12
Average seek time (ms)	30	25	20
Average access time (ms)	38	33	28
Average latency (ms)	8, 3	8, 3	8, 3
Data transfer rate (K bps)	1210	1192	1815
Controller model	MSP 4270	MSP 4575/MSP 4577	MSP 4370
Supported by system models	All	All except 107S	All except 107S

TABLE 3. MAGNETIC TAPE UNITS

Model	MTU 0320 MTU 0321	MTU 0420 MTU 0121	MTU 0432	MTU 0532	MTU 0437	MTU 0537	MTU 0637
Format							
Number of tracks	9	9	9	9	9	9	9
Recording density (bpi)	1600	1600	1600	1600	1600/6250	1600/6250	1600/6250
Recording mode	PE	PE	PE	PE	PE/GCR	PE/GCR	PE/GCR
Characteristics							
Controller models	MTA 4370	MTA 4370	MTP 4275	MTP 4275	MTP 4472 MTP 4572	MTP 4472 MTP 4572	MTP 4472 MTP 4572
Drives per controller	1-4	1-4	1-8	1-8	1-8/1-16	1-8/1-16	1-8/1-16
Tape speed (ips)	45	75	75	125	75	125	200
Data transfer rate (K bps)	72	120	120	200	468	781	1250
Supported by system models	X07	X07	307, 407, 507	307, 407, 507	All except 107S	All except 107S	X17/X27/ X17S

systems, respectively. For example, the 7/727 configuration can contain twice as many processors and peripherals as the 7/717. A typical 7/727 configuration would consist of two central processors, 8M to 16M bytes of main memory, two blocks of cache memory, from eight to thirty-two I/O processors, up to 108 disk drives and 64 magnetic tape units, and four network processors handling a maximum of 256 communications lines. The largest model, the 7/827, is a quadri-processor system which provides full duplication of the 7/817, except that main memory ranges from a basic 12M to 16M bytes, rather than to 20M bytes as might be expected.

The GCOS 7 operating system, which runs on all DPS 7 models, is compatible with the GCOS 64, the operating system used for the previous DPS 7 machines; therefore, software written for Level 64 and 64/DPS systems can be used on DPS 7 models. The principal task of GCOS 7 is optimizing program handling and dividing programs into segments which are fully relocatable and can be swapped in and out of memory as needed. Optimization of the processes associated with tasks—that is, getting them in and out of memory and synchronizing the in/out phase—is effected through firmware. When a program can be broken down into a number of subtasks that can be executed in parallel, the firmware synchronizes the operation.

Programming languages supported by the Bull DPS 7 Series include Cobol, Fortran, RPG2, and PL/1. For interactive purposes, APL and Basic are supported. Menu-driven facilities include a command language generator and interactive data management utilities.

The DPS 7 range offers a very wide variety of peripherals with the accent on disks and terminals. DPS 7 systems can be coupled to share peripherals. Such configurations enable peripheral and network processors to be switched between two DPS 7 systems.

In addition to launching the three new DPS 7 models, Bull has also restructured the Datanet range of communications processors which now includes four models: DN 7130, DN 7131, DN 7132, and DN 7133, and introduced the CpNet communications processor, Model CN 5105, a free-standing server for local or wide area networks. Bull also

number is within the range between the write and execute protection levels. At linking time, the programmer specifies protection levels to control access to program segments from other active programs.

An extension to the protection system is the capability to flag segments as completely unwritable. This feature guards against the most frequently encountered programming errors. The compilers always generate code and data in separate segments. By flagging the code segments as unwritable, the system prevents the code from being modified during execution.

RESERVED STORAGE: There is a reserved area in main memory for channel programs and tables describing the actual configuration. The boundary address is held in a special register (BAR). This reserved area is of variable length, approximately 20KB.

CENTRAL PROCESSORS

The 7/107 S, 7/307, 7/407, and 7/507 are single-processor systems, as are the 7/617, 7/717, 7/617 S, and 7/717 S. The 7/817 and 7/817 S are dual-processor machines. The 7/X27 systems are fault-tolerant versions of the 7/X17 models. The 7/627 and 7/727 have 2 central processors, and the 7/827 is a quadri-processor system.

DPS 7 central processors are composed of 7 minimachines, a control store and a processor bus on all models, and cache memory on the 7/X17, 7/X17 S, and 7/X27 models. This processing system is connected via its cache memory, where applicable, with the central bus, which also services main memory and any input/output processors. The I/O processors, which are not present on the 7/X07 systems, have their own control stores and main memories and are connected to the peripheral processors, which also have their own control stores and main memories. This distributed architecture enables various subsystems to operate simultaneously, allows subsystems to communicate with each other without tying up the main processor, and provides flexibility in distributed processing network environments.

The minimachines in the main processor are Pilot Machine (PIM), Address Calculation Machine (ACM), Data and Instruction Management Machine (DIM), Arithmetic and Logic Machine (ALM), Scientific Calculation Machine (SCM), Timer, and Maintenance Interface Machine (MIM).

CONTROL STORAGE: Control store contains firmware held in 56-bit words. Each word contains the instructions to be executed by the minimachines during a single cycle. The sequencing of firmware instructions is controlled by the Pilot machine. Short instructions require 2 microcode words; more complex instructions can require several dozen.

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TABLE 4. PRINTERS

Model	PUR 0705	PRU 1115	PRU 1515
Type	Belt	Belt	Belt
Max. speed (lpm)	750	1,180	1,540
Paper width	4 to 16 in.	4 to 16 in.	4 to 16 in.
Print positions	136	136	136
Horizontal spacing (char./in.)	10	10	10
Vertical line spacing (lines/in.)	6 or 8	6 or 8	6 or 8
Vertical format	Program controlled	Program controlled	Program controlled
Character sets	48/63/94	48/64/96/special	48/64/96/special
Slew speed (in./sec.)	25	25	44
Powered paper stacker	Optional	Standard	Standard
Printer dimensions (h x w x d)	39 x 36 x 26	45 x 36 x 26	45 x 36 x 26
Controller models	Integral	Integral	Integral
Supported by system models	All	All	All

has subdivided the Questar terminal family into the Questar 400 range of intelligent workstations and the Questar 200 color or monochrome display terminals.

COMPETITIVE POSITION

The DPS 7 line is designed for general business applications, ranging from manufacturing to office automation. A wide variety of activities can be handled by the system, such as administration, management, and distribution. DPS 7 systems have been installed in all types of organizations including banks, local and national administration buildings, and private businesses. The markets covered by the DPS 7 are medium to large organizations needing a centralized system, but which can also use other Bull products in a distributed fashion, usually the DSA networking facilities. With the three fault-tolerant 7/X27 models at the top end of the series, Bull is also aiming at large companies which require a high degree of system reliability.

The DPS 7 Series competes with the IBM 4300 Series. Specifically, the 7/507 competes with the 4341 Model Group 1; the 7/617 is comparable to the 4361 Model Group 5; and the 7/817 competes with the 4381. Other competition includes the Siemens 7.500 Series, the Hewlett-Packard 3000 Series, and the Sperry System 80 which, like the DPS 7, is specifically designed for distributed processing applications and offers a wide range of I/O configurations.

At the low end of the DPS 7 range, competitors include minicomputers such as the IBM System 38, the Hewlett-Packard HP 3000, and Digital Equipment Corporation's VAX family. In Europe, Bull views Digital Equipment Corporation as more of a competitor than IBM because Digital has developed good applications packages that can compete with Bull's packages in the vertical marketplace.

At the present time, the entry-level DPS 7/107S has been particularly successful, due to its price-performance ratio. Bull does not sell the DPS 7 in the scientific marketplace as yet, but might do so in the future.

The control store of the main processor is loaded when the system is initialized. It may contain up to 64K words, enabling the execution of the 64/DPS instruction set. Depending on the model, TTL (transistor-to-transistor logic) or CML (Current Mode Logic) technology is employed. Each firmware word is accompanied by 8 bits of autocorrection code.

Firmware is also used in the DPS 7 to perform functions traditionally performed by software. These include task management, procedure calls, data protection, etc. The use of firmware also permits the DPS 7 to implement the machine instruction sets of the 64/DPS running under GCOS 7, while providing software access to the firmware functions of the DPS 7.

The GCOS 7 operating system makes use of the task management mechanisms implemented in firmware. The main processor is capable of recognizing and controlling a task, a unit of a program more significant than a single instruction. A task is a sequence of interdependent instructions. A program can comprise a number of tasks, each able to execute in parallel with the others (multitasking).

A process consists of all the data and executable code associated with a task plus a process control block, a data structure recognized and manipulated by firmware. When the process stops running for any reason, a snapshot is taken of the main processor's status and stored in the process control block. When the process is restarted, the main processor is reset using the snapshot and the process continues where it left off. The mechanism for storing and reloading the process is completely automatic and works without any software intervention. Many such processes can be simultaneously recognized by the DPS 7, and their execution can be synchronized according to a multilevel priority system.

The DPS 7 uses firmware-controlled semaphores to interpret external events such as physical input/output termination, peripheral interrupts, operator interrupts, and messages from terminals. Using semaphores, it also synchronizes the execution of competing processes, passes messages between processes, and controls competing demands for system services.

A semaphore is a group of words containing a counter and a pointer to an associated queue. When the semaphore counter is negative, all the resources associated with it are busy, and processes are awaiting completion. When the counter is positive, all processes are satisfied and resources are free.

TABLE 5. COMMUNICATIONS CONTROL

Model	DCC 4270	DCC 4271	DN 7130	DN 7131	DN 7132	DN 7133	CN 5105
Number per system (min./max.)	1/2	1	1/4	1/4	1/4	1/4	*
Host couplers	—	—	1	2	2	4	—
Communication lines (max.)	6	4	23	47	79	143	44
Memory (min./max., M bytes)	—	—	1/2	1/2	1/2	1/2	1/2
Type of lines	Async/ sync	HDLC V28/V11	—	—	—	—	—
			—	—	—	—	—
Line controllers (max.)	—	—	2	3	5	9	3
—Line adaptors—V24/syn, V11, V24 async	—	—	6	12	20	36	12
—Among which are V24, V11, V35, and X.21 HDLC adaptors (max.)	—	—	5	7	11	23	5
High-speed controllers (max).	—	—	—	—	2	2	—
—V35, X.21 HDLC lines (min./max.)	—	—	—	—	1/2	1/2	**
ISO 8802.3 controllers (max.)	—	—	1	2	2	2	1
—LAN access points (min./max.)	—	—	1	1/2	1/2	1/2	1
Supported by system models	X07	X07	107S, 307, 407	407, 507	X17/X27/ X17S	X17/X27/ X17S	

**CpNet is remotely connected in a primary X.25 network, no. of CpNet-attachable depends on number of Datanet lines in a DPS 7 System.*
***1 V35/X.21 Line or 1 HDLC/X.21 Line*

ADVANTAGES AND RESTRICTIONS

The uniformity of the GCOS 7 operating system for all thirteen of the models in the DPS 7 line offers many benefits to users, the most notable of which is the capability for upgrading from entry-level models all the way to the top of the line with little or no change in software. Communications software running under GCOS 7 integrates the Bull Questar 200 and 400 terminals and workstations and the Bull Micral 30 and 60 microcomputers in the DPS 7 environment. Users can be assured that their DPS 7 systems will form an integral chain in their overall office automation strategies.

Bull has greatly increased the overall performance of the range with the addition of the new compact, MSU 1007 high-capacity disks. These units supply 2 billion bytes in a low-boy cabinet on the basic model.

The restructured DPS 7 line conforms to Bull's BlueGreen office integration strategy in that the four models of Bull's Datanet network processor integrate the features of the BlueGreen distributed data processing systems. This integration is achieved through Bull's ISO/DSA network architecture. The BlueGreen approach is especially advantageous in the areas of corporate information sharing and communications.

Redundancy is an important consideration for potential buyers, and this feature is supplied by the *27* dual-processor and quadri-processor systems. The *17* models of the series can evolve into redundant *27* models, if customers want that capability.

As the use of graphics becomes more widespread in businesses, users are looking for software that can fill that need. Bull has responded to the graphics demand by supplying GRAPH 7, a graphics package that runs on the DPS 7 systems under GCOS 7. The functions supported by GRAPH 7 include data analysis, decision support, report generation, map making, and diagrams. The two components of GRAPH 7 are DI3000, a set of Fortran subprograms for the creation of two- and three-dimensional

When the counter is zero, all resources are busy but no processes are waiting. This mechanism can be used in any situation involving processes waiting for the completion of any operation.

The DPS 7 provides an automatic firmware-implemented feature called the "call/exit" mechanism which is available with the GCOS 7 environment. Between entry to and exit from a procedure, the call to that procedure is represented by a record containing a work area, a save area, and a communications area. Whenever a call instruction is executed, this record is created and placed in a last-in/first-out (LIFO) queue called a stack. Whenever an exit instruction is executed, the last record placed in the stack is removed. There is one stack for each active process, and whenever a process is initiated, it is automatically provided with extra segments for the stack.

After a call instruction, the record placed in the stack contains all the local variables for the calling procedure, the contents of all the main processor's registers at the time of the call, the contents of the main processor's instruction counter at the time of the call, and any parameters to be passed to the called procedure.

When the exit instruction is executed, the registers and instruction counter are automatically restored from the record removed from the stack so that the calling procedures can continue processing.

REGISTERS: There are eight 32-bit Base Registers for internal address computation, sixteen 32-bit General Registers for data handling and indexing, four 64-bit Scientific Registers for floating-point data handling, one 32-bit Stack Register pointing to the stack associated with the running process, and one 28-bit Boundary Address Register holding the lowest absolute main memory address accessible by software.

ADDRESSING: Running under GCOS 7, the relative addressing mechanism is based on segmentation, and its aim is to make optimum use of memory space. Each program is executed as a collection of fully relocatable segments. A segment can reside in different places. As a program is being executed, its constituent segments can be moved within memory to make room for other programs, and, at a given point in time, some of its segments can be temporarily removed from memory and placed on disk.

figures, and BUSINESS, an interactive product adapted to business graphics.

Bull's other efforts in the software area are reflected by agreements made with software houses that enable the company to increase the number of software packages that can be run on its products. A notable example of Bull's commitment to software expansion is Bull's recent joint agreement with CINCOM SA for the promotion of the MANTIS fourth-generation system. MANTIS is fully integrated with GCOS 7 and can be used with traditional UFAS and IDS 2 files, and also with dedicated files. Bull has also entered into agreements with STEEB of West Germany and Thom'6 of the French Thomson Group.

In January 1985, Bull signed a joint promotion agreement for a set of packages developed by the French software house CISI to enable noncomputer specialists to use the solution center facilities offered on the DPS 7. This facility, known as INFOSERVICE 7, provides direct access to databases.

USER REACTION

Since the Bull DPS 7 was rated by users in Datapro's most recent French and German surveys of mainframe users, we have included both sets of ratings.

The *1986 Datapro Survey of French Users of Mainframes* brought responses from 41 users of Bull DPS 7 computers whose systems had an average life of two years, four months.

To the question, "Did the system do what you expected it to do?", 38 respondents replied yes, and 2 considered it too soon to judge. When asked if they would recommend their systems to another user, 35 answered affirmatively, and 5 were undecided.

Users were asked to evaluate the different aspects of their systems on a scale of 4.0 for Excellent, 3.0 for Good, 2.0 for Fair, and 1.0 for Poor.

French Survey Ratings:

	Weighted Average
Ease of Operation	2.83
Reliability of Mainframe	3.34
Reliability of Peripherals	2.83
Maintenance Service	
Responsiveness	3.00
Effectiveness	3.07
Technical Support	
Troubleshooting	2.54
Education	2.46
Documentation	2.22
Manufacturer's Software	
Operating System	3.15
Compilers & Assemblers	3.02
Applications Programs	2.29
Ease of Programming	2.85
Ease of Conversion	2.41
Overall Satisfaction	2.93

INDEXING: 15 levels.

INSTRUCTION REPERTOIRE: The repertoire consists of 195 instructions, including operations for address computations, and arithmetic instructions for performing decimal and binary operations on packed or unpacked data. Operands can be binary, fixed-point, or decimal in packed or unpacked format, bytes, byte strings, or bit strings. The Scientific Instruction Set adds 26 instructions to the standard set.

CACHE MEMORY: Models DPS 7/617, 7/717, 7/817, 7/617 S, 7/717 S, 7/718 S, 7/627, 7/727, and 7/827 have cache memory units. These units provide very fast access storage for data and instructions. Data and instructions stored in cache can be made available to the main processor up to 5 times as quickly as would be the case if they were retrieved from main memory. Cache memory is implemented in CML technology.

Data is held in cache memory in blocks of 16 consecutive bytes accompanied by autocorrection code. The 7/617, 7/617 S, 7/717 S, 7/817 S, and 7/717 have a capacity of 16KB, while models 7/627, 7/727, and 7/817 have 32KB of cache memory, and the 7/827 has access to 64KB cache memory. For reference purposes, cache memory is divided into 256 areas of 4 blocks each.

INTERRUPTS: There are no interrupts as such. Any hardware or software event is handled through semaphores, combined with a masking feature that is used when high-priority events occur.

INPUT/OUTPUT CONTROL

I/O CHANNELS AND PROCESSORS: The 7/X07 subgroup differs from the 7/X17, 7/X17 S, and 7/X27 models in that it contains integrated and optional I/O channels, rather than using I/O processors. The 7/107 S and 7/307 have two integrated and two optional I/O channels, and the 7/407 and 7/507 have four integrated and four optional channels. The number of I/O processors supported by a system ranges from a minimum of four on the 7/617 to a maximum of 32 on the 7/827.

All models contain one integrated Service and Unit Record Processor (SURP), but, apart from this, the configuration can be tailored to suit the user. Additional service and unit record processors can be added on most models. A SURP handles two essential functions:

- **As a service processor, it carries out both system initialization and maintenance, using dedicated channels to the main and peripheral processors.**
- **As a unit record processor, it controls card readers, diskettes, printers, and the system console. A communications processor is connected as a standard feature on the 7/107 S and is optional on other 7/X07 systems.**

Disk drives are supported by disk processors; the 7/107 S has one standard processor, and optional processors can be added to all systems. The I/O processor used by the 7/X07 models supports eight drives. The 7/X17 and 7/X27 subgroups use single-channel and dual-channel processors, the difference between them being that a single-channel processor controls up to 9 disk accesses and a dual-channel processor can monitor up to 18. The dual-channel controller also allows simultaneous access in read and write modes to the same disk unit.

Three types of magnetic tape processors are offered:

- **Type 1: one level of simultaneity, handles up to eight 9-track PE/NRZ tape drives of 800/1600 bpi, and supports transfer rates of 120K and 200KB per second.**

Bull DPS 7 Series

In the *German User Ratings of Mainframes*, the Bull DPS 7 was evaluated by six respondents whose systems had been in operation for an average of 28.82 months. In response to the question, "Did your system do what you expected it to do?", 100 percent of the users said yes. This perfect score also prevailed in the second key question, "Would you recommend your system to another user?" in the 100 percent affirmative response given by the users.

German Survey Ratings:

	Weighted Average
Ease of Operation	3.17
Reliability of Mainframe	3.67
Reliability of Peripherals	3.33
Maintenance Service	
Responsiveness	2.67
Effectiveness	2.83
Technical Support	
Troubleshooting	3.17
Education	2.83
Documentation	2.33
Manufacturer's Software	
Operating System	3.20
Compilers & Assemblers	3.20
Applications Programs	2.75
Ease of Programming	3.00
Ease of Conversion	3.40
Overall Satisfaction	3.20 □

- **Types 2 and 3: handle 9-track PE/GCR (phase encoded/group coded recording) drives with 800 or 1600/6250 bpi and transfer rates up to 1250KB per second at 6250 bpi. One of these types provides one level of simultaneity and the other type, two. The processor with one level of simultaneity supports 8 drives and the processor with two levels of simultaneity supports 16 drives.**

I/O PROCESSORS: These units are provided on the 7/X17, 7/X17 S, and 7/X27 subgroups. Each I/O processor has a control store of 4K-bit words, a main memory of 2KB, and a maintenance interface. Via a common memory interface unit, the I/O processor can transfer data to either the cache memory or the system's main memory. Four I/O processors are standard on the 7/617 and 7/717, and eight are standard on the 7/817. The 7/617 and 7/717 can support a total of 12 and 16 respectively, while up to 32 processors are available with the 7/817. I/O processor capabilities for the 7/X27 systems are twice those for the corresponding 7/X17 machines.

To help ensure system availability, the DPS 7 includes special channels that allow diagnostic tests to be run and the system to be reconfigured without interrupting user service.

Input/output operations are handled in 7/X17 and 7/X27 machines by an input/output processor, and peripheral or network processors. The input/output processor controls access to main or cache memory resulting from the execution of a channel program associated with an I/O request and generated by the main processor. The main functions of the I/O processor are consequently the reading or writing of data and the reading of channel commands. The peripheral and network processors control the exchange of data with the peripheral or network component involved in the request.

Each input/output processor is a fully independent processor controlling the transfer of data in parallel with other I/O processors in an I/O processor group. An I/O processor group can contain up to sixteen I/O processors and 7/X17 and 7/X27 systems can contain 1 or 2 groups depending on the model.

The operation of an I/O processor is managed by firmware held in a control store of 4K words. Each word contains 48 bits plus 8 autocorrection bits.

An I/O processor also has a memory of 2KB for holding sequences of channel commands being executed and data in transit. Data can be sent to main memory or cache memory in blocks of 16 bytes (a block size which optimizes the bus). This transfer is independent of the transfer speeds of individual peripherals.

Transfers of data to main or cache memory are controlled by a memory interface unit which is common to a group of I/O processors. Each I/O processor group also contains a maintenance interface which enables the service and unit record processor to initialize and test I/O processors. Each I/O processor, and consequently each channel, has a throughput of up to 2.5MB per second. The throughput of a group of I/O processors is up to 20MB per second. These rates permit the execution of more than 300 channel programs per second on a group of I/O processors.

A disk, magnetic tape, or network processor is connected to an I/O processor via a PSI (Peripheral Standard Interface) channel. This channel provides a data path for the transfer of one byte of data plus parity and the transfer of a control signal indicating the sending of a byte, acceptance of a byte, etc. The PSI standard specifies the protocol used in a data transfer for the purpose of executing a channel program, chaining commands, multiplexing several channel programs, etc.

After generating a channel program and requesting its execution, a main processor does not intervene further. Consequently, input/output operations can be executed in parallel with main processing. When a channel program has terminated, the I/O processor informs the Pilot machine.

Another important feature of the 7/X17 and 7/X27 architecture is that there is no direct link between peripherals and main processors. Via the bus, a main processor can launch an input/output operation on any peripheral. The disconnection of a main processor in a dual- or quadri-processor configuration does not affect the availability of peripherals to the other main processors.

Peripheral devices and network components on all models are controlled by specialized peripheral and network processors. Each processor is connected either directly to an I/O channel, or to an I/O processor in the central system.

SIMULTANEOUS OPERATIONS: The peripheral processing subsystems operate simultaneously with the central processor. Each subsystem operates under control of a microprogrammed disk or magnetic tape processor. Each peripheral processor contains its own arithmetic and logic unit, read/write memory, and read-only memory and is attached to the central system through a high-speed channel. The maximum total data rate for each of these systems is listed in the Characteristics Table. All devices and terminals attached to a unit record processor can operate concurrently. Mechanical operations on a disk or tape subsystem, such as seek and rewind, can proceed simultaneously with a data transfer on the same subsystem.

MASS STORAGE

Bull currently offers 3 disk-pack drives for the DPS 7 systems.

MSU0395 MASS STORAGE UNIT: This unit contains 300MB of data in removable disks. Average access time is 38 ms and the transfer rate is 1.2MB per second.

MSU0555 MASS STORAGE UNIT: This unit comprises a cabinet housing two 635MB fixed disk packs, yielding a total unformatted storage capacity of 1270MB. Each disk pack has 20 data surfaces, with 19,060 bytes per track and 1,676 tracks per surface. Average seek time is 25 milliseconds; average rotational delay is 8.3 milliseconds. The peak transfer rate is 1.2MB per second. Rotational speed is 3600 rpm. Each pack is accessed individually by a direct attachment to the mass storage processor. The validity of recorded information is ensured by the insertion of characters of check information (EDAC code: Error Detection and Automatic Correction). In each block of data, data integrity is enhanced by the automatic detection of defective tracks and the bypassing of these areas when writing to disk. A write protect capability allows the user to protect the disk packs individually against inadvertent writing. Online error and status reporting to the central system supports software-controlled diagnosis of the electronics. A built-in hardware diagnostic capability supports rapid offline diagnosis and testing.

MSU 1007 MASS STORAGE UNIT: This unit consists of a cabinet housing two 500MB fixed disk packs, yielding a total unformatted storage capacity of 1,000MB. Each disk pack has 12 data surfaces, with 30,240 bytes per track, and 1,433 tracks per surface. The average seek time is 20 milliseconds; average rotational delay is 8.3 milliseconds. The peak transfer rate is 1.8MB per second. Rotational speed is 3,600 rpm. Each pack is accessed individually by a direct attachment to the mass storage processor. EDAC and error status techniques are the same as those for the MSU 0555.

INPUT/OUTPUT UNITS

MTA MAGNETIC TAPE ADAPTOR: This controller is housed in the CPU cabinet of the 7/X07 models and is connected to the Service and Unit Record Processors (SURP). It controls nine-track tapes of 1600 bpi density up to a maximum of four tape units.

MTP 4370/4275 MAGNETIC TAPE PROCESSOR: This processor controls 9-track tape with a recording density of 800 or 1600 bpi controlling simultaneously up to 8 tape units.

MTP 4472/4572 MAGNETIC TAPE PROCESSORS: These units control 9-track tapes with recording densities of 1600 or 6250 bpi. The MTP 4472 controls up to eight units in its single-access version; the dual-access version MTP 4572 controls up to 16 units. The MTP 4572 is connected to the central system of the DPS 7 via two input/output processors.

Each MTP can be fitted with an optional manual channel switch permitting it to be shared by two DPS 7 systems in a coupled configuration.

MTU0320/MTU0321 MAGNETIC TAPE UNITS: These 9-track units operate at 45 inches per second and transfer data at 72KB per second at 1600 bpi.

MTU0420/MTU0421 MAGNETIC TAPE UNITS: These 9-track units operate at 75 inches per second and transfer data at 120KB per second at 1600 bpi.

MTU0432 MAGNETIC TAPE UNIT: This unit operates at 75 inches per second and transfers data at 120KB per second at 1600 bpi. Error-correcting features include read after write. Up to 8 drives can be connected to an MTP controller.

MTU0532 MAGNETIC TAPE UNIT: This unit has the same specifications as the MTU0432, except that it operates at 125 inches per second and transfers data at 200KB per second at 1600 bpi.

MTU0437 MAGNETIC TAPE UNIT: This unit operates at 75 inches per second and transfers data at a maximum rate of 468KB per second. Tape density is 1600 or 6250 bpi.

MTU0537 MAGNETIC TAPE UNIT: This unit has the same specifications as the MTU0437 except that the operation speed is 125 inches per second, yielding a maximum transfer rate of 781KB per second.

SERVICE AND UNIT RECORD PROCESSOR (SURP): This integrated controller has 5 device ports plus ports dedicated to the console and communications. A second processor, the SURP 4371, can be added, providing 3 more device ports plus a second communications port. Each peripheral device connects to a device port via an addressing attachment.

CRU0301 CARD READER: This tabletop unit reads at 300 cards per minute and has 1,000-card input and output hoppers. Options include IBM and Honeywell mark sensing adapters.

CRU0501 CARD READER: This tabletop unit reads at 500 cards per minute, but is otherwise the same as the CRU0301.

DDF4051/DDU4055 DISKETTE DRIVE: This unit has a capacity of 492KB on one drive. The transfer rate is 31.3KB per second.

DDU4056 DISKETTE DRIVE: This unit has a capacity of 985KB on two drives. The transfer rate is 31.3KB per second.

PRU 0705 BELT PRINTER: This unit has print belts with flexible fingers, a system already used in a range of Bull products. The nominal speed of the PRU 0705 is 650 lines per minute, the speed depending on the belt type and character set used:

48-character set—750 lpm
63-character set—650 lpm
94-character set—500 lpm

Belts are provided for individual countries and also for accounting applications. There are 136 print positions per line at 10 characters per inch. An English or French operator panel is offered.

PRU 1115 LINE PRINTER: This printer operates at a nominal speed of 900 lines per minute. Its speed is dependent on the character set used:

48-character set—1,180 lpm
64-character set—900 lpm
96-character set—686 lpm

There are 136 print positions per line at 10 characters per inch. Special character sets are also available. An English or French operator panel is offered.

PRU 1515 LINE PRINTER: This printer operates at a nominal speed of 1,200 lines per minute. The speed is dependent on the character set used:

48-character set—1,538 lpm
64-character set—1,200 lpm
96-character set—940 lpm

Special character sets are also available. There are 136 print positions per line at 10 characters per inch. An English or French operator panel is offered.

Bull DPS 7 Series

COMMUNICATIONS CONTROL

The DCC 4270 and 4271 Communications Controllers interface with the Service and Unit Record Processor. Through optional communication processors on the 7/X07 models, they provide up to 6 lines at a maximum speed of 19,200 bits per second in any mixture of synchronous and asynchronous modes.

In addition to directly supporting terminals, a DPS 7 system can support one or more remote batch, interactive job entry, or transaction processing DPS 6 satellite systems. DPS 7 systems can also be configured into dual, coupled systems that can share the same database and peripherals.

The Bull Datanet 7100 processors are designed to act as front end to Bull mainframes, such as the DPS 7. Although they can operate as remote communications processors, this function really belongs to the Bull CpNet which is designed for switching, concentration, and gateway services in a LAN or WAN environment. Both the Datanet and CpNet operate within Bull's Distributed Systems Architecture (DSA) environment and support Bull's BlueGreen strategy which is intended to provide improved networking capacities and compatibility across its entire product range.

Datanet and CpNet support the rules and protocols of the International Standards Organization's Open Systems Interconnection (OSI) in which all components in a network cooperate as peers with no hierarchical or other specific function required. DSA supports most public or private X.25 packet switched and X.21 circuit switched networks. It uses the HDLC protocol.

The Datanet range consists of four separate models: DN 7130, DN 7131, DN 7132, and DN 7133. The first model launched in the CpNet family is the CN 5105. Both ranges are based on Bull DPS 6 computer architecture. A basic CpNet or Datanet configuration consists of a 16-bit central processor and 1MB to 2MB of main memory. Modular in design, the CpNet and Datanet ranges have Megabus asynchronous bus links to all major modules, including the processor, performance and power extensions, and memory and device controllers. The DN 7130 supports up to 23 communications lines, the DN 7131 up to 47, the DN 7132 up to 79, and the DN 7133 up to 143 lines.

The CN 5105 consists of 44 communications lines, one LAN controller, and an integrated remote-loading feature which allows the CpNet software to be loaded and initialized over a primary network line or a LAN.

A host subsystem inside each Datanet model ensures connection to host computers through specialized microprogrammed couplers plugged into the Megabus. The host couplers provide the interface channel between the Datanet and the PSI channel of the DPS 7. Multiple couplers can be configured on a single Datanet, each providing the interface for one host channel. Channels can belong to the same or different hosts. Of the four Datanet models, DN 7130 provides one host connection, DN 7131 and DN 7132 provide two, and DN 7133 provides four. The couplers offer format conversion, control interface logic, and they support tests and downline loading. On DPS 7 mainframes, the host/Datanet connection is governed by the DSA Transport Protocol layer.

Communications within the primary network conform to the layered ISO and DSA protocols. Elements of the primary network can include Datanet or CpNet and distributed DPS 6 systems. Datanets can be configured as front ends, concentrators or switches, and can provide access to any type of host system or secondary network. Connections are made via dedicated lines or via packet switched or circuit switched networks using the HDLC protocol. CpNet can be configured as a concentrator, LAN or WAN gateway or switch, and can be remotely linked to any type of host system, including IBM systems such as System/370 (excluding 115 and 125) or 303X.

The secondary network includes terminals and computers that do not contain their own DSA mailboxes. Their physical connection can be local (direct-connect) or remote (via a modem over switched or dedicated lines or circuit or packet switched networks). Protocols supported by the secondary network include TTY, RCI, VIP, BSC, and X.25. Datanet and CpNet can be used to build a private X.25 network in which non-Bull systems can be linked up via a PASS-THROUGH function in an ISO-DSA environment.

Since Bull's version of DSA complies with the International Standards Organization's OSI reference model, Datanet and CpNet provide a natural connection point to ISO-based workstations from other vendors. These are able to access Bull DSA applications via the Open Systems Facilities (OSF) feature in Datanet's DNS (Distributed Network Supervisor) operating system. The OSF package also enables Datanet and CpNet to act as a DSA/SNA gateway providing IBM SNA access and file transfer between Bull and IBM mainframes via Bull's proprietary Unified File Transfer (UFT) application.

The lynchpin of Bull's communications strategy is the BlueGreen concept. Originally launched at SICOB in September 1985, BlueGreen is a new approach to corporate information processing and communications. BlueGreen refers to the capability of linking Bull's various data processing, communications, and office automation products to ensure that communications can occur between corporate, departmental, and group/personal computer systems.

Depending on the size and nature of the business, the central system in the BlueGreen concept can be a Bull DPS 4, DPS 7, DPS 88, DPS 90, or other mainframe. Within the BlueGreen configuration, a Bull DPS 6 running the DOAS 6 distributed office automation system acts as the file station, and workstations can be based on the Bull Questar 200 or 400 terminals, Bull Micral 30 or 60 microcomputers, or other systems. The BlueGreen strategy encompasses all the major data processing and communications functions such as file creation, storage/classification, processing, retrieval, queries, and communications.

Datanet processors make it possible to respond to and support the following types of procedures and terminals:

- Asynchronous, character mode line procedure
- KSR 33/35

  TN 300/1200
  TTU/8124/8126
  DTU 7172 (DTU 7171 mode)
  DKU 7001

- VIP synchronous line procedure

  HDLC
  VIP 7001/7002
  VIP 770/7760
  TTU 8221/8223
  STS 2840
  BSC

- 3270 synchronous line procedure

  Questar 200 Series range of synchronous and asynchronous display terminals and monochrome and color cluster display terminals.

Questar 400 Series intelligent distributed processing terminals, connected via Datanet 7100 either by emulating a Bull DK 7107 terminal, by an X.25 link through DSA and the UFT package, or by emulating IBM 3270. Questar 400 workstations can also be linked via applications programs such as Microfit 400, based on the Microfit 7 data transfer package. Microfit 7 enables users to set up a distributed information system based on Questar 400 terminals and Micral 30 personal computers.

- Satellite Systems

  DPS 6
  BlueGreen

- Public networks

  X.25 virtual-circuit packet switching, e.g., DATEX P, TRANSPAC

  X.21 circuit switching, e.g., DATEX

OPERATING SYSTEM

All DPS 7 models run under the GCOS 7 operating system which is available in three versions according to the size of the machine. GCOS 7-ES (Entry System) is available on the 7/107S, 7/307, and 7/407; GCOS 7-MS (Medium System) runs on the 7/307, 7/407, 7/507, and 7/617, and 7/617 S; and GCOS 7-LS (Large System) is for models 7/617, 7/717, 7/817, 7/627, 7/727, 7/827, 7/617 S, 7/717 S, and 7/817 S. The LS version can manage a greater number of central processors and terminals.

GCOS 7 is fully compatible with the earlier GCOS 64 operating system. It supports batch, remote batch, transaction, and interactive processing. Within GCOS 7 are three sets of products for development, production, and information processing.

The development system contains high-level languages, program generators, and interactive facilities such as debugging. The production system, which is intended for use in the processing of large amounts of data, includes the database management system, transactional monitor, and recovery tool. The information system is designed for nonexperienced users and contains a data and document handling system, and a graphics display.

The nucleus within GCOS 7, called System Support, allocates basic system resources, and includes:

- Virtual Memory Manager
- CPU Dispatching Automatic Control Manager
- Peripheral Interrupt Manager
- Device, Volume, and File Manager
- Online tests and diagnostics

In addition to System Support, Supervisory Functions are available under GCOS 7 for all 3 versions of the operating systems (ES, MS, and LS). These are:

- Menus
- Job management, including accounting and output reports
- FORMGEN, screen form generator
- Security and recovery mechanisms, including logging and checkpoint-restart
- Data management, including sort and merge of files, and privacy and access rights functions
- Program management, including library, text editor, linkage editor

GCOS 7-LS also contains the following functions: physical memory management, multiprocessor management, management of over 40 simultaneous interactive users, and virtual memory management of several disks.

The file management routines of GCOS handle allocation and deallocation of space for files, automatic label checking, automatic volume recognition, control of multiple concurrent accesses to files, and control of multiple copies and generations of files through the catalog. Additionally, they provide various access methods to different file organizations and they also provide file and volume utilities to support file housekeeping.

Disk files can be shared under GCOS 7. However, if file sharing is required, multiple access can occur only in read mode. If different jobs are to be run in parallel, GCOS provides General Access Control. GAC ensures the prevention of uncontrolled file updates and the establishment of coherent values of data stored in one or more files or databases, where such items are linked by logical relationships. GAC is needed only when concurrent updates are required. The sharing of a file in read mode only does not require any special action or the use of GAC.

The main file access system of GCOS 7, the Universal File Access System (UFAS), replaces random, sequential, and indexed sequential files. UFAS satisfies all the requirements of the ANSI Mass Storage Task Group recommendations for sequential, relative, and indexed access. It is independent of device characteristics, file organization, media addresses, and media formats.

Programs can access data sequentially, randomly by key, directly, or directly by relative position on the same UFAS file. The access method can change every time the file is accessed. UFAS file scan can be indexed or nonindexed. If indexes are used, they can be multiple-level, and records with indexes can be intermingled with records without indexes. UFAS can handle fixed-length, variable-length, and dynamically variable records, and a UFAS file can contain a mixture of different record types.

The file organization of a UFAS disk file is based on control intervals and control areas containing embedded freespace, thereby eliminating the need for overflow areas. When records are inserted into a UFAS file, they can be physically located in their logical positions on the file; access time is reduced and the need for frequent reorganization removed. In addition, the physical record sizes in a UFAS file are independent of the lengths of the logical records. When the file is moved from one medium to another, the physical record size can change to adapt to the new medium without affecting the file or the programs using it.

UFAS includes access to specific file items by any one of 15 characteristics without a prior sort. A dynamic file extension facility allows extension of files as required.

GCOS also supports classical files with the Basic File Access System (BFAS). BFAS includes three subsystems:

- Basic Sequential Access, which supports sequential files on disk units, EBCDIC code, and on tape using either EBCDIC or ASCII code. Records can be fixed, variable, or undefined.
- Basic Indexed Sequential Access, which supports indexed sequential files on disk. Files can have up to six levels of

index, with the highest level index being resident in memory. Overflow space can be reserved within the prime data areas on separate cylinders within the file.

- Basic Direct Access, which supports access by relative record number and by complete or partial physical address to disk-based files. Basic Direct Access includes a number of established randomizing algorithms.

DATA COMMUNICATIONS SOFTWARE

The GCOS 7 data communications software, together with the communications hardware and firmware, handles networks either through DCC 427X or through DN 713X. A network can include switched, private, and direct-connect lines as well as a variety of terminal types.

The *Frontal Network Processor Support* (FNPS) system manages the interface between DPS 7 and Datanet. It consists of two modules:

- A transport module that provides realtime functions when data is exchanged between a DPS 7 and Datanet 7100;
- An administration module which, among other functions, generates Datanet software and sends statistics collected by the Datanets to GCOS 7 system files.

FNPS is mandatory when users connect a Datanet to a DPS 7 system. FNPS-ES runs in a GCOS 7-ES environment and can handle one Datanet (DN 7130 only). FNPS-MS runs in a GCOS 7-MS environment and can handle one or two Datanets. FNPS-LS runs in a GCOS 7-LS environment and can handle up to four Datanets.

Transaction Driven System (TDS Standard Processor) is a conversational system for handling a message entered by a user via a terminal; the initiation of a processing routine specific to that type of message; the processing of the message; and the response sent to the terminal. A library of mostly user-written transaction processing routines (TPRs) corresponds to the various types of messages accepted by the system. TDS can handle several dozen different transaction types in a single session. Time and memory space are optimized by utilizing a single copy of a TPR even though the requests for that TPR may come from different terminals. TDS provides a batch interface allowing batch programs to interface with it as if they were terminals. This facility is particularly useful in debugging the transaction system without incurring realtime constraints. TDS has access to all files supported by GCOS as well as concurrent access control, journalization, and file recovery of UFAS files. Security is provided through controlled file access and authority codes. All input messages to TDS are journalized to guard against information loss.

The optional *Transactional Context Restart Facility (TCRF)* is used to restart interrupted transactional applications in TDS in the event of a system breakdown or on a backup system in a minimum amount of time, without stopping the system from operating. Warm start is effected by fully transferring the transactional environment, including the After Log of the interrupted system. The backup system does not have to be coupled to the failed system, but it must not be operating in transactional mode to avoid conflicting with the After Log.

GT.Writer provides SYSOUT functions for terminal users. The end user visibility is the same as for the standard GCOS 7 output writer. The principal features of this optional package include support for up to 450 terminals; network administrator concept; access from TDS, IOF, and batch programs; unique set of operator commands; restart after failure; support of any terminal recognized by GCOS 7; output security and privacy; and output rerouted from GT. Writer to the main printer or an RBF (Remote Batch Facility) station.

The *Remote Batch Facility Level 6 (RBF)* is used to receive jobs from a DPS 6 or its predecessor, the Mini 6, to request execution on DPS 7 and to send output reports to the DPS 6/Mini 6. These activities run simultaneously on disk, diskette, or magnetic tape.

The *File Transfer Facility Level 6 (FTF 6)* is used for exchanging files between a DPS 7 and a DPS 6/Mini 6. Files to be transferred must be organized sequentially with fixed-length records.

The *DSA File Transfer/Unified File Transfer (UFT)* package is used to transmit data bidirectionally between two DPS 7s via a DSA primary network. It also allows data to be exchanged with other products that have their own UFT. Data is transmitted record by record, regardless of the organization of the file supported by GCOS 7. Data held in the records can be compressed prior to transmission. Each DPS 7 can transmit several files simultaneously.

Distributed Job Processing (DJP) ensures that the full power of GCOS 7 software can be used in a distributed environment. DJP provides dialog between DPS 7 systems in a DSA network. Its main functions include submitting batch reports; receiving output reports; monitoring remote batch jobs; routing user messages to a system within the network; working in interactive mode between two DPS 7 systems; automatically chaining or initiating remotely submitted batch jobs at a given time.

Use of the DJP depends on the presence of a DSA File Transfer (UFT).

Microfit 7 is a data transfer package that is used to set up links between DPS 7, Questar 400, workstations, and Bull Micral 30 and 60 microcomputers within a GCOS 7 information system which can easily be accessed by nondata processing specialists.

DATABASE MANAGEMENT SOFTWARE

DATABASE MANAGER (DBM): This package manages, administers, maintains, and monitors an IDS II (Integrated Data Store) database. It includes an integrated IDS II database manager; a database utility for creating, administering, and validating IDS II databases; a DB DIALOG utility for interactive dialog with a database by means of direct use of the DML Cobol verbs related to IDS II databases.

DBM DATABASE REORGANIZATION (DBREORG): This package can be used by the database administrator to alter the organization of the database, and in some cases, to modify its content. The reasons for reorganizing the database include database is full; schema no longer satisfies requirements; performance is inadequate.

DBREORG runs in interactive or batch environments.

INTEGRATED QUERY SYSTEM (IQS): An interactive data inquiry language, IQS gives users fast access to company data. The information is displayed on a screen or printed in a standard format. IQS furnishes a virtual view of data to suit the user's requirements. It consists of the following modules:

- IQS: Basic Functions—designed for data processing staff who have an in-depth knowledge of the system. It allows them to develop simple or complex inquiries to solve users' problems.

Bull DPS 7 Series

- IQS: Line Driven—designed for occasional users of IQS in which inquiry is built up one line at a time;
- IQS: Menu Driven—provides inexperienced users with menus at all stages of inquiries;
- IQS: Update—allows users to modify data. It is covered by all the data protection and integrity features contained in GCOS 7. If several users working from the same virtual view of data are modifying data at the same time, the General Access Control Option is required.

PRODUCTIVITY AIDS

INTERACTIVE DEVELOPMENT FACILITY (IDF): IDF operates in an interactive GCOS 7 environment and enables the system administrator to control access to data contained in files according to the needs of the various system users (catalog); manage files and volumes (interactive utilities); build well-defined fields of activity for the various system users through Command Management.

Command Management is a menu-oriented processor that operates in incremental modes with user aids. It features the following three functions: enables users to create and maintain their own user commands written in GCL; enables users to group system commands and user commands into fields of activity such as payroll, inventory, or accounts; enables users to create and manage the links between the environments and the catalog, basically relating an environment to one or more users.

FULL SCREEN EDITOR (FSE): FSE is a GCOS 7-based text editor that provides full screen creation and maintenance of library files. FSE is menu-driven and contains an extensive help system.

INTERACTIVE DESIGN APPROACH (IDA): IDA consists of three modules:

- IDA-DSL SPEC provides development teams with tools for defining specifications for applications such as procedures, data, data transformation rules. Organizational resources are introduced and checked via the Dynamic Specification Language (DSL) nonprocedural language.
- IDA-DSL SIMU simulates systems specified via IDA-DSL SPEC according to the simulation procedures entered by the analyst.
- IDA-DSL PROTO uses prototyping parameters to build a reduced-scale prototype of the systems specified via IDA-DSL SPEC.

SINDIA 7 is both a method and a set of tools for simplifying the development of transaction processing applications running under TDS. Based on an approach that breaks down the dialog into several basic processing units, SINDIA 7 handles applications analysis, transaction definition, transaction environment definition (forms, messages, etc.), prototyping, program definition, documentation generation, and applications maintenance.

SINDIA 7 enables users to generate applications using synchronous VIP and Questar terminals, including color terminals.

DATA DICTIONARY: This information on a user's files, programs, transactions, procedures, and data.

PROGRAMMING LANGUAGES

Bull provides Cobol, RPG II, Fortran, Basic, Pascal, PL/1, APL, and GPL (GCOS Programming Language) for the DPS 7.

Cobol: DPS 7 Cobol conforms to ANSI 74 standards, including those of the MSTG (Mass Storage Task Group).

RPG: The RPG II language processors used in the DPS 7 system permit the interchange of data files among RPG II, Fortran, and Cobol programs. Object programs written in RPG II can also be linked with programs written in Cobol, Fortran, or other languages.

Fortran: DPS 7 Fortran meets the ANSI 77 standard and provides several extensions.

The language processor consists of two packages: the Fortran compiler and the Fortran runtime package. Fortran requires the implementation of the scientific instruction set. The language processor executes either in compile-only environment (with or without the production of compile units) or in a compile-and-go environment in which the output is submitted directly to a linking loader and the resulting program is executed as part of the job stream.

Basic: DPS 7 Basic is an incremental compiler that checks syntax and generating object code at the input of each instruction. Under GCOS 7, Basic programs can be developed and executed in either batch or interactive modes.

PL/1: GCOS PL/1 meets the ANSI standard. It also offers extensions designed to facilitate structured programming: for example, DO . . . UNTIL. It can call for routines written in Cobol and manipulate standard GCOS 7 files (BFAS, UFAS, MLDS). PL/1 is also able to manipulate processing of magnetic tapes containing ASCII files or files of a nonstandard format or record through the facilities provided by GCOS 7 data management.

APL: APL, like Basic, is designed to be used by nondata processing personnel. APL is implemented in a GCOS 7 interactive environment and from specialized terminals (for example, from the Anderson-Jacobson AJ 510 terminal).

GCOS 7 APL makes it possible to work on scalar variables, vectors, sets, and tables with a maximum of 15 dimensions. The usual functions of APL are available, and users can define and integrate their own functions.

Pascal: The GCOS 7 Pascal processor handles three language levels: Pascal as specified by ISO 7185 standards (including adjustable array parameters); SOL Pascal which features additional specifications to the ISO standards such as separate compilation of routines, calls to procedures written in other languages, and dynamic file assignment; and GCOS 7 Pascal which features several additional features such as string handling.

GPL: The GCOS Programming Language (GPL) is oriented toward the development of system software. Similar in some ways to PL/1, GPL has a free format syntax capable of manipulating strings of bits and list structures, and has powerful data declaration and manipulation capabilities.

APPLICATIONS SOFTWARE

Bull states that software houses are increasingly developing application programs and languages that will run under GCOS 7. The latest company to do so is CINCOM SA, with whom Bull recently signed a joint agreement for the promotion of the MANTIS fourth generation system. MANTIS is fully integrated within GCOS 7 and can be used either with traditional UFAS and IDS 2 files or with dedicated files. The system is now operational at a number of Bull DPS 7 sites in Europe.

A set of application packages such as the MRP II-based IMS 7 covers manufacturing requirements for management and communications in the areas of accounting, procure-

ment, sales, production, research, and decision support. Agreements have been signed with STEEB of West Germany, SPA, McCormack and Dodge, and THOM'6 of the French Thomson Group to satisfy the specific needs of the various countries covered by Bull's sales network.

In January 1985, Bull signed a joint promotion agreement for a set of packages developed by the French software house CISI to enable noncomputer specialists to use the solution center facilities offered on the DPS 7. This facility, known as INFOSERVICE 7, provides direct access to databases. It consists of the three following modules:

- ATHESA—interactive querying and analysis of hierarchical databases;
- PRIAM—software handling analysis and modeling for management of numerical tables; and
- CISIGRAPHE—software for graphic formatting of data.

BULL APPLICATIONS SOFTWARE:

MISTRAL V5: MISTRAL V5 is an information retrieval package which can be accessed from videotex terminals. The extended version offers document base creation and query facilities without any limitation on the number of users. Its main functions are retrospective search for use when a user requires all the information available on a particular subject; and selective dissemination for use when a user needs updating on the latest documentation available in a particular field.

The MISTRAL V5 FULL TEXT module supplies document base management facilities in full text format. MISTRAL V5 FACTUAL DATA enables the user to administer numerical databases. Calculations can be made on the information contained in the database, and the results are presented in tabular form via a simple nonprocedural language.

STA 7: An office automation package, STA 7 runs under the TDS transaction driven system and uses the IDS database system. It integrates word processing, electronic mail, filing/archiving, and document searches with existing applications. STA 7 is menu-driven and includes prompts and help functions.

GAV: This package simplifies the creation of TDS-based videotex applications. It furnishes a dedicated videotex service with the following functions: interface to user applications, screen management, message distribution and handling, document creation and management, and videotex administration (statistics and user billing).

GRAPH 7-DI300: A graphics package, GRAPH 7-DI3000 includes a set of Fortran subprograms which enable programmers to create and manipulate two- and three-dimensional objects. It offers general graphics tools such as image building and graphic primitives, 2-D view generation, and editing tools. Specialized functions are available for scientific, technical, typographical, and cartographical applications.

CS—Financial Control System.

GRAPH 7-BUSINESS: An interactive product, GRAPH 7-BUSINESS is particularly suitable for the creation of business graphics. It is designed for the nonspecialist user.

LIS-V2: A statistical inquiry package, LIS-V2 is an interactive decision support tool which can be adapted for use with national languages. Written in APL, LIS-V2 uses Questar terminals to extract information from a database. It produces statistical data in the form of graphs or bar charts, or as files which can be directly accessed by GRAPH 7.

AJACS (Automatic Job Accounting System): AJACS is offered in an entry version and an extended version. Operating in a batch environment, the entry version generates reports for monitoring the computer system and for optimizing the overall work load. The extended version is a comprehensive system for control, billing, performance evaluation, and computer resource planning. It prints several types of reports, such as tables and graphs using information provided by GCOS 7.

IMS 7 (Industrial Management System): IMS 7 is a set of modules designed for manufacturing companies. The following applications are covered: inventory management, customization of applications, bill of materials, orders and demands, materials requirement planning, standard cost control, materials management (runtime option), materials management (source code option), work center and routing management, capacity requirements planning, finite capacity option, master production scheduling, statistical forecasting, and purchasing.

FCS-EPS Financial Control System: FCS-EPS is a financial language that includes functions for forecasting, tax calculations, inflation accounting, and statistical analysis.

REMOTE MAINTENANCE SYSTEM DPS 7: RMS DPS 7 consists of a remote console interface adapter and software diagnostic interface modules to provide an extension to the system console for field engineers. The engineers are remotely located and connected via phone lines. Remote Maintenance System DPS 7 supplies the capability for troubleshooting hardware and firmware problems as well as software bugs. With this facility, key diagnostic programs that occur under DPS 7 GCOS can be remotely executed; correction of many software difficulties can be accomplished without on-site visits. Remote Maintenance System DPS 7 operates only when the system is in maintenance mode and provides documentation of all communications via the system console.

SERVICE AND SUPPORT

MAINTENANCE: The 1-year and 3-year basic monthly rentals entitle the user to 176 hours of central processor usage per month with on-call remedial maintenance between the hours of 8 a.m. and 6 p.m. on Mondays through Fridays. For scheduled usage beyond this period with on-call maintenance service, the user pays an additional charge which is a fixed percentage of the monthly maintenance charge. As an alternative, the user can obtain on-call maintenance service at standard hourly rates.

TRAINING: Courses lasting between 2 and 9 days are available and must be paid for separately by the customer. Introductory courses are run for both hardware and software, and more detailed software courses cover programming using high-level languages, IDS II database management system, QUERY, MISTRAL V5, and videotex.

DOCUMENTATION: Complete documentation in French and English can be obtained from Bull's documentation center at the following address: CEDOC, Parc Industriel d'Incarville, B.P. 110, 27100 Le Vaudreuil Ville Nouvelle, France.

PRICING

EQUIPMENT: DPS 7 equipment is available for purchase or for rent under a 1-year, 3-year, or 5-year lease.

SOFTWARE: Generally, the basic operating system, basic job management and file systems, programming tools such as linking and debugging aids, the job control language, and conversion aids are provided at no additional cost. Monthly license fees are charged for language processors, utilities, application packages, communications software, and advanced job management and file systems.

Bull DPS 7 Series

EQUIPMENT PRICES

		Purchase Price (FF)
DPS 7/107S	2MB main memory, three 300MB disk drives, one 750 lpm printer, 1 communications processor with 3 lines, and basic software + Cobol + TDS	1.100.000
DPS 7/307	4MB main memory, five 300MB disk drives, one magnetic tape (80KB), one 1,180 lpm printer, and 1 communications processor with 6 lines	1.900.000
DPS 7/407	4MB main memory, 4000MB disk store, one magnetic tape (468 KB), one 1,180 lpm printer, and 1 communications processor with 6 lines	3.000.000
DPS 7/507	8MB main memory, 4000MB disk store, two magnetic tapes (468KB), one 1,180 lpm printer, and 1 communications processor with 6 lines	3.900.000
DPS 7/617	6MB main memory, 5000MB disk store, 4 magnetic tapes (1250KB), two 1,180 lpm printers, and 1 network processor with 13 lines	6.000.000
DPS 7/627	6MB main memory, 5000MB disk store, 4 magnetic tapes (1250KB), two 1,180 lpm printers, and 1 network processor with 13 lines	8.300.000
DPS 7/717	8MB main memory, 10,000MB disk store, 4 magnetic tapes (1250KB), two 1,180 lpm printers, and 1 network processor with 35 lines	9.100.000
DPS 7/727	8MB main memory, 10,000MB disk store, 4 magnetic tapes (1250KB), two 1,180 lpm printers, and 1 network processor with 35 lines	11.900.000
DPS 7/817	8MB main memory, 20,000MB disk store, six magnetic tapes (1250KB) two 1,180 lpm printers, and 1 network processor with 51 lines	13.600.000
DPS 7/827	8MB main memory, 20,000MB disk store, six magnetic tapes (1250KB) two 1,180 lpm printers, and 1 network processor with 51 lines	17.500.000
DPS 7/617S	4MB main memory, 4000MB mass storage on 6 spindles, one 6250 bpi and 200 ips tape drive, one 1,180 lpm printer, 1 DN 7130 Datanet network processor with 15 communications lines	4.200.000
DPS 7/717S	8MB main memory, 4000MB disk storage, two magnetic tape drives, two printers, one DN 7132 network processor with 30 communications lines	6.100.000
DPS 7/817S	8MB main memory, 4000MB disk storage, two magnetic tape drives, two printers, one DN 7132 network processor with 57 communications lines	7.900.000

CpNet Pricing:

The Bull CpNet is available for purchase only. Its network supervisor package is marketed on a onetime fee basis. Quantity discounts are offered for the Bull CpNet and its software package.

Wide Area Network Multi-Server Environment configuration: Bull CN 5105 (hardware and software) with operator console, one 5¼-inch diskette, 1 MB of main memory, 7 synchronous/asynchronous lines, and 1 HDLC line: purchase price—212.000 FF; monthly maintenance charge—1.350 FF; onetime software package fee—50.000 FF plus monthly software support charge of 500 FF.

Local Area Network Multi-Server Environment configuration: Bull CN 5105 (hardware and software) with operator console, one 5¼-inch diskette, 1MB of main memory, 3 synchronous/asynchronous lines, 1 HDLC line, and 1 local area network controller: purchase price—237.000 FF; monthly maintenance charge—1.480 FF; onetime software package fee—50.000 FF; monthly software support charge of 500 FF plus LAN monthly software rental and support charge of 1.780 FF.

Datanet Pricing:

Bull DN 7130 (hardware and software) with operator console, 1MB of main memory, 1 host attachment, 15 synchronous/asynchronous lines, and 1 local area network controller: purchase price—343.000 FF; monthly maintenance charge—2.039 FF; monthly software rental—3.730 FF.

Bull DN 7133 (hardware and software) with operator console, 2 MB of main memory, 4 host attachments, 119 synchronous/asynchronous lines, 6 HDLC lines, 1 high-speed controller: purchase price—2.310.000 FF; monthly maintenance charge—11 210 FF; monthly software rental—8.130 FF. ■

Bull DPS 7

Product Enhancement

The addition of two new high-end models to the DPS 7 Series, the DPS 7/1017 and DPS 7/1027, moves the series onto a more powerful plateau that offers users machines in the 6 to 10 MIPS range, and, in effect, triples the power of the series. Unlike the earlier models in the DPS 7 Series which were developed by Bull, the 7/1017 and 7/1027 were developed by the NEC Corporation which also furnishes Bull with the DPS 90 mainframes.

The single-processor DPS 7/1017 and the dual-processor DPS 7/1027 run on the GCOS-7 XLS operating system, a new version of GCOS-7. The GCOS-7 XLS is capable of managing up to 2,500 terminals, 32 databases, and 400 shared files. It is also capable of dynamically reconfiguring the system.

Based on CML (Current Mode Logic) technology, the new models have a cycle time of 45 nanoseconds, a cache memory of 32KB, and a main memory of 64MB. They can make use of the peripherals that have been designed for use with the DPS 7 line.

In terms of price, a typical configuration of the DPS 7/1027 with 32MB of main memory, 8MB disk storage, 2 tape drives (6250 bpi), 1500 lpm printer, and two Datanet network processors for 158 lines will be offered for about 26 MF.

Bull has also introduced three new models to the low-end of the line: DPS 7/307S, DPS 7/407S, and DPS 7/507S. These models are offered in compact configurations, integrating fixed disks (MSU 1007), a Datanet 7135 network processor, and new (MTU 047) magnetic tapes capable of functioning in streaming mode. A typical configuration of the DPS 7/407S with 4MB of main memory, 2GB storage, tape drive, and a Datanet processor starts around 2 MF.

The Datanet communications processor has been packaged as a new version, responding, in terms of price, to the needs of the 7/407S system. It includes new DNS software that supports ISO/DSA and supports a maximum of 15 lines.

In addition, Bull has released a new version of GCOS-7 that can be run throughout the entire range. It will offer increased transaction processing capabilities and OSI applications layer compatibility with IBM's IMS/MVS systems. □