

Mohawk Data Sciences Series 21

MANAGEMENT SUMMARY

The modular design and multifunctional capabilities of the MDS Series 21 distributed data processing systems allow users to easily expand systems to include additional applications such as customized programming via Cobol and Mobol.

The Series 21's CP/M compatibility extends this ability to Basic, Fortran, Pascal and 'C,' as well as many CP/M compatible software packages, office support tools (electronic spreadsheet, electronic filing, word processing and report generation), and a wide range of batch and interactive communications emulators utilizing asynchronous, bisynchronous, SNA/SDLC, and X.25 protocols at speeds up to 9600 bps. This allows the Series 21 family to communicate with the mainframes of most major vendors.

WINC, MDS' Worldwide Integrated Communications, is also available on all appropriately configured Series 21 systems. This versatile network service allows Series 21 users to communicate with other Series 21 terminals or other communications networks throughout the world.

Series 21 systems allow users to choose from a wide variety of peripherals including disk drives (2.6 to 156 MB), tape drives, and printers (40 cps to 300 lpm).

The MDS Series 21 distributed processing system is offered in three versions comprising six models. The three versions which utilize these models are known as Single-Station Systems, Multi-Station Systems, and Advanced Performance Systems. The six models are the 21/10, 21/20, 21/40, 21/50, 21/60, and 21/70. The configuration determines the model used.

A distributed data processing system with capabilities including data entry, concurrent processing, on-line teleprocessing, word processing, multi-programming and user-programmability.

The Series 21 is comprised of six models in three basic versions: Single-Station Systems, Multi-Station Systems, and Advanced Performance Systems. The Multi-Station systems provide support for up to eight operator stations and printers, and up to 512K memory; the Advanced Performance Systems support up to 16 operator stations and printers, and up to 480K of memory. A variety of peripherals, including disk drives (up to 156MB), tape drives, and printers (40cps to 300lpm) can be configured with the Series 21.

The Series 21 basic systems range in price from \$6,000 to \$14,800. One- and three-year lease plans are also available.

CHARACTERISTICS

VENDOR: Mohawk Data Sciences Corporation, Corporate Headquarters, Seven Century Drive, Parsippany, NJ 07054. Telephone (201) 540-9080.

In Canada: MDS Canada, Ltd., 85 Indema Rd., Markham Township, Ontario. Telephone (416) 495-6060.



The Mohawk Data Sciences Series 21 family of distributed processing systems supports up to 16 workstations and includes an array of processors, operator stations, disks, diskettes, other storage devices, communications hardware, software, and printers. The Series 21 is a modular system which offers a chain of upward growth for future company computing needs. The system is compatible with virtually any mainframe computer.

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➤ The user of a Series 21 can start with a single key-to-diskette station performing data entry only. Additional keystations and diskette drives can be added, if desired, while the system is still dedicated to data entry. The modular design of the Series 21 lends itself readily to upgrading from a relatively simple to complex system or systems.

Deliveries of the Series 21 began in May 1977. Latest enhancements to the Series occurred in early 1983.

COMPETITIVE POSITION

Mohawk Data Sciences has enhanced their Series 21 systems which puts them in a more favorable competitive position. The Series 21 competes with the Nixdorf 600 Series, IBM 5280 and Series/1, Four-Phase Series IV, Harris 1600, Burroughs B 20, and Datapoint 8600.

Mohawk Data Sciences Series 21 has as its market target the multi-station networking environment. Like its competitors it functions well in a distributed processing environment. The Series 21 competes well in terms of its storage capability, offering memory up to 480K bytes, disk up to 156 megabytes, and up to four diskettes.

ADVANTAGES AND RESTRICTIONS

Mohawk Data Sciences has incorporated several features into their equipment which users find advantageous. The system offers users a choice of keyboard styles—data entry, keypunch, or typewriter for minimal operator training. There is also a large display screen with variable display attributes. Prompting capability guides the operator step by step through the transaction being performed.

There is also an Electronic Mail Service available which allows correspondence to be exchanged domestically and internationally via MDS' Worldwide Integrated Communications (WINC) network. It is reported that this service cuts International TELEX costs up to 70 percent.

Announced at the 1983 NCC by Mohawk was a new product called Personal Computing 21 which provides Series 21 users with the advantages of personal computing. With this new product, Series 21 users can access remote host computers or local shared data bases as well as personal computing programs.

The MDS System utilizes the building block principle for configuring a user's requirements. However, the user is restricted to a maximum of 16 operator stations and printers offered with the largest system packaged by MDS, the Advanced Performance System. If more stations and/or printers are required, another system is required. Also, there is a maximum limit of five operator stations which can access personal computing functionality at any one time.

USER REACTION

Four users of Mohawk Data Sciences Series 21 responded to Datapro's Survey of Key Entry Equipment which was ➤

➤ **DATE OF ANNOUNCEMENT:** February 1977.

DATE OF FIRST DELIVERY: May 1977.

SERVICED BY: Mohawk Data Sciences.

CONFIGURATION

There are three versions of the MDS Series 21 distributed processing systems: Single-Station Systems, Multi-Station Systems, and Advanced Performance Systems.

The Series 21 Single-Station Systems available from MDS feature a station console (128K-byte memory) with integrated CRT and movable keyboard with 78 keys, I/O device controllers for communications, a Diskette Support Unit which supports up to two diskette drives, and an optional printer (40, 45, 80, or 120 cps). Memory may be incremented to 256K bytes.

A second version of the Single-Station System features the same configuration with the additional advantage of storing data on double-sided, double density diskettes. Users may optionally configure a 5-, 10-, or 15-megabyte disk in addition to one diskette drive.

Both system versions offer concurrency (the ability to execute one foreground program and one background program simultaneously), support for CP/M-compatible software, WINC electronic mail, the ability to compile and execute customized programs via MDS Cobol and Mobol, and the ability to execute MDS-supplied utilities and software cataloged in Library 21.

Series 21 Multi-Station Systems offer support for up to eight operator stations and printers, memory to 512K bytes, up to four diskette drives, up to 156 megabytes of disk storage, and a variety of tape drives. The basic configuration consists of a controller console with 64K bytes of memory and one integrated diskette drive, one operator station with 15-inch diagonal display, and a movable keyboard with 78 keys.

Multi-Station Systems offer customized programming via MDS Cobol and Mobol, data communications (dual channel asynchronous, and/or bisynchronous and single channel SNA/SDLC) data entry, and concurrent execution of CP/M-compatible software with Series 21 software. In addition, Series 21 Multi-Station Systems support concurrency and multiprogramming which allows simultaneous running of one unique foreground program per CRT and one unique background program per system. The ability of the Series 21 to support multiprogramming varies depending on the system configuration and application mix.

Series 21 Advanced Performance Systems may be configured with up to 16 operator stations and printers, up to 480K bytes of memory, up to 156 megabytes of disk storage, up to four diskette drives, and a variety of tape drives. The basic Advanced Performance System configuration consists of one controller console with an advanced performance processor (increases system response and efficiency) and an integrated diskette drive, one operator station, and 128K bytes of memory.

The Advanced Performance Systems from MDS support all Series 21 software including turnkey, data entry, communications (dual channel asynchronous and/or bisynchronous and single channel SNA/SDLC and X.25 protocols) to 9600 bps, office support packages, and CP/M-compatible applications. Concurrency and multiprogramming are optional. ➤

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➤ conducted in November 1982. The respondents had four systems installed with a total of 31 keystations in operation. All of the systems were multi-station units. All respondents indicated they were volume operations, and all respondents had some data editing and/or validation method in place.

In terms of the future, three of the users indicated they planned a change, one user would change in less than 12 months to on-line terminals, and two users would switch to on-line terminals and/or distributed processing terminals after more than 12 months' time. When asked to rate their MDS Series 21 systems, all responded, and the ratings supplied by the users are summarized in the following table.

	Excellent	Good	Fair	Poor	WA*
Overall performance	2	2	0	0	3.5
Ease of operation	2	1	1	0	3.3
Hardware reliability	2	1	0	1	3.0
Maintenance service	1	1	1	0	3.0
Software	1	3	0	0	3.3
Technical support	1	3	0	0	3.3

*Weighted Average based on a scale of 4.0 for Excellent. □

➤ TRANSMISSION SPECIFICATIONS

Series 21 Multi-Station Systems and Advanced Performance Systems support dual channel asynchronous and/or bisynchronous communications or single channel SNA/SDLC communications at speeds up to 9600 bps. MDS offers a wide variety of software for batch and interactive communications including: 3270 Intelligent Emulation, 3274 SNA/SDLC, 3776 Remote Batch Emulation, BSC 2780/3780, Dataspeed 40 Asynchronous Emulation, HASP Workstation Emulation, and BSC 3741.

Series 21 Systems also feature support for WINC (Worldwide Integrated Communications), a versatile network service that meets a variety of communications requirements. WINC makes it possible to send and receive all types of communications from one operator station. WINC users may take advantage of the dial telephone network, satellite channels, low and high speed based lines, telex, and packet switching networks. Series 21 systems used for communications may also be used for data processing, programming, and word processing.

MDS operates the WINC communications centers in the United States and the United Kingdom. These centers are linked together to allow international communications.

SOFTWARE

A major Series 21 software enhancement was announced in early 1983. In addition to Series 21 support for a wide range of MDS-supplied software, the advent of Personal Computing-21, a licensed software product of MDS, made it possible to concurrently execute both CP/M-compatible and Series 21-compatible software on one system. Users have the ability to run multiple CP/M applications (such as programming, business, or personal applications) without interrupting Series 21 software execution.

This innovation extended Series 21 support to a wide variety of pre-written CP/M-compatible software packages, includ-

ing customized programming via Basic, Fortran, Pascal and 'C' languages as well as popular programs for educational, financial, and data base purposes. CP/M and Series 21 software and files may also share the same disk. Personal Computing-21 makes it possible for Series 21 users to greatly expand their system's potential by acquiring a variety of software from software vendors.

In addition to CP/M support on Series 21, MDS has several software packages developed specifically as office support tools. They include a word processing program, an electronic spreadsheet, electronic filing and retrieval, and report generation. MDS-supplied and licensed software is cataloged and described in Library-21.

Customized programming on Series 21 is facilitated by MDS Cobol and Mobol (Mohawk Business Oriented Language), both available through license with MDS.

Customized processing via Mobol enables local job turnaround, from source data to completed transaction, making the system a true extension of the central computer. Mobol builds intelligence into an information network by allowing local operator decisions. Mobol is characterized by its easy implementation and use for both programmer and operator. A single statement can define (or change) screen layout, display attributes, and field processing specifications.

MDS Cobol is a high-level programming language designed to facilitate batch processing. Cobol (Common Business Oriented Language) is a universally accepted programming language which uses powerful English-like commands. It allows the user to effectively process large volumes of business data.

MDS Cobol was established using standards set by the International Standards Organization (ISO) and the American National Standards Institute (ANSI). MDS Cobol programmers benefit from a broad range of functions and capabilities, including ISAM data management that enables efficient processing of business data. The externally compiled program facility (ECP) allows MDS Cobol and Mobol modules to be interchanged. This reduces repetitive programming and improves programmer productivity. The Cobol compiler reads source statements from disk or diskette at an average rate of 100 source lines per minute. Cobol's universal acceptance allows users to access a vast pool of experienced programmers, substantially reducing a customer's training costs. All appropriately configured Series 21 systems are capable of compiling and executing Cobol and Mobol programs.

Turnkey programs listed in Library-21 include:

- Word-21 is a word processing package that features easy operation and a number of powerful functions such as global search and replace, multiple paragraph reformatting, bold print, centering, word wraparound, book markers, page display, editing, and automatic table of contents.
- Plan-21 is an electronic spreadsheet program for financial forecasting and reporting. Plan-21 features computing capabilities that allow complex add, subtract, multiply, divide and percentage calculations; entry of numbers with up to 20 digits, worksheet altering, printing, and formatting flexibility.
- Report-21 is a software package designed to create management reports from stored data. The software allows the user to customize the parameters to individual requirements.

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- **Find-21** is a software tool that gives users the ability to catalog, cross-index, track, and retrieve a variety of information. Using a combination of keyboards, data specification, or logical operands, users can cross-index and retrieve data quickly.

In addition to programs for office support, MDS offers software for flexible data entry that allows users to develop and customize their own job formats. Utility programs developed by MDS for the Series 21 provide users with a variety of auxiliary functions that include copying files for archiving purposes and operator-executable system confidence tests that insure proper hardware functioning. The capability of an appropriately configured Series 21 to multi-program—execute a mixture of applications simultaneously on one system—allows users to fully benefit from Series 21's versatility.

COMPONENTS

Single-Station Systems

CONTROLLER CONSOLE: An integrated controller console/CRT (15-inch display) with movable keyboard may be configured with up to 256K bytes of memory. Included are I/O device controllers for communications, printer, and disk drives (floppy and fixed).

OPERATOR STATION: Integrated with the controller, the operator station has a 15-inch diagonal screen with 480 and 1920 display capability. It displays a full 128-character set in seven display modes, including reverse image, (black on white) blinking and blanked. Screen brightness is adjustable.

The cable-attached keyboard is movable and contains 78 keys of which 22 are special function keys. A 12-key numeric pad is also included. Three keyboard styles are available—data entry, typewriter, or alternate data entry (L-shaped exit key). Audible key clicks and error tones are operator-adjustable. A keyboard rest is also available.

DISKETTE SUPPORT UNIT: A separate cable-attached cabinet may be configured with up to two diskette drives capable of supporting either single-sided, single density diskettes or double-sided, double density diskettes. This unit will also support one diskette drive and either a 5-, 10-, or 15-megabyte fixed disk. Diskette format is IBM Basic Data Exchange with each single-sided, single density diskette capable of storing up to 243,000 bytes. Double-sided, double density diskettes conform to MDS DM1 format and store up to 985,000 bytes.

Multi-Station and Advanced Performance Systems

MODEL 2100 CONTROLLER CONSOLE: The controller console used with both the Multi-Station and Advanced Performance Systems includes a processor, up to 512K bytes of memory, device controllers for communications, magnetic tape, printers and disk drives. Up to four diskette drives may be integrated into the controller console or up to 20 megabytes of disk storage and two diskette drives may be integrated into the controller console. An optional compatible channel provides a bridge between a Series 21 system and other larger MDS systems. The controller is desktop height and compatible with business and office environments.

MODEL 2192/2195 OPERATOR STATIONS: The Operator Station is an interactive work station which operates under program control. It consists of a 15-inch display screen, movable keyboard connected by a 2½ foot (75 cm) cable, interface logic, and power supply. It is designed for

desktop or tabletop installation and can be located up to 2000 feet (600 meters) from the Controller Console.

The CRT displays a full 128-character set in seven display modes, including reverse image (black on white) blinking and blanked. It is capable of displaying 480 or 1920 characters.

Three keyboard styles are available: a typewriter keyboard, a data entry keyboard, and an alternate data entry keyboard. Each keyboard features a 12-key numeric pad. Keyboard styles may be mixed when multiple operator stations are used in a system configuration with a minimum of 96K bytes of memory. All keyboards support upper and lower case alphabetic characters.

During operation, the keyboard produces an adjustable, audible tone for each keystroke, and signals error conditions with an attention-getting sound as well as a flashing red light clearly visible to the operator.

Multi-Station Systems support up to eight operator stations; Advanced Performance Systems support up to 16 operator stations.

DISKETTE STORAGE: Up to four diskette drives may be integrated in the controller console on both Multi-Station and Advanced Performance Systems. Each diskette can store 243,000 bytes. The diskette format is IBM Basic Data Exchange.

DISK STORAGE: Multi-Station and Advanced Performance Systems will support up to 156 megabytes of disk storage utilizing separate disk drive units.

Model 2172 is a separate, freestanding cabinet supporting one or two 2.5-megabyte hard disks. The disk cartridge is removable, allowing files to be stored off-line (Not available on Advanced Performance Systems).

Model 2174 is a separate, freestanding cabinet with a 10-megabyte (Feature 704) or a 20-megabyte disk drive (Feature 706) to a maximum of 40 megabytes (non-removable).

Model 2175 comes in three versions:

- Model 2175-1 contains 13 megabytes of fixed storage and 13 megabytes of removable storage, for a total of 26 megabytes.
- Model 2175-2 contains 39 megabytes of fixed storage and 13 megabytes of removable storage, for a total of 52 megabytes.
- Model 2175-3 contains 65 megabytes of fixed storage and 13 megabytes of removable storage, for a total of 78 megabytes.

Two disk drive units of any model may be supported on an appropriately configured Series 21 system. A maximum storage capacity of 156 megabytes may be configured using two Model 2175-3 disk drives.

For enhanced performance under ISAM File Management, an Intelligent Disk Interface Processor (Feature 1170) and Fixed/Removable Disk Controller (Feature 1175) are available.

MAGNETIC TAPE DRIVES: Two compact, desktop tape drives and two floor console models are available: 9-track, 800 bpi (Models 2181/83), and 9-track, 1600 bpi (Models 2182/84). Models 2181 and 2182 accept 8½-inch reels ►

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► accommodating up to 1200 feet (360 meters) of 1/2-inch computer-compatible tape. Models 2183 and 2184 use 10 1/2-inch reels accommodating up to 2400 feet (720 meters) of tape. All four models operate at 25 inches per second, read/write, and may be located up to 15 feet (4.5 meters) from the Model 2100 Controller Console. (A magnetic tape drive precludes an MDS Compatible Channel.)

PRINTERS: Both Multi-Station Systems and Advanced Performance Systems support a variety of printers.

The Model 2141-3 is a high-quality, full-character serial printer which achieves a maximum print speed of 40 cps. It utilizes an upper/lower case 96-character graphic set with a full 132 position column width. This printer uses a 96-character plastic daisywheel print element and accommodates multipart forms. A friction feed platen, cut sheet feeder and a mechanical front feeder allow a variety of forms handling capabilities. This printer may be used as either a system or station printer. Up to eight Model 2141-3 printers may be configured on a Mult-Station System and up to 16 on an Advanced Performance System.

Models 2141-1 are 45-cps printers noted for their typewriter-like print quality. They utilize an upper/lower case 96-character graphic set with column width a full 132 positions. The serial print mechanism employs a daisywheel font. They accommodate multipart forms and paper is loaded from either front or rear. An optional forms tractor is available. These printers may be configured for station or system use. An appropriately configured Series 21 system will support up to eight Model 2141 printers.

The Model 2144 is a medium speed, bidirectional impact printer that produces a print line of up to 132 characters in length. The Model 2144 features an upper/lower case 96-character graphic set, and a maximum speed of 120 characters per second. It will accommodate single or multipart forms and has both switch selectable character and inter-line spacing. Particularly suited for table top applications, this printer may be located up to 2000 feet (600 meters) from the Model 2100 Controller Console. An appropriately configured Series 21 system will support up to 16 Model 2144 Printers.

Two line printer models are offered with belt-type print fonts for quiet, reliable operation.

The Model 2142-1 delivers from 90 to 240 lines per minute (depending on the number of characters printed per line). A 96-character font is standard, but a 64-character font is available.

The Model 2142-2 delivers from 230 to 340 lines per minute (depending on the number of characters printed per line). A 64-character font is standard, but a 96-character font is available.

Both models provide a full 132-column print line and can accommodate up to 6-part forms. Forms may be loaded from either front or rear, and a Vertical Format Unit (VFU) or top of form is standard. A paper tear bar is provided for rapid separation of perforated forms. Both models have a long-life ribbon cartridge.

Either printer is a compact pedestal-mounted unit and may be located up to 20 feet (6 meters) from the Model 2100 Controller Console.

The Model 2145 is a heavy duty, 300-lpm, impact drum printer. It uses the standard 64-character set or the optional upper/lower case 96-character set. This printer features servo-controlled paper and ribbon feed mechanisms. Multipart forms (original, plus 5 carbons) can be accommodated. Vertical forms handling is under software control using a direct access, vertical format unit (DAVFU). An internal, self-test mode provides a built-in means of exercising the printer off-line by selecting various test patterns and line formats.

A paper stacking receptacle is standard with the Model 2145 Line Printer to facilitate removal of processed forms. For operator convenience, the drum gate swings open 90 degrees to allow easy access during forms loading and ribbon changes. This printer may be located up to 15 feet (4.5 meters) from the Model 2100 Controller Console.

PRICING

The Series 21 is available for outright purchase or for lease on a 1-year and 3-year basis. The monthly cost figures below include prime-shift maintenance. A separate maintenance agreement is available for purchased units.

		Monthly Rental*			Monthly Maint.
		1-year Lease	3-year Lease	Purchase	
21/10-0	Basic Single-Station Desktop System; includes Console with 128KB, 1 SSSD, diskette drive	\$250	\$180	\$ 6,000	\$ 73.00
	Feature 2171; Additional SSSD Drive	46	34	1,459	7.00
21/10-2	Single-Station Desktop System; includes Console with 128KB, 1 DSDD diskette	291	212	7,035	73.00
	Feature 2173; Additional DSDD Diskette Drive	52	37	1,700	13.00
	Feature 1702; 5MB Fixed Disk Drive	108	75	3,500	15.00
	Feature 1704; 10MB Fixed Disk Drive	154	107	5,000	50.00
	Feature 1706; 15MB Fixed Disk Drive	200	139	6,500	65.00
	Feature 1164; Memory Increment; 64KB	44	30	1,400	28.00

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		Monthly Rental*			
		<u>1-year Lease</u>	<u>3-year Lease</u>	<u>Purchase</u>	<u>Monthly Maint.</u>
21/20	Data Entry System (base price); includes controller console, 1 operator station (M.2192), 1 diskette drive and controller, 1 dual-station controller, 64K memory and Mobol execution capability only	\$255	\$187	\$7,900	\$59.00
21/40	Application Processing System (base price); includes controller console, 1 operator station (M.2192), 1 diskette drive and controller, 1 dual-station controller, 64K memory and Mobol compiler	298	215	8,980	69.00
21/50	Multi-Programming System (base price); includes controller console, 1 operator station (M.2192), 1 diskette drive and controller, 4 dual-station controllers, 128K memory, Mobol compiler and multi-programming	485	355	11,380	111.00
21/60	Advanced Performance System (base price); includes controller console, 1 operator station (M.2192), 1 diskette drive and controller, 1 station controller, advanced performance processor and 128K memory	394	286	11,300	100.25
21/70	Advanced Performance 16-Station System (base price); includes controller console, 1 operator station (M.2195), 4 diskette drive and controller, 1 station controller (F.1095), advanced performance processor and 128K memory	511	371	14,800	106.25
Memory					
F.1164	64K byte incremental memory (512K maximum)	72	50	1,400	28.00
Disk/Diskette Storage					
F.2171	Additional Diskette Drive (4 maximum per system)	46	34	1,459	7.00
F.704	Integrated 10MB Fixed Disk	307	198	8,900	76.00
F.706	Integrated 20MB Fixed Disk	430	278	11,900	91.00
M.2172	2.5MB Disk	245	176	7,712	108.50
M.2175-01	13/13MB Fixed/Removable Disk	461	333	14,720	168.00
M.2175-02	39/13MB Fixed/Removable Disk	680	489	21,680	186.00
M.2175-03	65/13MB Fixed/Removable Disk	899	648	28,680	228.00
F.175	M.2175-OX Disk Controller	66	45	2,000	11.00
Operator Stations/Controllers					
M.2192	Operator Station	63	45	2,128	8.50
F.195	Dual-Station Controller (maximum 4 per system)	17	13	506	3.00
F.194	Multistation Extender (for 5th-8th operator station)	50	37	1,500	6.00
M.2195	21/70 Operator Station	63	45	2,128	12.25
F.1095	M.2195 Station Controller	117	85	3,500	6.00

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		Monthly Rental*			
		<u>1-year</u>	<u>3-year</u>	<u>Purchase</u>	<u>Monthly</u>
		<u>Lease</u>	<u>Lease</u>		<u>Maint.</u>
Printers/Printer Controllers					
M.2141	System Printer (45 cps)	\$141	\$103	\$4,293	\$37.00
F.141	M.2141 Printer Controller.	NC	NC	NC	NC
M.2141-01	Station Printer (45 cps)	157	113	4,960	36.00
F.192	M.2141-01 Printer Controller	25	18	800	12.00
M.2141-03	Station Printer (40 cps)	116	85	3,550	35.00
M.2144	Matrix Printer (120 cps)	81	53	1,900	35.00
F.1144	Single Port (M.2141-03/M.2144) Printer Controller (up to 75 feet)	25	18	750	3.00
F.144	Dual Port (M.2141-03/M.2144) Printer Controller (up to 75 feet)	45	33	1,375	5.00
F.1244	Single Port (M. 2141-03/M.2144) Printer Controller (up to 2000 feet)	25	18	750	3.00
F.244	Dual Port (M.2141-03/M.2144) Printer Controller (up to 2000 feet)	45	33	1,375	5.00
M.2142-01	90-240 lpm Printer	251	181	8,120	76.00
M.2142-02	230-340 lpm Printer	358	259	11,320	104.00
M.2145	300 lpm Printer	646	485	20,600	236.00
F.142	M.2142-OX Printer Controller	NC	NC	NC	NC
F.145	M.2145 Printer Controller	NC	NC	NC	NC
Tape Drives/Tape Drive Controllers					
M.2181	1200 feet/9 track/800 bpi	269	193	8,200	69.50
M.2182	1200 feet/9 track/1600 bpi	370	266	11,275	83.00
M.2183	2400 feet/9 track/800 bpi	340	280	11,000	83.00
M.2-84	2400 feet/9 track/1600 bpi	503	362	14,950	97.00
F.182	M.218X Tape Controller	NC	NC	NC	NC
Communication Controllers					
F.208	High Performance Communications	56	42	1,400	11.00
F.210	Extended Communications Adapter	56	42	1,400	11.00
F.212	Dual Communication Advanced High Speed (ASYNC/BSC/SDLC)	62	16	1,540	12.00
F.216	Dual Communication Bit-Oriented Protocol (ASYNC/BSC/SDLC/SNA-SDLC/X.25)	76	57	1,900	15.00

For software pricing contact vendor.

*Includes monthly maintenance.■

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MANAGEMENT SUMMARY

Mohawk Data Sciences has greatly expanded the capabilities of its Series 21 family of distributed processing systems. Enhancements made in the fourth quarter of 1980 include a family of fixed and removable disk drives for use on the Series 21/40 and 21/50 and the addition of up to four remote station printers on the System 21/50.

The Series 21 communications capabilities are extensive. Communication with a host computer is accomplished in batch or interactive mode, using Binary Synchronous, SDLC, or Asynchronous ASCII protocol. Transmission speeds from 600 to 9600 bits per second are permitted.

The MDS 3270 communications package gives users the option of either on-line or off-line transaction processing and provides intelligent terminal access to on-line information networks. The package includes an IBM 3270 Display Station Emulator, an intelligent 3270 network interface, 3270 batch utilities, and a programmable 3270 subsystem.

An electronic mail service program enables a Series 21 system to interface with MDS' worldwide integrated communications network (WINC) allowing a user to have the advantage of switched-network messages and data communications without the overhead of staffing and operating that network.

MDS provides several levels of software. One is a Formatted Data Entry Package (FDEP) that can be used on any Series 21 system. It is geared toward diskette-oriented data entry, verification and data validation. Extended Data Entry (EDE) offers enhanced capabilities and utilizes disk as well as diskette storage. Another software package, called MOBOL, operates on the 21/40 ➤

A family of distributed processing systems that offer a wide range of capabilities including: data entry, user programmability, multi-programming, concurrent processing, on-line teleprocessing, and word processing. Recent enhancements are a family of fixed and removable disk drives, a remote station printer, COBOL, and an Extended Data Entry program.

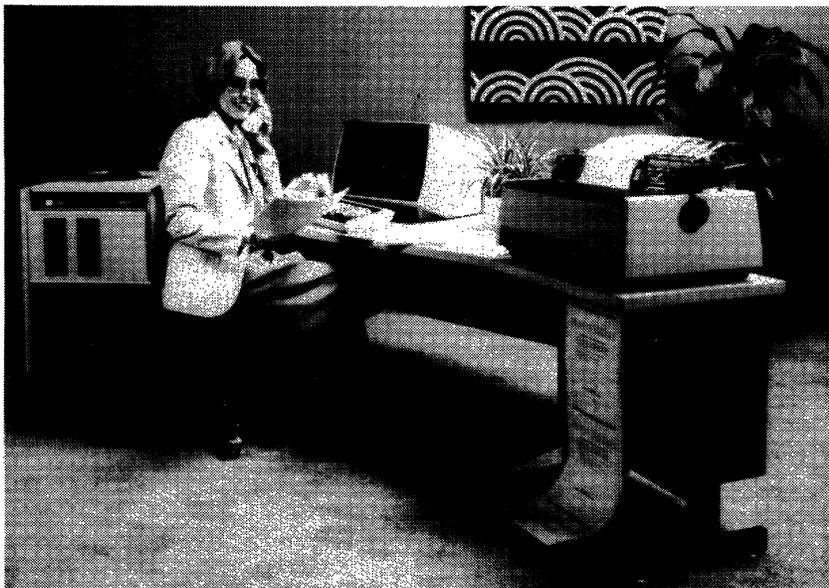
A basic Model 21/20 Data Entry System that includes a controller console, one operator station, one diskette drive, one diskette controller, one dual-station controller, and 48K bytes of memory is priced at \$7,035, or \$202.50 per month (including maintenance) on a three-year lease.

A basic Model 21/50 Distributed Data Processing System that includes a controller console, one operator station, one diskette drive, one diskette controller, one dual station controller, one memory expansion assembly, 128K bytes of memory, and user-programming functions is priced at \$15,100, or \$439.50 per month (including maintenance) on a three-year lease.

CHARACTERISTICS

VENDOR: Mohawk Data Sciences Corporation, Corporate Headquarters, Seven Century Drive, Parsippany, New Jersey 07054. Telephone (201) 540-9080.

DATE OF ANNOUNCEMENT: 21/20 and 21/40—February 1977; 21/50—April 1978. ➤



The MDS 21/50, the latest and most powerful Series 21 model, boasts a new, faster processor, diskette and rigid disk storage, and concurrent multi-task processing. The 21/50 can run programs written for the 21/20 and 21/40, and utilizes the same terminals and I/O devices as the smaller systems.

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▷ and 21/50 and is a high-level, English-like command-language designed for customized application programs. MDS ANSI-standard COBOL complements MOBOL and facilitates batch processing, report editing, and data manipulation. Word processing and various system utilities are also available. Concurrency, an option on 96K-byte 21/20 and 21/40 systems, permits two separate applications.

The Series 21 distributed processing system is offered in three versions: the basic System 21/20 for basic data entry functions, the 21/40 for customized (user-programmable) data entry and processing and the 21/50 for higher-volume workloads and multi-programming which permits the simultaneous execution of three different tasks.

The user of a Series 21 can start with a single key-to-diskette station performing data entry only. Additional keystations and diskette drives (up to four of each) can be added, if desired, while the system still is dedicated to data entry.

The system can be upgraded to a 21/40, permitting user programming in the special MOBOL language and the addition of hard disk storage. With the 21/40, users can create and update files, process data locally, and print reports. To upgrade from a 21/20 or 21/40 to a 21/50 requires replacing the processor; however, keystations and peripherals may be retained, and programs developed for the two smaller systems can be run on the 21/50. All upgrades can be done in the field.

Deliveries of the Series 21 began in May 1977. Deliveries of the 21/50 began during the fourth quarter of 1978.

USER REACTION

Datapro spoke to four users of the MDS Series 21 during February 1981. The users' names were supplied by MDS. These users had a total of 19 Series 21 systems and 41 keystations in operation. There were six single-station systems. All of the current systems had been installed for about two years. Two users had replaced other types of key entry equipment, and the other two users said the Series 21 systems were new implementations. Three users were employing communications capabilities on their systems. Host computers used with the systems were the Sperry Univac 7045, the IBM 4341, Honeywell Level 66/DPS, and the Burroughs 2701. The ratings supplied by these users can be summarized as follows:

	Excellent	Good	Fair	Poor	WA*
Overall performance	4	0	0	0	4.0
Ease of operation	3	1	0	0	3.8
Hardware reliability	3	1	0	0	3.8
Maintenance service	3	1	0	0	3.8
Software	1	3	0	0	3.3
Technical support	3	1	0	0	3.8

*Weighted Average on a scale of 4.0 for Excellent.

▶ **DATE OF FIRST DELIVERY:** 21/20 and 21/40—May 1977; 21/50—fourth quarter 1978.

NUMBER DELIVERED TO DATE: Over 1,000 (as of May 1978).

SERVICED BY: Mohawk Data Sciences.

CONFIGURATION

The MDS Series 21 is a modular, operator-oriented system consisting of from one to four keystations. The basic System 21/20 provides for data entry and media conversion utility software. It consists of a controller console that can support from one to four CRT keystations and one to four diskette storage units. A system printer, magnetic tape drive or data-recorder, and communications capability are also available on the basic system. Memory capacity is expandable from 48K bytes to 96K bytes.

The System 21/40 provides the same features as the 21/20 and can support fixed and removable disk drives ranging in size from 2.5 megabytes to 26 megabytes. The 21/40 permits the user to generate his own programs for local data base access, transmission, report printing, etc. in Mohawk Business Oriented Language (MOBOL) or COBOL.

The System 21/50 uses the same keystations as the 21/20 and 21/40, but the 21/50 central processor is twice as fast and its minimum main memory capacity is 128K bytes, expandable to 256K bytes. This system offers multi-programming capabilities and can support up to 156 megabytes of fixed and removable disk storage. It can also accommodate up to four station printers in addition to a system printer.

TRANSMISSION SPECIFICATIONS

All Series 21 systems can communicate with a host processor using either Binary Synchronous or SDLC protocol. The systems are compatible with the IBM 2780, 3780, and 3270. Systems 21/40 and 21/50 support a 3270 Network Interface package which permits intelligent terminal access to on-line teleprocessing networks. Data rates from 600 bps to 9600 bps are acceptable for free-standing communications. When communicating in background mode 4800 bps is the maximum data rate. Point-to-point transmission may be switched or non-switched, while multipoint must be non-switched. The system communicates in EBCDIC code and in batch mode only.

An Electronic Mail Service program enables a series 21 system to interface with MDS' worldwide integrated communications network (WINC) for exchanging messages domestically and internationally.

SOFTWARE

FORMATTED DATA ENTRY PACKAGE (FDEP): This software runs on all Series 21 systems. The principal objective of FDEP is to facilitate the conversion of data entry tasks from keypunch or key-to-tape devices to the Series 21 system. Up to 10 program levels per job can be specified. Each program level permits a user to describe records up to 128 bytes in length. On a system with multiple keystations (up to 4), each operator may be performing a different data entry task.

The FDEP software provides for record insert and delete, two methods of search and update, four accumulators, modulus 10 and 11 check digit schemes, automatic and auxiliary duplication, and operator prompting. When using FDEP, the CRT's can display up to 480 characters.

▶ The FDEP software permits communication with a host processor on a non-concurrent, batch basis. ▶

Mohawk Data Sciences Series 21

➤ All users reported minimal system downtime. Three users mentioned ease of operation as a major strength of the Series 21 systems. One user said that he had selected the equipment because he was pleased with the performance of other MDS equipment. He was also happy that the equipment could be upgraded easily. A second user told us he was impressed with the system's reliability and he pointed out that the CRT screen character size was very easy for operators to read. Another user who was using his systems in a time-sharing environment, said the Series 21 was priced reasonably and was versatile. He had chosen the MDS systems because they offered both bisynchronous and asynchronous communication capabilities using the same hardware. He also said the system could be used as a stand-alone minicomputer.

A few weaknesses were mentioned by the users. One user said that he would like to see a preventive routine maintenance schedule put into effect by MDS. Another user reported switching to the 600 lpm printer after experiencing many problems with his 300 lpm printer. One user also noted that he had encountered many "growing pains" with MDS software changes but he felt the problems were now corrected.

Only one user planned to replace his systems within the next year. He was considering a switch to an IBM 8100 data base network structure system. □

➤ **EXTENDED DATA ENTRY (EDE):** EDE offers a number of enhanced capabilities over FDEP and utilizes disk storage in performing data entry, verification, and validation operations. Any Series 21 system with a minimum of 96K bytes of memory can support EDE. The EDE software provides for user-defined formats, memory storage of multiple job descriptions, data sets, five accumulators, and data field source and boundary codes. **JOBXLATE** is a job translation program that validates job descriptions before translating them into object code for reloading. EDE also supports a data set management utility and a variety of system utilities: **MEDIAU**, **DISKETTU**, **PRINTERU**, and **DISKU**.

MOBOL: A high-level, multi-purpose language designed for production data entry in operator-interactive environments. It permits users of the 21/40 and 21/50 to generate programs to perform functions not possible with FDEP. Some of these include:

- **Advanced data validation**—MOBOL programs can provide additional check digit schemes, expanded accumulation, table look-up, and range checking.
- **Local transaction processing**—MOBOL programs can be written for the creation and maintenance of local data bases, actual transaction processing, and report formatting and printing.

MOBOL programs can use either data-entry-style CRT formats of 480 characters or full-screen formats of 1920 characters. MOBOL programs written for the 21/40 can be run on the 21/50.

A MOBOL object program is compiled on the System 21/40 or 21/50 after the operator has entered the source program statements via the keystation, using FDEP, and stored them on a diskette.

Three MDS-supplied utility programs are available: **MOBOLIST**, which displays or prints source statements and compilation notes; **MOBOLMON**, a debuffer; and

MOBOLREF, which creates a cross-reference listing of MOBOL data name and statement labels.

MOBOL supports either BSC or SDLC communications protocol.

Both FDEP and MOBOL program execution are bundled in the base and purchase prices of the Series 21 systems.

COBOL: Introduced to complement MOBOL, MDS COBOL facilitates batch processing, report editing, and general output data manipulation. MDS COBOL meets ANSI 1974 low-intermediate level standards and offers extended key/screen handling capabilities anticipated in ANSI's 1980 specifications. The language will function on a System 21/40 with 96K bytes of memory and on all System 21/50's in one to four station configurations.

The COBOL compiler reads source statements from disk or diskette at an average rate of 100 source lines per minute. Two or more COBOL programs or one MOBOL and one COBOL program may be compiled concurrently. It may execute concurrently with customer-written MOBOL programs or MDS-supplied software such as data entry, data communications and word processing.

MDS COBOL allows inter-program communications, and offers segmentation and spill memory features. An MDS supplied program called **KYSOURCE** is used to enter COBOL source statements and provide for line insertions/deletions, editing, printing and syntax analysis.

The license fee for MDS COBOL is \$65 per month or a one-time charge of \$2,500. Initial installation costs \$200 and maintenance costs \$20 monthly per system.

WORD PROCESSING: Three programs are available:

- **Word Processing**—This program provides main functions of writing, storing, verifying and correcting text data.
- **Word Processing Printing**—This program provides formatted printing of finished documents and is used to output BDE-compatible diskettes or print tapes.
- **Word Processing Utilities**—This program reorganizes, edits, and reformats files that have been altered through text insertions, deletions, or updates.

MDS word processing software supports one to three operator stations on the System 21/40 and one to four stations on the System 21/50. Users may select either data entry or typewriter style keyboards.

CONCURRENCY: The package available for Systems 21/20 and 21/40 with a minimum of 96K bytes of main memory permits the execution of one unique background program concurrent with one unique foreground program. A background task such as communications can be assigned to a "virtual operator station" which can be controlled from any physical station in the system configuration. The two programs can run under control of one or two operators. Thus, a single-station system can assign communications to the "virtual station" while the operator is occupied with keying or some other foreground task. When the background program requires the controlling operator's attention, the operator can then swap the foreground task in progress with the background task, perform the required functions on the background program, and swap back again. Only one foreground program at a time is permitted.

Since workstations can share applications, Series 21 systems, whether single task, concurrent, or multi-programming, can all support up to four workstations. ➤

Mohawk Data Sciences Series 21

COMPONENTS

CONTROLLER CONSOLE: The controller console is a compact desk-height unit that houses the processor, up to four diskette drives, the optional controllers for communications, the external I/O device controllers, and up to 256K bytes of random-access memory. An optional MDS-compatible channel provides an interface to larger MDS systems. A single 10-megabyte fixed disk drive may be integrated into the controller console. When an integral disk drive is present only two diskette drives may be incorporated into a controller console.

OPERATOR KEYSTATION: Consists of a CRT display and detached keyboard. The keyboard has 66 keys that can be arranged in a typewriter, data entry, or alternate layout arrangement. A 12-key numeric pad is standard on either keyboard. Multi-national language sets are also available. All keys emit an audible tone when depressed.

The CRT display has a 15-inch diagonal screen. It can display a full 128-character set in any of 3 brightness intensities. It features blinking characters or words and a blinking cursor. The screen can also display in reverse image (black on white). All of the above features are controlled by the program.

Any Series 21 System can have from one to four operator keystations located up to 2000 feet from the controller console. Keystations can be added regardless of the number of diskette drives on the system. On the 21/20, the CRT can display up to 480 characters; on the 21/40, and 21/50, either 480 or 1920 characters.

DISKETTE STORAGE: Each diskette storage unit can read and write on removable diskettes (floppy disks). Each diskette can store 243,000 bytes of 1898 records, each 128 bytes in length. The diskette format is IBM Basic Data Exchange; i.e., 1 index track plus 73 data tracks, each divided into 26 sectors. A minimum 21/20, 21/40, or 21/50 configuration must have at least one diskette drive housed within the controller console, plus one operator keystation. Diskettes may be added regardless of the number of keystations. Four diskette drives are the maximum number permitted on any Series 21 system.

DISK STORAGE: The System 21/40 can support either a 2.5-megabyte removable disk drive (Model 2172), a 10-megabyte integral or free-standing disk drive (Feature 704), or a combination 13-megabyte removable and 13-megabyte fixed disk drive (Model 2175-1).

The System 21/50 can support multiple disks from a single controller. It can support a maximum of one integral 10- or 20-megabyte fixed disk drive and two free-standing 10- and 20-megabyte disk drives (Features 704 and 706). Alternatively, the system can be configured to provide fixed and removable disk storage: the Model 2175-1 disk drive offers 13 megabytes each of removable and fixed storage, the Model 2175-2 disk drive offers 13 megabytes of removable storage and 39 megabytes of fixed storage, and the Model 2175-3 disk drive offers 13 megabytes of removable storage and 65 megabytes of fixed storage. Any two of these drives may be combined up to a total capacity of 156 megabytes.

The first type of disk storage unit is a front-loading, cartridge-type unit. The disk itself is contained within an IBM 2315-type cartridge with a capacity of 2.5-million bytes. Transfer rate is 195,000 bytes per second. Average access time is 70 milliseconds. This disk may be retained if the system is upgraded to a 21/50.

The fixed disk drive is a single-platter (10 megabytes) or dual-platter (20 megabytes) unit which can replace two of the

diskette drives in the controller console. If the customer wants to retain four diskette drives, the unit is available in a separate cabinet. These units use Winchester technology (as in the IBM 3340). The data transfer rate is 889,000 bytes per second. Access time is 20 milliseconds per track or 87 milliseconds average.

The newest family of disk drives combine both fixed platters and a removable front-loading single-platter cartridge on a single spindle. The drives are housed in a freestanding cabinet that can be located up to 50 feet from the Series 21 controller console. The data transfer rate is 1,209,000 bytes per second with an access time of 6 milliseconds per track.

MAGNETIC TAPE DRIVES: Two types of magnetic tape drives are available, both with either the 9-track, 800-bpi format or the 9-track, 1600-bpi format. One type is a table-top unit that accepts only 7-inch tape reels. The other is a free-standing floor model that accepts up to 10.5-inch reels. It is also possible to connect an MDS 1100 or 6400 Data Recorder to the Series 21 for an installation looking for a very low-cost tape drive. A combination 10-megabyte disk drive and 9-track, 7-inch tape reel is available for systems 21/40 and 21/50.

1200/2300/2400 COMPATIBILITY: Any of the Series 21 systems can be directly connected to either an MDS 1200/2400 system or an MDS 2300 intelligent terminal. This has the potential of providing the Series 21 with additional communications emulators.

PRINTERS: Two serial impact printers are available on the Series 21. One type is a system printer intended for use with any Series 21 configuration. The System 21/50 can also support up to four remote station printers located up to 2000 feet from the controller console. The printers operate bidirectionally and produce correspondence-quality copy at 45 characters per second. A 96-character ASCII subset is standard. Various printwheels containing different typefaces are available and are readily changeable by the operator. Horizontal character spacing is 10 to the inch depending on the typeface, thus providing a 132-character print line. Vertical spacing of six lines per inch is standard. Multipart forms up to 15 inches wide can be accommodated. A friction-feed platen is standard, and a tractor feed attachment is available as an option. Paper may be loaded from the front or rear and stacks on a rear paper shelf. The station printer and its associated CRT may operate independently or in conjunction with each other.

Two line printers are available. One operates at speeds of from 90 to 240 lines per minute, and the other operates at speeds of from 230 to 340 lines per minute. It has a 132-column print line, character spacing of 10 per inch, and line spacing of 6 per inch. Marginally punched, fan-fold forms of up to 6 parts, measuring up to 15 inches in width and up to 22 inches in depth, can be used.

A second type of line printer is available which operates at 600 lines per minute when equipped with a 64-character set or 435 lines per minute when equipped with a 96-character set. The printer has a 132-character line, 10-character-per-inch spacing, and line spacing of 6 or 8 lines per inch. It accepts marginally punched forms up to 16.75 inches wide and up to 22 inches deep, containing up to 6 parts.

PRICING

The Series 21 is available for outright purchase or for lease on a 1-year, 2-year, 3-year, or 5-year basis. The monthly cost figures below include prime-shift maintenance. A separate maintenance agreement is available for purchased units.

Mohawk Data Sciences Series 21

	Monthly Rental*		Purchase	Monthly Maint.
	1-Year Lease	3-Year Lease		
21/20 Data Entry System; includes controller console, one operator station, one diskette drive, one diskette controller, and one dual-station controller, and 48K bytes of memory	\$235.50	\$202.50	\$7,035	\$51.50
21/40 Application Processing System; includes controller console, one operator station, one diskette drive, one diskette controller, one dual-station controller, one memory expansion assembly, 48K bytes of memory, and programmability	288	247	8,395	61.00
21/50 Distributed Data Processing System; includes controller console, one operator station, one diskette drive, one diskette controller, one dual-station controller, one memory expansion assembly, 128K bytes of memory, and programmability	511.50	439.50	15,100	111.50
Feature 165—each additional 16K bytes of memory	21	18	585	7.00
Feature 163—each additional 32K bytes of memory	42	37	1,170	14.00
Each additional Model 2171 diskette drive	44	37	1,459	7.00
Model 2172—2.5MB removable-medium disk drive	303.50	268.50	7,712	108.50
Feature 704—10MB fixed-medium disk drive	295	256	8,200	76.00
Feature 706—20MB fixed-medium disk drive	398	343	10,800	91.00
Model 2131—10MB fixed-medium disk drive and 9-tk. 7-inch reel magnetic tape	464	405	12,000	138.00
Model 2175-1—13/13MB fixed/removable-medium disk drive	536	470	14,720	168.00
Model 2175-2—13/39MB fixed/removable-medium disk drive	728	630	21,680	186.00
Model 2175-3—13/65MB fixed/removable-medium disk drive	945	816	28,680	228.00
Feature 175—disk controller	103	88	3,500	18.00
Each additional Model 2192 operator station	58.50	49.50	2,128	8.50
Feature 191—dual-station controller	15	13	506	3.00
Model 2141—45-cps system printer	150	130	4,293	37.00
Model 2141-1—45-cps station printer	161	139	4,960	36.00
Model 2142-1—90-240-lpm printer	276	240	8,120	76.00
Model 2142-2—230-340-lpm printer	390	339	11,320	104.00
Model 2145—600-lpm printer	751	676	20,600	236.00
Feature 201, 202—bisynch. communications adapter	27	24	623	11.00
Feature 208—high-speed bisynch. communications adapter	56	49	1,400	11.00
Feature 205—dual modem select	9	8	250	3.00
Feature 206—data rate select	4.75	4.75	120	1.75
Feature 207—communications panel	—	—	75	—
Feature 101—operator station table	—	—	150	—
Feature 901—keyboard rest	—	—	11	—
Model 2181—magnetic tape; 9-tk.; 800 bpi, 7-inch reel	283.50	244.50	8,200	69.50
Model 2182—magnetic tape; 9-tk., 1600 bpi, 7-inch reel	377	324	11,275	83.00
Model 2183—magnetic tape; 9-tk., 800 bpi, 10.5-inch reel	393	337	11,000	83.00
Model 2184—magnetic tape; 9-tk., 1600 bpi, 10.5-inch reel	498	426	14,950	97.00
Feature 180—compatible channel to 2300/2400	33	29	880	11.00
Feature 181—data-recorder interface	22.25	19.25	775	4.25
Model 2112—7-track Data Recorder	199	183	1,800	109.00
Model 2114—9-track Data Recorder	229	207	2,400	109.00
Model 2115—7- or 9-track Data Recorder	229.50	204.50	2,800	89.50

*Includes monthly maintenance. ■

Mohawk Data Sciences Series 21

MANAGEMENT SUMMARY

Mohawk Data Sciences, in its announcement of the Series 21, termed it the company's "most important product introduction since its key-to-tape data recorder 12 years ago." That's a powerful statement. Considering the effect of the key-to-tape machine on the market, it's a pretty tough act to follow. The key-to-tape data recorder was an innovative product that was instantly distinguishable from everything else on the market at the time. The Series 21, by contrast, has some formidable competition already on the market, and, except for logotypes, is almost physically indistinguishable from competitive systems. Nevertheless, Mohawk's new product has some attractive features.

The Series 21 is billed as a distributed processing system, and is quite flexible in terms of what is required to get on the air and how extensively the system can grow. The equipment is offered in two versions, the basic System 21/20 and the more powerful System 21/40. Mohawk also provides two levels of software. One is a Formatted Data Entry Program (FDEP) that can be used on either the 21/20 or 21/40. Mohawk claims that, with this package, a data entry job now being performed on a key-punch or key-to-tape unit can be converted in a matter of hours. The second software package, called MOBOL, operates only on the 21/40 and is a high-level COBOL-like language that permits the user to write programs in "English" and compile them on the 21/40.

Mohawk has made an effort to keep the single-station Series 21 modest in price, and Datapro feels that the ➤

Programmable display oriented terminal for data entry and distributed processing applications.

Up to four display stations can be incorporated, supported by diskette or cartridge disk storage, printers, and other peripherals. Batch mode communications at up to 9600 bps using BSC or SDLC protocols are supported.

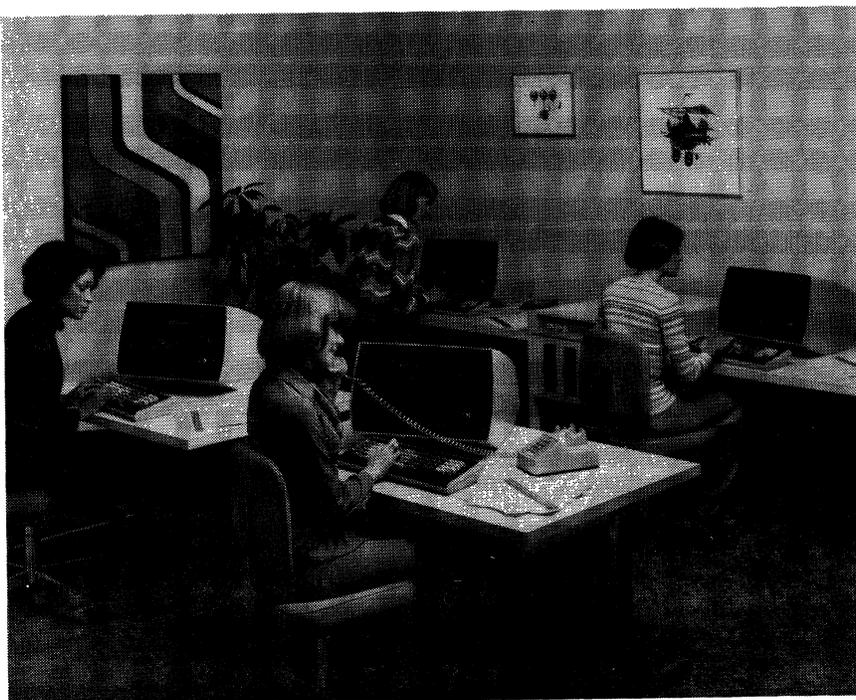
A basic 21/40 system with 32K bytes of memory, one diskette drive, communications interface, and one display station costs \$218 per month on a three-year arrangement including maintenance.

A fully expanded 21/40 system with four display stations, 64K bytes of memory, cartridge disk drive, serial printer, and communications interface costs about \$780 per month on a three-year arrangement including maintenance.

Non-programmable 21/20 system is intended for data entry only; it can be field upgraded to 21/40.

CHARACTERISTICS

VENDOR: Mohawk Data Sciences Corporation, Corporate Headquarters, 1599 Littleton Road, Parsippany, New Jersey 07054. Telephone (201) 540-9080. ➤



Four keystations and four diskette drives permit simultaneous processing of the same job by four operators or four different data entry jobs. That's an attractive configuration for \$450 per month including maintenance. The Series 21 can be field-upgraded to a system that the user can program in a high-level language.

Mohawk Data Sciences Series 21

➤ company has succeeded. Furthermore, this philosophy has been carried through to the larger configurations. At one time, Mohawk had a substantial OEM customer base and manufactured everything it sold. Traditionally, the company configured systems only out of components that it manufactured. In many cases this resulted in higher-powered (and consequently higher-priced) components than were absolutely necessary to a smoothly functioning system. In the case of the Series 21, Mohawk is using diskette drives, disk drives, and printers obtained from other sources.

The user of a Series 21 can start with a single key-to-diskette station performing data entry only. Additional keystations and diskette drives (up to four of each) can be added, if desired, while the system still is dedicated to data entry.

By adding 32K bytes of semiconductor memory, the system is upgraded to a 21/40, permitting user programming in the special MOBOL language and the addition of disk storage. With the 21/40, users can create and update files, process data locally, and print reports.

Communication with a host computer is accomplished in batch mode only, using Binary Synchronous or SDLC protocol. Transmission speeds from 600 to 9600 bits per second are permitted. □

➤ **DATE OF ANNOUNCEMENT:** February 1977.

DATE OF FIRST DELIVERY: May 1977.

NUMBER DELIVERED TO DATE: —

SERVICED BY: Mohawk Data Sciences.

CONFIGURATION

The MDS Series 21 is a modular, operator-oriented system consisting of from one to four keystations. The basic System 21/20 provides for data entry and media conversion utility software. It consists of a controller console that can support from one to four CRT keystations and one to four diskette storage units. A serial printer, magnetic tape drive, and communications capability are also available on the basic system.

The system can be upgraded to a System 21/40 by adding 32,000 bytes of memory to the controller console. This permits the user to generate his own programs for local data base access, transmission, report printing, etc., in a high-level language called MOBOL.

TRANSMISSION SPECIFICATIONS

Both the 21/20 and 21/40 can communicate with a host processor using either Binary Synchronous or SDLC protocol. Both systems are compatible with the IBM 2780, 3780, and 3770. Data rates from 600 bps to 9600 bps are acceptable. Point-to-point transmission may be switched or non-switched, while multipoint must be non-switched. The system communicates in EBCDIC code and in batch mode only.

COMPONENTS

CONTROLLER CONSOLE: The controller console is a compact desk-height unit that houses the processor, up to

four diskette drives, the optional controllers for communications, the external disk and tape drive controllers, and up to 64K bytes of random-access memory. A Series 21/20 controller console can be field-upgraded to a 21/40.

OPERATOR KEYSTATION: Consists of a CRT display and detached keyboard. The keyboard has 66 keys that can be arranged either in a typewriter or data entry arrangement. A 12-key numeric pad is available as an option on either keyboard. All keys emit an audible tone when depressed.

The CRT display has a 15-inch diagonal screen. It can display a full 128-character set in any of 3 brightness intensities. It features blinking characters or words and a blinking cursor. The screen can also display in reverse image (black on white). All of the above features are controlled by the program.

Both the System 21/20 and 21/40 can have from one to four operator keystations. Keystations can be added regardless of the number of diskette drives on the system. On the 21/20, the CRT can display up to 480 characters; on the 21/40, either 480 or 1920 characters.

DISKETTE STORAGE: Each diskette storage unit can read and write on removable diskettes (floppy disks). Each diskette can store 243,000 bytes or 1898 records, each 128 bytes in length. The diskette format is IBM Basic Data Exchange; i.e., 1 index track plus 73 data tracks, each divided into 26 sectors. A minimum 21/20 or 21/40 configuration must have at least one diskette drive housed within the controller console, plus one operator keystation. Diskettes may be added regardless of the number of keystations. Four diskette drives are the maximum number permitted on either Series 21 system.

DISK STORAGE: The disk storage unit for the 21/40 is a front-loading, cartridge-type unit. The disk itself is contained within an IBM 2315-type cartridge with a capacity of 2.5 million bytes. Transfer rate is 195,000 bytes per second. Average access time is 70 milliseconds.

MAGNETIC TAPE: A Series 21 system can include either a 9-track, 800-bpi, 25-ips or 9-track, 1600-bpi, 25-ips tape drive. It is also possible to connect an MDS 1100 or 6400 Data Recorder to the Series 21 for an installation looking for a very low-cost tape drive.

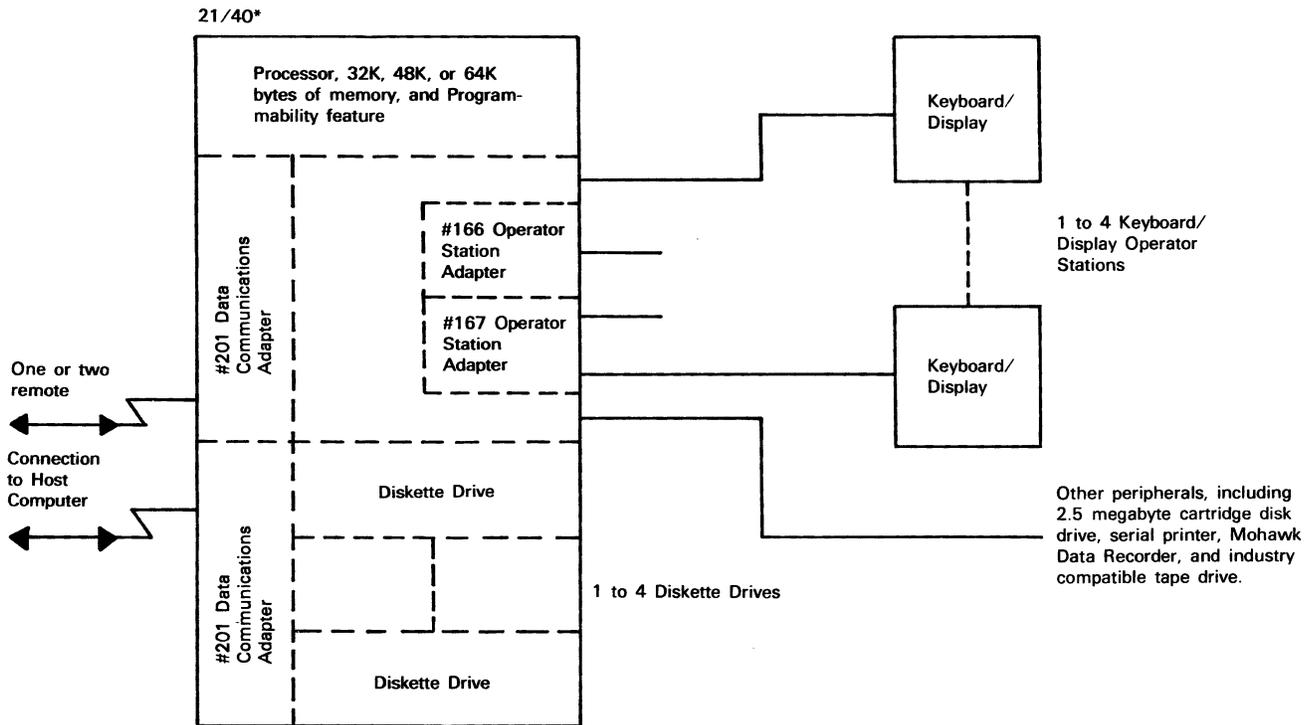
1200/2300/2400 COMPATIBILITY: Either the 21/20 or 21/40 can be directly connected to either an MDS 1200/2400 system or an MDS 2300 intelligent terminal. This has the potential of providing the Series 21 with additional communications emulators.

PRINTERS: Two serial impact printers are available on the Series 21. The first of these is a 5-by-7 dot matrix machine rated at 165 characters per second. Horizontal character spacing is 10 per inch. Vertical line spacing is 6 per inch. The machine has an adjustable sprocket feed that will accommodate forms up to 14 $\frac{1}{4}$ inches wide with up to 6 parts. A 64-character ASCII subset is standard.

The second printer is a serial impact machine that produces correspondence-quality copy at 45 characters per second. A 96-character ASCII subset is standard. Various printwheels containing different type fonts are available and are readily changeable by the operator. Horizontal character spacing is either 10 or 12 to the inch depending on the type font, thus providing a 132- or 158-character print line. Vertical spacing of six or eight lines per inch is standard. Forms up to 15 inches wide can be accommodated. A friction-feed platen is standard, and a tractor feed attachment is available as an option. ➤

Mohawk Data Sciences Series 21

Configuration



*Configurations for 21/20 is essentially the same without memory and Programmability features. The 21/20 can be field upgraded to a 21/40.

► **COMMUNICATIONS:** Both the 21/20 and 21/40 can communicate with a host processor using either Binary Synchronous or SDLC protocol. Both systems are compatible with the IBM 2780, 3780, and 3770. Data rates from 600 bps to 9600 bps are acceptable. Point-to-point transmission may be switched or non-switched, while multi-point must be non-switched. The system communicates in EBCDIC code and in batch mode only.

SOFTWARE

FORMATTED DATA ENTRY PACKAGE (FDEP): This software runs on both the 21/20 and the 21/40. The principal objective of FDEP is to facilitate the conversion of data entry tasks from keypunch or key-to-tape devices to the Series 21 system. Up to 10 program levels per job can be specified. Each program level permits a user to describe records up to 128 bytes in length. On a system with multiple keystations (up to 4), each operator may be performing a different data entry task.

The FDEP software provides for record insert and delete, two methods of search and update, four accumulators, modulus 10 and 11 check digit schemes, automatic and auxiliary duplication, and operator prompting. When using FDEP, the CRT's can display up to 480 characters.

The FDEP software permits communication with a host processor on a non-concurrent, batch basis.

MOBOL: A high-level, multi-purpose language that permits users of the 21/40 to generate programs to perform functions not possible with FDEP. Some of these include:

- **Advanced data validation**—MOBOL programs can provide additional check digit schemes, expanded accumulation, table look-up, and range checking.
- **Local transaction processing**—MOBOL programs can be written for the creation and maintenance of local data bases, actual transaction processing, and report formatting and printing.
- **Multi-tasked processing**—MOBOL programs permit each of the operators (up to 4) on the system to concurrently perform a unique function, including batch transmission.

MOBOL programs can use either data-entry-style CRT formats of 480 characters or full-screen formats of 1920 characters.

A MOBOL object program is compiled on the System 21/40 after the operator has entered the source program statements via the keystation, using EDEP, and stored them on a diskette.

MOBOL supports either BSC or SDLC Communications protocol.

Both FDEP and MOBOL program execution are bundled in the base and purchase prices of the Series 21 systems.

PRICING

The Series 21 is available for outright purchase or for lease on a 12-month or 36-month basis. The monthly cost figures below include prime-shift maintenance. A separate maintenance agreement is available for purchased units. ►

Mohawk Data Sciences Series 21

		Monthly Rental*									
		1-Year Lease	3-Year Lease	Purchase	Monthly Maint.			1-Year Lease	3-Year Lease	Purchase	Monthly Maint.
21/20	Data Entry System; includes controller console, one operator station, one diskette controller, and one dual-station controller	\$190	\$162	\$6,270	\$32	2192	Operator Station (1 included in base system; maximum four per system)	51	43	1,978	6
						191	Dual-Station Controller	14	12	506	2
21/40	Application Processing System; includes controller console, one operator station, one diskette drive, one diskette controller, one dual-station controller, one memory expansion assembly, 32K bytes of memory, and programmability	232	197	7,660	39	911	Typewriter-Style Keyboard	N/C	N/C	N/C	N/C
						912	Data Entry-Style Keyboard	N/C	N/C	N/C	N/C
						171	Diskette Controller	N/C	N/C	N/C	N/C
						2171	Diskette Drive (1 included in base system; maximum four per system)	42	35	1,459	5
160	Programmability	42	35	1,390	7	2172	Disk drive, 2.5 mega-	250	215	7,712	55
164	16K-byte Memory	38	33	1,175	10	2141	Serial printer, 45 cps (maximum one per system)	135	116	4,293	27
165	Module					901	Tractor feed attachment for 2141	9	8	300	2
166	Operator Station Adapter (needed for second operator station)	19	17	600	5	201	Data Communications Synchronous and SDLC Adapter, 2000-9600 bps (maximum two per system)	24	21	623	8
167	Operator Station Adapter (needed for third and fourth operator station; Feature 166 is a prerequisite)	19	17	600	5						
180	MDS-Compatible Channel (direct 2300/2400 System interface)	27	23	880	5						
181	MDS Data Recorder Interface	13	11	424	3						

*Includes monthly maintenance.

Several prices, notably those of the 165-cps printer and the tape drives, were not final at the time of our publication deadline. ■

Mohawk Data Sciences Series 21

New Product Announcement

Mohawk Data Sciences introduced the System 21/50 in April 1978, a new top-of-the-line model for its Series 21 family that doubles the performance range of the existing models. The new member features up to double the main memory capacity of the 21/40 (the previous high end of Series 21), twice its processing speed, and double the fixed disk storage capacity of either the System 21/40 or the entry-level System 21/30. Mohawk's new distributed processing system introduces multiprogramming and concurrent task execution to the Series 21 family. The System 21/50 can execute as many as three concurrent tasks, including one background task, such as batch communications with the host computer or media conversion. User programs are written in MOBOL, Mohawk's Business-Oriented Language, just as they are for the System 21/40. MOBOL programs written for the System 21/40 will also run on the System 21/50.

System 21/50's basic configuration is similar to that of the System 21/40. Major components include a controller cabinet that contains a 250-nanosecond microprocessor with 64K to 128K bytes of RAM memory in 32K-byte increments; one to four diskette drives or one or two diskette drives and a 2.5-, 10-, or 20-million byte (formatted capacity) fixed disk; one to four operator stations (keyboard/display units); and peripheral options including printers, magnetic tape drives, and a 7-, 9-, or 7-/9-track Data Recorder. The four printers available are rated at 45 cps, 90 to 240 lpm, 90 to 340 lpm, and 600 lpm. Two models of industry-compatible, 9-track magnetic tape units are available with a recording density of 800 bpi NRZI or 1600 bpi PE. System 21/50 employs the same operator stations as the System 21/40. Features include a 15-inch, 1920-character display screen and a standard 66-key data entry keyboard. Alternate keyboard arrangements are available.

Communications support includes concurrent batch transmission to the host computer at 2400 to 4800 bits per second and interactive transmission at up to 9600 bits per second. Emulators are provided for IBM 2780, 3780, and 3776 protocols. IBM BSC and SDLC protocols are supported.

		Monthly Charges*					
		1-Year Lease	2-Year Lease	3-Year Lease	5-Year Lease	Purchase	Monthly Maint.
	System 21/50 with 64K bytes of RAM memory, one diskette drive, and one operator station; does not include communications interface	\$477	\$453	\$405	\$386	\$14,950	\$80
F163	Additional RAM Memory, 32K bytes	76	72	66	—	2,350	20
2171	Diskette Drive; 3 max.	42	40	35	—	1,459	5
	Fixed Disk Drive:						
2172	25 Megabytes	273	261	238	—	7,712	78
F704	10 Megabytes	260	248	223	—	8,200	55
F706	20 Megabytes	352	334	330	286	10,800	65
2192	Operators Station	51	48	43	—	1,978	6
F191	Dual Station Controller; one required for 3rd & 4th operator stations	14	13	12	—	506	2
F910	Numeric Pad	3	3	3	—	153	0
2141	Printer; 45 cps	135	129	116	—	4,293	27
2142-1	Printer, 90 to 240 lpm	245	235	210	—	8,120	55
2142-2	Printer, 230 to 340 lpm	340	325	295	—	11,320	75
2145	Printer, 600 lpm	685	655	610	—	20,600	170
F201	Communications BSC/SDLC Adapter; 2400 to 4800 bps	24	23	21	—	623	8
F202	Communications Adapter; 600 or 1200 bps	24	23	21	—	623	8
F208	Hispeed BSC Communications Adapter; 9600 bps	53	50	46	43	1,400	8
F205	Dual Modem Select	8	8	7	—	250	2
F206	Data Rate Select	4	4	4	—	120	1
	Communications Panel; for F205 & F206	75**	75**	75**	75**	75	0
F101	Operator Station Table	150**	150**	150**	150**	150	0
F901	Keyboard Rest	11**	11**	11**	11**	11	0
	Magnetic Tape Drives:						
2481	9 track, 800 bpi, 10-inch reel	250.50	239.50	216.50	—	8,000	62.50
2482	9 track, 1600 bps, 10-inch reel	334.50	318.50	287.50	—	11,000	75.50
2181	9 track, 800 bpi, 7-inch reel	250	238	214	—	8,200	50
2182	9 track, 1600 bpi, 7-inch reel	335	319	286	—	11,275	60
F180	Mohawk 2300-/2400-Compatible Channel	30	29	26	—	880	8
F181	Data Recorder Interface; 1 max.	13	12	11	—	424	3
	Data Recorder:						
2112	7-track	162.25	157.25	146.25	—	1,800	72.25
2114	9-track	185.75	178.75	163.75	—	2,400	65.75
2115	7/9-track	172	164	147	—	2,800	32

* Includes maintenance.

**Single Use Charge. □

Mohawk Data Sciences 2300 System



The MDS 2300 shown above is equipped with the optional card reader, cartridge tape drive (directly beside the card reader), and line printer. This is a popular configuration for remote job entry.

MANAGEMENT SUMMARY

The Mohawk 2300 System operates as a remote station for entering source data and preparing business documents such as invoices and purchase orders. The system performs all arithmetic operations, formats data under program control, and stores keyed data for subsequent processing at a central site.

The 2300 can store a local data base for updating and lookup purposes. Such files can be exchanged with other 2300's or with a central site. When not being used for document processing, the 2300 is available for remote job entry (RJE), offering a choice of communications emulators. An optional feature enables the system to communicate on-line with a remote CPU in an inquiry/response mode.

The system can communicate with another 2300 or Mohawk's 1200 and 2400 Systems; with various IBM systems and terminals; and with various systems supplied by other manufacturers which support IBM 2780 and

3780 terminals. The 2300 uses IBM Binary Synchronous Communications conventions. Data transmission is in half-duplex mode using EBCDIC code at speeds up to 9600 bps.

An IBM 3735-compatible, programmable keyboard/display terminal designed for document preparation, remote job entry, and basic file lookup and updating functions.

Features include 4K bytes of main memory, a 9-inch CRT unit, up to 806.4K bytes of disk storage, magnetic tape drive, card reader, character or line printer rated at up to 100 cps or 900 lpm, and transmission rates of up to 9600 bps.

A typical configuration including one controller with a 300-lpm printer, 460.8K bytes of disk storage, a cartridge tape drive, and a card reader sells for \$20,899 and leases for \$920.25 on a one-year lease.

CHARACTERISTICS

VENDOR: Mohawk Data Sciences Corporation, Corporate Headquarters, Parsippany, New Jersey 07054. Telephone (201) 540-9080.

DATE OF ANNOUNCEMENT: 1973.

DATE OF FIRST DELIVERY: 1974.

NUMBER DELIVERED TO DATE: Information not available.

SERVICED BY: Mohawk Data Sciences.

CONFIGURATION

The 2307 Control Unit consists of a desk-height cabinet that houses a minicomputer with 4K bytes of main memory, a disk drive, a keyboard, a CRT display, and associated controllers. Optional components include a Binary Synchronous Communications Adapter, 9-track magnetic tape drives, cartridge tape drives, a card reader, character, matrix or line printers, and additional storage.

TRANSMISSION SPECIFICATIONS

Transmission is effected in half-duplex, synchronous mode at 9600, 4800, 2400, 2000, or 1200 bits/second. Communications at 1200 bits/second uses a nonsynchronous modem. MDS supplies modems for rates up to 2400 bits/second, but for the higher rate the user must obtain a suitable modem from another source. MDS supplies an appropriate controller for all of the specified rates. Binary Synchronous Communications (BSC) protocol is used, with EBCDIC selected as the transmission code. Voice-grade lines are employed on dial-up or private facilities.

The 2300 is compatible with an IBM System/360, 370, or System/3 computer equipped for BSC. It can operate under QTAM, BTAM, or TCAM. The 2300 can share a private communications line with other IBM BSC terminals, such as the 2770, 2780, and 3780 terminals and the 1130 computer.

The 2300 can be operated in an unattended mode to receive or transmit. Transmitted data is always in 476-byte blocks, including field and record delimiters, but excluding line control characters. As an alternative to employing the disk for collecting data that is later transmitted in Remote Batch mode, the user can write the output file on cartridge magnetic

Mohawk Data Sciences 2300 System

➤ Essentially, the 2300 System is an intelligent source-data recording station that employs a single keyboard, a 9-inch CRT display, a minicomputer with 4K bytes of memory, and a 230K-byte head-per-track disk storage unit. An optional data communications controller is available and will usually be included. Disk capacity can be expanded in two increments, one of 230.4K bytes and a second of 460.8K bytes, to provide a maximum of 806.4K bytes of storage available to the user and an overall total of 921.6K bytes.

The 2300 System cannot be employed as a free-standing computer. Through its standard File feature it can, however, perform simple file lookup and file update functions. It has several significant features not found in the IBM 3735, including a higher transmission speed and a tutorial CRT. The maximum transmission speed of the 2300 is 9600 bps, versus only 4800 bps for the 3735. The 2300 CRT display exhibits tutorial instructions and systems messages in English; the 3735 has no CR ␣, and the indicator lamps on its panel provide only limited information.

Perhaps the most important superiority of the 2300 over the IBM 3735 is its much larger disk storage capacity. A full day's work can readily be accumulated by the standard disk, and much more can be stored on an expanded disk file, such as names, addresses, part numbers, and prices.

Another advantage of the 2300 system is its ability to incorporate a computer-compatible magnetic tape drive or a cartridge tape drive. Output data can be written on the tapes, which can then be hand-carried or mailed to another location. For example, the tape reels or cartridges could be transported to the central computer facility for loading into the CPU, so that the need to transmit the data would be eliminated. Next, the CPU could record the FDP's and other instructions needed by the 2300 for its next day of operation on the tape, which would now be carried back to the 2300 site and entered into the system via the tape. When communications are employed, data is compressed and efficiently transmitted under the disciplines of BTAM, TCAM, or QTAM, whichever is installed.

USER REACTION

In February 1979, Datapro interviewed nine 2300 System users, who reported on their experiences with a total of 72 systems. Seven of the users had only one or two systems installed, but one user had 23 units and another had 40. The ratings assigned by these users are summarized in the table below.

	Excellent	Good	Fair	Poor	WA*
Overall performance	2	7	0	0	3.2
Ease of operation	5	4	0	0	3.6
Hardware reliability	3	2	4	0	2.9
Maintenance service	3	5	1	0	3.2
Software	5	2	1	1	3.2
Technical support	3	4	2	0	3.1

*Weighted Average on a scale of 4.0 for Excellent.

➤ tape or computer-compatible tape. This information can not only be transmitted if desired, but mailed or hand-carried to the CPU site as well.

Terminal-to-terminal communications between 2300 Systems is standard, using a no-charge feature designated as the Remote Copy function. This feature provides for either cartridge-to-cartridge or cartridge-to-tape communications between two 2300 terminals, or between a 2300 and a Mohawk 1200/2400 System operating the IBM 2968 emulator. Speeds up to 9600 bps are supported.

The multi-point inquiry feature of the 2300 enables the system to communicate with the host CPU in an on-line, multi-point environment over leased lines. The multi-point monitor assumes a common constant contact with the central processor. The dispersed terminals "listen" to the same line as the CPU polls, and respond only when they recognize their unique ID. The central site, in turn, is alert to responses from remote terminals inquiring after CPU information. This two-way communication between terminal and mainframe ordinarily does not interrupt operator activities, unless the terminal is programmed to incorporate fresh data from a dynamic CPU data base for a particular document in preparation.

Five 2300 RJE communications programs, 2780/3780/2968/Remote Copy, and 360/20 HASP, are provided to enable the user to communicate with various IBM computer systems and terminals and with various Mohawk systems in RJE mode. Communications with other manufacturers' systems which support IBM 2780 and 3780 terminals is also supported. These programs provide point-to-point communications using transfer rates of up to 9600 bps.

DEVICE CONTROL

As the operator keys data from source documents, the 2300 control processor generates the required output data, performing any of the four arithmetic operations when necessary, and under program control it formats this information as desired.

Usually, formatted data will be transmitted to the central computer for processing. A reverse flow, from the computer to the terminal, supplies the 2300 with updated file information and data to be printed. If print data overflows the disk storage, it can be stored on magnetic tape for later runoff.

More generally, the IBM 360 or 370 central computer is used to assemble Forms Description Programs that are coded in macro statements, and a utility program formats this material into a program that is ultimately transmitted to the 2300 system.

Forms Description Programs (FDP's) act as one level of program control in the 2300 system; the other is the Terminal Control Program (TCP). Both programs are stored on the 2300 disk and together control the operation of the 2300 system. The TCP, which is transferred from the disk to the control unit as needed, interprets the FDP and provides detailed control. Hence, the operator need only select the task to be performed, enter data, and initiate automatic diagnostic checking in the event of malfunction. All other functions are performed under this two-level program library.

In particular, an FDP specifies the form format (such as location of each field, number of lines per page, etc.), editing procedures, and checking operations to be performed on each field. The FDP also implies I/O operations by specifying the source or destination of data and calls for data manipulations, such as arithmetic or conditional comparisons.

➤ **OPERATING MODES:** *Local Mode* enables the operator to employ the keyboard/printer as a standard typewriter and thus acts as the starting point for selecting other operating

Mohawk Data Sciences 2300 System

- The reported length of usage ranged from one year to three years. None of the users had plans to replace their 2300 Systems.

While the ratings indicated a fair degree of user satisfaction, there were a few negative comments. Three users reported problems with the system's printer, and one said the system broke down frequently. Conversely, another user, who termed the 2300 System "just fantastic," reported no down-time at all. This user had a preventive maintenance contract, which he felt accounted for the system's reliable performance. □

- ▶ **modes.** Information keyed in Local Mode is not recorded on the magnetic disk.

Enter-Form Mode transfers control of the system to the FDP selected by the operator. FDP's are identified by a three-digit number. An FDP can have an operator message, which the operator can print, display, or bypass before starting the data entry operation. Messages typically include setup instructions, application name, form number, etc.

Under FDP control, the following internal functions are executed to effect processing of the form as desired: statement of data source (e.g., keyboard, special storage, central computer, etc.); destination (e.g., printer, cartridge tape, or special storage); class of data (numeric, alphabetic, self-checking, etc.); processing (arithmetic, testing or branching operations); and editing (defines the format of the output data). Each form processed in Enter-Form Mode is stored on the disk with a unique three-digit record serial number that provides identification for later recall.

In *Playback Mode*, records recorded in Enter-Form Mode can be retrieved from the disk for updating or correcting or to produce additional copies of the form records. When in Playback Mode, the operator can cause the system to print a character, a field, or a line at a time or order continuous printing of the records. This mode, like Enter-Form Mode operation, is under FDP control.

Request Mode enables selection of one of the many auxiliary operations of the system, such as: Communicate Mode (causes records to be compressed and transmitted in IBM 3735 BSC mode); Erase CPU Data (causes records received from the CPU to be erased from the system disk); Erase Operator Data (deletes records that were created by the 2300); FDP listing (effects a printed listing of the FDP's currently available in the 2300 terminal); Data Listing (effects a printed listing of the records currently stored in the 2300 terminal); Diagnostics (enables one of the system diagnostics to be executed as selected); Cartridge Utility (used on systems employing the cartridge tape drive); Tape Utility (used on systems having an IBM-compatible tape drive); and Data Compression (used to compress the size of records stored on the 2300 disk).

Communications is initiated to transmit the operator's output of the day to the CPU, to receive a message from the CPU, or to obtain new FDP's (a new complete set must be received for each day's operation).

OPERATION: Generally, FDP programs are assembled by the remote CPU and loaded into the 2300 terminal via a transmission line. Because all programs must be transferred at the same time, the task of adding or modifying a single program imposes the need to retransfer all programs.

The operator fills out a form under control of a particular FDP in the Enter-Form Mode. The program automatically positions the paper form and the print mechanism for each field. As the operator proceeds, the CRT displays the fields currently being entered and thus enables the operator to sight-verify and correct the keyed information before it is printed on the form and written on the disk. If constant

information is pulled from storage under FDP control and automatically printed, the operator continues without interruption to key the next field.

The end of the form can be handled automatically under FDP control or manually by the operator. After completing a form, the operator can continue processing another form under control of the operative FDP, select a different FDP for processing another form type, or enter another operating mode.

The TCP executes the operations specified by the FDP. In most application environments there will be several FDP's to draw from on the disk, but there is only one TCP.

The three basic operations that can be performed on data are validation, arithmetic, and editing. Data fields can be checked for content (alphanumeric, alphabetic, or numeric), length (maximum, minimum, or exact), value (greater than, less than, or equal to), and/or self-check (modulo 10 or 11). A data field specified as optional causes checks to be suspended if the operator skips the field. Batch numbers can be assigned, with provisions for identifying up to 128 different batches. Hence, accumulation of batch totals is made possible. Arithmetic operations are performed with counters; two counters or one counter and another storage area can be assigned.

ERROR CONTROL: Checks are made on data transfers over the communications line and within the 2300 system. Parity is checked when the data is read from the disk, dynamic buffers, and arithmetic and logical control units.

If errors are made while in the Enter-Form Mode, the operator can backspace and retype the correct entry provided that the field has not been completed. Corrections to errors that are discovered after completion of a field are usually made in the Playback Mode, which permits a completed record to be recalled using the three-digit record number.

The 2300 emphasizes extensive self-diagnostic capabilities. Tests included within the TCP implement testing of the control unit electronics, disk surfaces, communications adapter, keyboard/printer, and communications functions. Testing of the 2307 Control Unit is performed automatically each time the terminal is turned on and whenever a hardware error is detected. Other tests are conducted upon operator request. Reports are generated for the disk surface and on-line (communications functions) tests; the results of the other tests are displayed by means of indicator lights on the keyboard and by error messages on the CRT.

SOFTWARE

There are three categories of software that relate to the 2300 system: IBM System/360 and 370 system software, Mohawk 2400 system software for 2300 support, and Mohawk 2300 system software.

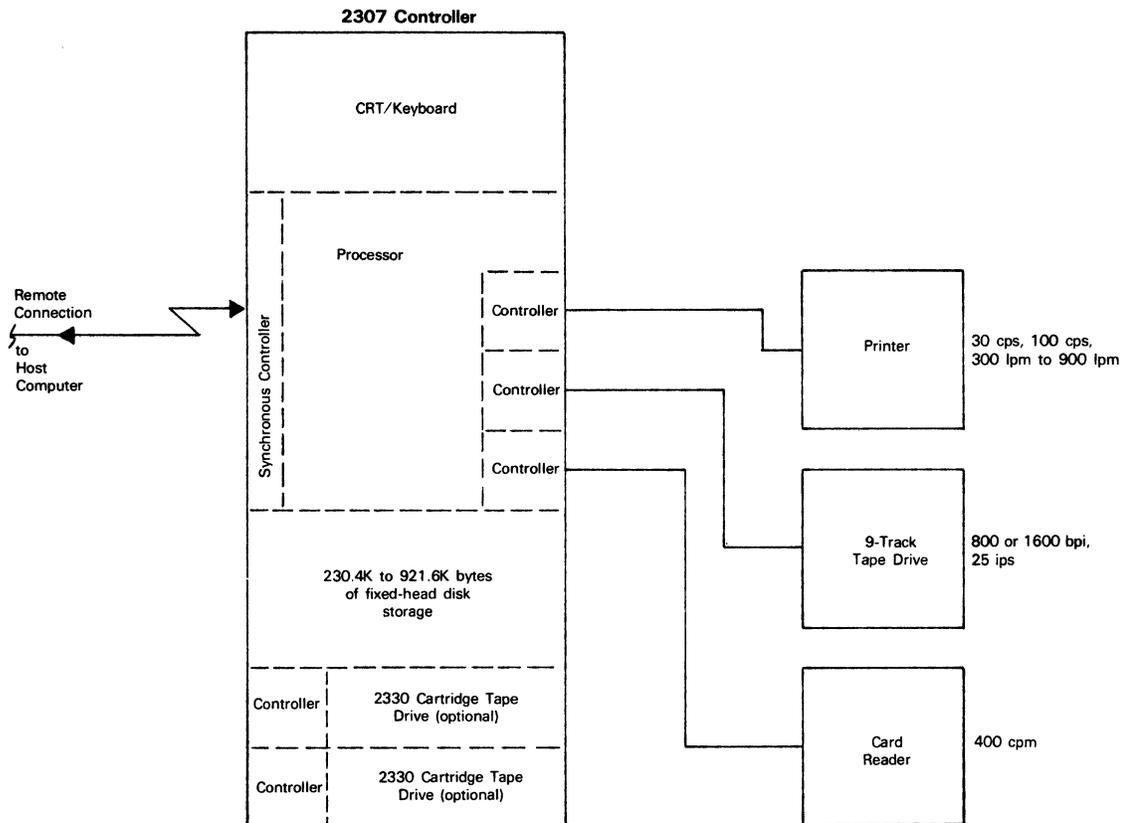
The IBM computer assembles Forms Descriptions Programs and supports BSC communications under OS for TCAM and BTAM and under DOS for BTAM. The minimum IBM systems that can support the MDS 2300 are a System/360 Model 22 with 32K bytes of storage and a System/370 Model 125.

The Applications Package, supplied by IBM for its 3735 and also usable with the MDS 2300, is a series of programs that permit the DOS user to specify, assemble, and store for later transmission application programs for the 2300 system. Application programs can be specified in a language that resembles RPG in format and can be coded on RPG statement sheets.

If the user has a Mohawk 2400 system, the 2300 File Manager and Communications programs can be installed in the 2400 system. The File Manager program makes it possible to generate FDP object programs suitable for transmission to a 2300 terminal in the 2400 system. The File Manager also permits initial creation of an FDP file and other functions. The Communications program enables the

Mohawk Data Sciences 2300 System

Configuration



Mohawk 2400 to emulate the communications characteristics of the IBM 360 or 370 with respect to 2300 terminal communications.

The 2300 Terminal Control Program supplied by Mohawk is located in a write-protected area of the disk drive of the 2300 system. It incorporates the following instructions: Hardware Control, FDP Interpretation, Utility Programs, Communications Programs, and Hardware Diagnostics. The TCP also implements operation on the CRT display, controls printing and carriage and platen motion, performs a test on all surface areas of the disk, and includes a write/read on open areas of the disk.

COMPONENTS

KEYBOARD: Has a pattern similar to that of a typewriter, with the addition of control keys and indicators. A special numeric pad is included. Optional keytop layouts are available. The keyboard implements a set of 64 upper and lower case characters.

CRT DISPLAY: The 9-inch CRT screen acts as a data, message, and general information display medium for system/operator communication. The presentation consists of 4 lines of 32 characters each. A 5-by-7 matrix forms the characters. The top line displays the operating mode, the second line displays guidance messages, the third line presents error messages, and data keyed by the operator appears on the fourth line. A cursor in the form of an underscore indicates the operator's position in the field.

DISK STORAGE: Basic unit has 230.4K-byte head-per-track disk, with approximately 115.2K bytes available to the user. The disk is interfaced to the system by an associated

controller. It holds all the software for operating the system except for a small control and handling program in main memory. In particular, the Terminal Control Program (TCP), Forms Description Programs (FDP), and system diagnostic programs are stored on the disk. Approximately 115K bytes of storage are allotted for FDP's (application programs) and for data input to cover a day's operation.

ADDITIONAL DISK STORAGE: The first increment of storage adds 230.4K bytes, providing approximately 345.6K bytes to the user. A second increment of 460.8K bytes brings the total capacity to 921.6K bytes, with 806.4K bytes available to the user.

MAGNETIC TAPE DRIVES: Either a Model 2481 or 2482 tape drive can be attached to the 2307 Control Unit. Both drives have a 2400-foot reel capacity and a forward speed of 25 inches/second. Model 2481 operates at 800 bits/inch and Model 2482 operates at 1600 bits/inch. Both are 9-track units.

CARTRIDGE TAPE DRIVES: One or two Mohawk 2330 tape drives can be mounted within the operator's desk.

These units utilize 3M Data Cartridges that hold 300 feet of 1/4-inch tape and have a capacity of 1740 80-character records/track. Serial recording on 4-track tape is standard.

CARD READER: Can read 80-column punched cards at a speed of 400 cards per minute. Hopper capacity is 1000 cards, and stacker capacity is 1100 cards. The reader is field-installable and may be mounted on top of the 2307 cabinet or on a customer-supplied table.

PRINTERS: Seven different printers are available for use on the 2300 system:

Mohawk Data Sciences 2300 System



Printer Type and Model	Print Positions	Rated Speeds		
		48-Char. Set	64-Char. Set	96-Char. Set
2340 Char.	132	—	—	30 cps
1310 Matrix	132	—	100 cps	—
2343 Drum	132	—	300 lpm	—
2444 Chain	132/136	380 lpm	160-450 lpm*	—
2445 Chain	132	600 lpm	—	—
2441 Drum	132/136	—	600 lpm	436 lpm
2442 Drum	132/136	—	900 lpm	660 lpm

PRICING

Mohawk 2300 Systems and components can be purchased outright or leased under Mohawk's 1-, 2-, or 3-year fixed term plan (12-, 24-, or 36-month obligation). Discounts of 10% and 17.5%, respectively, are offered under the 2- and 3-year plans. The discounts apply to rentals only, not to maintenance. The following table shows the basic monthly rental on a 1-year lease, and the prices shown include maintenance.

*Varies with character set size (16 to 128 characters).

		Monthly Rental*	Purchase	Monthly Maint.
2307-1	Controller (includes communications port and selector)	\$273.50	\$ 7,999	\$ 73.50
2307-2	Controller, with 300-lpm chain printer	682.25	13,499	232.25
2307-3	Controller, with 600-lpm chain printer	915.75	19,999	265.75
2330	Cartridge Magnetic Tape Drive (4-track)	31.50	1,000	6.50
2330	Cartridge Drive Controller	28.25	1,000	6.25
2481	Tape Drive; 9-track; 800 bpi	239.75	7,320	68.75
2482	Tape Drive; 9-track, 1600 bpi	325.75	10,320	83.75
1310	Matrix Printer; 100 cps	217.50	6,000	74.50
1310	Matrix Printer Controller	11.25	400	2.25
2340	Character Printer; 96 char., 30 cps	140.00	4,600	21.00
2340	Character Printer Controller	NC	NC	NC
2444	Chain Printer; 380 lpm	479.75	8,775	166.75
2445	Chain Printer; 600 lpm	817.75	20,220	201.75
2343	Drum Printer; 300 lpm	275.50	4,000	127.50
2441	Drum Printer; 600 lpm	702.50	20,600	187.50
2442	Drum Printer; 900 lpm	840.00	30,000	90.00
2353	Card Reader; 400 cpm	127.50	3,600	33.50
2353	Card Reader Controller	11.25	400	2.25
Keylock		25.00**	25**	—
230.4K bytes additional disk storage		39.50	1,400	6.50
460.8K bytes additional disk storage		78.75	2,800	12.75
Up to 16K bytes memory		46.00	1,500	10.00
Synchronous Clock		11.25	320	2.25
Alternate Modem Select		11.25	400	1.25
Voice/Data Switch		3.00	80	—
Select/Standby Switch		3.00	80	—
Data-Rate Select		3.00	80	—
Multi-Point Inquiry		—	—	—

* Includes prime-time maintenance.

**One-time charge.■

Mohawk Data Sciences 2300 System



The MDS 2300 shown above is equipped with the optional card reader, cartridge tape drive (directly beside the card reader), and line printer. This is a popular configuration for remote job entry.

MANAGEMENT SUMMARY

The Mohawk 2300 System, when first announced, was described as a "Document Processing System" and was promoted as a remote station for the preparation of business documents such as invoices, purchase orders, receiving reports, etc. These documents were to be prepared at the remote site under program control, with the system performing all arithmetic operations and storing all of the keyed data, as well as supplying relevant additional data, for subsequent transmission to the host processor site.

As it turned out, many of the user installations are currently operating more in the manner of batch terminals than document preparation systems. Most of the transmission is from the central site out, and line printers, rather than keyboard-driven printers, are commonly employed at the remote sites.

The 2300 can store a local data base for updating and lookup purposes. Such files can be exchanged with other 2300's or with a central site. When not being used for document processing, the 2300 is available for remote job entry (RJE), offering a choice of communications emulators. An optional feature enables the system to communicate on-line with a remote CPU in an inquiry/response mode.

Programmable display/keyboard terminal for local document preparation, remote job entry, and limited file update and lookup functions.

Standard features include 128 character display and 230.4K bytes of disk storage. The terminal can be expanded to include a maximum of 806.4K bytes of disk storage, a 30 cps to 600 lpm printer, a 9-track magnetic tape drive, one or two cartridge tape drives, and a 400 cpm card reader. Data transmission of up to 9600 bps is supported.

A typical configuration including a 300-lpm drum printer, a total of 460.8K bytes of disk storage, one cartridge tape drive, and a synchronous communications controller leases for \$682 per month, including maintenance, on a two-year lease and sells for \$19,800.

The 2300 was originally introduced as a replacement for the IBM 3735; it appears to have outlived the 3735 because of increased peripheral speed capabilities and larger disk storage capability.

CHARACTERISTICS

VENDOR: Mohawk Data Sciences Corporation, Corporate Headquarters, Parsippany, New Jersey 07054. Telephone (201) 540-9080.

DATE OF ANNOUNCEMENT: 1973.

DATE OF FIRST DELIVERY: 1974.

NUMBER DELIVERED TO DATE: Information not available.

SERVICED BY: Mohawk Data Sciences.

CONFIGURATION

The 2307 Control Unit consists of a desk-height cabinet that houses a minicomputer with 4K bytes of main memory, a disk drive, a keyboard, a CRT display, and associated controllers. Optional components include a Binary Synchronous Communications Adapter, 9-track magnetic tape drives, cartridge tape drives, a card reader, character, matrix or line printers, and additional storage.

TRANSMISSION SPECIFICATIONS

Transmission is effected in half-duplex, synchronous mode at 9600, 4800, 2400, 2000, or 1200 bits/second. Communications at 1200 bits/second uses a nonsynchronous modem. MDS supplies modems for rates up to 2400 bits/second, but for the higher rate the user must obtain a suitable modem from another source. MDS supplies an appropriate controller for all of the specified rates. Binary Synchronous Communications (BSC) protocol is used, with EBCDIC selected as the transmission code. Voice-grade lines are employed on dial-up or private facilities.

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▷ The system can communicate with another 2300 or Mohawk's 1200 and 2400 Systems; with various IBM systems and terminals; and with various systems supplied by other manufacturers which support IBM 2780 and 3780 terminals. The 2300 uses IBM Binary Synchronous Communications conventions. Data transmission is in half-duplex mode using EBCDIC code at speeds up to 9600 bps.

Essentially, the 2300 System is an intelligent source-data recording station that employs a single keyboard, a 9-inch CRT display, a minicomputer with 4K bytes of memory, and a 230K-byte head-per-track disk storage unit. An optional data communications controller is available and will usually be included. Disk capacity can be expanded in two increments, one of 230.4K bytes and a second of 460.8K bytes, to provide a maximum of 806.4K bytes of storage available to the user and an overall total of 921.6K bytes.

The 2300 System cannot be employed as a free-standing computer. Through its standard File feature it can, however, perform simple file lookup and file update functions. It has several significant features not found in the IBM 3735, including a higher transmission speed and a tutorial CRT. The maximum transmission speed of the 2300 is 9600 bps, versus only 4800 bps for the 3735. The 2300 CRT display exhibits tutorial instructions and systems messages in English; the 3735 has no CRT, and the indicator lamps on its panel provide only limited information.

Perhaps the most important superiority of the 2300 over the IBM 3735 is its much larger disk storage capacity. A full day's work can readily be accumulated by the standard disk, and much more can be stored on an expanded disk file, such as names, addresses, part numbers, and prices.

Another advantage of the 2300 system is its ability to incorporate a computer-compatible magnetic tape drive or a cartridge tape drive. Output data can be written on the tapes, which can then be hand-carried or mailed to another location. For example, the tape reels or cartridges could be transported to the central computer facility for loading into the CPU, so that the need to transmit the data would be eliminated. Next, the CPU could record the FDP's and other instructions needed by the 2300 for its next day of operation on the tape, which would now be carried back to the 2300 site and entered into the system via the tape. When communications are employed, data is compressed and efficiently transmitted under the disciplines of BTAM, TCAM, or QTAM, whichever is installed.

USER REACTION

Datapro spoke to five users of the 2300 System to elicit their comments on its performance. In several cases, these users were remotely located, had no knowledge of data processing, and were reluctant to make any comment. After assuring them that their anonymity ▷

▶ The 2300 is compatible with an IBM System/360, 370, or System/3 computer equipped for BSC. It can operate under QTAM, BTAM, or TCAM. The 2300 can share a private communications line with other IBM BSC terminals, such as the 2770, 2780, and 3780 terminals and the 1130 computer.

The 2300 can be operated in an unattended mode to receive or transmit. Transmitted data is always in 476-byte blocks, including field and record delimiters, but excluding line control characters. As an alternative to employing the disk for collecting data that is later transmitted in Remote Batch mode, the user can write the output file on cartridge magnetic tape or computer-compatible tape. This information can not only be transmitted if desired, but mailed or hand-carried to the CPU site as well.

Terminal-to-terminal communications between 2300 Systems is standard, using a no-charge feature designated as the Remote Copy function. This feature provides for either cartridge-to-cartridge or cartridge-to-tape communications between two 2300 terminals, or between a 2300 and a Mohawk 1200/2400 System operating the IBM 2968 emulator. Speeds up to 9600 bps are supported.

The multi-point inquiry feature of the 2300 enables the system to communicate with the host CPU in an on-line, multi-point environment over leased lines. The multi-point monitor assumes a common constant contact with the central processor. The dispersed terminals "listen" to the same line as the CPU polls, and respond only when they recognize their unique ID. The central site, in turn, is alert to responses from remote terminals inquiring after CPU information. This two-way communication between terminal and mainframe ordinarily does not interrupt operator activities, unless the terminal is programmed to incorporate fresh data from a dynamic CPU data base for a particular document in preparation.

Four 2300 RJE communications programs, 2780/3780/Remote Copy, and 360/20 HASP, are provided to enable the user to communicate with various IBM computer systems and terminals and with various Mohawk systems in RJE mode. Communications with other manufacturers' systems which support IBM 2780 and 3780 terminals is also supported. These programs provide point-to-point communications using transfer rates of up to 9600 bps.

DEVICE CONTROL

As the operator keys data from source documents, the 2300 control processor generates the required output data, performing any of the four arithmetic operations when necessary, and under program control it formats this information as desired.

Usually, formatted data will be transmitted to the central computer for processing. A reverse flow, from the computer to the terminal, supplies the 2300 with updated file information and data to be printed. If print data overflows the disk storage, it can be stored on magnetic tape for later runoff.

More generally, the IBM 360 or 370 central computer is used to assemble Forms Description Programs that are coded in macro statements, and a utility program formats this material into a program that is ultimately transmitted to the 2300 system.

Forms Description Programs (FDP's) act as one level of program control in the 2300 system; the other is the Terminal Control Program (TCP). Both programs are stored on the 2300 disk and together control the operation of the 2300 system. The TCP, which is transferred from the disk to the control unit as needed, interprets the FDP and provides detailed control. Hence, the operator need only select the task to be performed, enter data, and initiate automatic diagnostic checking in the event of malfunction. All other functions are performed under this two-level program library. ▶

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➤ would be preserved, we were able to elicit ratings on the hardware and maintenance, but they could not rate the software or ease of programming since all programming was done at the central site. This explains why there were fewer responses for those questions. The oldest of the 2300 systems had been installed for over four years, and the most recent for less than two months.

The users we interviewed included an insurance company branch office and a home office, a state government office, a trucking company, and a regional school system office. One user had no communications capability and mailed its tape reels to the central processor site. Three of the users had one 2300 system each, one had 12 systems, and the fifth had 52. Their ratings are summarized in the following table.

	Excellent	Good	Fair	Poor	WA*
Overall performance	3	2	0	0	3.6
Ease of operation	1	3	1	0	3.0
Hardware reliability	0	4	1	0	2.8
Ease of programming	0	3	0	0	3.0
Maintenance service	4	1	0	0	3.8
Software	0	2	0	0	3.0
Technical support	0	3	2	0	2.6

*Weighted Average on a scale of 4.0 for Excellent.

One user, who had a 760-lpm line printer on the system, did not like the Mohawk line printer even though he rated the system Excellent in overall performance. In comparison with the IBM 1403 and 5203, he felt that it is very difficult to load forms and to position the forms tractors horizontally on the Mohawk printer. This user was responsible for the Fair rating for ease of operation. Another user felt that the technical support had been very good when the system was being installed, but that Mohawk had "deserted" the system recently; while his current applications were running satisfactorily, this user felt that the system has not been upgraded, and gave it only a Fair rating for technical support. This same user, however, rated the system Excellent in terms of overall performance and maintenance service.

The user with 52 systems selected the MDS 2300 after running a benchmark in parallel with the IBM 3735. This user felt that the systems were functionally equal, but that the 2300 was considerably lower in price, thereby saving his company several hundred thousand dollars. This user gave the 2300 System satisfactory, though not exceptional, ratings. We questioned the fact that he was not overly enthusiastic about it and yet had installed over 50 units. He emphasized that the systems were indeed performing satisfactorily and were the equal of the 3735, but that the company's requirements were growing and therefore it was starting to look at more advanced equipment. □

➤ In particular, an FDP specifies the form format (such as location of each field, number of lines per page, etc.), editing procedures, and checking operations to be performed on each field. The FDP also implies I/O operations by specifying the source or destination of data and calls for data manipulations, such as arithmetic or conditional comparisons.

OPERATING MODES: *Local Mode* enables the operator to employ the keyboard/printer as a standard typewriter and

thus acts as the starting point for selecting other operating modes. Information keyed in Local Mode is not recorded on the magnetic disk.

Enter-Form Mode transfers control of the system to the FDP selected by the operator. FDP's are identified by a three-digit number. An FDP can have an operator message, which the operator can print, display, or bypass before starting the data entry operation. Messages typically include setup instructions, application name, form number, etc.

Under FDP control, the following internal functions are executed to effect processing of the form as desired: statement of data source (e.g., keyboard, special storage, central computer, etc.); destination (e.g., printer, cartridge tape, or special storage); class of data (numeric, alphabetic, self-checking, etc.); processing (arithmetic, testing or branching operations); and editing (defines the format of the output data). Each form processed in Enter-Form Mode is stored on the disk with a unique three-digit record serial number that provides identification for later recall.

In *Playback Mode*, records recorded in Enter-Form Mode can be retrieved from the disk for updating or correcting or to produce additional copies of the form records. When in Playback Mode, the operator can cause the system to print a character, a field, or a line at a time or order continuous printing of the records. This mode, like Enter-Form Mode operation, is under FDP control.

Request Mode enables selection of one of the many auxiliary operations of the system, such as: Communicate Mode (causes records to be compressed and transmitted in IBM 3735 BSC mode); Erase CPU Data (causes records received from the CPU to be erased from the system disk); Erase Operator Data (deletes records that were created by the 2300); FDP listing (effects a printed listing of the FDP's currently available in the 2300 terminal); Data Listing (effects a printed listing of the records currently stored in the 2300 terminal); Diagnostics (enables one of the system diagnostics to be executed as selected); Cartridge Utility (used on systems employing the cartridge tape drive); Tape Utility (used on systems having an IBM-compatible tape drive); and Data Compression (used to compress the size of records stored on the 2300 disk).

Communications is initiated to transmit the operator's output of the day to the CPU, to receive a message from the CPU, or to obtain new FDP's (a new complete set must be received for each day's operation).

OPERATION: Generally, FDP programs are assembled by the remote CPU and loaded into the 2300 terminal via a transmission line. Because all programs must be transferred at the same time, the task of adding or modifying a single program imposes the need to retransfer all programs.

The operator fills out a form under control of a particular FDP in the Enter-Form Mode. The program automatically positions the paper form and the print mechanism for each field. As the operator proceeds, the CRT displays the fields currently being entered and thus enables the operator to sight-verify and correct the keyed information before it is printed on the form and written on the disk. If constant information is pulled from storage under FDP control and automatically printed, the operator continues without interruption to key the next field.

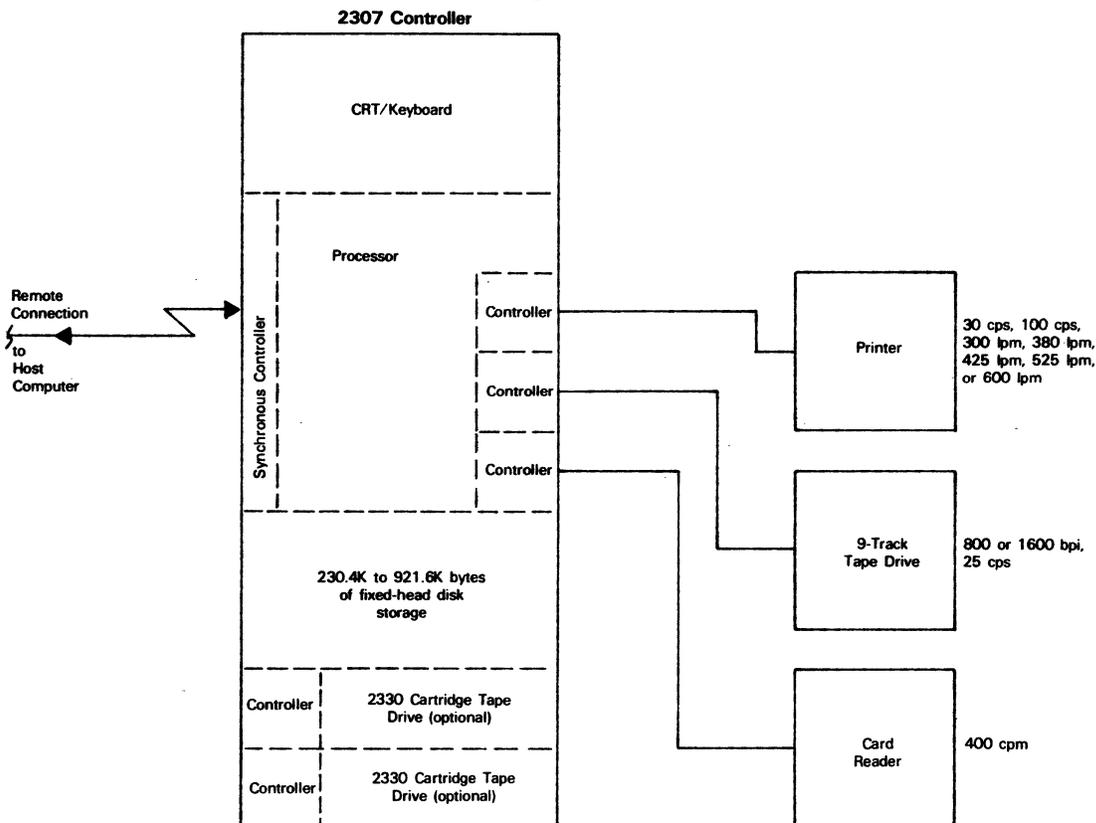
The end of the form can be handled automatically under FDP control or manually by the operator. After completing a form, the operator can continue processing another form under control of the operative FDP, select a different FDP for processing another form type, or enter another operating mode.

The TCP executes the operations specified by the FDP. In most application environments there will be several FDP's to draw from on the disk, but there is only one TCP.

The three basic operations that can be performed on data are validation, arithmetic, and editing. Data fields can be checked for content (alphanumeric, alphabetic, or numeric),

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length (maximum, minimum, or exact), value (greater than, less than, or equal to), and/or self-check (modulo 10 or 11). A data field specified as optional causes checks to be suspended if the operator skips the field. Batch numbers can be assigned, with provisions for identifying up to 128 different batches. Hence, accumulation of batch totals is made possible. Arithmetic operations are performed with counters; two counters or one counter and another storage area can be assigned.

ERROR CONTROL: Checks are made on data transfers over the communications line and within the 2300 system. Parity is checked when the data is read from the disk, dynamic buffers, and arithmetic and logical control units.

If errors are made while in the Enter-Form Mode, the operator can backspace and retype the correct entry provided that the field has not been completed. Corrections to errors that are discovered after completion of a field are usually made in the Playback Mode, which permits a completed record to be recalled using the three-digit record number.

The 2300 emphasizes extensive self-diagnostic capabilities. Tests included within the TCP implement testing of the control unit electronics, disk surfaces, communications adapter, keyboard/printer, and communications functions. Testing of the 2307 Control Unit is performed automatically each time the terminal is turned on and whenever a hardware error is detected. Other tests are conducted upon operator request. Reports are generated for the disk surface and on-line (communications functions) tests; the results of the other tests are displayed by means of indicator lights on the keyboard and by error messages on the CRT.

SOFTWARE

There are three categories of software that relate to the 2300 system: IBM System/360 and 370 system software, Mohawk 2400 system software for 2300 support, and Mohawk 2300 system software.

The IBM computer assembles Forms Descriptions Programs and supports BSC communications under OS for TCAM and BTAM and under DOS for BTAM. The minimum IBM systems that can support the MDS 2300 are a System/360 Model 22 with 32K bytes of storage and a System/370 Model 125.

The Applications Package, supplied by IBM for its 3735 and also usable with the MDS 2300, is a series of programs that permit the DOS user to specify, assemble, and store for later transmission application programs for the 2300 system. Application programs can be specified in a language that resembles RPG in format and can be coded on RPG statement sheets.

If the user has a Mohawk 2400 system, the 2300 File Manager and Communications programs can be installed in the 2400 system. The File Manager program makes it possible to generate FDP object programs suitable for transmission to a 2300 terminal in the 2400 system. The File Manager also permits initial creation of an FDP file and other functions. The Communications program enables the Mohawk 2400 to emulate the communications characteristics of the IBM 360 or 370 with respect to 2300 terminal communications.

The 2300 Terminal Control Program supplied by Mohawk is located in a write-protected area of the disk drive of the 2300 system. It incorporates the following instructions: Hardware Control, FDP Interpretation, Utility Programs, Communications Programs, and Hardware Diagnostics. The TCP also implements operation on the CRT display, controls printing and carriage and platen motion, performs a test on all surface areas of the disk, and includes a write/read on open areas of the disk.

COMPONENTS

KEYBOARD: Has a pattern similar to that of a typewriter, with the addition of control keys and indicators. A special

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► numeric pad is included. Optional keytop layouts are available. The keyboard implements a set of 64 upper and lower case characters.

CRT DISPLAY: The 9-inch CRT screen acts as a data, message, and general information display medium for system/operator communication. The presentation consists of 4 lines of 32 characters each. A 5-by-7 matrix forms the characters. The top line displays the operating mode, the second line displays guidance messages, the third line presents error messages, and data keyed by the operator appears on the fourth line. A cursor in the form of an underscore indicates the operator's position in the field.

DISK STORAGE: Basic unit has 230.4K-byte head-per-track disk, with approximately 115.2K bytes available to the user. The disk is interfaced to the system by an associated controller. It holds all the software for operating the system except for a small control and handling program in main memory. In particular, the Terminal Control Program (TCP), Forms Description Programs (FDP), and system diagnostic programs are stored on the disk. Approximately 115K bytes of storage are allotted for FDP's (application programs) and for data input to cover a day's operation.

ADDITIONAL DISK STORAGE: The first increment of storage adds 230.4K bytes, providing approximately 345.6K bytes to the user. A second increment of 460.8K bytes brings the total capacity to 921.6K bytes, with 806.4K bytes available to the user.

MAGNETIC TAPE DRIVES: Either a Model 2481 or 2482 tape drive can be attached to the 2307 Control Unit. Both drives have a 2400-foot reel capacity and a forward speed of 25 inches/second. Model 2481 operates at 800 bits/inch and Model 2482 operates a 1600 bits/inch. Both are 9-track units.

CARTRIDGE TAPE DRIVES: One or two Mohawk 2330 tape drives can be mounted within the operator's desk.

These units utilize 3M Data Cartridges that hold 300 feet of 1/4-inch tape and have a capacity of 1740 80-character records/track. Serial recording on 4-track tape is standard.

CARD READER: Can read 80-column punched cards at a speed of 400 cards per minute. Hopper capacity is 1000 cards, and stacker capacity is 1100 cards. The reader is field-installable and may be mounted on top of the 2307 cabinet or on a customer-supplied table.

PRINTERS: Seven different printers are available for use on the 2300 system:

Printer Type and Model	Print Positions	Character Set	Rated Speed
2340 Character	132	96	30 cps
1310 Matrix	132	64	100 cps
2343 Drum	132	64	300 lpm
2444 Chain	132/136	16 to 128	450 to 160lpm*
2445-4 Chain	132	64	425 lpm
2445-5 Chain	132	64	525 lpm
2445-6 Chain	132	64	600 lpm

*Rated speed for 48 character set is 380 lpm.

PRICING

Mohawk 2300 Systems and components can be purchased outright or leased under Mohawk's 1-, 2-, or 3-year fixed term plan (12-, 24-, or 36-month obligation). Discounts of 10% and 17.5%, respectively, are offered under the 2- and 3-year plans. The discounts apply to rentals only, not to maintenance. The following table shows the basic monthly rental on a 1-year lease, and the prices shown include maintenance.

Monthly Rental*

		1-Year Lease	Purchase	Monthly Maint.
2307	Controller	\$314	\$10,400	\$70
2330	Cartridge Magnetic Tape Drive (4-track)	31	1,000	6
2330	Cartridge Drive Controller	28	1,000	6
2481	9-track, 800-bpi Tape Drive	230.50	8,000	59.50
2482	9-track, 1600-bpi Tape Drive	314.50	11,000	72.50
1310	100-cps Matrix Printer	210.50	7,400	67.50
1310	Matrix Printer Controller	11	400	2
2340	30-cps Character Printer (96 char.)	139	4,600	20
2340	Character Printer Controller	NC	NC	NC
2444	380-lpm Chain Printer	535.50	16,650	150.50
2445-4	425-lpm Chain Printer (64 char.)	570.50	18,060	150.50
2445-5	525-lpm Chain Printer (64 char.)	687	22,360	167.00
2445-6	600-lpm Chain Printer (64 char.)	798.50	25,900	182.50
2343	300-lpm Drum Printer	269	4,000	121
2353	400-cpm Card Reader	127.50	3,600	33.50
2353	Card Reader Controller	11	400	33.50
Keylock		25**	25**	—
Selector Channel (required for 9-track tapes and line printers)		28	1,000	6
230.4K bytes additional disk storage		39	1,400	6
460.8K bytes additional disk storage		78	2,800	12
Synchronous Communications Controller		23	1,000	6
Synchronous Clock		11	320	2
Alternate Modem Select		11	400	1
Voice/Data Switch		3	80	—
Select/Standby Switch		3	80	—
Data-Rate Select		3	80	—
Multi-Point Inquiry		—	—	—

*Includes equipment maintenance.

**One-time charge. ■

