

DEC Datasystem 500

MANAGEMENT SUMMARY

On February 13, 1975, DEC unveiled its new top-of-the-line Datasystem 570, based on the equally new PDP-11/70 processor. The new business computer system doubles the user capacity of the previous top of the Datasystem line, providing on-line capabilities to as many as 63 users under CTS-500/E, DEC's time-sharing software package.

The Datasystem 570 is an on-line, multiterminal system aimed at users who will eventually wish to build up distributed processing networks rather than have single, stand-alone business machines. Although application software developed on smaller 500-series Datasystems will run on the new, more powerful 570, upgraded systems will not be able to take full advantage of the faster I/O speeds available with the PDP-11/70 processor. This is because the peripheral controllers offered with the smaller Datasystems cannot be interfaced to the new 32-bit high-speed DMA channel, making much of the hardware in the older Datasystems unusable with the PDP-11/70 processor.

The DEC Datasystems are sold as enhanced, packaged configurations of standard DEC minicomputer equipment plus an operating system and appropriate program development aids such as language processors, debug tools, utilities, edit-programs, etc. These systems are

The DEC Datasystem 500 family of business computer systems offers compatible growth through five models based on three DEC PDP-11 processors. Capabilities range from small single-user systems to multiterminal, time-shared, interactive systems that can be connected into distributed processing networks.

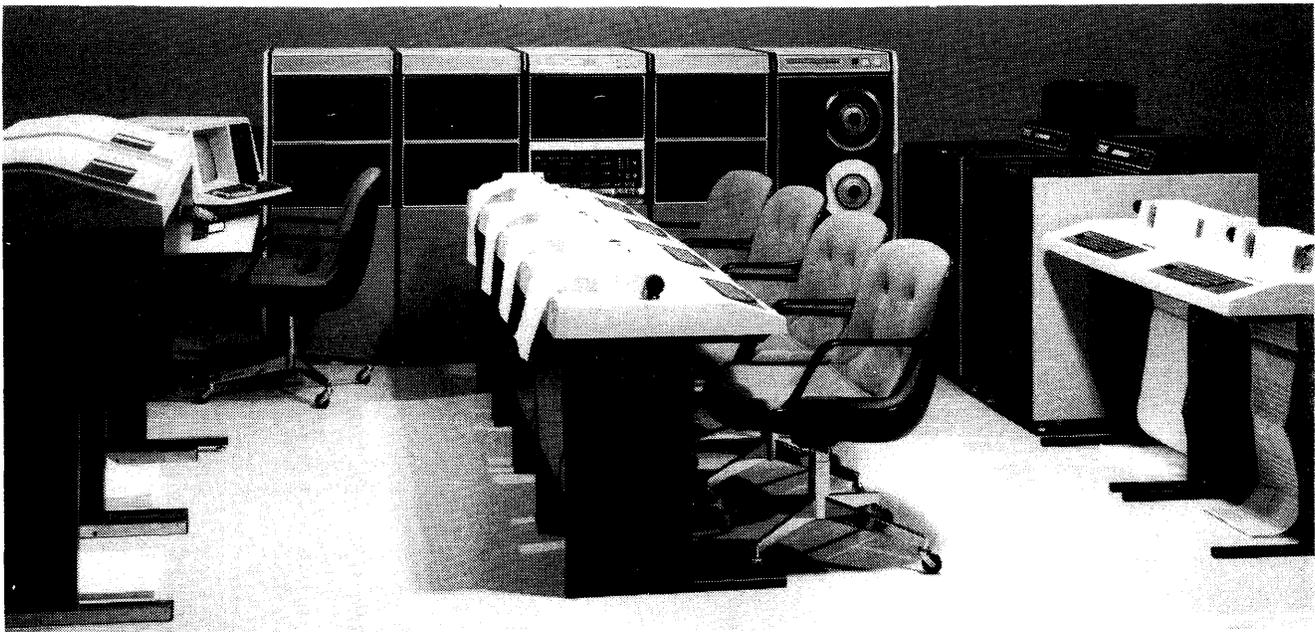
CHARACTERISTICS

MANUFACTURER: Digital Equipment Corporation (DEC), 146 Main Street, Maynard, Massachusetts 01754. Telephone (617) 897-5111. DEC is a worldwide corporation with sales and service offices in all major U.S. cities and in major cities throughout Canada and the Western world.

MODELS: DEC Datasystem 500, Models 530 and 540 (based on the PDP-11/40), Models 550 and 560 (based on the PDP-11/45), and Model 570 (based on the PDP-11/70).

DATA FORMATS

BASIC UNIT: For the DS-530, 540, 550, and 560, the basic data unit is a 16-bit word plus one parity bit. For the DS-570, the basic data unit is an eight-bit byte plus one



The newest DEC Datasystem, the 570, is an on-line multiterminal system based on the new DEC PDP-11/70 and announced with the new processor in February 1975. The configuration shown here includes (from left to right, in the background) a pair of 132-position 300-lpm DEC LP11 line printers, a VT50 DECscope display terminal and keyboard, a PDP-11/70 with 192K bytes of

core storage, power supplies, and I/O controllers all packaged in three 52-inch-high "low boy" Datasystem cabinets, a DEC TU16 magnetic tape drive, and two DEC RP04 88-megabyte disk drives. The six hard-copy terminals shown (four in the center foreground) are 30-cps LA36 DECwriter II's. This system sells for \$181,000.

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▷ designed primarily for sale either to sophisticated end users or to "systems houses." A primary characteristic of both of these marketplaces is the ability to develop their own applications software, thus reducing the amount of hand-holding support needed directly from DEC. The DEC Datasystems are not turnkey systems dedicated to specific problem solutions with pre-programmed applications. Rather, applications programs must either be developed directly by the end user or prepared for him by a systems house.

Currently, the Datasystem 500 lineup includes the Model 530 system for small-scale users; the 540, 550, and 560 systems that can be used for heftier batch operations, for time-sharing with as many as 32 users, and for data base processing of 704-million-byte (or smaller) data bases; and the 570 system for up to 63 time-shared users and connection into a distributed processing network.

What distinguishes the DEC Datasystems from configurations that are otherwise available from DEC on a piecemeal basis is that the components in the DEC Datasystems are physically packaged into special consoles, desks, and other functional office furniture, and that several modifications to the basic PDP-11 CPU and its configuration rules have been made.

Human engineering features and additional customer support services are also included in the DEC Datasystems package, such as delivery, installation, and shakedown of operations under the user's choice of operating system.

At one time, the packaged DS-500 systems cost more than separately purchased DEC components. However, more recent pricing has changed that, making an already good value even better.

The basic marketing strategy for DEC's DS-500 line is to promote the systems as alternatives to centralized computing facilities in large or geographically dispersed companies that have remote sites with either localized time-sharing requirements, numerous small-to-medium-scale data bases, or medium-sized batch processing requirements. A DS-500 system can also be considered as a centralized computing facility on its own merit for medium-sized companies or for divisions of larger companies.

The original DEC Datasystem 500 line, introduced in February 1972, included the DS-520 for batch data processing, the DS-700 series for 16- or 32-user time-sharing, and the DS-800 series for processing data bases of up to 10 million bytes. The 520 and 700 used the PDP-11/20 as their base processor, while the 800 series used the PDP-11/15.

A significant upgrading of the Datasystem 500 family occurred in July 1973, when the original Model 520 was replaced by the Model 530. (The 520's PDP-11/20 is no longer manufactured.) This system for batch or time-shared operations is based on the more powerful ▷

▶ parity bit. Sixteen-bit words are also defined for certain instructions, with words beginning at even memory locations only. All models of the DS-500 series can handle byte-mode operations.

FIXED-POINT OPERANDS: 16-bit words or 8-bit bytes are used as operands in both single- and double-operand instructions. Bit manipulation is provided through Boolean AND/OR instructions.

FLOATING-POINT OPERANDS: Optional 32-bit single-precision operands with an 8-bit exponent and signed 24-bit fraction on the 530 and 540; and 64-bit double-precision operands with an 8-bit exponent and signed 56-bit fraction on the 550 and 560. Single-precision hardware is available on the 530 and 540, while single- and double-precision hardware is available for Models 550, 560, and 570. Floating-point software subroutines are also available for all models.

INSTRUCTIONS: One-, two-, or three-word instructions. There are no decimal instructions in any PDP-11 processor; however, under the CTS-500/E operating system, decimal pseudo-instructions have been implemented. Addressing in all PDP-11's is by byte. For all DS-500 models, the maximum directly addressable memory is 64K bytes, through the use of 16-bit internal registers. The addition of Memory Management (standard in the 570, optional in all others) increases the system memory limit to 248K bytes in the 530, 540, 550, and 560, and to 1.5 million bytes in the Model 570.

Eight address modes are provided with each operand address, consisting of three bits to specify address mode and three bits to specify the register used to calculate the address. The modes consist of "Register" (operand in register), "Register Indirect" (operand address in register), "Auto Increment/Decrement Indirect" (self-incrementing/decrementing register which points to an address in memory), "Indexed," and "Indexed Indirect,"

INTERNAL CODE: ASCII.

MAIN STORAGE

STORAGE TYPE: Magnetic core or MOS, depending on model (see CAPACITY, below).

CYCLE TIME: 1.0 microsecond per word for core, and 450 nanoseconds per word for MOS.

CAPACITY: For the DS-530, the basic configuration includes 56K bytes of user memory. There is actually 64K in the system, but the upper 8K address space in the PDP-11 systems is reserved for use as I/O device registers. The basic 530 does not have the Memory Management option installed, and cannot be expanded without field modification.

For the DS-540, 550, and 560 systems, which include the Memory Management feature in the basic configuration, the minimum memory installed is 64K bytes. The 560, however, has 32K bytes of core plus 32K bytes of MOS memory, while the 540 and 550 are supplied with core memory only. The Memory Management feature permits expansion of all these systems to 248K bytes of user program area.

For the DS-570, the basic configuration includes 128K bytes of core memory, expandable to 1.5M bytes. (Memory Management is standard.) This appears to be a contradiction from the figures given in the PDP-11 report (M11-384-301); however, the limitation is imposed by the physical dimensions of the "lowboy" cabinets supplied. ▶

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PERIPHERALS/TERMINALS

DEVICE	DESCRIPTION	SPEED
MAGNETIC TAPE		
TU10D	Industry-compatible; 45-ips; 7-track, 200/556/800 bpi; 9-track, 800 bpi; 10-inch reel	36 KBS
TU16	Industry-compatible; 45 ips, 9-track, 800/1600 bpi; 10-inch reel	36/72 KBS
TS03	Industry-compatible; 12½ ips, 9-track; 800 bpi; 7-inch reel max.	10 KBS
LINE PRINTERS		
LS11-C	132-position, 64-character, impact, dot-matrix	60 lpm
LP11-VA	132-position, 64-character	300 lpm
LP11-WA	132-position, 96-character	230 lpm
LP11-SA	132-position, 96-character	800 lpm
LP11-RA	132-position, 64-character	1200 lpm
CARD EQUIPMENT		
CR11	Reader, 80-column	300 cpm
TERMINALS		
LA36	DECwriter II, hard-copy output	30 cps
VT05	Alphanumeric CRT, 20 lines x 72 characters, local or remote	2400 bps
VT50	DECscope, 12 lines x 80 characters, numeric pad	9600 bps

▷ PDP-11/40. At the same time, the DS-700 and 800 systems were replaced by the Models 540, 550, and 560. The 540 is also based on the 11/40, differing from the 530 only by the addition of the memory management feature, while the 550 and 560 models use the PDP-11/45. (The 800's PDP-11/15 is likewise no longer manufactured.) The major difference between a 560 and a 540 or 550 is memory makeup. The latter models have 64K bytes of core installed, while the 560 has 32K bytes of core and 32K bytes of MOS memory.

The latest DS-500 model, the 570, is based on DEC's new PDP-11/70, which features, among other things, 240-nanosecond cache memory, memory mapping without overhead, and a special 32-bit data bus for high-speed DMA transfers. The effective cycle time of the cache and main memory combination is less than 400 nanoseconds.

A detailed description of the entire DEC PDP-11 Family is contained in Report M11-384-301.

DEC expects a typical configuration of the DS-570 to include three or four 88-megabyte disk drives, one or perhaps two 9-track, 1600-bpi tape drives, and two or more 300-lpm line printers. The PDP-11/70's special bus and cache memory constitute the chief differences between the DS-570 and the DS-560. To date, only four special controllers are available for use with the new fast bus: the RS03 and RS04 fixed-head disk controllers, the RP04 IBM 3330-compatible disks, and the TU16 9-track, 1600-bpi magnetic tape unit. In addition, if the higher rate offered by the 32-bit fast bus is not required, the

▶ **CHECKING:** A parity bit is standard with each word.

STORAGE PROTECTION: None, unless the memory map is considered. The process of mapping automatically provides hardware storage protection.

RESERVED STORAGE: The uppermost 8K bytes of address space in all models is reserved for I/O registers. This aspect should not be considered wasteful of precious main memory space, since the I/O programming flexibility provided through this mechanism more than offsets the reduction in memory space.

CACHE MEMORY: A 240-nanosecond bipolar cache memory is provided with the Model 570 CPU. This 2048-byte memory effectively reduces the main memory cycle time to less than 400 nanoseconds.

It is beyond the scope of this report to cover memory characteristics extensively. For more detailed information, please see Report M11-384-301, which covers the entire PDP-11 family of computers.

CENTRAL PROCESSORS

For specific information, please see Report M11-384-301.

GENERAL: The DS-530 and 540 systems use TTL logic to achieve processor cycle times compatible with the core memory cycle time. The Models 550, 560, and 570 use Schottky logic, multilayer PC boards, and an additional bus to make their cycle times nearer to that of the various semiconductor memories available.

REGISTERS: DS-500's have eight user-accessible 16-bit registers (six general-purpose, one stack pointer, and one program counter), and one 16-bit processor status register. The general-purpose registers can be used as index registers, hardware stack pointers, or accumulators. In Models 530 ▶

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The only full-package Datasystem offered by DEC is the Datasystem 535. Unlike its unbundled counterparts, this system is sold in one basic configuration complete with software. The DS-535 is a combination of the most popular configurations of the DS-530 and 540. The basic system shown includes a PDP-11/40 CPU with 96K bytes of core memory, two 2.4-megabyte cartridge disks, power supplies, and four terminal interfaces contained in two low boy-style cabinets. Also shown is a VT05 display and a 132-position LS11 dot-matrix printer. This system, including the CTS-500/E operating system, is priced at \$60,200.



▷ above peripherals can also interface with the Unibus, and still work at their normal speeds. (The special PDP-11/70 fast bus and fast controllers for these peripherals serve only to assist the central processor.)

Although the DS-500's are not marketed directly against installed IBM equipment, the DEC RPG II language is largely compatible with RPG II on the IBM 1130, 360/20, and System/3. Whether planned or not, there is often competition from these systems, as well as from the NCR 399; the Basic/Four line; the Quantel 800, 900, 1100, and 1200 systems; Burroughs' recently upgraded B 700 Series systems; and NCR's Century 8200 (a mini emulating an NCR Century 101). Also, in this year of the business machine, several minicomputer companies are offering packaged business systems for the first time; notably, General Automation's DM-100 Series, which also spans a wide range of capabilities with compatible systems. A comprehensive listing and summary of all the major entries in this rapidly expanding marketplace is presented in Report M11-050-201. *Minicomputer Specifications—Business.*

At present, the business minicomputer market is probably the fastest-growing segment of the data processing field. In this highly competitive market area, the cost/performance characteristics of the Datasystem 500 family have earned DEC a modest but growing share, with about 500 systems currently installed.

USER REACTION

Datapro's policy regarding user reaction surveys is, whenever possible, to gather data from experienced, long-term users of each system we investigate for you. Hence, some ▷

▶ and 540, there are two stack pointers (kernel and user modes), while Models 550, 560, and 570 have three stack pointers (kernel, user, and supervisor modes), plus a full duplicate set of general-purpose registers.

INDIRECT ADDRESSING: Single level is standard in all models.

INSTRUCTION REPERTOIRE: Models 530 through 560 have 14 single-operand, 8 double-operand, 17 branch, 3 subroutine, 2 program control, 6 trap, 10 condition code operator, and 4 miscellaneous instructions. In addition, four instructions are provided by the optional extended instruction set, and four instructions are added by the optional floating-point hardware.

Model 570 has 16 single-operand, 10 double-operand, 17 branch, 3 subroutine, 3 program control, 6 trap, 10 condition code operator, and 7 miscellaneous instructions. Addition of floating-point hardware adds 28 more.

INSTRUCTION TIMINGS: All times are machine timings for full-word, fixed-point operands, in *microseconds*.

Instruction	Models	Models 550, 560	Model	
	530, 540	Core	MOS	570
Load/Store:	2.42/2.24	1.84	1.01	2.40
Add/Subtract:	2.66/2.80	1.84	1.01	2.70
Multiply/Divide:	9.66/11.30	4.68/8.58	3.86/7.76	4.80/9.25
Compare and Branch:	2.75	2.03	1.35	2.55

INTERRUPTS: Four-level automatic priority interrupt system, plus seven additional software-supported levels of interrupts for all models. Each of the interrupt levels can attach multiple, independently prioritized peripheral devices.

PHYSICAL SPECIFICATIONS: All Datasystem 500's are 50 inches high and 30 inches deep. The DS-530 and 535 are 22 inches wide, and weigh 330 pounds, while the DS-540 ▶

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➤ confusion arose when we first made inquiries among owners of Datasystem 500's. But the confusion was eliminated when we realized that the DEC Datasystem 500 series has existed only since 1972 and the larger models—the 540 through 560—were not introduced until a year later, in 1973. Hence, some of the long-term users we contacted had not purchased Datasystem 500's as such, but had purchased PDP-11/40 systems which were later offered as packaged Datasystems. These users still tend to call their systems PDP-11's.

Another reason why some of the users did not refer to their systems as Datasystems was that they were housed in standard PDP-11-style cabinets instead of the normally supplied "lowboy" Datasystem cabinets. However, these users mentioned that they had insisted on the higher 72-inch cabinets because of the use of tape drives in their systems and the difficulty of mounting tape reels on drives installed in the low cabinets.

Despite these initial mutual misunderstandings, we contacted five users of Datasystem 500's and found indications of a very flexible and powerful system. The 5 users had a total of 22 systems installed and about 10 more currently on order, a significant commentary in itself. The average installation time for these systems was nearly two years when averaged across the five users and would be $2\frac{1}{2}$ years if the average were taken across the 22 systems.

The users we surveyed were using their systems for business applications, but these applications were more sophisticated than those noted when conducting similar surveys for smaller business minicomputer systems, such as the DEC Datasystem 340 or the Burroughs B 700 systems. Those smaller systems were being used primarily for the traditional business applications: accounts payable, accounts receivable, inventory control, payroll, order entry, record keeping, etc. In contrast, and reflecting the more powerful processors employed, the DS-500's were being used as multiterminal, interactive processing systems (10 to 32 terminals were typical) for more specialized uses. Examples included benefits computations for retirement plans, and data entry and record transfers between insurance company regional offices. Two of the single-system users were able to do all their own processing plus sell time to a few other users.

The types of businesses employing the Datasystem 500's also reflected the difference between these users and users of smaller systems. While the DS-340 and B 700 systems were generally used as stand-alone accounting systems, with little or no other data processing being performed, the DS-500 users we surveyed included two insurance companies, a small college, a large bank, and an appliance distribution chain with outlets in five states.

Reactions to the Datasystems were extremely favorable, a point that was underscored by the fact that three of the five users we interviewed had additional systems on order. All the systems were running under CTS-500/E, although some users referred to this operating system as the ➤

➤ through 570 are twice as wide and weigh 660 pounds. All systems require 115 VAC, 60 Hz (or 230 VAC, 50 Hz) power with a voltage tolerance of ± 10 percent. The operating temperature range for all Datasystem 500's is 65 to 75 degrees Fahrenheit.

INPUT/OUTPUT CONTROL

UNIBUS: All Datasystem 500's have a single column Unibus that treats all components or modules of a system as equal-level devices for data access/transfers, including the processor, memory modules, and peripherals. Models 550 and 560 have two of these plus a special dedicated bus. The priority of any device connected to the busses is determined by its physical position, and the processor is normally attached so that it has the highest priority.

There is no logical limit to the number of device attachment that can be made to the Unibus, with bus access and control handled by the interrupt system. The maximum Unibus data transfer rate is 2.5 million words/second, and it always operate in a master/slave manner.

SOLID-STATE BUS: On Models 550 and 560, a high-speed memory bus is provided to permit the execution of programs from high-speed semiconductor memory at up to eight million words per second without overloading the Unibus' capacity.

32-BIT BUS: In addition to a standard Unibus, a special expanded-capability bus has been added to the PDP-11/70 (the base of the DS-570). This bus is not accessible to normal programming needs such as loading registers, etc., but only to DMA transfers between cache memory and mass storage peripherals. Only special high-speed controllers interface this special bus, which handles four eight-bit bytes per transfer.

CONFIGURATION RULES: There is only one real limit upon DS-500 system configurations—the length of the Unibus—and that limit is such that any system approaching the maximum length would contain more equipment than is found in even the largest business systems or could be driven by existing programming. The Unibus can be expanded in groups of 19 units (20 minus one for connections), and the signals repowered through bus repeaters and additional power supplies. In general, each device that ties into the Unibus imposes one load per slot that it occupies. (That is, a one-card controller usually is one load and a two-card controller is two loads.) Each block, then, can handle 19 loads and 50 feet of cabling. Each repeater drives an additional 19 loads and 50 feet of cabling.

System expansion is accomplished through BA11-F expansion boxes which contain space for up to nine mounting panels called system units, plus a power supply. There are two types of system units available, one for CPU's, memories, etc., and one for peripheral controllers. Systems are configured by interconnecting the system units to form the necessary number of slots needed for the components. Each system unit contains 20 slots into which modules are inserted, some requiring up to six slots.

Each expansion box contains space for nine system units, but each cabinet has space for only one expansion box.

All DS-500 models are supplied with sufficient cabinets, mounting chassis, power supplies, and Bus Repeaters to enable the maximum configuration to be implemented without difficulty. The DS-530 processor is in one cabinet and will support up to 56K bytes of core memory, any of six peripheral device combinations, and up to four com- ➤

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▷ “commercial version of PDP-11 RSTS/E.” Nearly all the users felt that the CTS-500/E operating system and the BASIC-Plus language were very good and quite appropriate to the needs. Three mentioned that the BASIC-Plus incremental compiler, although slow, provided an excellent facility for debugging application programs. The only negative remarks voiced by the users were their wishes for more business utility programs from the vendor, software to provide IBM-compatible formatting, ability to directly interface standard IBM systems, and a better log-on and billing routine for CTS-500/E. Two users also felt that the PIP utility could be enhanced.

The hardware received equally enthusiastic reviews, although there were a few negative comments. In particular, one user felt the TU10 tape drive was too slow and had gone over to the TU16 at 1600 bpi. Two other users expressed some displeasure with the Centronics 101 dot-matrix printer, mentioning alignment problems as the primary complaint. However, it should be noted that this unit is not necessarily meant to withstand the hard usage that some systems impose upon it.

The results of the interviews are tabulated below. Of the 11 questions normally included in our survey, two occasionally generate spotty responses: technical support and application programs. Users sometimes decline to comment on the quality of technical support received from a vendor because they have had no occasion to ask for any; they are either sophisticated enough to accomplish any changes or expansions on their own, or they use the system as delivered. Application programs received little response because DEC does not offer any with the DS-500 systems; hence, this category has been deleted.

	Excellent	Good	Fair	Poor	WA*
Ease of operation	5	0	0	0	4.0
Reliability of mainframe	3	2	0	0	3.6
Reliability of peripherals	0	4	1	0	2.8
Maintenance service:					
Responsiveness	1	4	0	0	3.2
Effectiveness	0	2	3	0	2.4
Technical support	0	2	0	1	2.3
Compilers and assemblers	4	1	0	0	3.8
Operating systems	4	1	0	0	3.8
Overall satisfaction	3	2	0	0	3.6
Credibility of vendor	2	3	0	0	3.4

*Weighted Average on a scale of 4.0 for Excellent.

Although 43 of the 48 responses (about 90 percent) were in the good to excellent range, there were two categories with weighted averages significantly lower than the others: effectiveness of maintenance service and technical support. Even though the responsiveness of maintenance service category was rated highly, the users felt that DEC's maintenance force was only recently becoming really effective in diagnosing and fixing Datasystem hardware and software problems. The less-than-enthusiastic response to the technical support question was attributed by two users to oversegmentation in the DEC marketing organization. ▷

► munications lines. The Model 540, 550, and 560 processors include an expander cabinet and will accommodate up to 248K bytes of main memory, and any of six peripheral device combinations, and up to four communications lines. The DS-570 systems include 128K bytes of core memory and expansion facilities for up to 1.5M bytes plus peripherals. In DS-500 systems requiring 5 to 32 lines for communications (or up to 63 lines for the DS-570), a separate cabinet is supplied for the purpose.

In DS-570 systems, optional 32-bit high-speed I/O controllers (limited to four per system) can be used with the RP04 (88MB disk), RK05 (fixed-head swapping disk), and 1600 bpi (fast) magnetic tape units.

SIMULTANEOUS OPERATIONS: Overlapped instruction execution and memory access are provided. Individual blocks of 16K bytes can be independently interleaved on Models 550 and 560. The Model 570, with its cache memory system, does not require interleaving for greater effective speed. Instead of accessing alternate memories, it transfers three extra bytes into cache memory each time a location is read from main memory. DMA I/O operations are concurrent with processing and with one another.

MASS STORAGE

RS03/RS04 FIXED-HEAD DISKS: These two similar disk drives are single-plotter units with an 8.5-millisecond average access time and a data transfer rate of 500K bytes per second. The RS03 has 64 heads and records data on only one surface of the disk, producing a capacity of 256K bytes per drive. The RS04 has 128 heads and records data on both surfaces, resulting in a doubled capacity, or 512K bytes. Reliability is enhanced in the RS04 drive by recording odd and even bits on opposite sides of the disk. Up to eight drives of either type can be connected to the RJS03/4 controller.

RK05 DECPACK CARTRIDGE DISK: This drive uses the familiar IBM 2315-type cartridge and double-density recording to hold up to 2.4 million bytes of data. Average access time for the RK05, including head movement, is 70 milliseconds, and the data transfer rate is approximately 180K bytes per second. Up to eight RK05's can be connected to the RK11 controller, and overlapped seek operations are permitted between drives.

RP04 MOVING-HEAD DISK: This disk drive uses an IBM 3336-type disk pack and stores up to 88 million bytes per drive. Average access time is 36 milliseconds, including head positioning and rotational delay times. The data transfer rate is 806K bytes per second, and a 132-byte FIFO (first in, first out) buffer is provided for reliability. Up to eight RP04 drives can be attached to the RJP04 controller, and overlapped seek operations are permitted between drives. On the RS-570, these units can be connected via a 32-bit controller.

RP03 MOVING-HEAD DISK: This unit stores over 40 million bytes per drive on IBM 2316-type 20-surface disk packs. Average access time is 29 milliseconds, including head positioning and rotational delay times. The data transfer rate is 267K bytes per second, and a 132-byte FIFO (first in, first out) buffer is provided for reliability. Up to eight RP03 drives can be connected to an RP11 controller. On a DS-570, these units can be connected via a 32-bit controller.

INPUT/OUTPUT UNITS

See the Peripherals/Terminals table on the third page of this report. ►

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▷ In general, the Datasystem 500's appear to be reliable, powerful systems. Despite the minor complaints mentioned above, all five users reported uptimes of no less than 90 percent on a monthly basis and, more typically, 95 to 99 percent when averaged over a year. □

► COMMUNICATIONS CONTROL

Communications interfaces for the DS-500 series equipment are offered as two subsystem packages called a Type I Subsystem and a Type II Subsystem. The Type I Subsystem is offered to users who have no more than eight terminals in their systems and who do not expect to expand. The Type II Subsystem is expandable in groups of 16 terminals. The following interface units are offered for use with both Type I and Type II Subsystems.

The DS5C3/DS5C4 Asynchronous Line Unit provides EIA or 20mA current-loop interfacing for one line. Data rates are switch-selectable at 100 to 300 bits per second. This unit is for local terminals only.

The DS5C5 Multiple-Line Modem Controller provides interfacing and control signals for 4, 8, 12 or 16 lines. Attaching line adapters provide either an EIA or a 20mA current-loop interface. Speed and code are established under software control. Speeds range from 110 to 2400 bits per second.

SOFTWARE

OPERATING SYSTEMS: Three different operating systems are available for any of the DS-500 models. Each is provided with an appropriate level of program development and utility system support.

COMMERCIAL TIME-SHARING SYSTEM: CTS-500/E is an outgrowth of the PDP-11 Resource Time-Sharing System (RSTS) and its extended (RSTS-E) version. CTS-500/E can support up to 32 concurrent users (depending upon processing demands) on a Model 540, 550, or 560 system, 8 concurrent users on a Model 530 system (up to about 6 if heavy usage is expected), or up to 63 concurrent users on a DS-570 system. Program development support for BASIC and BATCH/COBOL is provided. A 2780 batch terminal emulator package is available, which permits remote job entry as one of the 63 concurrent jobs possible. A powerful sort program (System/3-compatible) is also provided.

The minimum CTS-500/E configuration consists of a 96K-byte DS-500 system, two disks, and a line printer. CTS-500/E systems were first delivered in February 1972.

COMMERCIAL DATA MANAGEMENT SYSTEM: CDMS-500 is a data management system based upon MUMPS-11, (Massachusetts General Hospital Multiprogramming System) and is designed to support 1 to 32 active users with a data base of up to 704 million bytes. CDMS-500 supports variable-length data strings stored without preformatting in a hierarchical storage structure where frequently used data is optimally placed. Program development support for the MUMPS high-level Interpretive language is also provided. A powerful sort program (System/3-compatible) is also available.

The minimum DS-500 system required for CDMS-500 is a 56K-byte processor with one disk drive. An 8-user configuration requires 64K bytes of main memory, 2 or more disk drives, an industry-compatible magnetic tape drive, and a line printer. At present, CDMS-500 is not available on the DS-570 system. CDMS-500 systems were first delivered in August 1973.

COMMERCIAL OPERATING SYSTEM: COS-500 is a disk-based, batch-oriented system that offers program development support for RPG II (compatible with IBM System/3 and Burroughs B 700 and B 1700), a macro assembler, and FORTRAN IV (compatible with IBM 1130), as well as program development aids for on-line debugging (ODT), RPG trace, general-purpose editing (EDIT-II), and non-DEC RPG conversion aids.

COS-500 runs on a 56K-byte system with two disk drives, a card reader, operator console, and line printer. COS-500 systems were first delivered in July 1972.

LANGUAGES: COS-500 offers support for RPG II, FORTRAN IV, and a macro assembler. CDMS-500 uses the MUMPS interpretive language, and CTS-500/E uses BASIC-Plus and a batch version of COBOL which is a subset of ANSI COBOL-74.

RPG II provides DS-500 users with an automated procedural language. It can be used on any DS-500 system with 64K bytes of main memory, a display terminal, two disk cartridge drives, a card reader, and a line printer.

MUMPS-11 is a highly specialized language for on-line interactive systems with large data bases. It has data base management characteristics rather than file management characteristics. Under this structure, records can be accessed by multiple users for continuous updating, examination, etc.

BASIC-Plus is used for on-line transaction-oriented business applications. It is a true time-sharing language based on an enhanced form of the original Dartmouth BASIC. Added to the programming language are string-handling commands, record I/O capabilities, multiterminal job capabilities, and extended program statement provisions which allow statements to exceed one line.

APPLICATIONS SOFTWARE: All applications must be developed either by the user or by a systems house. DEC does not directly provide applications such as payroll, etc.

PRICING

The DS-500 models are available for purchase or on third-party, full-payout leases for one-, three-, and five-year terms (arranged by DEC through Digital Leasing, a joint venture with U.S. Leasing Corporation). Five-year lease terms, for instance, are available for a monthly payment of 2.4 percent of the purchase price.

The COS-500 software is available separately for \$6,500, CDMS-500 for \$5,000, and CTS-500/E for \$6,500.

SUPPORT: Separately priced hardware maintenance by DEC is available through a field support force of more than 2,500 personnel. Purchase of a DS-500 includes full installation/setup of the hardware and desired operating system.

EQUIPMENT: The following typical system purchase prices include controllers, adapters, and software.

DS-535 SINGLE-USER SYSTEM: Consists of a PDP-11/40 CPU with 96K bytes of memory, extended arithmetic unit, real-time clock, bootstrap loader, and memory management; an LA36 DECwriter II console terminal, two RK05 2.4M-byte cartridge disks, and interfaces for four terminals (LA36 or VT50). Also included in the package is the CTS-500/E operating system. Purchase price is \$54,000, including installation and software licensing. ►

DEC Datasystem 500

► **FOUR-USER TIME-SHARING DATASYSTEM 540:**
Consists of a 96K-byte PDP-11/40 CPU operating under CTS-500/E, 4.8M-byte DECpack disk storage, 60-lpm printer, four CRT's, and four-line data communications interface. Purchase price is \$86,453.

TWELVE-USER TIME-SHARING DATASYSTEM 540:
Consists of a 128K-byte PDP-11/40 CPU operating under CTS-500/E, LA36 DECwriter II, 512K-byte swapping disk, 7.2M-byte DECpack disk storage, 9-track magnetic tape unit, four CRT's, teletype, and 10-line data communications interface. Purchase price is \$142,424.

FOUR-USER DATA MANGEMENT DATASYSTEM 540:
Consists of 56K-byte PDP-11/40 CPU operating under CDMS, LA30 DECwriter II, 40M-byte DECpack disk storage, 9-track magnetic tape unit, 300-lpm printer, four CRT's, and four-line data communications interface. Purchase price is \$108,179.

BASIC DATASYSTEM 570 CONFIGURATION: Consists of a 128K-byte PDP-11/70 CPU with real-time clock, bootstrap loader, an LA36 DECwriter II console, and two Datasystem cabinets with desk. Purchase price is \$55,300. ■

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Field Instal. Charge
DATASYSTEM 500 BASIC UNITS				
DS530-CA	PDP-11/40, 56K-byte parity memory, real-time clock, bootstrap loader, LA36 DECwriter II, desk, and cabinet	\$21,425	\$148	-
DS535-CA	PDP-11/40, 96K-byte parity memory, memory management, real-time clock, bootstrap loader, extended instruction set, LA36 DECwriter II, two RK05 disks, four terminal line interfaces, desks, cabinet, CTS-500/E software and license, training, and update services for one year	54,000	407	-
DS535-CB	Equipment and software only, as above; does not include training and update service	52,000	407	-
DS540-CA	PDP-11/40, 64K-byte parity memory, memory management, real-time clock, expansion box, bus repeater, extended arithmetic option, bootstrap loader, LA36 DECwriter II, desk, and two cabinets	30,070	185	-
DS550-CA	PDP-11/45 64K-byte parity memory, memory management, real-time clock, bootstrap loader, expansion box, bus repeater, LA36 DECwriter II, desk, and two cabinets	41,275	245	-
DS-560-CA	PDP-11/50, 32K bytes MOS memory, 32K bytes core memory, memory management, real-time clock, bootstrap loader, expansion box, bus repeater, LA36 DECwriter II, desk, and two cabinets	41,275	399	-
DS-570-AA	PDP-11/70, 128K bytes parity memory, real-time clock, bootstrap loader, LA36 DECwriter II, desk, and two cabinets	55,300	N/A	-
PROCESSOR OPTIONS				
FP11-B	Floating-point processor for 550 and 560 only	5,600	45	100
KE11-E	Extended instruction set; required on 530 systems to run CDMS-500	1,470	11	75
KT11-D	Memory management; required on 530 systems over 56K bytes	2,600	21	100
MEMORY				
DS5MH*	128K-byte parity memory	8,000	54	-
DS5MM*	192K-byte parity memory	15,000	108	-
DS5MS*	248K-byte parity memory	23,000	162	-
MJ11-AE**	64K-byte expansion memory module	7,100	N/A	-
MJ11-AA**	64K-byte expansion memory with expansion box	13,500	N/A	-
DS5MJ**	256K byte expansion memory in a cabinet, with space for two additional MJ11-AA expansions	33,000	N/A	-
MJ11-AC**	256K byte expansion memory in expansion box; consists of one MJ11-AA and three MJ11-AE's	31,000	N/A	-
MASS STORAGE				
DS5RA-AA	512K-byte RJS03 fixed-head disk plus controller	14,900	75	550
DS5RA-BA	Additional RS03 fixed-head disk	9,500	55	230
DS5RB-AA	1024K-byte RJS04 fixed-head disk plus controller	19,200	85	685
DS5RB-BA	Additional 1024K-byte RS04 fixed-head disk	13,800	55	230
DS5RC-AA	88M-byte RJP04 moving-head disk plus controller	35,000	220	1,040
RP04-AA	Additional 88M-byte RP04 disk drive	25,900	190	585
DS5RD-AA	40M-byte RP03 moving-head disk plus controller	35,500	233	665
RP03-AA	Additional 40M-byte RP03 disk drive	20,000	159	425
DS5RE-AA	4.8M-byte RK05 DECpack disk system plus controller; includes two RK05 disk drives	16,100	170	760
RK05-AA	Additional 2.4M-byte RK05 disk drive	5,100	64	260
DS5RF-AA	1024K-byte RWS04 fixed-head disk and high-speed controller (for DS-570 systems only)	21,200	N/A	N/A
DS5RH	88M-byte RWP04 moving-head disk plus high-speed controller (for DS-570 systems only)	35,000	N/A	N/A
RK05-11	2.4M-byte disk cartridge for RK05 or DS5RE	99	-	-
RP02-P	40M-byte disk pack for RP03 or DS5RD	295	-	-
RP04-P	88M-byte disk pack for RP04 or DS5RC	795	-	-

*For DS-530 through DS-560 systems only. Amount of memory specified is the total for the system, including the standard amount packaged in each system.

**For use with DS-570 systems only.

DEC Datasystem 500

EQUIPMENT PRICES

		<u>Purchase Price</u>	<u>Monthly Maint.</u>	<u>Field Instal. Charge</u>
MAGNETIC TAPE EQUIPMENT				
DS5TA-ED	9-track, 800 bpi, 45 ips TU10 tape drive and controller	11,500	101	640
TU10D-EE	9-track, 800 bpi, 45 ips TU10 tape drive	8,000	74	400
DS5TA-FD	7-track, 200/556/800 bpi, 45 ips TU10 tape drive and controller	13,225	101	640
TU10D-FE	7-track, 200/556/800 bpi, 45 ips TU10 tape drive	9,725	74	400
DS5TB-EA	9-track, 800/1600 bpi, 45 ips TJU16 tape drive and controller	15,500	120	550
DS5TB-EE	9-track, 800/1600 bpi, 45 ips TU16 tape drive	8,950	60	280
DS5TC-EA	9-track, 800/1600 bpi, 45 ips TWU16 tape drive and high-speed controller (for use with 570 systems only)	15,500	N/A	N/A
TM8	9-track, 800 bpi, 12½ ips TS03 tape drive and controller (max. 7-inch reels)	6,450	N/A	N/A
TS03	9-track, 800 bpi, 12½ ips tape drive	3,500	N/A	N/A
LINE PRINTERS				
LP11-RA	132 positions, 64 characters, 1200 lpm	31,500	154	250
LP11-SA	132 positions, 96 characters, 800 lpm	34,700	154	250
LP11-VA	132 positions, 64 characters, 300 lpm	10,500	72	220
LP11-WA	132 positions, 96 characters, 230 lpm	12,500	72	220
LS11-C	132 positions, 64 characters, 60 lpm dot-matrix printer	6,200	58	120
CARD EQUIPMENT				
CR11	80-column, 300-cpm reader	5,100	53	240
TERMINALS				
LA36-CA	DECwriter II, 300 bps	1,950	25	50
VT50	DECscope CRT, 9600 bps	1,250	22	40
VT05-AA	CRT terminal, 2400 bps, 20mA interface	2,795	23	80
VT05-AX	CRT terminal, 2400 bps, EIA interface	2,870	23	80
DS500-VT	Substitute VT05 display for LA36 DECwriter II on DS-500 systems	945	—	—
COMMUNICATIONS				
DS5C1	Type I communications subsystem for up to 4 lines	275	—	50
DS5C3-AE	20mA interface for 300-bps local hard-copy terminal	550	6	60
DS5C3-AN	20mA interface for 2400-bps local video terminal	550	6	60
DS5C4-A	EIA interface for remote modem, 110 to 300 bps	595	6	60
DS5C5-AZ	EIA interface for one remote line with program-selectable characteristics and speeds	1,400	11	100
DS5C6-A	Type II communications subsystem multiplexer for 1 to 16 lines; includes space for DS5C5 interfaces	7,700	42	275
DS5C7-AA	Type II communications subsystem expander for 17 to 32 lines; includes space for 16 additional DS5C5 interfaces	4,700	43	175
DS5C5-AA	EIA line interface with modem control for 4 remote lines	2,280	24	120
DS5C5-AB	EIA line interface with modem control for 8 remote lines	3,200	30	160
DS5C5-AC	EIA line interface with modem control for 12 remote lines	4,120	35	200
DS5C5-AD	EIA line interface with modem control for 16 remote lines	5,040	40	240
DS5C5-AE	EIA line interface without modem control for 4 lines	530	11	40
DS5C5-AF	20 mA line interface for 4 local lines	200	5	40
DS5C5-AG	4-line EIA interface expansion for DS5C5-AA, AB, or AC above	920	5	40
CABINETS				
DS5BA-AA	DS-500 upgrade cabinet with bus repeater, expansion box, power supply, and power control	4,300	21	175
H967-DH	DS-500 expansion cabinet with expander box, power supply, and power control	3,000	16	100
H967-HA	300/500 option cabinet with power control	800	—	—
H967-JA	Installation angling kit	520	—	—
H970-DA	300/500 desk	700	—	—
H980-DA	300/500 chair	299	—	—

SOFTWARE PRICES

		<u>Purchase Price</u>
QP500-AD	CTS-500/E including license and 3 training credits	\$6,500
QP500-CD	CTS-500/E including license	5,000
QP500-DZ	CTS-500/E license	4,500
QJ820-AD	CDMS-500 including license and 2 training credits	5,000
QJ820-CD	CDMS-500 including license	3,500
DS5XX-XY	CTS-500/E and COS-500/E including license and 6 training credits	9,750
QS918-5Z	10 days of DDS-500 software consulting; does not include expenses	3,600
QS920-SZ	4 weeks of DDS-500 software consulting; does not include expenses	6,000