Data General Commercial Systems Family

MANAGEMENT SUMMARY

Data General has expanded its initial CS/40 Commercial Systems offering with two more CS/40 models, a single CS/20 model, and three CS/60 models. The packaged system line now extends from the single-user, entry-level CS/20 to multiprogramming CS/60 models that support concurrent applications processing, program development, data communications, and utility functions.

The basic component of each of the CS systems is a Data General microNova, Nova 3, or Eclipse S/130 processor equipped with floppy, cartridge, or pack disk storage and from one to 12 terminals. Other common denominators for the systems are an interactive COBOL compiler and Data General's Interactive COBOL Operating System (ICOS), an adaptation of the proven RDOS system. The COBOL compiler is implemented at either Level 1 or Level 2 of the 1974 ANSII standard. It is not the same as the compiler used in Data General's Eclipse systems, which boasts full Level 2 implementation.

The choice of COBOL as the programming language for the CS series seems to confirm Data General's basic OEM posture. It is not likely that small end users would hire a full-time COBOL programmer, but systems houses can tap the large pool of available COBOL programmers to develop both generalized and specialized applications programs efficiently. Data General has tied a wide range of processors together with compatible software to provide a broad choice of hardware for systems developers to build upon.

A summary of the nine currently available CS models follows: ▷

> Data General's packaged Commercial Systems line, which now includes one CS/20, five CS/40, and three CS/60 models, is based on proven hardware and software. MicroNova, Nova, or Eclipse S/130 processors drive the systems, and ICOS, an adaption of Data General's RDOS, is the operating system. Prices of the systems range from $13,800 to over $200,000.

CHARACTERISTICS

MANUFACTURER: Data General Corporation, Route 9, Westboro, Massachusetts 01581. Telephone (617) 366-8911.

Data General is a leading manufacturer of minicomputers, peripherals, and associated equipment. The company maintains sales offices in most major North American cities and in South America, Europe, and Australia. Manufacturing operations are located in Southboro, Massachusetts; Westbrook, Maine; Portsmouth, New Hampshire; Johnston Center, North Carolina; and Sunnyvale, California. Assembly operations are also performed in Hong Kong and in Thailand.

MODELS: CS/20; CS/40 Mod C1, C3, C4, C5, and C6; CS/60 Mod C3, C5, and C6.

DATE ANNOUNCED: CS/20, May 1978; CS/40 Mod C1, C3, and C5, May 1977; CS/40 Mod C4 and C6, December 1977; CS/60, May 1978.

DATE OF FIRST DELIVERY: CS/40 Mod C1, C3, and C5, September 1977; CS/20, September 1978; CS/60, September 1978.

NUMBER INSTALLED TO DATE: Not available. ▶
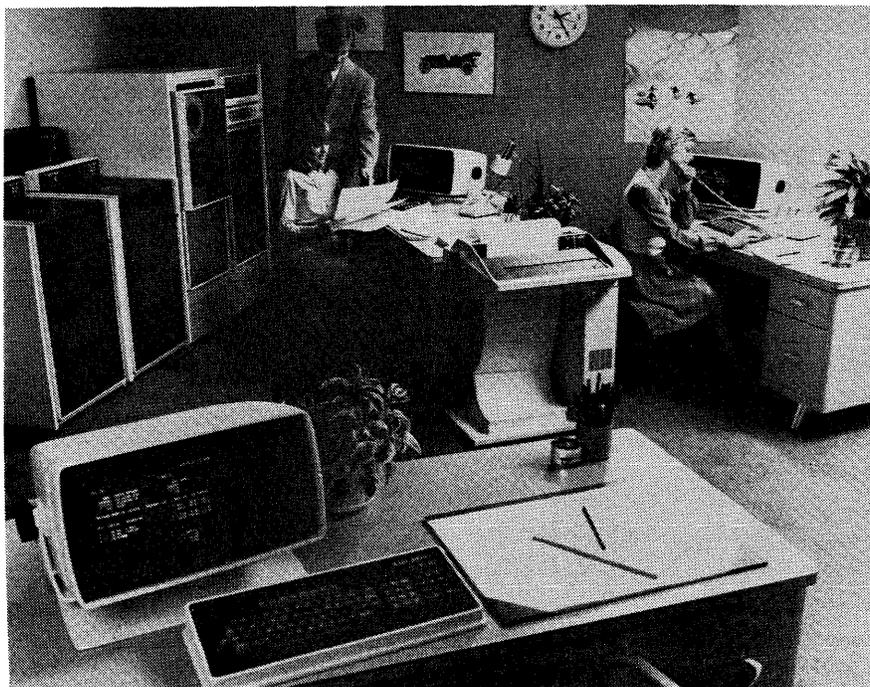
The CS/60 Model C6, the largest model available in the packaged CS line, is a commercially oriented system designed for applications such as order entry and sales and inventory tracking, either as an independent system or as part of a network. Interactive COBOL is the programming language. The illustrated system includes 192K bytes of main memory, 296 megabytes of disk pack storage, a 9-track 800-bpi tape transport, a 60-cps printer, and Dasher CRT terminals.

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CS FAMILY CHARACTERISTICS

MODEL	CS/20	CS/40	CS/60
Processor	microNova	Nova 3/12 or 3/D	Eclipse S/130
Maximum number of terminals	1	1, 4, or 9	4, 9, or 17
Recommended number of terminals	1	1, 2, or 4	2, 4, or 9
Main memory capacity, bytes: Minimum Maximum	64K 64K	64K 64K	64K 256K
Standard disk model	6038	6045 or 6067	6046 or 6067
Disk capacity, bytes: Minimum Maximum	630K 1.26M	10M or 50M 40M or 760M	20M or 50M 80M or 850M
Communications	Optional	Optional	Optional
Run-time monitor	Single terminal	Disk swapping or memory mapping	Disk swapping or memory mapping

▷ ● CS/20—single-user system with a microNova processor, 64K bytes of MOS memory, and from 630 to 1260K bytes of floppy disk storage.

● CS/40 Mod C1—single-user system with a Nova 3/12 processor, 64K bytes of MOS memory, and 10 to 40 megabytes of disk cartridge storage. Each disk drive includes one removable and one non-removable 5-megabyte cartridge.

● CS/40 Mod C3 and C5—include a Nova 3/D processor, 64K (C3) or 128 to 192K (C5) bytes of MOS memory, 10 to 40 megabytes of disk cartridge storage, and up to four (Mod C3) or nine (Mod C5) interactive terminals.

● CS/40 Mod C4 and C6—also based on the Nova 3/D processor, with 64K (C4) or 128K (C5) bytes of MOS memory, a 9-track 800-bpi tape transport, and up to four (Mod C4) or nine (Mod C6) interactive terminals. Fifty-, 96-, or 190-megabyte disk pack drives are standard, but up to 200, 384, or 760 megabytes of disk storage are available.

● CS/60 Mod C3 and C5—include an Eclipse S/130 processor, 64K (Mod C3) or 128 to 256K (Mod C5) bytes of MOS memory. 20 to 40 megabytes of disk cartridge storage, a 9-track 800-bpi tape transport, and up to four (Mod C3) or nine (Mod C5) interactive terminals.

● CS/60 Mod 6—supports up to 12 interactive terminals using an Eclipse S/130 processor with 128 to 256K bytes of memory, Up to four 50-, 96-, or 190 megabyte disk pack drives can be included for a maximum of 760 megabytes of mass storage, and a 9-track 800-bpi magnetic tape transport is available for backup.

The CS/20 is a desk-top unit designed for use by ▷

▶ **DATA FORMATS**

BASIC UNIT: 16-bit word or 8-bit byte.

FIXED-POINT OPERANDS: 16-bit words can be interpreted as signed or unsigned binary numbers, logical words, memory addresses, or portions of decimal character strings.

Decimal numbers can be either character decimal or packed decimal. In character decimal format, each digit is an 8-bit ASCII character, and the sign is either carried separately as an extra character at the beginning or end of the decimal string or by modifying either the first or last digit in the string. The packed decimal format places each digit in 4-bit hexadecimal code with a separate sign character at one end of the string.

FLOATING-POINT OPERANDS: 32-bit single-precision operands with a 7-bit exponent and signed 24-bit fraction; and 64-bit double-precision operands with a 7-bit exponent and signed 56-bit fraction. Single- and double-precision floating-point arithmetic is implemented through software subroutines. No hardware floating-point arithmetic is available.

INSTRUCTIONS: One-word instructions. There are four basic instruction types; each with different formats: Jump and Modify Memory, Mova Data, I/O, and Arithmetic and Logic. In all instructions, bits 0-2 specify the instruction type.

In Jump and Modify instructions, bits 3 and 4 identify the specific function (op code), and the rest of the word contains information used to calculate the effective address, including an 8-bit displacement, 2-bit index register specification, and 1-bit indicator to specify direct or indirect addressing.

In Move Data instructions, bits 3 and 4 address an accumulator, and the rest of the word is identical in structure to the Jump and Modify type above.

In I/O instructions, bits 5 through 9 specify the function (indication of transfer direction, selection of an I/O device register, and/or specification of an operation). Bits 3 and 4 select an accumulator for transfer, and bits 10 through 15 indicate a specific device. ▶

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PERIPHERALS/TERMINALS

DEVICE	DESCRIPTION	MANUFACTURER
MAGNETIC TAPE EQUIPMENT		
6021	Add-on transport and controller; industry-compatible, 9-track, 10.5-inch reels, 75 ips, 800 bpi, vacuum columns, 8 drives per controller; 60 KBS	Data General
9120	Transport and controller; industry-compatible, 9-track, 10.5-inch reels, 75 ips, 800 bpi, vacuum columns, 8 drives per controller; 60 KBS	Data General
9160	Transport and controller; industry-compatible, 9-track, 10.5-inch reels, 75 ips, 800/1600 bpi	Data General
LINE PRINTERS		
9129	Dasher LP2 Serial; 5 x 7 dot matrix, 132 positions, 64 ASCII character set, 10 or 5 characters per inch, 6 lines per inch; 180 cps	Data General
9125	Drum; 136 positions, 64 ASCII character set, 10 characters per inch, 6 or 8 lines per inch, 4- to 16.8-inch paper, 12 channel VFU; 300 lpm	Dataproducts 2230
9128	Drum; 136 positions, 96 ASCII character set, 10 characters per inch, 6 or 8 lines per inch, 4- to 16.8-inch paper, 12 channel VFU; 240 lpm	Dataproducts 2230
TERMINALS		
9164	Terminal printer, 5 x 7 dot matrix, inclined right 10 degrees, 132 positions, 96 character set (128 opt.), 10 characters per inch, 6 lines per inch, 40-character buffer, 4- to 15-inch forms; receive only; 60 cps; CS/20 only	Data General
6053	CRT display/keyboard, 1920 characters, 24 lines by 80 characters, 96 ASCII character set, 5 x 8 dot matrix, detachable teletype style keyboard, 8 ftn. keys, 11 key data entry pad, and other features such as direct cursor positioning and programmable intensity; CS/40 and CS/60 only	Data General

▷ companies with revenues of $100,000 to $1 million. It is currently the only small business computer that can be programmed in interactive COBOL. Data General expects many end users to purchase CS/20's through business system suppliers who will develop specialized application programs in areas such as accounting, billing, inventory control, and payroll.

The CS/20 is a single-user system, but it can be equipped for use as a remote data station in a communications network. Data General expects typical CS/20 installation sites to include corner retail stores, law and medical offices, and other organizations with 4 to 25 employees and data processing needs in accounting, billing, and inventory control.

The CS/60, at the top of the line, can serve as a dedicated or distributed system for firms in the $5 to $25 million range, according to Data General. Concurrent operations with up to 12 active terminals are supported.

The interactive COBOL compiler allows programs written for the CS/20 to be run on the CS/40 and CS/60 models without recompilation. Down-loading, within hardware limitations, is possible. Menu selection control and fill-in-the-blanks data entry are featured. The single-pass compiler generates from 60 to 120 lines of code per minute on the CS/20, 300 to 600 on the CS/40, and 800 to 1100 lines per minute on the CS/60, according to Data General.

The Interactive COBOL Operating System (ICOS) for the ▷

▶ Arithmetic and Logic instructions use bits 1 and 2 to identify an accumulator containing a second operand (if present), bits 5 through 7 to specify primary function, and the rest of the word to specify secondary functions, if any.

For all memory reference instructions, bits 5 through 15 are used for addressing, using bits 8 through 15 as the displacement or direct address. Each instruction and address 256 words directly, or can use either relative or base register addressing.

INTERNAL CODE: ASCII and binary.

MAIN STORAGE

TYPE: Dynamic MOS RAM, requiring 64 refresh cycles every 1.8 milliseconds. Refresh is overlapped with CPU execution.

CYCLE TIME: 960 nanoseconds for the CS/20; 700 nanoseconds for the CS/40 and CS/60.

CAPACITY: 64K to 256K bytes in 64K increments.

CHECKING: None on the CS/20, optional even or odd software parity checking on the CS/40, and standard Error Checking and Correction (ERCC) on the CS/60.

STORAGE PROTECTION: None on the CS/20, an optional memory management unit on the CS/40, and an optional memory allocation and protection unit (MAP) on the CS/60.

The CS/40 memory management unit divides main memory into 2K-byte pages and protects them through software support. I/O, validity, and runaway defer protection are also provided for the CS/40. Validity protection prevents users from altering or addressing physical memory assigned to another user or the supervisor, and runaway defer protection prevents infinite indirect loops. ▶

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▷ CS series is an adaptation of Data General's proven RDOS operating system. It provides data management facilities, multi-terminal control, program development aids, and spooling capability. Sequential, relative, and multiple-key indexed sequential (ISAM) access methods are included. ICOS can address up to 256K bytes of main memory and support up to 12 terminals in concurrent processing. It includes on-line program development and interactive debugging capabilities, and supports transaction-driven applications processing.

Three utility function areas are supported on the CS systems: sorting, data base backup, and data communications. Up to six files can be merged together, with larger systems sorting indexed sequential files on one of up to four alternate keys or the primary key. Records can be reformatted and fields can be deleted during the sort. The reorganization utility can convert indexed or relative files to sequential files and vice versa, and can also copy files from one media to another. Optional synchronous communications with other CS computers and either larger Data General or IBM-compatible host systems are supported. Batch data communications are controlled by DG's RJE-80 facility using IBM 3780/2780 protocols and HASP workstation emulators.

USER REACTION

Four users of Data General's Commercial Systems line responded to Datapro's 1979 survey of minicomputer and small business computer users. These four users had a total of five systems installed, all CS/40 models, and all were purchased systems that were being used for business data processing. The user with two CS/40 systems also listed program development as one of his applications. Three users were utilizing in-house personnel to write their applications programs, while the fourth reported that he was using only application packages available from Data General. In one case the in-house programming effort was being supplemented by purchased proprietary software packages.

Two of the CS/40 systems had 64K bytes of main memory and three interactive terminals on-line, and the other three systems had 128K bytes of memory and four interactive terminals. Each of the systems had 10 million bytes of disk storage, and two systems were configured with one magnetic tape unit. All of these systems had been installed for less than one year.

The table below summarizes the ratings provided by these users.

	Excellent	Good	Fair	Poor	WA*
Ease of operation	4	0	0	0	4.0
Reliability of mainframe	4	0	0	0	4.0
Reliability of peripherals	4	0	0	0	4.0
Maintenance service:					
Responsiveness	3	1	0	0	3.8
Effectiveness	2	1	1	0	3.3
Technical support	2	2	0	0	3.5
Manufacturer's software:					
Operating system	3	0	1	0	3.5
Compilers and assemblers	4	0	0	0	4.0
Applications programs	4	0	0	0	4.0 ▷

➤ The CS/60 MAP unit also provides I/O, validity, and runaway defer protection, as well as write protection and data channel protection. MAP allocates memory in 2K-byte blocks, up to 32 blocks per user. MAP or the memory management unit is required if main memory is expanded beyond 64K bytes. Both translate 15-bit logical addresses into 20-bit physical addresses for loading programs and data into upper memory.

CENTRAL PROCESSOR

All of the Commercial System (CS) processors feature power monitor/auto restart, automatic program load, and a real-time clock.

The CS/20 CPU and 4K RAM are built on one 7.5-by-9.5-inch printed circuit board, with asynchronous and general-purpose I/O boards as well as PROM memory boards included on a rack-mountable 18-slot chassis. A hand-held programmer's console is standard.

The CS/40 and CS/60 processors, mounted on 15-inch-square boards, feature a hardware last-in, first-out stack facility as well as a hardware multiply/divide feature. Both are housed in a 12-slot chassis.

The CS/60 series is based on microprogrammed architecture with an asynchronous memory bus to accommodate various storage types and communications/peripheral interfaces. Programmed I/O transfer, a priority interrupt system, and a direct memory access channel are included. Variable-length stack frames with randomly accessible elements provide subroutine linkages and preserve contact integrity in re-entrant coding. The floating-point capability is a 64-bit double-precision operation with four 64-bit accumulators and a monitoring status register. It is implemented in firmware, rather than as a separate processor.

The CS/60 programmer's console includes an Address Compare facility to aid in debugging real-time assembly programs. Three user modes are provided: Monitor, Stop/Address, and Stop/Store. In Monitor mode, the programmer can dynamically display the contents of any memory location via console data switches while a program is executing. Stop/Address mode allows a programmer to halt the CPU at a preset address or breakpoint; on the console are shown both the instruction and the address of the instruction attempting to access the preset location. Stop/Store mode halts the CPU only if a program tries to alter a preset storage location.

CONTROL STORAGE: 0.5K, 1K, 2K, or 4K words of PROM (programmable read-only memory) are available for the CS/20. Each size of PROBM module is separately mounted on a memory board. The CS/40 does not include control storage. The microprogrammed CS/60 machines all run under the influence of microinstructions automatically accessed from control storage that is inaccessible to users. The read-only memory (ROM) consists of 2K 56-bit words with an access time of 200 nanoseconds.

REGISTERS: All CS processors have four 16-bit accumulators and a 15-bit program counter. Two accumulators can be used for address indexing. The CS computers also have a last-in/first-out (LIFO) push-down stack implemented in any 256 consecutive memory locations and two additional hardware registers, the stack pointer and the frame pointer. The stack pointer identifies the first memory location designated as the stack, and the frame pointer marks intra-stack boundaries to permit several "register saves" to be accumulated in the stack.

Beyond these hardware registers, the CS processors also have 16 reserved memory locations which function as auto-increment or auto-decrement registers when addressed indirectly. ➤

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	Excellent	Good	Fair	Poor	WA*
Ease of programming	4	0	0	0	4.0
Ease of conversion	4	0	0	0	4.0
Overall satisfaction	3	1	0	0	3.8

*Weighted Average on a scale of 4.0 for Excellent.

These users were obviously well satisfied with their CS/40 systems on the basis of their experience to date. Positive comments included "easy to use" and "reliable." Only one user offered any negative reaction, citing a "slow operating system" as a system disadvantage.□

ADDRESSING MODES: All CS processors have six addressing modes: direct (256 words), indirect (multi-level), indexed, indexed-indirect (pre-indexing), program-relative, and program relative-indirect.

When memory mapping is implemented, the 15-bit logical address coming from the CPU or data channel is translated to a 20-bit physical address. Memory access cycle time is unchanged.

The mapping information needed to service a CPU or data channel request is given to the address translation hardware by the operating system through I/O instructions that reference the address translation hardware. This information is transmitted before the supervisor enables either the user map or the data channel map.

All addresses can be mapped, including those acquired from DMA controllers.

INSTRUCTION REPERTOIRE: The CS/20 and CS/40 processors have the same basic complement of 4 Jump and Modify Memory instructions, 2 Move Data instructions, 7 stack processing instructions, 16 I/O instructions, and 8 arithmetic and logic instructions. (There are 256 variations on each of the arithmetic and logic instructions.) Hardware multiply/divide instructions are standard. The CS/60's complement of instructions includes: Arithmetic (30); Logical (15); Byte Manipulation (4); Bit Manipulation (7); Data Movement (2); Stack Manipulation (10); Program Flow Alteration (12); I/O (8); CPU (8); ERCC (3); Real-Time Clock (1); and Power Fail/Auto Restart (2).

INSTRUCTION TIMINGS: The timings shown in the accompanying table are for full-word, fixed-point operands, in microseconds.

	CS/20	CS/40*	CS/60
Load/Store	2.88	1.15	1.0
Add/Subtract	2.4	0.7	0.6
Multiply/Divide	41.3/59.0	5.8/6.5	7.2/8.2
Compare & Branch	2.88**	1.7	2.6

*Average of minimum and maximum values.
**Jump instruction.

INTERRUPTS: A 16-level programmed priority interrupt facility is used to recognize interrupts for I/O operations. Each device on CS/20 and CS/40 systems is wired to one of 16 bus positions, and is either authorized or denied authorization to interrupt particular service routines by an Interrupt Disable Mask Bit that corresponds to the bus positions of the device. A CS/60 interrupt-handling instruction, Vector, provides servicing through device identification and vectoring to a device handler or through device identification, saving the machine state, switching stacks, and priority updating. The interrupt facility is implemented in hardware.

PHYSICAL SPECIFICATIONS: The CS/20 is housed in an 18-slot chassis that is 5.25 inches high, 19 inches wide, and 27.5 inches deep. The CS/40 and CS/60 chassis are 10.5 inches high, 19 inches wide, and 23 inches deep. They weigh up to 130 pounds.

Power requirements for all chassis types are 110, 120, 220, or 240 VAC +10 percent, 47 to 63 Hz. Operating temperatures are 32 to 132 degrees F. A relative humidity of up to 90 percent, noncondensing, can be tolerated. The BTU/hour output of the processors ranges from 1023 to 4080.

INPUT/OUTPUT CONTROL

INPUT/OUTPUT CHANNELS: An I/O bus and a Direct Memory Access (DMA) channel are standard on all CS processors. The I/O bus is serial in nature, and it functions to provide communication between mainframe-based I/O boards and the CPU board. The DMA data channel provides a multiplexer-like capability, and can be seized by any device through a data channel request to handle 16-bit data transfers to and from main memory. DMA is used for disc and magnetic tape I/O, as well as for high-speed terminals. The channel transmission rates range from 148,000 to 1.25 million words per second for input, and from 173,000 to 714,285 words per second for output.

SIMULTANEOUS OPERATIONS: DMA input/output operations are overlapped with processing through cycle stealing so as to be concurrent on all systems. Within the CS/40 and CS/60 processors, overlapped execution of one instruction and fetching of the next (i.e., "pipelining") take place automatically.

CONFIGURATION RULES

Up to 61 (CS/20), 62 (CS/40), or 59 (CS/60) peripheral devices can be attached to the I/O bus. Peripherals available with the various packaged systems, rather than available slots, limit the sizes of CS systems that can be configured.

MASS STORAGE

6038 FLOPPY DISC SUBSYSTEM: Consists of a four-drive controller and either a 6038 single drive or a 6039 dual drive. Each floppy disc stores up to 315K bytes on 77 tracks. Maximum storage capacity is 1.26 million bytes on a four-drive subsystem. Average head positioning time is 260 milliseconds, and average rotational delay is 83 milliseconds. Data transfer rate is 31K bytes/second. The 6038 drives feature IBM 3740 compatibility and are supported by Data General's Interactive COBOL Operating System (ICOS). The controller occupies one slot. The 6038 drives are manufactured by Data General.

6045 CARTRIDGE DISC SUBSYSTEM: Each subsystem consists of a controller and one or two 10-megabyte, top-loading cartridge disc drives. The systems are being manufactured at Data General's Westbrook, Maine facility.

Each drive employs two platters, one fixed and the other an IBM 5440-type removable cartridge, both mounted on a common spindle. Each platter is capable of storing 5,013,504 bytes, or 2,506,762 bytes per surface. There are 200 tracks per inch, 408 tracks per surface, 408 cylinders per drive, and 4 surfaces per drive. Recording density is 2200 bits per inch. All tracks are divided into 12 sectors of 512 bytes each, yielding a formatted track capacity of 6144 bytes. Each cylinder consists of four tracks, giving a formatted cylinder capacity of 24,576 bytes. Total drive capacity is 10,027,008 bytes.

Drive rotational speed is 2400 rpm. Track-to-track, average, and full-stroke head positioning times are 8, 38, and 70 milliseconds, respectively. The data transfer rate is 312,500 bytes per second. Drive start-up to full operating speed takes ▶

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▶ 30 seconds, and the drive requires 25 seconds to come to a full stop.

6046 CARTRIDGE DISC SUBSYSTEM: Identical to the 6045 subsystem except that the recording density is doubled, giving each drive a capacity of 20 megabytes.

6060, 6061, AND 6067 DG/DISC STORAGE SUBSYS-TEMS: Consist of a 96-, 190-, or 50-megabyte disc pack drive and a controller for up to four drives. Thus, the same controller can handle from 50 to 760 megabytes of on-line storage. The drives are 3330-type units designed and manufactured by Data General at its Westbrook, Maine facility. Model 6060 is a 96-megabyte drive, Model 6061 is capable of storing 190 megabytes, and Model 6067 is a 50-megabyte drive. Data density is 4040 bits per inch for all three drives, although their track densities are different. The drives employ a servo track-following technique that allows 192 tracks per inch for a total of 411 tracks per surface on the Model 6060, and 370 tracks per inch for a total of 815 tracks per surface on the Model 6061 and 6067. These are a total of 411 or 815 cylinders, each containing 19 tracks on the 6060 and 6061, or 5 tracks on the 6067.

The Model 6060 employs an IBM 3336-type pack, while the Model 6061 and 6067 utilize an IBM 3336-11-type pack. The 6060 and 6061 disc packs contain 10 platters with 19 usable surfaces, while the 6067 contains 3 platters with 5 usable surfaces. There are 24 sectors per track and 512 bytes per sector, yielding 12,288 bytes per track. Total surface capacity is either 5,050,368 or 10,014,720 bytes per surface, depending on the model. Total formatted drive capacity is 95,956,992 bytes for Model 6060, 190,279,680 bytes for Model 6061, and 50,073,600 bytes for Model 6067.

Disc rotational speed is 3600 rpm, and average rotational delay is 8.3 milliseconds. Track-to-track head positioning time is 6 milliseconds, average head positioning time is 35 milliseconds, and average access time is 43.3 milliseconds.

The controller employed with these drives can handle up to four Model 6060, 6061, or 6067 drives in any combination. Software limitations restrict the number of controllers per system to two. The controller features independent command and read/write channels and reserve-and-trespass capabilities for users to transfer data. In multiple shared-disc environments, privileged file structures are allowed. The controller is connected directly to the standard Eclipse data channel. An error correction feature makes it possible to direct and correct all error bursts of 11 bits or less.

INPUT/OUTPUT UNITS

See Peripherals/Terminals table.

COMMUNICATIONS CONTROL

REMOTE JOB ENTRY CONTROL PROGRAM (RJE80): Allows for remote job entry and communications between CS processors and IBM 360/370 systems, or between CS processors and other Data General computers. Support is provided for four types of RJE systems:

● Point-to-point communications between a CS system emulating an IBM 2780/2780 and an IBM 360/370 host.

● Point-to-point communications between two Data General systems running RJE80.

● Multi-drop Data General systems emulating IBM 3780 slave terminals, communicating with an IBM 360/370 host.

● Multi-drop Data General Systems emulating IBM 3780 slave terminals, communicating with a Nova or Eclipse master system also running RJE80.

The Dasher LP2, Data General's first in-house manufactured printer, prints at 180 cps and features bi-directional printing and built-in logic to cause spacing or skipping directly to the next character to be printed. Its dot matrix printing mechanism allows printing at 6 or 8 lines per inch with standard, elongated, compressed, or elongated-compressed character sizes.

RJE80 is supported by ICOS. Features include horizontal and vertical printer format control; error detection on transmission and reception; and disc, tape, or card transmission to remote systems. Transmission between host systems may be to unattended RJE80 systems, and because of device-independent I/O capabilities, any combination of I/O devices can be utilized without additional software.

IBM HASP II WORKSTATION EMULATOR: Lets a CS/60 system emulate an IBM HASP remote job entry workstation. Its multileaving capability can include up to seven input and seven output data streams. Efficiency of data transmission is achieved by interleaving and data compression. The emulator supports both disc and tape storage. Hardware requirements include a CS/60 with card reader or magnetic tape drive, line printer, and a real-time clock.

SOFTWARE

OPERATING SYSTEM: *Interactive COBOL Operating System (IOCS)* is a full-scale operating system that supports multi-tasking, file management, and file access. It can schedule and allocate program resources to many different sub-program tasks. It is a comprehensive, modular system with a system generation procedure allowing the user to tailor the operating system to his hardware configuration and his COBOL applications.

ICOS can be used either interactively from a console keyboard or in batch mode from job streams entered via disc files. On the larger systems, ICOS can simultaneously support both foreground and background tasks, so that users ▶

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► can run two jobs at the same time. The higher-priority job, which is normally a real-time or response-dependent system supervisor program, is run in the foreground, while the lower-priority job is run in the background. Data from a background job is typically processed while waiting for an event or for data from the foreground job. Background mode can be used to develop new programs without interrupting ongoing jobs. Foreground and background programs can be hardware-protected from each other and from the operating system.

Also available to ICOS users is the CLI command interpreter and job supervisor. Any program that an on-line user can execute interactively from the console can be called.

ICOS supports only the interactive COBOL programming language.

On the Nova 3/D and Eclipse-based systems, ICOS supports two-partition multiprogramming with 32K-word user program areas and an operating system area of up to 32K words (typical size is 8K to 12K words). Mapped ICOS provides an extensive file management capability. It features a common I/O interface, checkpointing for a background task, program segmentation, and communication between tasks. Mapped ICOS supports systems of up to 256K words, with each partition protected from the remainder of main memory. Mapped ICOS foreground/background designations are merely a reference to the usual priority designations, which are set up by the user and can be altered at any time. The two partitions could even be given equal priority.

ICOS supports sequential, relative, and indexed files. Sequential file records can be of fixed or variable length. Relative record numbers can range up to 65,535. Indexed file keys are alphanumeric strings of up to 100 characters in length. Primary, alternate, generic, or sequential keys can be used. The CS/60 Models 4 and 6 support up to 4 alternate keys.

Printer spooling under ICOS can be either automatic or operator-controlled.

LANGUAGE: *Interactive COBOL,* the only programming language currently supported on the CS systems, implements the Level 1 ANSI COBOL-1974 Nucleus, Table Handling, Sequential I/O, Relative I/O, Indexed Sequential (ISAM) I/O, and Library modules, and includes several Level 2 modules. It provides for complex conditions (AND, OR, NOT, and parentheses) and sign conditions, and supports the standard 96-character ASCII set and floating-point data formats. Nested IF and PERFORM UNTIL statements are provided for structured programming.

A Screen Section is included in the Data Division for entry and inquiry/response formats. Screen interaction is allowed through the ACCEPT and DISPLAY verbs.

Interactive COBOL supports sequential, relative, and indexed sequential (ISAM) access methods. ISAM allows up to five search keys, and a duplicate key feature is supported on the CS/60, C5 and C6 models. ISAM keys can be up to 100 bytes long, and records up to 4K bytes in length are allowed. Record and file lockout are provided for multi-user applications. The Printed Access Scheduling System (PASS) allows the operator to determine the printing sequence of print files.

UTILITIES: The utility library for the CS systems includes standard file sort/merge, copy, and reorganization programs as well as an RJE80 communications subsystem and a HASP workstation emulator. Program development utilities include a text editor and an interactive debugger. Special features of the text editor include text insertion from other files, global search and replace, and relocation of multiple sections. The interactive debugger allows programmers to start, stop,

or suspend program execution, to set traps (break points), and to show the results of the current process on the CRT. While execution is suspended, the programmer can examine and change the contents of storage, using COBOL-like verbs, and then rerun the program from the previous breakpoint. The following standard utilities are also included: Sort/ Merge, Copy, Filestats, Analyze, Reorg, Delete, Append, Rename, Xfer, and Print.

APPLICATIONS: The packaged CS systems are intended to be sold primarily to OEM's and system development houses. No separate application packages have been announced for the CS series to date.

PRICING

POLICY: Data General offers the CS series on a purchase-only basis. With the On-Call Service contract, all parts and labor are included at no additional cost.

Normal prime-time on-call contract service hours are 9 a.m. to 5 p.m. Charges quoted in the price list are applicable to customers within 100 miles of a service center. Additional but uniform monthly charges are in effect beyond 100 miles of a Data General service center. These charges are $150 for customers between 100 and 300 miles from the center and $225 for customers beyond 300 miles.

Data General software is licensed and bundled so that it is included without additional charge on a system with sufficient hardware to operate it.

The Data General Software Subscription Service provides automatic updates and documentation for Data General software at a price ranging from $50 to $350 per software product, and for $75 per product on any order totalling $1,000 or more.

The Hardware Subscription Service provides automatic updates, additions, and notification of new documentation on all Data General hardware for a fixed yearly fee. It is available to any owner of Data General equipment. This includes owners who have purchased their equipment through another vendor. Initial subscriptions include updates for one year. Prices are as follows: CS processors, $980; peripherals, $920; and communications and I/O, $920. Additional log books for any of the above topics are $500 each without updates. Yearly renewal rates are $480 for CS processors, $420 for peripherals, and $420 for communications and I/O. A 40 percent discount applies for additional updates beyond the first to the same type of log book, ordered at the same time and deliverable to the same address.

Data General provides training courses for customers at its Westboro, Massachusetts headquarters; at its Western Training Center in El Segundo, California, in Chicago, Illinois; and at its United Kingdom Training Center in Greenford, Middlesex, England. Two training credits are given for each system purchased (end user) or two training credits per purchase agreement (OEM). One training credit entitles a customer to approximately one man-week of training. Schedules for training courses can be obtained at any Data General field office.

On-site training is available when necessary. Costs involve $600 per day (with a three-day minimum) for instructional charges including the instructor's daily expenses, instructor's travel expenses, $100 per weekend for subsistence when incurred, and a per-student charge for actual documentation used.

The Data General Users' Group provides a forum for interchange of programs. The programs are available for a fee to cover reproduction and distribution costs.

Prices shown in the Equipment Prices list are for single-unit ►

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quantities. Standard OEM three-to-five quantity discounts of 19 percent apply. Discounts of about 40 percent are available for quantities of 200 or more units.

EQUIPMENT: The following typical system purchase prices include interactive COBOL, system utilities, and all required control units, adapters, and cables.

CS/20 SYSTEM: Includes microNova processor with 64K bytes of MOS memory, CRT control console, four floppy disk drives (1.2 megabytes), and Dasher TPI 60-cps printer. Purchase price is $17,720.

CS/40 MOD C1 SYSTEM: Includes Nova processor with 64K bytes of parity MOS memory, CRT control console, 10-megabyte disk cartridge and 315K floppy disk subsystem, Dasher 60-cps terminal printer, and one workstation desk. Purchase price is $33,415.

CS/40 MOD C3 SYSTEM: Includes Nova processor with 64K bytes of parity MOS memory, CRT control console, 10-megabyte disk cartridge and 315K floppy disk subsystem, Dasher 60-cps terminal printer, 3 Dasher display terminals, and 3 workstation desks. Purchase price is $40,245.

CS/60 MOD C5: Includes Eclipse processor with 128K btes of MOS memory, 20-megabyte disk subsystem, 5 Dasher display terminals, CRT control console, Dasher 180-cps printer, 300-lpm printer, and RJE 80 communications package. Purchase price is $76,340.

CS/60 MOD 6: Includes Eclipse processor with 256K bytes of MOS memory, 380-megabyte disk subsystem, 800/1600-bpi tape transport, 8 Dasher interactive terminals, Dasher 180-cps printer, one 300-lpm printer, and RJE 80 communications package. Purchase price is $151,920.■

EQUIPMENT PRICES

		Purchase Price	On-call Service	Factory Service
BASIC SYSTEMS				
All CS/20 systems include microNova processor, CRT console, 64K bytes of NMOS memory, and interactive COBOL; no printer is included.				
9172	With dual-diskette 630K-character subsystem	$10,945	$89	$45
9173	With 3-diskette 945K-character subsystem	13,845	122	61
9174	With 4-diskette, 1260K-character subsystem	14,845	129	65
All CS/40 Nucleus Model C1, C3, and C5 systems include a Nova 3/D processor, MOS parity memory, 10-megabyte disc cartridge subsystem, single-drive diskette subsystem, 4 terminal ports, and interactive COBOL; all models require the selection of a system printer and console.				
9150	Model C1 with 64K bytes of MOS memory	25,990	280	140
9151	Model C3 with 64K bytes of MOS memory	27,240	280	140
9152	Model C5 with 128K bytes of MOS memory	33,440	354	177
All CS/40 Nucleus Model C4 and C6 systems include a Nova 3/D processor, MOS parity memory, 9-track 800-bpi magnetic tape subsystem, and interactive COBOL; all require the selection of a system printer and console.				
9153	Model C4 with 64K bytes of MOS memory, 50-megabyte disc pack subsystem	49,590	365	183
9154	Model C6 with 128K bytes of MOS memory, 50-megabyte disc pack subsystem	55,790	440	220
9155	Same as 9153 except 96-megabyte disc pack subsystem	53,590	395	198
9156	Same as 9154 except 96-megabyte disc pack subsystem	59,790	470	235
9157	Same as 9153 except 190-megabyte disc pack subsystem	58,790	395	198
9158	Same as 9154 except 190-megabyte disc pack subsystem	64,990	470	235
All CS/60 Nucleus models include Eclipse S/130 processor, ERCC MOS memory, and interactive COBOL; all require the selection of a system printer and console.				
9166	Model C3 with 64K bytes of memory, 20-megabyte disc cartridge subsystem, 4-terminal connector	34,350	288	144
9167-K	Model C5 with 128K bytes of memory, 20-megabyte disc cartridge subsystem, two 4-terminal connectors	43,750	351	176
9167-M	Same as 9167-K except 192K bytes of MOS memory	48,750	381	191
9167-N	Same as 9167-K except 256K bytes of MOS memory	53,750	411	206
9169-K	Model C6 with 128K bytes of memory, 50-megabyte disc pack subsystem, 9-track, 75-ips, 800-bpi tape transport, two 4-terminal connectors	67,970	541	271
9169-M	Same as 9169-K except 192K bytes of memory	72,950	571	286
9169-N	Same as 9169-M except 256K bytes of memory	77,950	601	301
9170-K	Same as 9169-K except 96-megabyte disc pack subsystem	67,950	541	271
9170-M	Same as 9169-M except 96-megabyte disc pack subsystem	72,950	571	286
9170-N	Same as 9169-N except 96-megabyte disc pack subsystem	77,950	601	301
9171-K	Same as 9170-K except 192-megabyte disc pack subsystem	73,150	541	271
9171-M	Same as 9170-M except 192-megabyte disc pack subsystem	78,150	571	286
9171-N	Same as 9170-M except 192-megabyte disc pack subsystem	83,150	601	301
MASS STORAGE				
For CS/40 systems:				
6031-B	Add-on single diskette drive	2,400	35	18
6050	Add-on 10-megabyte disc cartridge drive; Model C1, C3, or C5 only	9,000	80	40
6067-A	Add-on 50-megabyte disc pack drive; Model C4 or C6 only	14,800	140	70
6060-A	Add-on 96-megabyte disc pack drive; Model C4 or C6 only	20,800	160	80
6061-A	Add-on 190-megabyte disc pack drive; Model C4 or C6 only	26,000	160	80

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EQUIPMENT PRICES

		Purchase Price	On-call Service	Factory Service
MASS STORAGE (Continued)				
For CS/60 systems:				
9139	Add-on 10-megabyte disc cartridge drive; Model C5 or C6 only	8,000	—	—
9161-A	Add-on 20-megabyte disc cartridge drive; Model C3 or C5 only			
6067-A	Add-on 50-megabyte disc pack drive	14,800	140	70
6060-A	Add-on 96-megabyte disc pack drive	20,800	160	80
6061-A	Add-on 190-megabyte disc pack drive	26,000	160	80
MAGNETIC TAPE EQUIPMENT				
6021	Add-on magnetic tape subsystem; includes industry-compatible 9-track, 800-bpi, 75-ips transport	9,900	90	45
For CS/40 Models C1, C3, and C5 and CS/60 systems:				
9120	Magnetic tape subsystem; includes industry-compatible 9-track, 800-bpi, 75-ips transport; not for CS/20	11,050	90	45
9160	Same as 9120 except 800/1600 bpi			
LINE PRINTERS				
9129	Dasher LP2 serial printer subsystem; 180 cps, 7x9 dot impact matrix printer, 10 or 5 cpi	4,050	46	23
9128	Line printer subsystem; includes 240-lpm, 136-column, 96-character set printer and controller	14,700	70	35
9125	Line printer subsystem; includes 300-lpm, 136-column, 64-character set printer and controller	12,300	74	37
TERMINALS				
9164	Dasher TP1 terminal printer; 60 cps, RO; for CS/20 only.	2,875	27	14
6053-G	Dasher CRT; 24 lines by 80 characters, 5x8 dot matrix, 96-character set, blink and underscore; not for CS/20	2,290	20	10
6055	Print Station for 6053 display	2,500	30	15
6041-F	Dasher TP1 terminal printer; RO, 60 cps, 132-column, 5x7 dot impact printer; for CS/40 only	2,625	30	15
9123	Expansion module for 4 additional CRT's; includes 4 asynchronous display controllers and 32K words of MOS memory; for CS/40 only	6,800	53	27
9165	Expansion module for 4 additional CRT's with 4 asynchronous display controllers; for CS/60 only	1,400	18	9
COMMUNICATIONS—SYNCHRONOUS				
9178	Synchronous line interface, modem cable, IC/RJE 80 software license; for CS/20 only	1,000	—	—
9122	Same as 9178 except for CS/40 and CS/60	2,500	15	8