

R 1176

NCR Century Series

MANAGEMENT SUMMARY

The present family of NCR Century Series computers consists of eight disc-oriented models released over a period of six years. Middle-of-the-range systems in the family include the Century 100 and 200 processors (the original members of the NCR Century Series announced in March 1968), the Century 101 (released in April 1972), and the two newest additions to the product line, the Century 151 and Century 201 (announced in May 1974). The product line is rounded out at the top by the Century 251 (released in January 1973) and the Century 300 (announced in September 1970), and in the small-scale performance category by the Century 50 (unveiled in December 1970).

With the Century 300 offering more than 25 times the internal performance of the Century 50, the Century Series offers a broad range of upward-compatible systems. In addition, NCR is gearing up to market its multiprocessor Century 350 system in the United States. The Century 350 occupies a unique position in the NCR computer product line, with specially designed software support oriented toward large-scale multiprocessing in on-line financial applications.

As originally introduced, the Century Series represented a belated but impressive entry into the third-generation computer sweepstakes, with an appropriate complement of peripheral equipment and software for the hotly contested small-scale business data processing marketplace. Early announcement of a larger, more powerful processor was promised at the time the Century 100 and 200 were announced, but it was more than two years before the third, most powerful member of the family was released.

At the time of its release, the long-promised Century 300 processor provided a natural growth path for installed Century 200 systems and helped to promote acceptance of the smaller Century 100 and 200 systems by providing tangible evidence of the capability for upward growth with full compatibility.

NCR's Century Series computers span a wide range of computational capability from the small-scale Century 50 to the large-scale Century 300. Recent activity within the product line includes two new processors, the Century 151 and 201, new peripherals including large-capacity mass storage, and some attractive pricing modifications.

CHARACTERISTICS

MANUFACTURER: NCR Corporation, Dayton, Ohio 45409. Telephone (513) 449-2000.

MODELS: NCR Century 50, 50 Mod 1, 100, 101, 151, 200, 201, 251, and 300 Computer Systems.

DATA FORMATS

BASIC UNIT: 8-bit byte. Each byte can represent 1 alphanumeric character, 1 or 2 BCD digits (in unpacked or packed format, respectively), or 8 binary bits. (Four consecutive bytes form a "word" in the Century 251 and Century 300 systems.)

FIXED-POINT OPERANDS: Can range from 1 to 256 bytes in length, in either decimal or binary mode. (On the Century 251 and 300, a "word binary" mode is available that takes particular advantage of their 4-byte address; each 4-byte word is treated as a signed 31-bit integer.)

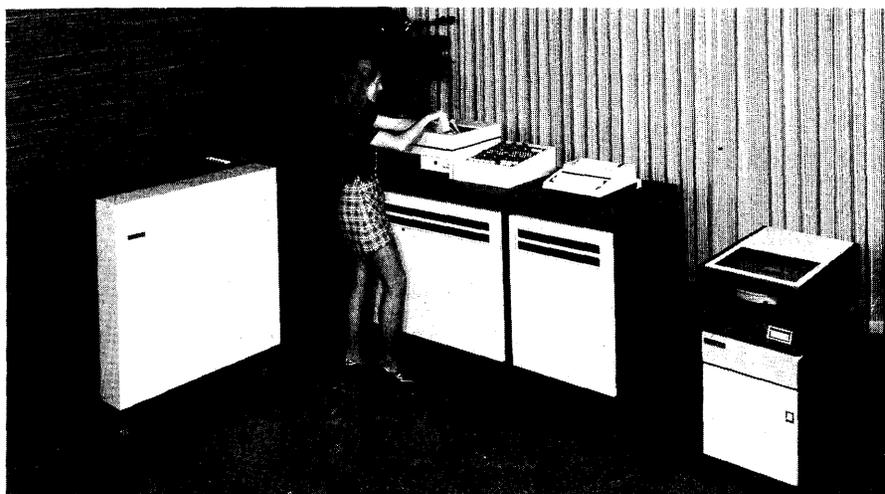
FLOATING-POINT OPERANDS: Consist of a 7-bit hexadecimal exponent and a 24-bit or 56-bit fraction (in "short" or "long" format, respectively).

INSTRUCTIONS: 4 or 8 bytes in length, specifying 1 or 2 memory addresses, respectively.

INTERNAL CODE: ASCII.

MAIN STORAGE

STORAGE TYPE: Thin-film, short-rod for Century 50, Century 100, and Century 200 systems with up to 49K bytes; each plated copper rod stores 1 bit and is 0.006 inch in diameter and 0.110 inch long. Conventional magnetic core storage is used for the Century 101, for expanded Century 200 systems (64K bytes or larger), and



One of the two May 1974 additions to the NCR Century Series computer family, the compact Century 151 is the first to utilize MOS main memory. The Basic System pictured here features 32K bytes of 750-nanosecond MOS memory, an integrated 300-lpm line printer and 300-cpm card reader, and 9.8 million bytes of disc storage.

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➤ In reality, however, the price/performance gap between the Century 200 and 300 proved to be too wide for the majority of Century 200 users, and the Century 251 was developed three years later as a more practical upgrade for the more than 800 Century 200 systems then installed worldwide.

The low end of the Century Series product line was set by the December 1970 unveiling of the Century 50, which embodies some striking technical features for an entry system in its class. Thus, the range of Century processing capability was established by the end of 1970, and has not since been extended. But significant additional activity has taken place within the Century Series, including 1) the release of additional, intermediate processors, 2) dramatic developments in peripheral availability resulting from the NCR-CDC joint venture, and 3) further development of an already extensive line of commercially oriented application software—more than 50 major systems, many of which include multiple, separately usable program subsystems.

Throughout the life cycle of the Century Series, price reductions and performance enhancements have kept the series cost-competitive and have helped to stave off incursions of competitive mainframe vendors into the NCR installed base.

The May 1974 announcements illustrate NCR's continuing efforts to provide attractively priced upgrade systems for its installed base, to strengthen its capabilities in the area of on-line processing, and to supply the necessary computer systems to support the company's highly successful activities in the business machines and point-of-sale marketplaces.

What NCR announced in May 1974 included 1) two new intermediate systems—the Century 151 and Century 201—aimed at upgrading the more than 3,000 installed Century 100, 101, and 200 systems; 2) a doubled main memory capacity for the Century 251 system and a specially priced Century 251 configuration eligible for three- and five-year rental terms; 3) a new complement of peripheral devices, including a 100-million-byte disk unit; and 4) significant purchase and rental price reductions for Century 300 systems.

Shortly after the May announcements, NCR disclosed that it had achieved its original marketing goal to sell 5,000 Century Series machines. With the heaviest concentration of these systems in the Century 50, 100, and 200 range, the new processor models and attractive pricing of its larger models should strengthen NCR's efforts to maintain this customer base until the results of its joint computer development activities with Control Data Corporation are unveiled.

In order to continue to attract new users to the NCR fold, the company has also released a new low-cost Century 50 configuration, the Century 50 Mod 1. Announced in late April 1974, the Century 50 Mod 1 is targeted at accounting machine users and other small companies about to install their first computer system.

NCR design engineers set a bold course in the Century Series with a number of significant technical innovations. Primary among these was the use of a thin-film, short-rod main memory. Prior to NCR's adoption of this ➤

➤ all Century 201, 251, and 300 systems. The Century 151 has metal oxide semiconductor (MOS) main memory.

CAPACITY: See table. Specific memory sizes available for each processor are summarized below.

Century 50 Mod 1: 16,384 or 32,768 bytes.
Century 50 or 100: 16,384 or 32,768 bytes.
Century 101: 16,384; 24,576; 32,768; 49,152; or 65,536 bytes.
Century 151: 32,768; 49,152; 65,536; 98,304; or 131,072 bytes.
Century 200: 32,768; 49,152; 65,536; 98,304; 131,072; 196,608; 262,144; 393,216, or 524,288 bytes.
Century 201: 65,536; 98,304; 131,672; 196,608; 262,144; 393,215; or 524,288 bytes.
Century 251: 98,304; 131,072; 196,608; 262,144; 393,216; or 524,288 bytes.
Century 300: 131,072 to 4,194,304 bytes. A Century 300 system can include from 1 to 8 Memory Storage Units (MSU's) containing 131,072, 262,144, 393,216, or 524,288 bytes each. Each MSU consists of four equal-sized memory modules that cycle independently of each other.

CYCLE TIME: See table. In the Century 251, word addresses are interleaved among two memory modules within the MSU to permit overlapped accessing. In the Century 300, word addresses are interleaved among four memory modules within each MSU to permit overlapped accessing. The Century 251 and 300 can access one, two, or three bytes during each cycle instead of the standard four bytes.

CHECKING: Parity bit with each word is generated during writing and checked during reading.

STORAGE PROTECTION: None in the Century 50, 50 Mod 1, 100, 101, or 151. Provided by the optional Multiprogramming Feature for the Century 200 and 201. In the Century 251 and 300, storage protection is provided by multiple base address and limit address registers. For each active program, one base address register (BAR) and one limit address register (LAR) define the lower and upper address limits of main storage that can be accessed.

RESERVED STORAGE: In the Century 50 through 201 Processors, byte locations 0 through 1279 are reserved for registers, control words, and the resident executive. In the Century 251, byte locations 0 through 3071 are reserved for registers, control words, and specific portions of the resident executive. In the Century 300, byte locations 0 through 3071 are reserved for these purposes.

CENTRAL PROCESSORS

INDEX REGISTERS: The Century 50 through 201 provide 63 index registers, located in main storage. In the Century 251 and 300 a separate set of 63 index registers is maintained in reserved storage for each active program.

INDIRECT ADDRESSING: None in the Century 50 or 100; up to 5 levels in the Century 101, 151, 200, 201, 251, and 300, which can be combined with indexing.

INSTRUCTION REPERTOIRE: The Century 50 and 100 each have 19 instructions: decimal add and subtract, binary add and subtract, move, compare, pack, unpack, repeat, wait, input/output, and 8 different branch instructions. Arithmetic can be performed only in unpacked decimal and binary modes, upon unsigned fields up to 256 bytes in length. Standard subroutines are used for multiplication and division.

The Century 101 and Century 151 have 34 standard instructions, including all of the Century 50 or 100 instructions plus optional instructions for multiply and divide and a Command feature for logical bit manipulation.

The Century 200 and 201 have 39 standard instructions, including all of the Century 50 or 100 instructions plus ➤

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CHARACTERISTICS OF THE CENTURY SERIES SYSTEMS

	Century 50	Century 100	Century 101	Century 151	Century 200	Century 201	Century 251	Century 300
SYSTEM CHARACTERISTICS								
Maximum no. of processors supported by standard software	1	1	1	1	1	1	1	1
Operating systems	B1, B2	B1, B2	B1, B2	B1, B2	B1, B2, B3	B1, B2, B3	B1, B2, B3, B4	B1, B3, B4
Typical system rental	\$1,800	\$2,600	\$3,600	\$4,600	\$5,500	\$8,200	\$14,000	\$19,000
MAIN STORAGE								
Cycle time, microseconds	0.8	0.8	1.2	0.75	0.8 or 0.65*	0.65	1.2	0.65
Bytes accessed per cycle	1	1	2	2	2	2	4	4
Minimum capacity, bytes	16K	16K	16K	32K	32K	64K	96K	128K
Maximum capacity, bytes	32K	32K	64K	128K	128K	512K	256K	4096K
Storage increment size, bytes	16K	16K	8K or 16K	16K or 32K	16K or 32K	32K, 64K, or 128K	32K or 64K	128K
Main storage type	Thin-film, short-rod	Thin-film, short-rod	Core	MOS	Thin-film, short-rod*	Core	Core	Core
Interleaving	None	None	None	None	None	None	2-way	4-way/8-way
Storage protection	None	None	None	None	Optional	Optional	Standard	Standard
Reserved storage, bytes	1,280	1,280	1,280	1,280	1,280	1,280	3,072	3,072
CENTRAL PROCESSORS								
No. of hardware instructions	19	19	37	37	66	67	71	71
Index registers	63	63	63	63	63 for each active program	63 for each active program	63 for each active program	63 for each active program
Maximum no. of interrupts	2	2	9	9	8	8	16	16
Floating-point hardware	None	None	None	None	Optional	Optional	Standard	Standard
Decimal instructions	2	2	5 (+2 opt.)	5 (+2 opt.)	5 (+1 opt.)	5 (+1 opt.)	9	9
Divide hardware	None	None	Optional	Optional	None	None	Standard	Standard
Indirect addressing	None	None	5 levels	5 levels	5 levels	5 levels	5 levels	5 levels
IBM 1400 Series compatibility	None	None	None	None	Optional	Optional	None	None
NCR 315 compatibility	None	None	None	None	Optional	Optional	Optional	Optional
INSTRUCTION TIMES (fixed-point decimal, in microseconds):								
Add, unsigned, unpacked (5 digits)	59	59	28.8	18.0	18 (or 15)*	15	9.9	9
Add, signed, packed (5 digits)	**	**	25.2	15.8	14 (or 11)*	11	9.0	7.2
Multiply, unsigned, unpacked (5 digits)	**	**	**	**	**	**	**	20
Multiply, signed, packed (5 digits)	**	**	127.2	79.5	129 (or 105)*	105	22.8	18.5
Divide, unsigned, unpacked (5 digits)	**	**	**	**	**	**	**	15.3
Divide, signed, packed (5 digits)	**	**	134.4	84.0	**	**	11.1	12.9
I/O CONTROL								
Total number of trunks	2	2	4	4	8	8	7	11
Maximum aggregate I/O data rate, bytes/sec	148KB	148KB	416KB	1,056KB	900KB	1,700KB	2,700KB	4,300KB
Common trunk transmission rates, bytes/sec:								
Standard trunks	108KB***	108KB 40KB	416KB 120KB	545KB 120KB	2 x 130KB 77KB*** 1KB***	3 x 120KB 2 x 487KB 1 x 900KB	2 x 826KB 173KB	6 x 850KB 210KB***
Optional additional trunks	40KB	None	277KB 120KB	900KB 120KB	2 x 420KB 2 x 130KB	77KB*** 1KB***	4 x 826KB 900KB	4 x 1,100KB

*0.8-microsecond thin-film memory is used in 32K and 48K Century 200 systems; larger Century 200's use 0.65-microsecond core memory, resulting in faster instruction times.

**Handled by subroutine; timings not available.

***Integrated trunk. On the Century 300, the 8-position integrated multiplexer can accommodate a data transfer rate up to 190KB on any one position, subject to an overall multiplexer data rate of 210KB.

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▷ memory technology, its use had been limited to state-of-the-art military and advanced engineering systems. (A thin-film long-rod technology was employed earlier in the NCR 315/RMC systems). The use of thin-film, short-rod memory and monolithic integrated circuitry permitted the various Century models (except for the Century 300, which has used only conventional magnetic core main memory) to have a "low-boy", table-top look that made them significantly different in appearance from that of most competitive data processing systems. Furthermore, significant savings in development cost were possible with the thin-film technology, thus permitting more "bang per buck" in other aspects of the system design.

A number of problems, however, were reported among some of the earlier installations of the thin-film, short-rod memory systems. NCR responded positively to the resulting market pressure by providing optional magnetic core memory on the Century 200, and by releasing the Century 300 with magnetic core memory only. Later, the Century 200 configuration rules were revised, retaining thin-film memory on the "basic" system with less than 64K bytes, but providing magnetic core memory for all expanded Century 200 systems. This high-performance magnetic core memory, with a cycle time of 650 nanoseconds per 2-byte access, is 23 percent faster, considerably more compact, and only 5 to 15 percent more expensive (depending upon capacity) than the basic Century 200 short-rod memory. The more recently announced Century 101 and 251 use core memory only, while the newly announced Century 151 marks NCR's first use of metal oxide semiconductor (MOS) main memory.

High production costs for certain Century Series peripheral devices have been a chronic problem at NCR. This factor, combined with a long-standing and mutually satisfactory original equipment manufacturer's (OEM) arrangement between NCR and Control Data Corporation, was primarily responsible for the formation of an equally-owned joint venture between NCR and CDC. Under an agreement announced in principle in January 1972, a jointly owned subsidiary called Computer Peripherals, Inc. was set up to produce magnetic tape equipment, printers, and punched card equipment. CDC is also now NCR's supplier of disc drives for the Century Series. The new Model 658 Disc Unit, magnetic tape subsystems, card-processing equipment, and high-speed printers now available with Century Series processors are results of the CDC-NCR arrangement, which should assure the continuing availability of top-quality peripheral equipment at substantially reduced manufacturing costs to NCR.

Compatibility between the Century computers and other currently popular systems is limited. IBM-compatible tape units and an 8-bit byte data format are used, but the internal code is ASCII rather than EBCDIC, and System/360 and 370 compatibility has also been ignored in both the processor instruction repertoire and the removable disc packs. Optional compatibility features enable a Century 200 or 201 to execute machine-language programs written for the second-generation NCR 315 or IBM 1401 computers.

NCR has maintained full upward compatibility within the Century Series. The Century 50 and 100 Processors ▷

► facilities for packed, signed, decimal addition and subtraction, editing, code translation, scanning, and bit and character testing. Up to 27 more instructions can be added by the optional features listed below:

Multiply feature: provides fixed-point multiplication of packed decimal fields.

Command feature: provides logic and table compare instructions.

Floating Point feature: provides 12 instructions for floating-point arithmetic in "short" (4-byte) and "long" (8-byte) formats.

Multiprogramming feature: provides base and limit address registers, interval timer, and other hardware facilities to make multiprogrammed operation practical.

Trace (Console Debug) feature: provides 3 special instructions to facilitate program debugging.

NCR 315 Compatibility feature: provides 3 additional instructions and a separate Emulation Unit, enabling a Century 200 to execute programs written for NCR 315 computers.

IBM 1401 Compability feature: provides special instructions that facilitate software simulation of IBM 1401, 1440, or 1460 computers. Internal speed of the Century 200 in Compatibility mode is about 1.5 times that of the original 1401.

The Century 251 and 300 have 71 instructions, all standard, including all of the Century 200 instructions except those associated with the optional NCR 315 and IBM 1401 Compatibility features. There are 7 classes of Century 251/300 instructions:

Decimal Arithmetic: 9 instructions for adding, subtracting, multiplying, dividing, and comparing signed, packed BCD fields; for adding and subtracting unsigned, unpacked BCD fields; and for packing and unpacking BCD fields.

Fixed-Point Binary: 10 instructions for adding, subtracting, multiplying, dividing, and shifting word-oriented (4-byte) binary operands; for adding, subtracting, and comparing variable-length binary fields; and for performing binary-to-decimal and decimal-to-binary conversions.

Floating-Point: 12 instructions for adding, subtracting, multiplying, dividing, and comparing floating-point operands in both short (1-word) and long (2-word) formats.

Data Movement: 3 instructions for internal data transfer operations.

Logical: 8 instructions for editing, scanning, code translation, and Boolean operations.

Transfer: 13 instructions for testing, branching, and counting.

Special: 16 instructions for various hardware functions such as input/output, loading base and limit address registers, repeating an instruction, setting up trace/monitor conditions, handling interrupts, etc.

INSTRUCTION EXECUTION TIMES: See table.

INTERRUPTS: See table.

TIME-OF-DAY CLOCK: In the Century 101, 251, and 300 only, an optional clock register, located in main memory, provides a binary indication of the time of day for use in controlling real-time programs, schedulers, and job accounting routines. The clock is incremented every 25 microseconds.

INPUT/OUTPUT CONTROLS

I/O CHANNELS: See table. Basic Century channels can accommodate 8 I/O positions.

The basic Century 151 operates with a minimum I/O configuration of two common trunks, each with eight I/O ►

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▷ have a “stripped-down” repertoire of just 19 instructions. The Century 101, about 2.5 times as fast as the 100, and the Century 151, about 3.5 times as fast as the 100, have 34 standard instructions plus 3 optional instructions. This repertoire is essentially that of the Century 200 except for the 200’s NCR 315 and IBM 1401 emulation instructions and certain commands used heavily in multiprogramming. Both the Century 200 and 201, which are about 5 times as fast internally as the 100, have 39 standard instructions, with additional instructions for NCR 315 and IBM 1401 emulation, floating-point arithmetic, decimal arithmetic, and multi-programming available through field-installable optional features.

The Century 251, with approximately three times the processing power of the Century 200, and the Century 300, about five times as fast as the 200, have 71 standard instructions, including all those available for the smaller processors except instructions associated with the optional NCR 315 and IBM 1401 series compatibility. Thus, except for NCR 315 and IBM 1401 emulation, which is available only for the Century 200 and its successor, the Century 201, NCR stresses that all hardware differences between the various processors are resolved by standard software, so that users can easily move up from the small-scale Century 50 to the large-scale 300 without reprogramming.

All software for the Century computers is disc-oriented and highly integrated. The principal software facilities include four levels of operating systems, compilers for the COBOL, FORTRAN, and RPG languages and NCR’s own NEAT/3 language, and an impressive assortment of utility routines and business-oriented application programs. COBOL and FORTRAN compilers are each offered at three different levels, tailored for operation on different equipment configurations. Also provided is a conversational-mode compiler for the BASIC language, available for the Century 50 (with an optional hardware support package) and all of the larger processor models.

NEAT/3 is a combination of COBOL and symbolic assembly language that places an unusually strong emphasis upon the use of macro-instructions to facilitate coding. NCR is encouraging Century users who are first-time computer users to program exclusively in the “Level 1” version of NEAT/3. At this level, all coding consists of macro-instructions and pre-coded “Major Functions.” Thus, the programmer does not need to concern himself with machine instructions or other hardware details. NCR states that most Century 50 user select NEAT/3, Level 1 as their principal programming language. For more advanced programmers, higher-level versions of NEAT/3 permit full utilization of all the Century hardware facilities.

Customer support for the Century Series computers is focused on several Regional Systems Centers. These facilities are staffed by specialists in the major fields serviced by NCR. The centers also provide training courses for customer personnel, facilities for customer backup, and computers on which customers can compile and test their programs before their own systems are delivered.

NCR’s pricing structure can best be described as containing a “basic bundle.” Under the plan announced in September 1969, NCR supplies certain essential and ▷

▷ positions. Two additional optional trunks can be added to the system to provide an additional 16 I/O positions. One is a low-speed trunk with a transfer rate of 120KB and the second is a high-speed trunk with a 900KB transfer rate.

The basic Century 201 includes eight I/O trunks. Three are common trunks with eight I/O positions and a transfer rate of 120KB each. Two are medium-speed common trunks with a data transfer rate of 487KB, and one is a high-speed common trunk with a 900KB data transfer rate. In addition, there are two slow-speed trunks, one with dedicated positions for a card or paper tape reader, I/O writer, and console, and the second with a dedicated position for a printer. One slow-speed common trunk can be buffered to provide a second 900KB trunk.

The Century 251 system has two high-speed trunks, with 4 positions each for free-standing peripherals or controllers, and one 8-position multiplexer trunk as standard. Three positions are reserved for the interval timer, I/O writer, and CRT display system; the other five positions can be used for free-standing peripherals or controllers. Four additional 8-position standard trunks are also available for the Century 251.

On the Century 300, six high-speed trunks, with 4 positions each for free-standing peripherals and/or controllers, and one 8-position multiplexer trunk are standard. Three of the multiplexer positions are reserved for the interval timer, I/O writer, and CRT display system; the other five positions can be used for free-standing peripherals and/or controllers. Four optional 8-position “very high-speed trunks” are also available for the Century 300.

SIMULTANEOUS I/O OPERATIONS: A maximum of two I/O operations can occur concurrently with computing in a Century 50 or Century 100 system. The Century 101 can perform up to eight I/O operations on four trunks simultaneously with computing due to a greater system bandwidth and the multiplexer channel. The basic Century 151 can perform five low-speed I/O operations on the multiplexer trunk and one high-speed I/O operation concurrently with processing; addition of the optional slow-speed and high-speed trunks allows a total of eight I/O operations to be performed concurrently with processing.

The Century 200 can perform four or eight I/O operations concurrently with processing (i.e., one operation per I/O channel). The Century 201 can perform up to eight operations (one on each I/O channel) up to the maximum system I/O bandwidth of 1700KB.

In the Century 251, one I/O operation can occur on each of the eight subchannels of the multiplexer trunk and on one position on each of the high-speed trunks concurrently with computing, resulting in 14-way I/O simultaneity. Also, with two-way memory interleave, the I/O Control Unit and the Arithmetic Logic Unit of the Century 251 Processor can access main storage simultaneously.

On the Century 300, one I/O operation can occur on each of the 6 high-speed trunks, on each of the 8 subchannels of the multiplexer trunk, and on each of the 4 very high-speed trunks (if installed) concurrently with computing, resulting in 18-way I/O simultaneity. Also, the Input/Output Control Unit and the Instruction Look-Ahead and Execution Units of the Century 300 Processor can all access main storage simultaneously.

I/O DATA RATES: See table.

I/O INTERFERENCE: Due to the “cycle-stealing” technique used in the Century Series, the Century 50 or 100 processor is delayed for an average of 4.8 microseconds for every byte transferred to or from main storage. The Century 101 has an I/O interference of 2.4 to 6.0 microseconds per byte, depending upon the data rate of the I/O channel. The Century 151, with its faster main memory speed, incurs a delay of from 1.1 to 4.2 microseconds per byte, depending on the I/O channel.

The Century 200 is delayed 3.0 or 1.1 microseconds per byte for I/O operations on the standard or high-speed ▷

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▷ predetermined systems support and educational assistance along with the hardware. Once the basic allotments have been exceeded, any additional NCR support services that may be needed are separately priced. Most software is supplied without extra charge.

NCR's pricing policy represents a reasonable "middle road" between the overall package pricing that has been traditional for the computer industry and the complete separation of hardware and software prices, which is becoming more common among mainframe vendors as the cost of producing software assumes a larger portion of the overall cost of manufacturing a computer system. At present, however, NCR supplies with the Century systems the basic software support, programming languages, and training required for system implementation, with additional software, support, and education conveniently available to users who need this further assistance and are willing to pay for it.

NEW PERIPHERALS

Along with two new processor models, NCR introduced a bevy of new peripheral products in its May 1974 announcement. The new I/O equipment includes:

- The Model 684-301 Card Punch and its companion upgrade model, the 684-101 Card/Read Punch. Both models feature speeds of 100 cards per minute when punching 80 columns and a maximum of 460 cards per minute when punching a single column per card. The read/punch model reads 80-column cards at speeds of 500 cards per minute and can read and punch Hollerith or binary code in a single pass or in separate passes.
- Two new printers employing a horizontal moving train with changeable train arrays. The medium-speed 646 Printer operates at 1,200 lines per minute with a 48-character set and at burst speeds of up to 2,500 lines per minute with customized train configurations. The high-speed Model 647 Printer operates at 2,000 lines per minute with a 48-character set, with burst speeds of up to 3,500 lines per minute with a specially tailored print train. The new printers are products of NCR's joint peripheral venture with Control Data Corporation. Model 747 will be available for Century 101, 151, 200, 201, 251, and 300 systems; Model 646, however, will not be available with Century 200 and 201 configurations.
- Two new families of magnetic tape units, both offering cost savings over previous models. The 634 Magnetic Tape Subsystems provide low- and medium-speed tape handling capabilities with data transfer speeds ranging from 4K to 80K bytes per second. The NCR 634 features a "master/slave" configuration, in which the master unit includes both control electronics and one tape drive and can control up to three additional slave tape units. Both 7- and 9-track drives are available. The 9-track NCR 634 models can handle both NRZI at a density of 800 bits per inch and phase-encoded recording 1600 bits per inch. The two new NCR 635 Magnetic Tape Units are high-performance drives capable of data transfer rates of up to 320K bytes per second at 1600 bits per inch. Both models read and write on 9-track tape using the phase encoding technique, with NRZI available as an option. ▷

▶ channels, respectively. The Century 201 is delayed 3.0 microseconds per byte for operations on low-speed channels, 1.1 microseconds per byte for high-speed channel operations, and 0.55 microsecond per byte for operation on the very high speed channel.

On the Century 251, due largely to the 2-way memory interleaving, the maximum system I/O data rate of 2.74 million bytes/second can be maintained with a minimal central processor I/O degradation.

On the Century 300, due largely to the 4-way memory interleaving, the maximum system I/O data rate of 4.3 million bytes/second can be maintained with a central processor I/O degradation of 0 to 150 nanoseconds per byte.

MASS STORAGE

655 SERIES DUAL-SPINDLE DISC UNITS: One of NCR's unique 655 series disc units is included in each Century 50 through 200 Basic System, and a second unit can be added to a Century 50 or 100 without adding a separate controller. Each unit has two independent spindles, and each spindle is capable of driving a removable disc pack. The 3-disc NCR 955-1 disc pack stores up to 4,194,304 bytes (or 8,388,608 packed decimal digits) in 512-byte sectors, with 8 sectors per track. Each spindle has a comb-like access mechanism with 12 read/write heads servicing each of the 6 recording surfaces. Up to 262,144 bytes per pack can be read without head movement (524,288 bytes per dual-spindle unit).

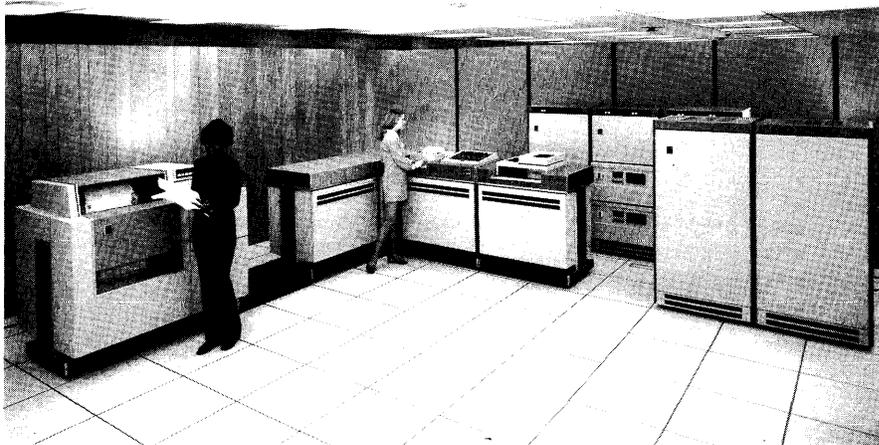
Types 655-151 (basic unit for Century 50 only) and 655-152 (optional second unit for Century 50 only) have an average head movement time of 131 milliseconds, while Types 655-101 (basic unit for Century 100 only) and 655-102 (second unit for Century 50 or 100) have an average head movement time of 44.7 milliseconds. All four dual-spindle models have an average rotational delay of 20.8 milliseconds and a data transfer rate of 108,000 bytes/second. All four models are for "integrated" attachment to the Century 50 or 100, respectively, and do not require controllers.

The 655-201 Dual-Spindle Disc Unit is similar to the 655-101 or 655-102 except that it is a "free-standing" unit that is used with the 625-101 Disc Controller. Up to four 655-201 units (or up to eight spindles) can be attached to each controller. The same 955-1 disc pack is used with the 655-201 unit. The 655-201 is part of the Century 101 and 200 Basic Systems.

657-101/102 DISC SUBSYSTEM: Provides medium-capacity random-access storage in removable 11-high disc packs. Each NCR 957-1 disc pack stores up to 29.8 million bytes of data in standard-density format or up to 47.7 million bytes in "double-density" format. The 957-1 pack is physically compatible with the IBM 2316 pack, although the recording formats differ. Each spindle holds one disc pack and has a comb-like access mechanism with one read/write head serving each of the 20 recording surfaces. Average head movement time is 60 milliseconds and average rotational delay is 12.5 milliseconds. Capacity and data transfer rate depend upon which of two controllers is used:

- The 625-201 Disc Controller records data at a density of 2200 bpi. Maximum data capacity is 7459 bytes per track, 149,180 bytes per cylinder, and 29.8 million bytes per 11-disc pack. Data transfer rate is 315,000 bytes/second. Available for the Century 101, 151, 200, 201, 251, and 300, the 625-201 can control up to eight 657-type spindles for a total on-line capacity of 238.4 million bytes.
- The 625-202 Dual-Density Disc Controller can record data at either 2200 or 3500 bpi, under programmed control. Maximum data capacity at the higher density is 11,944 bytes per track, 238,880 bytes per cylinder, and 47.7 million bytes per pack. Data transfer rate is 500,000 bytes/second. Available for the Century 151, 201, 251, and 300, the 625-202 can control up to eight 657-type spindles for a total on-line capacity of 381.6 million bytes. ▶

NCR Century Series



The NCR Century 201, introduced in May 1974, provides raw processing power roughly equal to that of the original Century 200 but features expanded I/O capabilities for connection of larger and faster disc storage units. A basic 64K Century 201 system with 96 million bytes of disc storage can be rented for \$6,500 per month on a 1-year lease.

➤ Up to eight 635 tape units can be connected to a 624-401 Magnetic Tape Control Unit. Although the NCR 634 and 635 Magnetic Tape Units offer no new breakthrough in magnetic tape technology (such as the IBM 6250 bits-per-inch tape density), they provide magnetic tape capability at considerably more attractive cost/performance levels than previous models for NCR Century Series users.

- The NCR 658 Disc Subsystem, which can include up to 16 disk drives, each with a 100-million-byte capacity, for a total of up to 1.6 billion bytes of on-line storage for Century 251 and 300 systems. The Model 658 supplies substantially more on-line mass storage than was previously available with the Model 657 Disc Subsystem at a lower cost per byte.

THE CENTURY 50

The "new" NCR Century 50, unveiled on April 30, 1974, and designated the Century 50 Mod 1, is a somewhat slower and significantly cost-reduced version of the original entry-level Century 50 unveiled in 1970. The new Century 50 basic configuration consists of a central processor with 16,384 bytes of main memory, a dual-spindle disc drive with a 153-millisecond access time and an on-line storage capacity of 8.4 million bytes, a 125-lpm printer, and a 300-cpm card reader. Monthly rental is \$1,275 under a one-year contract or \$1,050 under a five-year contract, and is \$47,000—just about the equivalent of the purchase price of the minimum configuration for an IBM System/3 Model 6, exclusive of the additional charges for programming languages, systems analyst support, and training that would accrue to the System/3 customer.

Though the Century 50 offers little that is new in the way of hardware or software technology, it does embody most of the technological innovations that have distinguished the Century Series since its introduction. Monolithic integrated circuits are used extensively, and NCR's distinctive thin-film, short-rod memory provides a fast cycle time of 800 nanoseconds per one-byte access. Every Century 50 system includes at least one dual-spindle disc unit, with 12 read/write heads serving each of the 6 recording surfaces of each removable 3-disc pack. Moreover, all of the Century Series software is

➤ The 657-type disc drives are available in either one-spindle units (Model 657-101) or two-spindle units (Model 657-102). The one-spindle model can be converted to a dual-spindle unit with a 6571 Add-on Drawer.

658-101 DISC SUBSYSTEM: Provides large-capacity random-access storage in interchangeable 10-high disc packs that are physically compatible with the IBM 3336 Disk Packs used in the IBM 3330 Disk Storage Subsystem. Up to 16 NCR 658-101 Disk Drives can be connected to a Century 251 or 300 system for a total of up to 1.6 billion bytes of on-line storage. Each NCR 658-1 disk pack stores up to 100 million bytes and is organized in one of two formats. The single sector per track format contains 11,884 bytes per sector and the eight sector per track format contains 1,322 bytes per sector.

Each disk pack holds 404 data cylinders (plus 7 spares) of 19 tracks each. Head movement time ranges from 10 to 55 milliseconds and averages 30 for random accesses. Average rotational delay is 8.4 milliseconds, and data transfer rate is 806,000 bytes per second. Rotational Position Sensing and Command Retry are standard features. Error correction circuitry in the control unit permits detection and correction of errors in 11-bit bursts of data or address information. The Model 625-301 Control Unit contains a magnetic tape cassette handler for loading the control program, loading and reading on-line and off-line diagnostic programs, and recording statistical usage/error logging data. In addition, the control unit utilizes interchangeable address plugs to facilitate servicing of individual disc drives.

Up to eight NCR 658-101 Disc Units can be attached to a 625-301 Control Unit. Attachment of additional drives, up to a maximum of 16 disc drives per control unit, requires an optional Model 0658-0001 Drive Expansion Feature. One Model 625-301 Control Unit can be attached to a Century 251 system via a medium-speed trunk or to a Century 300 system via a medium-speed or high-speed trunk. A Century 300 system can contain two Model 625-301 Control Units, attached either to one medium-speed trunk and one high-speed trunk or to two high-speed trunks.

653-101 CRAM (CARD RANDOM ACCESS MEMORY): Provides relatively low-cost random-access storage for large data files. Each unit stores 113 million bytes of data in a removable cartridge containing 384 oxide-coated Mylar cards. Each card has 144 tracks, and each track can hold 2623 bytes of data. A 36-head access mechanism moves to one of four positions to serve all the tracks. Card drop time is 90 to 125 milliseconds, head movement time is approximately 25 milliseconds, average rotational delay is 24 milliseconds, and data transfer rate is 83,000 bytes/second. The overall average access time is 125 milliseconds per card. Up to eight CRAM units can be connected to a 623-201 CRAM Controller.

NCR Century Series

➤ disc-oriented, and even the smallest Century 50 system can utilize an integrated operating system and COBOL, BASIC, and FORTRAN compilers.

The Century 50 Processor has the same data formats, instruction repertoire, memory cycle time, and instruction execution times as the Century 100 Processor. To get the price down, NCR reduced the speeds of the basic printer and disc unit and somewhat restricted the possibilities for connecting additional peripheral equipment. Like the Century 100, the Century 50 processors has a limited repertoire of just 19 instructions. Addition and subtraction can be performed only in binary or unpacked decimal mode, upon unsigned fields ranging from 1 to 256 bytes in length. Since few users will program the Century 50 at the machine-instruction level, the limited instruction set is not likely to cause programming difficulties. However, the Century 50 must use subroutines to perform multiplication, division, editing, code translation, and other operations that can be accomplished by single machine instructions in many larger computers.

When originally announced, the Century 50 was bound by strict configuration rules. Since that time, the rules have been eased considerably. All types of NCR peripherals—MICR, OCR, magnetic tape, punched card, paper tape, and data communications—can now be connected to the Century 50 in addition to the standard devices in the basic system. Currently, only the non-availability of the highest-speed, highest-performance Century 100 peripherals distinguishes a Century 50 from a larger Century Series computer system.

The Century 50 has plainly been designed and priced to compete effectively against the popular IBM System/3. The newly announced Century 50 Mod 1 is targeted directly at IBM's small-scale System/3 Model 6, while the larger Century 50 Basic configuration, which comes equipped with a faster printer and card-oriented I/O devices at a monthly rental of \$1,350 on a five-year lease, is designed to compete with disc-oriented System/3 Model 10 systems. Since every Century 50 system includes disc storage, the Century 50 is not directly competitive with card-oriented System/3 configurations. Instead, NCR stresses the many advantages of batch-mode magnetic file processing with disc-based master files.

The lowest-priced System/3 Model 6 configuration that is supported by IBM software rents for \$1,002 per month, \$273 less than a Century 50 Mod 1 Basic System. That System/3 Model 6, however, has only 8K bytes of main memory and a single 2.45-million-byte disc drive. A System/3 Model 6 configuration that is more directly comparable with the Century 50 Mod 1 would include a 16K processor, a 115 character-per-second printer with 132 positions, a 5496 Data Recorder, and two disc drives with 9.8 million bytes. This System/3 Model 6 configuration rents for \$2,051 per month (or \$776 more than the basic Century 50).

Among the significant differences between the Century 50 and the IBM System/3 Model 10 are the following:

- The Century 50 offers full program compatibility with a broad line of larger computers, while the System/3 does not.

➤ INPUT/OUTPUT UNITS

633 MAGNETIC TAPE HANDLERS: Six models of CDC-built 633 Series tape units are offered. Data transfer rates range from 10,000 to 240,000 bytes/sec. All use standard 1/2-inch tape, have vacuum-capstan drives, and use photocell sensing. Up to 8 tape units can be connected to a 624-type control unit. The following models are available:

633-111: 9 tracks; phase-encoded; 1600 bytes/inch; 80,000 bytes/sec. Forward tape speed 50 ips, rewind speed 150 ips. Requires 624-111 Controller.

633-117: 7 tracks; NRZI; 200, 556, or 800 char/inch; 10,000, 27,800, or 40,000 char/sec. Forward tape speed 50 ips; rewind speed 150 ips. Requires 624-179 Controller.

633-119: 9 tracks; NRZI; 800 bytes/inch; 40,000 char/sec. Forward tape speed 50 ips; rewind speed 150 ips. Requires 624-119 or 624-179 Controller.

633-121: Dual-drive unit with same characteristics as 633-111.

633-211: 9 tracks; phase-encoded; 1600 bytes/inch; 144,000 bytes/sec. Forward tape speed 90 ips; rewind speed 240 ips. Requires 624-211 Controller. Not usable with Century 100.

633-311: 9 tracks; phase-encoded, 1600 bytes/inch; 240,000 bytes/sec. Forward tape speed 150 ips; rewind speed 380 ips. Requires 624-311 Controller. Not usable with Century 100.

634 MAGNETIC TAPE SYSTEM: The NCR 634 Series tape units provide low-speed tape handling capabilities for 7- and 9-track magnetic tape. The 634 Series employs a "master/slave" operating technique in which each "master" unit contains a tape drive, the control electronics, and the trunk interface, and can control up to three additional "slave" units each containing a tape drive and associated read/write electronics. Three master units and three slave units are available; 9-track master tape units with the dual-mode option permit NRZI and phase-encoded tape units to be intermixed in one master/slave combination. The following "master" units and their associated "slave" units are available:

634-117 Master Unit: 7 tracks; NRZI; 200/556/800 bits/inch; 5,000/13,900/20,000 char/second. Forward tape speed is 25 ips; rewind speed is 160 ips.

- 634-107 Slave Unit: 7 tracks; 200/556/800 bits/inch; 5,000/13,900/20,000 char/sec.

634-119 Master Unit: 9 tracks; phase encoded or dual mode (phase encoded and NRZI); 1600 bytes/inch (phase encoded)/800 bytes per inch (NRZI); 40,000/20,000 bytes/sec. Forward tape speed is 25 ips; rewind speed is 160 ips.

- 634-109 Slave Unit; 9 tracks; phase encoded and/or NRZI; 1600 bytes/inch (phase encoded)/800 bytes/inch (NRZI); 40,000/20,000 bytes/sec.

- 634-107 Slave Unit (described above).

634-219 Master Unit: 9 tracks; phase encoded or dual mode (phase encoded and NRZI); 1600 bytes/inch (phase encoded)/800 bytes/inch (NRZI); 80,000/40,000 bytes/sec. Forward tape speed is 50 ips; rewind speed is 240 ips.

- 634-209 Slave Units; 9 track; phase encoded or dual mode; 1600 bytes/inch (phase encoded)/800 bytes/inch (NRZI); 80,000/40,000 bytes/sec.

- 634-107 Slave Unit (described above).

635 MAGNETIC TAPE SYSTEM: The NCR 635 Magnetic Tape Units are high-performance, 9-track tape drives that can read or write data with either the NRZI or phase encoded recording techniques. Up to eight Model 635 Magnetic Tape Units can be connected to a 624-401 Control Unit. Controllers equipped with the 0624-0001 Dual-Model feature can be used to control 7-track NCR 634-107 Magnetic Tape Units recorded with the NRZI

NCR Century Series

- ● The Century 50 can have a maximum of 16.8 million bytes of on-line disc storage, compared with up to 81.9 million bytes for the System/3.
- All of the current Century 50 software is supplied at no extra charge, whereas most of the System/3 software is separately priced.
- NCR offers a \$1,500 training allowance for the Century 50 and a \$1,000 training allowance for the Century 50 Mod 1, compared to none for the System/3. NCR also offers a support allowance equal to two months' rent on a one-year rental contract.

On balance, the Century 50 shapes up as an appropriate choice for many companies that are installing their first computers or upgrading from punched cards to disc systems. By providing effective disc-oriented business data processing capabilities at a very reasonable price, the Century 50 neatly fills the gap that previously existed between NCR's electronic accounting machines and the larger Century Series computers.

THE CENTURY 100, 101, AND 200

The basic Century 100 system consists of a central processor with 16,384 bytes of rod memory, two I/O channels, one dual-spindle disc drive, a 450-lpm printer, and either a 300-cpm card reader or 1000-cps paper tape reader. The processor contains built-in controllers for the three standard peripheral units. The memory capacity can be increased to 32,768 bytes, and a wide range of peripheral equipment can be connected.

The basic Century 101 system consists of a processor with 16,384 bytes of core memory, two I/O channels (one of which is a five position multiplexor channel), one dual-platter disc drive, a 300-lpm printer, and a 300-cpm card reader. The memory capacity can be expanded to 64K bytes, two more I/O trunks can be added, and a wide range of peripheral equipment can be connected.

The basic Century 200 system consists of a processor with 32,768 bytes of rod memory, four I/O channels, a console typewriter, one dual-spindle disc drive, a 1500-lpm drum printer, and either a 300-cpm card reader or 1000-cps paper tape reader. A Century 200 can be expanded by adding up to 524,288 bytes of memory, four more I/O channels, numerous peripheral units, and several worthwhile optional features. For expanded Century 200's (64K bytes or larger), all main memory is of the magnetic core type.

THE CENTURY 151 AND 201

The newly introduced Century 151 provides an intermediate step between the Century 101 and the Century 201. Although it is equipped with the same instruction set as the Century 101, the 151 offers performance enhancements designed to increase its suitability for the applications that are gaining widespread use among computer users. Features that distinguish the Century 151 from the Century 101 include a doubled main memory capacity and a greatly expanded I/O capability that permits attachment of larger quantities of on-line disc storage. The Century 151 also marks NCR's first use of MOS main memory in its computer line. Basic memory size is 32,768 bytes, and is expandable in increments of either 16K or 32K bytes up to a maxi-

➤ recording technique as well as the 635 Magnetic Tape Units. Features available with the Model 635 drives include automatic tape reel latching and automatic tape threading. Two models are available:

- 635-109: 9 tracks; 1600 bytes per inch (phase encoded)/800 bytes/inch (NRZI); 160,000/80,000 bytes/sec. Forward tape speed is 100 ips; rewind speed is 480 ips.
- 635-209: 9 tracks; 1600 bytes/inch (phase encoded)/800 bytes/inch (NRZI); 320,000/160,000 bytes/sec. Forward tape speed is 200 ips; rewind speed is 640 ips.

680-201 CARD READER: Reads 80-column cards serially at 1200 cards per minute. Has one input hopper and one output stacker with capacities of 4,000 cards each. A reject stacker with a capacity of 240 cards is also provided. Does not require a controller.

682-100 INTEGRATED CARD READER: Integral part of the Century 50 through 251 Basic Systems. Reads standard 80-column cards at a peak rate of 300 cards per minute. Cards are read in serial, column-by-column fashion by 12 photo-electric cells. Cards punched in Hollerith code (Extended A or H set) are translated into the internal (ASCII) code by a combination of hardware and software techniques. Has a 1000-card input hopper and a single 1000-card output stacker. Does not require a controller. The 682-100 is not available for the Century 300.

684-101/301 CARD READ/PUNCH: Reads 80-column cards serially at speeds of up to 500 cpm and punches column-by-column at 100 to 460 cpm, depending on the number of columns punched in each card. The Model 684-301 operates as a card punch only and can be field-upgraded to a Model 684-101 Card Read/Punch unit. Both Hollerith and binary code can be read and punched, either in one pass or in separate passes. Can operate as a card reader, card punch, or reader/punch for updating punched card files. Has a 1200-card input hopper and a 1300-card output stacker plus a card offset capability. Attaches to a position on a common trunk. Available for Century 101, 151, 200, 201, 251, and 300 systems.

686-102 CARD READ/PUNCH: Reads 80-column cards serially at up to 800 cpm and punches column-by-column at 83 to 294 cpm, depending on the number of columns punched. Has a single card feed path, a 1500-card input hopper, and two 1800-card programmable output stackers plus a 100-card reject stacker. Does not require a controller.

686-111 CARD READ/PUNCH: Reads 80-column cards serially at up to 560 cpm and punches column-by-column at 60 to 180 cpm, depending on the number of columns punched. Has a 1500-card input hopper and two 1800-card programmable output stackers plus a 100-card reject stacker. Does not require a controller. Available for the Century 50 as well as for the larger models.

686-201 CARD READER: Reads 80-column cards serially at up to 750 cpm. Has a 1500-card input hopper and two 1800-card programmable output stackers plus a 100-card reject stacker. Does not require a controller. Available for the Century 50.

686-302 CARD PUNCH: Punches 80-column cards at 83 to 294 cpm, depending on the number of columns punched. Does not require a controller.

686-311 CARD PUNCH: Punches 80-column cards at 60 to 180 cpm, depending on the number of columns punched. Does not require a controller. Available for the Century 50.

687-301 CARD PUNCH: Punches 80-column cards at 100 cpm. Has an 800-card input hopper and an 800-card output stacker. Requires a 622-701 controller.

662-100 INTEGRATED PUNCHED TAPE READER: Available as an integral part of the Century 50 through 201 Basic Systems; may be selected as an alternative to the 682-100 Card Reader. Reads 5-, 7-, or 8-channel punched tape at a peak rate of 1000 characters (100

NCR Century Series

▷ mum of 131,072 bytes without change to the physical size of the system. The Century 151 MOS memory has a cycle time of 750 nanoseconds to access one or two bytes of data, nearly twice the speed of the Century 101.

The basic Century 151 configuration includes two trunks: one high-speed trunk and a multiplexer trunk with a five-position priority scanner. Two optional channels, with maximum data transfer rates of 120KB and 900KB, can expand the total I/O rate for the system to 1056K bytes per second. Expansion of the I/O capability of the Century 151 allows attachment of up to eight Model 657 Disc Drives in the "double-density" format for a total on-line capacity of 381.6 million bytes of disc storage per controller.

The basic Century 151 configuration includes a processor with 32,768 bytes of MOS main memory, a dual-platter disc unit with a 9.8-million-byte storage capacity, a 300-cpm card reader, a 300-lpm printer, and an I/O writer. Monthly rental for the basic system is \$2,975 or \$2,675 for a one-year or five-year lease, respectively, and the purchase price is \$133,695.

Software support for the Century 151 includes the Basic Executive and Dual Operating Executive operating system levels and the COBOL, FORTRAN, RPG, BASIC, and NEAT/3 programming languages.

The Century 201 fits squarely between the Century 200 and the Century 251 in price/performance and features enhanced I/O capabilities, large-capacity disc storage units, and multiprogramming capabilities. The Century 201 incorporates core main memory with an access time of 650 nanoseconds and enhanced I/O capabilities. Basic I/O facilities of the Century 201 processor include eight I/O trunks, one of which can accommodate a data transfer rate of 900K bytes per second. As an option, one of the low-speed trunks can be buffered to provide a second 900KB trunk to provide dual access to a Model 657 "double-density" Disc Subsystem. From 65,536 to 524,288 bytes of core main memory can be configured with the system.

A Basic NCR Century 201 system includes a processor with 65,536 bytes of core memory, a 300-cpm card reader, a 1500-lpm printer, and a 96-million-byte dual-spindle disc unit. Monthly rental is \$6,500 on a one-year lease and \$5,525 on a five-year lease, and purchase price is \$300,000.

With the exception of a nearly doubled total system I/O data rate and expanded on-line mass storage capabilities, the Century 201 offers the same instruction set and processing power as large Century 200 systems equipped with 650-nanosecond core memory, and will supplant the older Century 200 in NCR's marketing line-up. Rental prices for the older Century 200 basic system, with only 32K bytes of main memory and considerably less disc storage, begin at a lower price tag than the more powerful Century 201 basic system, which offers twice the amount of main memory and ten times the amount of disc storage. Main memory increments, however, are priced to make the Century 201 progressively less expensive than comparable Century 200 processors as the main memory sizes are increased. As a result, a Century 201 basic system including a processor with 512K bytes of main storage will rent for \$12,500 per

▷ inches) per second. Can read strips or rolls varying from 1 to 350 feet in length. Standard code is ASCII with even parity, but any user-defined code with either odd or even parity can be read. Does not require a controller. Not available with the Century 300.

660-101 PUNCHED TAPE READER: Reads 5-, 7-, or 8-channel tape at 1500 char/sec. Uses photoelectric read cells with either continuous or start/stop operation with a rewind rate of 150 inches/sec. Does not require a controller. Available for the Century 50.

665-101 TAPE PUNCH: Punches 5-, 7-, or 8-channel tape at 200 char/sec. Operates in either continuous or start/stop mode.

626-101 PRINTER CONTROLLER: Connects any of the following free-standing printers to Century 100 or larger computer system through a common trunk attachment: 640-102, -200, -205, -210, -215, or -300.

640-102 INTEGRATED PRINTER: Integral part of the Century 100 Basic System. Can also be connected to a Century 50 or 200. Has 132 print positions and 64 printable characters. Peak speed is 450 lpm with 64-character set. Optional 52-character set enables all-numeric printing at 900 lpm. Print spacing of 6 or 8 lines per inch is available. Requires a 626-101 Controller for use as an additional free-standing unit with a Century 100 or 101, and for attachment to Century 151 and larger systems.

640-122 PRINTER: Standard printer in the Century 50 Basic System. Prints up to 200 alphanumeric lines per minute. Has 132 print positions and 64 printable characters. Print spacing is 6 or 8 lines per inch. Available for the Century 50 only. Does not require a controller.

640-132 PRINTER: Can be selected as a higher-speed substitute for the basic 640-122 Printer on the Century 50 only. Has 132 positions and a standard set of 64 printable characters. Prints up to 300 alphanumeric lines per minute. Optional 51-character set with double numerics permits all-numeric printing at 600 lpm. Print spacing of 6 or 8 lines per inch is available. Does not require a controller.

640-200 PRINTER: Usable as integrated printer in the basic Century 200 system. Can also be connected to Century 100 or larger system as a free-standing unit via the 626-101 Controller. Has 132 print positions and 64 printable characters, with 160 print positions and a 52-character print set optionally available. Peak speed is 1,500 lpm. Optional 52-character set enables all-numeric printing at 3,000 lpm. Continuous Form Tab Set Handling is available. Not usable with the Century 50 or 101.

640-210 PRINTER: Same as the 640-200, except has 160 print positions.

640-300 PRINTER: Usable in the same manner as the 640-200, including installation as the integral printer in the Century 101 system. Has 132 print positions and up to 128 printable characters (double alpha). Peak speed is 1,200 lpm with 64-character set. Requires the 626-101 Controller for attachment to a common trunk.

646-201 TRAIN PRINTER: Prints at up to 1,200 lines per minute with 16, 20, 44, or 48 character sets and somewhat slower speeds with 52 or 64 character sets. Maximum speed in the burst mode is 2,500 lines per minute with a 16-character set. Has 132 print positions. Print spacing of 6 or 8 lines per inch is available. Has an integrated controller. Available with the Century 101, 151, 251, and 300.

647-201 TRAIN PRINTER: Prints at a peak speed of 2,000 lines per minute with a set of up to 48 characters, and at 3,500 lines per minute in the burst mode with a 16-character set. Can be equipped with 16, 20, 44, 46, 48, 52, and 64 character sets. Prints at 6 or 8 lines per inch in 132 print positions. Includes an integrated controller. Available with Century 101, 151, 200, 201, 251, and 300 systems.

NCR Century Series

▷ month in comparison to \$19,250 per month for a Century 200 basic system with a 512K central processor. To further enhance the Century 201's posture in multi-programming environments, NCR has halved the price of the optional Multiprogramming Feature.

Current Century 200 users can upgrade to a Century 201 configuration by purchasing a Century 200/201 Upgrade Kit for a one-time charge of \$15,750, and adding the necessary features, such as 650 nanosecond memory, the octaplex I/O system, and larger discs, that transform the Century 200 to a minimum Century 201 configuration.

Software support for the Century 201 includes the Basic Executive, Dual Operating System Executive, and B3 Multiprogramming Executive operating system levels, Stage III COBOL, all available NCR FORTRAN compilers, RPG, BASIC, and NEAT/3.

THE CENTURY 251

Introduced in January 1973 as the sixth member of NCR's Century Series line of computers, the Century 251 has a little more than three times the processing power of the Century 200 and 201 and slightly more than one-half the power of the Century 300 processor. When it was originally announced, the 251 offered users with requirements of 96K to 256K bytes of main memory a much more powerful processor with greater I/O configuration capability at a purchase price only 10 to 25% higher or a rental price about 2 to 25% higher than the Century 200, depending upon memory size and length of lease contract.

With the advent of the Century 201, NCR performed some restructuring of the 251 system, including expanding the allowable main memory capacity to 524,288 bytes and announcing a new basic configuration, similar to those available with smaller Century Series processor models with one-, three-, and five-year lease terms. The packaged Century 251 system includes a 192K-byte processor with a Time-of-Day Clock, two Model 657-102 Dual-Spindle Disc Units (192 million bytes), 1500-lpm printer, and 300-cpm card reader and rents for \$12,420 or \$10,600 on a one-year or five-year lease, respectively. Purchase price is \$540,909. Thus, a more powerful Century 251 system with three times the main memory and nearly twice the on-line mass storage capacity rents for approximately twice the price of the Century 201 basic system. However, Century 251 memory increments are progressively less expensive for larger capacities, so that the rental for a Century 201 basic system with 512K bytes of main storage is only 25% less than the Century 251 packaged system with 512K bytes.

In essence, the Century 251 is a lower-cost, lower-performance version of the Century 300, with full field-upgrade potential to a complete Century 300 system. This upgrade is done through the installation of a Century 300 "Performance Package." The cost of this package is the different in price between a comparably sized Century 300 and 251 mainframe. The design of the Century 251 processor and main memory is derived directly from that of the Century 300 processor. The 251 implements the full Century 300 instruction set, although its basic instruction execution times are generally about 10 to 15 percent slower than those of the 300. The core memory used in the 251, although fundamentally similar to that of the 300, has only 2-way ▷

▶ **6101 I/O WRITER:** Standard in the Century 200 system and optional in the Century 50, 100, and 101, this I/O unit facilitates operator/computer communication by providing keyboard input and typed hard-copy output at a rated speed of 6 characters per second. It consists of an ASCII keyboard and a typing unit with pin-feed platen.

420-1/420-2 OPTICAL CHARACTER READERS: Both models read journal tapes imprinted with NCR Optical Font (NOF) characters at 52 lines per second. From 1 to 32 characters can be read from each line, and the units recognize 10 stylized numeric digits and 6 special symbols. Differences between the 420-1 and 420-2 include the following:

	<u>420-1</u>	<u>420-2</u>
Journal roll length	100 feet (max.)	130 feet (max.)
Transport speed	6.5 ips	13 ips
Read speed	26 lines/sec (max.)	52 lines/sec (max.)
	832 cps	1664 cps
Rescan time	160 msec/line	40 msec/line
Manual entry required	entire line	unreadable characters

The 420 readers are connected to the common trunk through the 622-301 OCR Control Unit.

670-101 MICR SORTER/READER: Reads MICR-encoded documents of intermixed sizes, thicknesses, and paper weights at up to 600 documents per minute. Has 11 pockets capable of holding up to 225 items each. Also usable for off-line sorting. Consists of a 622-401 Controller and a 404-111 Sorter. Available for the Century 50 as well as for the larger models.

671-101 MICR SORTER/READER: Reads MICR-encoded documents at up to 1200 per minute. Has 18 pockets. An endorser feature is available as an option. Also usable for off-line sorting. Not available for the Century 50 or 100. Includes a controller.

736 DATA RECORDERS: These keyboard-to-tape recorders, manufactured by Mohawk Data Sciences, can be connected on-line with the 622-201 Controller or 621-101 Controller with associated adapter to provide low-speed magnetic tape input (at up to 1500 char/sec) and output (at up to 700 char/sec.) Available for the Century 50 as well as for the larger models.

COMMUNICATION CONTROL

INTEGRATED COMMUNICATIONS ADAPTER (ICA): Handles up to 10 synchronous or asynchronous lines as an integrated unit on the Century 101 and 151 Processors. ✓

621-101 COMMUNICATIONS CONTROLLER: Controls up to 15 lines, at transmission speeds of 45 to 50,000 bits/sec. Has a 16-position priority scanner and single-character buffer. Most I/O control functions must be performed by the Century 50 through 300 Processor. A variety of asynchronous communications adapters and interface devices are available. An adapter is required for each communication line handled. The 621-101 must be connected to a position on a low-speed trunk only.

621-103 COMMUNICATIONS MULTIPLEXOR: Capable of handling 16 to 256 lines, using 4 ROM transmission/control character tables, centralized character parity assembly and stripping, plus centralized BCC, CRC, and function code control. A Hardware Assisted Software Queue (HASQ) feature is also available to help identify the terminals; this feature is standard with the 621-103 on the Century 300 and optional on all other Century systems. The 621-103 connects to the common trunk of any Century Series processor. A "bucket" operation capability is also available to permit the transmission of a record of indeterminate length through a hardware technique of using dual buffers. The 621-103 simultaneously handles both synchronous and asynchronous devices using various transmission codes and speeds. Asynchronous devices can operate at 16 speeds ranging from 45 to 2400 bits/sec, and synchronous devices at speeds ranging from 600 to 50,000 bits/sec. ▶

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▷ interleaving instead of 4-way, and is slowed to a 1.2-microsecond cycle time from 0.68 microsecond in the 300. Due primarily to the 2-way interleaving, the Century 251's effective access time is about two-thirds that of the Century 300 and about twice as fast as that of the less powerful Century 200.

All peripherals, communication subsystems, and software operating systems available for the Century 300 can be used with the 251. However, the Century 251 cannot have the Very High Speed Trunks provided as options for the Century 300; only two standard trunks and an integrated multiplexer trunk are included in the "basic" system, with four additional trunks optional. The overall maximum I/O data transfer rate and the individual trunk transmission rates are slowed somewhat, but not enough to preclude attachment of the fastest NCR peripherals available today, including the Model 658 Disc Storage Subsystem.

THE CENTURY 300

The NCR Century 300 provides impressive hardware and software facilities for multiprogrammed batch processing of business and scientific applications. It is also an effective performer in real-time and data communications environments. Thus, the Century 300 shapes up not only as the logical choice for current users of the NCR 315/RMC or Century 251 computers who need more processing power, but also as a system that merits careful consideration by many companies shopping for a new medium-scale computer.

Monthly rentals for Century 300 systems begin at about \$15,000, with most systems falling into the \$20,000 to \$25,000 range. The "basic" Century 300 package, unlike other basic Century systems, is not a complete configuration; it consists of the processor and main memory only. Among the major improvements offered by the Century 300 over the smaller NCR Century computers are the following:

- From 131K to 4096K bytes of core storage with a 680-nanosecond cycle time per 4-byte access.
- Four to 32 independently cycling core memory modules with 4-way interleaved addressing.
- Overlapped operation of two independent functional units—an Instruction Look-Ahead Unit and an Execution Unit—within the central processor.
- An Input/Output Control Unit capable of handling 18-way I/O simultaneity and a total data rate of up to 4.3 million bytes per second.
- A 16-level priority interrupt system.
- A standard Operator Communication Center that includes a CRT display, printer, keyboard, and control panel.

The Century 300 Processor uses monolithic integrated circuits of the same basic type used in the smaller Century systems. "Hard-wired" logic is used in preference to the more flexible (but often slower) microprogramming control techniques employed in many other contemporary computers. An optional emulator for the older NCR 315 and 315 RMC computers is available for the Century 300. ▷

▶ **692-600 ASYNCHRONOUS ADAPTER:** Handles up to 16 transmission speeds ranging from 45 to 2400 bits/second, and permits attachment of popular NCR devices such as the 270 Financial Terminal, 260 General Purpose Terminal, and 399 Accounting Computer, as well as other non-NCR devices.

693-600 SYNCHRONOUS ADAPTER: Supports speeds from 600 to 50,000 bits/second for popular IBM binary synchronous (BSC) terminal devices or processor-to-processor communications. Operates under the B2 Software Executive and the BSC application package in IBM 2780 mode. For 16K systems, binary synchronous support is offered in a dedicated mode of operation only. With 32K bytes, a flexible, multitask communications capability is supported.

BINARY SYNCHRONOUS COMMUNICATIONS PACKAGE: This facility equips a Century 50 to act as a remote "satellite" system capable of communicating with a central Century 101 or larger computer via a single half-duplex or full-duplex line. Data is transmitted in binary synchronous (BSC) mode at a speed of 1800 to 4800 bits per second, using ASCII code. The package includes a multiplexer, a single-line synchronous adapter, and an adapter for the 6101 Input/output Writer, which is required for system operation in the communications mode. Supporting software enables the Century 50 to receive data from the central Century system and write it in disc storage, and to read data from disc storage or cards and transmit it to the central system. Software is also available to link the Century 50 to other manufacturers' computer systems.

BASIC-I HARDWARE PACKAGE: This feature equips a Century 50 system with the minimum on-line equipment required for use of NCR's BASIC-I Programming Language. It consists of a multiplexer and a single-line asynchronous adapter. The basic feature supports one remote data terminal; additional terminals can be supported by means of a 692-100 Asynchronous Adapter for each line.

SOFTWARE

OPERATING SYSTEMS: NCR provides four different levels of integrated, disc-resident operating systems for the Century Series computers. Each consists of a Monitor, an Executive, and several other routines. The Monitor controls the sequencing, loading, and linking of programs. The Executive is a run-time supervisor that handles all I/O operations, error conditions, and program overlays. The four levels can be summarized as follows:

BASIC EXECUTIVE (B1): All Century computers can use the basic B1 operating system. This system, delivered in November 1968 with the first Century 100 installations, handles batch-mode processing of one program at a time. The B1 system consists of a Monitor, an I/O Executive, Resident Sector Management subroutines, and Disc Management, Log, and Display routines.

The Monitor is called into main memory at the start of each day and at the end of each program. It controls the sequencing, linking, and loading of programs. It can run a series of programs as directed by a control string entered via punched cards, punched tape, or the console keyboard. The Monitor provides calendar and date-controlled protection of files and calendar-controlled scheduling and modification of programs. The I/O Executive is divided into a memory-resident portion and a disc-resident portion. The memory-resident portion occupies about 4000 bytes of main memory and handles all I/O operations, error conditions, program overlays, and subroutine calls. The disc-resident routines are called into main memory when needed to deal with less frequent situations such as open and closing of files, retries of I/O operations that failed, etc.

The Disc Management routines are used primarily to ensure that the system discs always contain accurate, up-to-date versions of the NCR software. The Log routines maintain a system disc log of status information ▶

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➤ The Century 300 can use all of the peripheral equipment available for the Century 100 or larger, plus a number of other high-speed devices. The flexibility of the Century 300 hardware is somewhat limited, however, by the fact that no dual-channel peripheral controllers have been announced to date.

Perhaps because of the dramatic increase in processing power that the Century 300 offered over the Century 200 in the original product line-up of 1970, the Century 300 got off to a relatively slow start. That extremely large price/performance gap was filled by the NCR 251 in 1973. Then, on April 1, 1974, NCR reduced the rental and purchase prices for Century 300 basic systems by 5% and drastically reduced the price of main memory increments. Rental and purchase price reductions range from 30% for a 256K Century 300 Processor to 44% for a 512K Century 300 Processor. In addition, Century 300 users—as well as Century 251 users—will have unlimited use of their systems for the basic rental price, a definite asset for on-line system users.

In summary, the NCR Century Series shapes up as a mature third-generation system that has been kept up-to-date in price and performance through a succession of new processor models, hardware and software enhancements, and significant price reductions. The upward compatibility of these systems over a wide range of computational capability plus NCR's commitment to supply both specialized software and data entry devices to meet the needs of targeted industry sectors should continue to make them strong contenders for users with small- to medium-scale computing requirements.

USER REACTION

A survey of 20 users of NCR Century Series computer systems revealed the particular strengths of the NCR product line in the computer marketplace. Of the 20 installations, four were Century 100 systems, four were Century 101's, five were Century 200's, three were Century 251's, two were Century 50's, and two were Century 300 computer systems. Here's how the users rated their systems:

	Excel- lent	Good	Fair	Poor	W.A.
Ease of operation	15	4	1	0	3.7
Reliability of mainframe	14	6	0	0	3.7
Reliability of peripherals	6	9	4	0	3.1
Maintenance Service:					
Responsiveness	13	6	1	0	3.6
Effectiveness	9	10	1	0	3.4
Technical support	4	9	6	0	2.9
Manufacturer's software:					
Operating system	12	6	2	0	3.5
Compilers and assemblers	7	10	2	1	3.2
Applications programs	5	8	3	0	3.1
Ease of conversion	12	4	3	0	3.5
Overall satisfaction	9	10	1	0	3.4

W.A.—Weighted Average on a scale of 4.0 for excellent.

Almost all of the Century Series users interviewed gave high reliability ratings to their central processors. Some problems with peripherals were reported; the NCR 655 disc units and some older tape drives were singled out most often for causing reliability problems. Several users reported that the NCR 657 disc units were more reliable ➤

➤ such as hardware malfunctions and incorrect operating procedures. The Display routines provide communication links between the operator and either the programmer or the operating system.

DUAL OPERATING EXECUTIVE (B2): Usable on all Century systems with at least 32K bytes of main storage, this operating system divides main memory into two distinct areas. One is dedicated to a single real-time program. The other can be used for sequential processing of batch programs. A Dynamic Storage Allocation feature allows memory for servicing terminals to be allocated as a central pool. The Resident Sector Management feature allows the operating system to map program and software overlays into unassigned areas of memory. The B2 system was delivered late in 1969. Its resident portion occupies about 9K to 12K bytes of main storage.

MULTIPROGRAMMING EXECUTIVE (B3): Usable on Century systems with at least 64K bytes and the Multiprogramming Feature, this operating system divides main memory into two or more partitions of at least 16K bytes each. Each partition has its own set of 63 index registers, its own disc unit, and its own job stream, so its operations are largely independent of those in other partitions. The B3 system was delivered late in 1969.

Principal extensions added to the B3 operating system since its initial release include resource-sharing features such as 1) the use of a single system disk unit, shared by all active programs, rather than a separate disk unit for each partition; 2) the capability for programs running in different partitions to access a shared disc file and to read and write in separate files on a shared disc unit; 3) a Common Program Library Disc that permits programs in several partitions to store programs, utility routines, and user routines on a single disk unit; and 4) a Peripheral Reassignment feature that permits the operator to reassign peripherals among partitions without interrupting operation of the system. The extended B3 operating system also supports operator communications via a CRT display unit in Century 251 and 300 systems and spooling of printer output to disc for eventual printing.

MULTIPROGRAMMING EXECUTIVE (B4): A still more powerful multiprogramming operating system, called B4, can support any number of concurrent jobs, limited only by system resources. (For most Century 251 installations, that number will not exceed 10.) B4 has been operational on the Century 300 since March 1972. Among the B4 extensions over earlier Century operating systems are: 1) spooling of both input and output data; 2) expanded operator communication facilities, with system status displays organized in a hierarchical structure; 3) comprehensive job scheduling and job accounting routines; 4) facilities for inter-job communication among active programs; 5) remote job entry facilities; 6) checkpoint and restart facilities to aid in recovery from system failures; and 7) dynamic reallocation of peripheral devices and main storage. B4 makes extensive use of overlays and has a minimum practical resident main memory requirement of 64K bytes; additional memory up to a total of about 100K bytes is utilized if available. B4 is the primary operating system for Century 251 and 300 computers.

COBOL: Three different COBOL compilers are available, as described below. All use source languages based on ANS COBOL.

STAGE I COBOL: Usable on a basic 16K Century 50 or larger, the Stage I language is a restricted but useful subset of ANS COBOL. Stage I COBOL is upward-compatible with NCR's own Stage II and III COBOL implementations and with any ANS COBOL compiler. The language includes selected elements from the Nucleus, Sequential Access, Random Access, Table Handling, Segmentation, and Library modules of ANS COBOL; the Sort and Report Writer modules are not implemented. Within the Nucleus module, the COMPUTE and EXAMINE statements are not implemented and there are limitations upon the ADD, ALTER, GO TO, MOVE, PERFORM, and SUBTRACT statements. Subscripting and indexing are ➤

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▷ performers and that they were planning to upgrade to the newer magnetic tape drives recently released by NCR.

The NCR Century Series systems represented in this survey replaced a wide variety of equipment. Two of the three Century 50 systems studied here replaced IBM System/360 Model 20 systems. Neither of these Century 50 customers used the NCR RPG compiler. As a result, both customers had to rewrite the IBM 360/20 RPG programs into NEAT/3 equivalents. Both users, however, described themselves as very satisfied with the resulting Century 50 systems.

The most successful conversions were upgrades within the Century Series product line. In these cases, almost everyone ranked "Ease of Conversion" as either good or excellent. Time and again, the NCR customers cited the upward compatibility within the Century family as one of the outstanding features of the product line.

Applications programs play an important role in most NCR Century Series installations. A large proportion of the accounts included in this survey had implemented one or more of the NCR-supplied applications programs, and over 80 percent of these users gave the packages a good or excellent rating—a substantial achievement in view of the difficult task of creating generalized software packages aimed at meeting the needs of many customers.

Of NCR's four operating systems, the B-4 level received the most praise. It was described as a tremendously effective operating system; users liked its multiprogramming capabilities, its ease of use, and its operator communications facilities.

Averaging the ratings of users of systems ranging from the entry-level Century 50 to the powerful Century 300 inevitably results in some oversimplification. However, one response applied equally to all of the systems—the users' satisfaction with the NCR Century Series price/performance. Nineteen of the 20 installations represented in our survey rated their overall satisfaction with their systems as either good or excellent. The systems' capabilities to meet the overall processing requirements of their users at very attractive prices was described by many users as a major source of their satisfaction with the NCR Century Series. □

▶ limited to a single level. Compilation speed, according to NCR, is about 50 or 100 statements per minute on a 16K or 32K Century 100, respectively.

STAGE II COBOL: Usable on any 32K or larger Century system, the Stage II language consists of the following ANS COBOL modules: high-level Nucleus, Random Access, and Sequential Access; medium-level Table Handling; and low-level Segmentation and Library. Compilation speed, according to NCR is about 100, 200, or 500 statements per minute on a Century 200 with 32K, 65K, or 262K bytes, respectively.

STAGE III COBOL: Usable on Century 200 and larger systems at least 65K bytes of main memory, the Stage III language is stated to be a complete, high-level implementation of ANS COBOL, including the Sort and Report Writer modules. Compilation speed, according to NCR, is about the same as for Stage II COBOL.

BASIC: A compiler for BASIC, an algebraic language designed for time-sharing computers, can be used on Century 200 and larger systems. Programs are compiled as they are entered from remote teletypewriters and can be executed immediately. Diagnostic messages permit on-

the-spot correction of many errors. An accounting routine facilitates billing by recording the amount of computing time used by each programmer at each terminal.

NCR announced the BASIC-I Programming Language for use with Century 100 systems in April 1971 and for the Century 151 in May 1974. The package is separately priced and available in two versions, for dedicated and "dual" (shared-use) systems. The dedicated version can be used on a 16K Century 50 and accommodates up to 10 data terminals. The dual system requires a 32K Century 50, supports up to 10 terminals, and allows concurrent background processing. The BASIC-I language is a subset that is upward-compatible with the BASIC compiler for the Century 200 and larger computers.

FORTRAN: Three different FORTRAN compilers are offered:

CENTURY BASIC FORTRAN: Usable on a basic 16K Century 50 or larger, Century Basic FORTRAN is an implementation of the American National Standard Basic FORTRAN language (FORTRAN II), with a number of useful extensions. Among the extensions are: 1) an unlimited number of array dimensions, 2) longer statement labels and symbolic names, 3) an expanded character set, 4) additional I/O format capabilities, and 5) mixed-mode arithmetic.

CENTURY INTERMEDIATE FORTRAN: Usable on a 32K Century 50 or larger, this version includes all of Century Basic FORTRAN plus a number of additional extensions, and is compatible with the "Basic FORTRAN IV" language for the IBM 1130. The 32K version includes tracing and error-checking functions, random disc access, sense light routines, and four additional statements: DATA, EXTERNAL, DEFINE FILE, and Data Type (INTEGER, REAL, DOUBLE PRECISION, COMPLEX, or LOGICAL).

CENTURY FULL ANS FORTRAN IV: Usable on a 32K Century 101 or larger, this full implementation of ANS FORTRAN also includes two popular extensions: mixed-mode arithmetic and an unlimited number of dimensions in an array.

ASSEMBLER: NEAT/3 is NCR's version of an assembler language for the Century Series. Strong emphasis is placed upon the use of macro-instructions and "Major Functions" to facilitate coding. Major Functions are pre-coded routines to perform common data processing functions such as Accumulate, Collate, and Master File Update; the programmer fills out a questionnaire to tailor these routines to his needs. The disc-oriented NEAT/3 Compiler is usable on all Century systems.

NEAT/3 Level 1 is a subset of NEAT/3 that provides an easy-to-learn programming language and faster compilation.

RPG: A bundled RPG compiler is available for use on Century 50 through 200 systems with a minimum of 16K bytes of main memory, dual disc units, a printer, and a card reader. Use of indexed sequential file processing raises the main memory requirement to 32K bytes.

NCR 315/RMC TRANSLATOR: Translates programs written in NEAT assembly language for the NCR 315/RMC computer into NEAT/3 source statements for the Century 251 and 300. The translator itself runs on the 315/RMC. Input is from punched cards, and output is on either cards or magnetic tape, together with a printed listing. Source statements that cannot be automatically translated are flagged on the listing for manual recoding.

UTILITY ROUTINES: Both disc and tape sort generators are available. There is also an adequate complement of utility routines to handle file creation, library maintenance (SPUR and OPUR), data transcription, overlay control (OMAP), disc file management, tracing, memory dumps, etc.

APPLICATION PROGRAMS: NCR offers "packaged" programs to handle key applications in manufacturing, food processing, wholesale distribution, retailing, schools, financial institutions, hospitals, and local government. ▶

**NCR Century Series
EQUIPMENT PRICES**

		<u>Purchase</u> <u>Price</u>	<u>Monthly</u> <u>Maint.</u>	<u>Rental</u> <u>(1-year</u> <u>lease)*</u>	<u>Rental</u> <u>(3-year</u> <u>lease)*</u>	<u>Rental</u> <u>(5-year</u> <u>lease)*</u>
COMMUNICATION CONTROL (Continued)						
621-103	Communications Multiplexor (256 lines)	12,000	35	200	—	—
692-600	Asynchronous Adapter for 621-103	1,500	7.50	75	—	—
693-600	Synchronous Adapter for 621-103	2,250	7.50	100	—	—
691-101	Secondary Cage for 621-103	7,500	8	120	—	—
690-103	Auxiliary Bay	8,000	3	160	—	—
691-102	Secondary Cage for 690-103	7,500	9	120	—	—
692-401	Asynch. Polling Adapter for 621-101/102; 1 line/cage	5,000	10	100	—	—
692-402	Asynch. Polling Adapter for 621-101/102; 2 lines/cage	7,000	15	140	—	—
692-403	Asynch. Polling Adapter for 621-101/102; 3 lines/cage	8,250	20	165	—	—
692-405	Terminal Adapter for 621-101/102; 1 line cage	4,800	15	100	—	—
692-406	Terminal Adapter for 621-101/102; 2 lines/cage	6,700	20	140	—	—
693-200	735/736 Encoder Adapter for 621-101/102	8,250	15	175	—	—
693-300	General Purpose Synchronous Adapter for 621-101/102	7,750	25	160	—	—
6901	Transparency Feature	675	0	15	—	—
6902	Wide Band Feature	450	0	10	—	—
694-201	Voice Response Adapter for 621-101/102; 1 line/cage	4,800	15	100	—	—
694-202	Voice Response Adapter for 621-101/102; 2 lines/cage	8,200	20	175	—	—
798-100	Voice Response Unit	24,200	40	525	—	—
7981	Voice Source Assembly Feature for voice source redundancy	6,500	0	150	—	—
7982	Output Module Feature for two additional channels	1,200	0	25	—	—
7983	Expansion Cage Feature for more than 10 channels	2,400	10	50	—	—
7984	Power Supply Feature for more than 28 channels	650	0	15	—	—
—	Voice Film — 1st Copy	300	0	—	—	—
—	Voice Film — Each Add'l. Copy	50	0	—	—	—
5621	Century 50 Binary Synchronous Communication Package (requires 6101 I/O Writer; feature 6051 not required)	20,500	75	425	—	—

*Rental prices include equipment maintenance.