NCR Century 50

MANAGEMENT SUMMARY

The NCR Century 50, introduced on December 15, 1970, is the fourth and smallest member of NCR's growing Century Series product line. System rental prices range from $1,500 to $2,725 per month, and customer deliveries are scheduled to begin in March 1971, just 90 days after announcement.

Though the Century 50 offers little that is new in the way of hardware or software technology, its low price and impressive performance make it a significant new contender in the "entry-level" segment of the business computer market, which is currently dominated by the IBM System/3.

The Century 50 embodies most of the technological innovations that have distinguished the larger Century 100 and 200 systems since their introduction in March 1968. Monolithic integrated circuits are used exclusively, 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 on each removable 3-disc pack. Moreover, all of the Century Series software is disc-oriented, and even the smallest Century 50 system can ▷

NCR's new small-scale business data processing system offers the advantages of disc-oriented file processing at prices as low as $1,500 per month. Though its own expansion possibilities are limited, the Century 50 maintains full upward compatibility with the larger Century Series computers.

CHARACTERISTICS

MANUFACTURER: The National Cash Register Company, Dayton, Ohio 45409.

MODEL: NCR Century 50.

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.

FIXED-POINT OPERANDS: Can range from 1 to 256 bytes in length, in either decimal or binary mode.

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. ▶

The model holds one of NCR's 3-disc packs, which fits onto the dual-spindle disc unit behind her. The Century 50 processor, at left, includes an integrated 300-cpm card reader and control panel.

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utilize an integrated operating system and COBOL 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 has reduced the speeds of the basic printer and disc unit and has greatly restricted the possibilities for connecting additional peripheral equipment.

The Century 50 Basic System consists of a central processor with 16,384 bytes of rod memory, a dual-spindle disc drive with a 153-millisecond average access time and an on-line storage capacity of 8.4 million bytes, a 200-lpm printer, and either a 300-cpm card reader or a 1000-cps punched tape reader. This basic configuration rents for $1,500 per month, including maintenance, or sells for $95,000. (Incidentally, that purchase-to-rental ratio of 63.3 to 1 is one of the highest we've seen.)

A buyer stands to save $850 per month, or $17,000 on the purchase price, by choosing a Century 50 Basic System instead of its Century 100 counterpart. In return, he'll have to accept a 250-lpm reduction in rated printing speed and an 88-millisecond increase in average disc access time.

Century 50 users can expand the basic configuration by:

- Doubling the main memory capacity to 32,768 bytes.
- Substituting a faster disc unit with an average access time of 65 milliseconds, as used in the larger Century systems.
- Substituting a faster printer with a rated speed of either 300 or 450 alphanumeric lines per minute.
- Adding a second dual-spindle disc unit with either the 153-millisecond or 65-millisecond average access time.
- Adding an Input/Output Writer (console typewriter).

At present, these are the only expansion possibilities. No data communications, magnetic tape, MICR, or OCR equipment can be used with the Century 50, and no facilities for punched card or punched tape output are currently offered. But any Century 50 user who needs these facilities can easily move up to a Century 100 or 200 system with little or no reprogramming.

Like the Century 100, the Century 50 processor has a limited repertoire of just 19 instructions. Addition and subtraction can be performed only in binary or unpacked

INTERNAL CODE: ASCII.

MASS STORAGE

STORAGE TYPE: Thin-film, short-rod. Each plated copper rod stores 1 bit and is 0.006 inch in diameter and 0.110 inch long.

CAPACITY: 16,384 or 32,768 bytes.

CYCLE TIME: 800 nanoseconds per 1-byte access.

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

STORAGE PROTECTION: None.

RESERVED STORAGE: Byte locations 0 through 1279 are reserved for registers, control words, and the resident executive.

CENTRAL PROCESSOR

INDEX REGISTERS: 63, located in main storage.

INDIRECT ADDRESSING: None.

INSTRUCTION REPERTOIRE: 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.

ADD TIME: 59 microseconds (for 2-addresss decimal addition of unsigned, unpacked 5-digit fields).

INPUT/OUTPUT CONTROL

I/O CHANNELS: 2.

CONFIGURATION RULES: The Century 50 Basic System includes these integrated peripheral units: 200-lpm alphanumeric printer, 300-cpm card reader or 1000-cps punched tape reader, and one dual-spindle disc unit. The only permissible additions are a second dual-spindle disc unit, an Input/Output Writer (console typewriter), and a 300/600-lpm or 450/900-lpm printer (in place of the basic 200-lpm model).

SIMULTANEOUS I/O OPERATIONS: Maximum of 2 I/O operations concurrently with computing.

I/O DATA RATE: Maximum of 118,000 bytes/second for any one I/O operation; no peripheral device with a transfer rate above 40,000 bytes/second can operate concurrently with a disc read or write operation.

I/O INTERFERENCE: Processor is delayed 4.8 microseconds for every byte transferred to or from main storage.

MASS STORAGE

DUAL-SPINDLE DISC UNITS: One of these disc units is included in the Century 50 Basic System, and a second unit may be added. Each unit has two independent spindles, and each spindle is capable of driving a remov-

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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.

Within the Century Series, NCR has maintained full upward compatibility. All hardware differences among the various processors are resolved by the standard software, so conversions from a Century 50 to any of the larger Century processors can generally be accomplished without reprogramming.

Compatibility between the Century computers and other currently popular systems is limited. The Century systems have an 8-bit byte internal data format and use standard 80-column, Hollerith-coded cards. But compatibility with the IBM System/360 and 370 has been ignored in the internal data code (which is ASCII rather than EBCDIC), in the processor instruction repertoire, and in the removable disc packs.

Principal software facilities for the Century 50 include a batch-mode operating system, COBOL and FORTRAN compilers, assemblers for NCR's own NEAT/3 language and for a subset called elementary NEAT, and a variety of utility routines and application programs. Most of this software is already in use in Century 100 installations, and all can be used on a 16K Century 50 Basic System.

NEAT/3 is essentially a symbolic assembly language, but it places an unusually strong emphasis upon the use of macro-instruction facilities. NCR is encouraging most Century 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. For more advanced programmers, higher-level versions of NEAT/3 permit full utilization of all the Century hardware facilities.

Elementary NEAT is a new version of the NEAT/3 language that has been developed specifically for the Century 50. It offers an easy-to-learn subset of the more commonly used NEAT/3 language elements, together with higher compilation speeds. NCR expects most Century 50 users to select elementary NEAT as their principal programming language.

Customer support for the Century Series computers is focused on several Regional Systems Centers. These facilities are staffed by specialists in the major fields served by NCR. The centers also provide training courses

able disc pack. The 3-disc NRC pack stores up to 4,194,304 bytes (or 8,388,608 packed decimal digits) in 512-byte sectors. Each spindle has a comb-like access mechanism with 12 read/write heads serving each of the 6 recording surfaces. Up to 262,144 bytes per pack can be read without head movement.

Two models of the disc units are available, differing only in access times and costs. Types 655-155 (basic unit) and 655-152 (optional second unit) have an average head movement time of 131 milliseconds, while Types 655-101 (basic unit) and 655-102 (second unit) have an average head movement time of 44 milliseconds. Both models have an average rotational delay of 20.8 milliseconds and a data transfer rate of 108,000 bytes/second.

INPUT/OUTPUT UNITS

682-100 INTEGRATED CARD READER: Integral part of the Century 50 console. 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 photoelectric 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 hopper and a single 1000-card stacker.

662-100 INTEGRATED PUNCHED TAPE READER: Integral part of the Century 50 console; 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 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.

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.

640-132 PRINTER: Can be selected as a higher-speed substitute for the basic 640-122 Printer. Has 132 print 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.

640-102 PRINTER: Fastest printer available for the Century 50 system; can be selected as a substitute for the basic 640-122 Printer. Has 132 print positions and a standard set of 64 printable characters. Prints up to 450 alphanumeric lines per minute. Optional 51-character set with double numerics permits all-numeric printing at 900 lpm.

6101 INPUT/OUTPUT WRITER: This optional 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.

SOFTWARE

OPERATING SYSTEM: NCR Century 50 and 100 systems use the basic Century operating system, which is called the B1 system and is also available (along with other, more powerful operating systems) for the larger Century Series processors. This integrated, disc-resident operating system handles the batch-mode processing of

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for customer personnel and computers on which customers can compile and test their programs before their own systems are delivered. Century 50 buyers receive a 20-hour testing and debugging allowance at no additional charge.

NCR's pricing structure can best be described as "partial unbundling." NCR supplies certain essential and predetermined systems support, educational assistance, and software without extra charge. Once the basic allotments have been exceeded, any additional NCR services that may be needed are separately priced.

The Century 50 has plainly been designed and priced to compete effectively against the popular IBM System/3. Since every Century 50 system includes disc storage and costs at least $1,500 per month, the Century 50 will not be directly competitive with card-oriented System/3 Model 10 configurations nor with the newer, keyboard-oriented System/3 Model 6. Instead, NCR will stress the many advantages of batch-mode "magnetic file processing" with disc-based master files, bringing the Century 50 into head-to-head competition with disc-oriented System/3 Model 10 systems.

The lowest-priced System/3 Model 10 disc configuration that is supported by IBM software rents for just $1,325 per month—$175 less than the Century 50 Basic System—but has only 12K bytes of main storage and a single 2.46-million-byte disc drive. A System/3 configuration that is more directly comparable with the Century 50 Basic System would include a 16K processor, a 200-lpm printer with 132 print positions, a multi-function card unit with a 250-cpm reading speed and 60-cpm punching speed, and two disc drives with a total storage capacity of 7.37 million bytes. This System/3 configuration rents for $1,865 per month (or $365 *more* than the basic Century 50) and sells for $79,450 (or $15,550 *less* than the basic Century 50).

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

- The Century 50 uses standard 80-column cards, whereas the System/3 uses IBM's new 96-column cards.
- The Century 50 offers full program compatibility with larger computers, while the System/3 does not.
- The Century 50 offers higher printing speeds, while the System/3 offers higher card input speeds.
- The Century 50 offers no punched card output facilities, whereas IBM's multi-function card unit handles both reading and punching.

one program at a time. It was delivered in November 1968 with the first Century 100 installations. The B1 system consists of a Monitor, an I/O Executive, 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 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 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.

COBOL: Century 50 systems will use NCR's Stage I COBOL, a restricted but useful subset of the American National Standard (formerly USA Standard) COBOL language. 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 limited to a single level. Stage I COBOL programs can be compiled and executed on a 16K Century 50 Basic System.

FORTRAN: Century 50 users have a choice of two FORTRAN compilers, depending upon the main memory capacities of their systems. The 16K version, called 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.

The 32K version, called Century Intermediate FORTRAN, 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).

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- The Century 50 can have up to 16.8 million bytes of on-line disc storage, compared with a maximum of 9.8 million bytes for the System/3.
- The Century 50 disc units have faster access times and can access far more data at each position of the read/write heads, whereas the System/3 disc units have a higher data transfer rate.
- The Century 50 offers no data communications or MICR facilities, whereas the System/3 offers no punched tape reader.
- All of the current Century 50 software is supplied at no extra charge, whereas most of the System/3 software is separately priced.
- Century 50 users can program in COBOL, FORTRAN, NEAT/3, or elementary NEAT, whereas System/3 users are limited to RPG II or assembly language.
- NCR offers a $1,500 training allowance, compared with none for the System/3.

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. □

ASSEMBLERS: NEAT/3 is the symbolic assembly 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 the Century 50 Basic System.

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

UTILITY ROUTINES: NCR offers a disc sort generator for the Century 50, together with an adequate complement of utility routines to handle file creation, data transcription, overlay control, disc file management, tracing, memory dumps, etc.

APPLICATION PROGRAMS: NCR provides "packaged" programs to handle key applications in manufacturing, food processing, wholesale distribution, retailing, schools, hospitals, and local government. Among the application programs available to Century 50 users at no extra charge are:

Retail Accounts Receivable
Accounts Payable
Payroll and Personnel Management
Inpatient Accounting
Post-Discharge Accounts Receivable
Order Billing
Stewardship and Management Accounting
Student Scheduling and Grade Reporting
Requirements Planning
Production Scheduling
Emphasis–Phase I
Utility Billing
Department Store Sales Audit
General Reporting System

PRICING

CENTURY 50 BASIC SYSTEM: Includes 16K processor, 300-cpm card reader (or 1000-cps punched tape reader), 200-lpm printer, and one dual-spindle disc unit with 153-millisecond average access time (8.4 million bytes total). Monthly rental and purchase prices are $1,500 and $95,000, respectively

MAXIMUM CENTURY 50 SYSTEM: Includes 32K processor with input/output writer, 300-cpm card reader (or 1000-cps punched tape reader), 450/900-lpm printer, and two dual-spindle disc units with 65-millisecond average access time (16.8 million bytes total). Monthly rental and purchase prices are $2,725 and $145,550, respectively.

SOFTWARE: In the future, NCR software will either be priced separately or included in the price of the hardware, depending on the "value and uniqueness" of each offering. At present, all of the software described in this report is available to Century 50 users at no extra charge, although the associated documentation is separately priced.

SUPPORT: NCR systems support is billed to Century 50 users at the rate of $20 per hour or $120 per day.

EDUCATION: All educational services are separately priced. Each Century 50 installation receives a training allowance of $1,500, which provides approximately 6 man-weeks of training.

CONTRACT TERMS: The standard NCR rental contract permits 200 hours of use per month. Occasional extra-shift operation beyond the basic 200 hours per month is billed at the rate of 20% of the basic hourly rate for the Century 50 Basic System and 10% of the basic hourly rate for all additional components. An unlimited-use contract is available at an additional charge of 10% over the basic rental. A 50% purchase option credit applies to all NCR Century Series equipment. ■

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
Century 50 Basic System, including:		95,000	210	1,500
615-50/616-200	Processor with 16K Bytes of Memory			
682-100	Card Reader; 300 cpm			
640-122	Printer; 200 lpm, 132 positions			
655-155	Dual-Spindle Disc Unit; 8.4 million bytes, 153-msec access time			
Substitutions for Century 50 Basic System:				
615-50/616-300	Processor with 32K Bytes of Memory**	18,750	10	400
662-100	Punched Tape Reader; 1000cps (in place of Card Reader)**	0	−15	0
640-132	Printer; 300/600 lpm, 132 positions**	6,000	15	150
640-102	Printer; 450/900 lpm, 132 positions**	12,000	30	350
655-101	Dual-Spindle Disc Unit; 8.4 million bytes, 65-msec access time**	5,000	35	150
Additional Equipment:				
6101	Input/Output Writer	4,800	15	100
655-152	Dual-Spindle Disc Unit; 8.4 million bytes, 153-msec access time	26,500	75	550
655-102	Dual-Spindle Disc Unit; 8.4 million bytes, 65-msec access time	28,750	110	625
6401	Printer Feature; 6/8 Lines/Inch (for 640-122, 640-132, or 640-102)	1,000	0	25

* Rental prices include equipment maintenance.
** Prices are added to Basic System price.