All About Mainframes

Dispelling belief that large mainframes are becoming extinct, all mainframe vendors introduced new models or added enhancements to already existing systems in 1987 and the first half of 1988. Control Data replaced its entire Cyber line from top to bottom. Unisys introduced the low-end A 1, A 4, and A 6 Series; the medium-scale 2200/400; and the large-scale A 17. IBM beefed up its 3090 Series with the enhanced-performance 3090E models. Honeywell Bull unveiled the DPS 7000 line of medium-sized systems and the large-scale DPS 8000. NAS announced the medium-range AS/VL Series. Amdahl surprised the industry by scooping IBM with its announcement of the very large-scale 5990 Series, which will compete with the future IBM Summit.

This report is an overview of general-purpose mainframes. For more detailed information on these systems, see the individual product reports in this volume. The comparison columns in this report are divided into three different sections: small-scale systems, medium-scale systems, and large-scale systems. This arrangement makes it easier to compare systems in the same performance range. Thirty-five computer systems and model groups from seven vendors are represented.

The micro has not replaced the mainframe as some industry wizards had prophesied. Instead, mainframes started to "think small." So-called smallframes or departmental systems appeared. These systems feature mainframe architecture and operate under mainframe operating systems. It all started with IBM's 9370 Information System which was quickly followed by the Unisys 2200/200 and A 1, A 4, and A 6 systems, and the Control Data Cyber 930. IBM is marketing the 9370 as a distributed system, but the majority of sales are standalone systems for small businesses, defining their own market niche. Small systems are an important complement to, but will not replace, the large-scale mainframes, particularly in companies with large data bases requiring fast and efficient on-line updating.

MAINFRAME FEATURES

Physically, the mainframe grows ever smaller. Current technology—Very Large Scale Integration (VLSI), Emitter Coupled Logic (ECL) circuitry, and denser chip packaging—reduces the footprint. Main memory capacity continues to increase. In most mainframes the 256K-bit memory chip is standard and many vendors are using 1M-bit chips in their systems. Main memory capacity ranges up to 2 gigabytes of main storage for the quad-processor AS/XL 100 from NAS. The new Amdahl 5990 model main memory is 512 megabytes with up to 2 gigabytes of optional Expanded Storage (ES).

Various Expanded Storage concepts have been implemented to enhance the mainframes' main storage capabilities. IBM first introduced Expanded Storage with its 3090 Series in 1985. Unisys has an extended main storage feature to remove limitations on memory addressing. Amdahl has a similar option that allows users to set aside a portion of main memory for expanded storage. Control Data employs the Unified Extended Memory feature, which allows main memory to be partitioned into areas reserved for execution and areas reserved for data

The Honeywell Bull DPS 8000 Series are medium-scale mainframes designed to handle interactive on-line and distributed processing. The DPS 8000 is configured with one or two central processors and features from 16 to 256 megabytes of memory, and 16 to 32 I/O channels.

All About Mainframes

TABLE 1. USER RATINGS OF MAINFRAMES.

	1987	1986	1985	1984	1983	1982	1981
Ease of operation	3.4	3.3	3.3	3.4	3.3	3.2	3.3
Reliability of mainframe	3.7	3.7	3.4	3.5	3.6	3.5	3.5
Reliability of peripherals	3.3	3.4	3.2	3.2	3.2	3.1	3.1
Maintenance service:							
Responsiveness	3.4	3.5	3.3	3.4	3.3	3.2	3.2
Effectiveness	3.3	3.4	3.2	3.3	3.2	3.1	3.1
Technical support:							
Troubleshooting	3.2	3.1	2.9	3.0	2.8	2.7	2.7
Education	3.0	3.0	2.9	2.8	2.7	2.7	2.7
Documentation	2.8	2.9	2.6	2.7	2.6	2.6	2.6
Manufacturers software:							
Operating system	3.3	3.3	3.3	3.3	3.2	3.1	3.1
Compilers & assemblers	3.3	3.3	3.1	3.3	3.2	3.2	3.2
Application programs	2.8	2.7	2.5	2.8	2.7	2.7	2.7
Ease of programming	3.0	3.0	2.9	3.1	3.0	3.0	3.1
Ease of conversion	3.0	2.9	2.9	3.0	3.0	3.0	3.0
Overall satisfaction	3.2	3.2	3.1	3.2	3.1	3.1	3.1

storage. Most mainframes employ pipelining and memory interleaving to further enhance system speed.

Another innovation for mainframes is fault-tolerant or fully redundant systems. Honeywell, for instance, offers redundant versions within its DPS 88 and DPS 90 large-scale mainframe lines. The NCR 9800 System achieves fault tolerance through the use of multiple, loosely coupled, function-specific processors. A form of redundancy in the Unisys A Series is accomplished with the Mirror Disk. This feature duplicates realtime data on disk units and maintains multiple copies of disk packs.

MARKET TRENDS

Last year, sales and profits for large-system vendors were quite satisfactory. Manufacturers, market researchers, and analysts are expecting the same for 1988. New mainframe sales will probably be modest but steady because the marketplace is maturing and the majority of sales are replacements. The demand for more processing power is also moderating; the large systems installed in financial institutions, government, and *Fortune* 1000 companies generate only incremental increases. This sends vendors scrambling for different niche markets including the large and profitable engineering and technical area.

To accomplish this, mainframe vendors are planning to implement UNIX and make it a part of commercial computing. Amdahl, Control Data, IBM, NCR, and Unisys are the mainframe vendors that have made big UNIX commitments. The only obstacle to wider industry acceptance is the lack of a single standard for UNIX. Unisys, in cooperation with AT&T, hopes to open up commercial markets for UNIX in high-volume transaction processing and software development.

Mainframes are not yet ready to join the dinosaurs. Vendors are becoming more competitive and are exploring various options. The immense processing power and fast response time of a mainframe are needed to handle large data bases and to manage complex communications networks plus heavy on-line transaction processing for such organizations as banks, insurance companies, airlines, and other transportation companies. In sum, the general-purpose mainframe remains vital to organizational health.

USER SATISFACTION RATINGS

When evaluating mainframes, it is important to determine how experienced users evaluate their systems. As part of Datapro's 1987 annual Computer System User Survey, more than 6,000 mainframe users were asked to rate their systems and 1,281 users responded. New systems and models introduced after January 1987 are not covered in the survey.

The survey questionnaires allow users to rate numerous categories. The results are summarized and presented numerically as weighted averages. For each category, the numerical equivalent of the ratings—4 for Excellent, 3 for Good, 2 for Fair, and 1 for Poor—is multiplied by the total number of ratings for each; the sum of those products is divided by the total of all ratings for that category and expressed as a weighted average to two decimal places. The results of these calculations are listed in Table 1.

For details of the 1987 Datapro Computer System User Survey, please refer to the report "User Ratings of Mainframes" on Page 70C-000EB-101.

THE COMPARISON COLUMNS

In order to help you compare the differences and relative costs of the general-purpose mainframes on the market today, comparison columns detailing important, functional characteristics are provided. All information in the columns was furnished by the vendors whose products are represented.

The comparison column entries and their definitions are explained in the following paragraphs.

All About Mainframes

MODELS

This entry lists all the models in a manufacturer's series.

SYSTEM CHARACTERISTICS

Number of CPUs. The number of central processing units (CPUs) that can be supported at one time by a system. While multiple CPU systems require more complex operating systems, their capabilities are greater than single CPU systems.

Number of I/O Processors. Because of expanding input/output (I/O) demands, manufacturers have elected to meet the peripherals' servicing requirements with a dedicated input/output processor.

Plug-Compatible with. IBM or other systems with which the mainframe is interchangeable without modification. Compatibility may be hardware and/or software.

MAIN STORAGE

Main storage or memory in a computer is usually the fastest and most accessible storage in the system, and the one from which most instructions are executed.

Type. The different types of memory and the capacity of the memory chip used in the system.

Cycle Time. The time interval which is needed between the initiation of two successive, independent memory operations is stated in nanoseconds.

Access Time. This entry refers to the time in nanoseconds to read out any randomly selected word in memory. Access time equals latency plus transfer time.

Minimum Capacity. The basic main memory capacity included in the system is listed in megabytes.

Maximum Capacity. The total amount of main memory the system can hold.

Increment Size. A designated fixed increment to expand main memory.

Expanded Storage. Additional memory for system use only to reduce paging and swapping loads.

CACHE STORAGE

Type. This entry lists the type of cache or buffer memory.

Cycle Time. The time interval required between two successive cache or buffer operations.

Minimum Capacity. The minimum cache or buffer storage included with the system is listed in kilobytes.

Maximum Capacity. The total amount of cache or buffer memory the system can hold.

Increment Size. A designated fixed increment to expand cache memory.

CENTRAL PROCESSOR

Relative Performance (MIPS). Millions of instructions per second (MIPS) is a relative, not absolute, CPU performance measurement.

Machine Cycle Time. The time interval in which the CPU performs a number of operations. It is the time required to change the information in a set of registers. The internal cycle time may be synchronous (fixed or variable) or asynchronous.

Word Length. The number of binary elements or bit strings considered as an entity and handled by the CPU. Generally, the longer the word length, the greater the CPU efficiency.

INPUT/OUTPUT CONTROL

Integrated I/O Channels. These are normally in an integrated I/O processor that contains and controls channels. The channels can generally be configured for either byte- or block-multiplexer operation.

Other I/O Channels. The types of channels available are selector and multiplexer channels. Channel units are increasingly becoming small, programmed processors to

The Unisys A 9 System is a general-purpose mainframe with a main memory from 12 to 24 megabytes and 6 kilobytes of cache memory. The system includes two I/O cabinets with up to 40 data link processors.

All About Mainframes

permit extension of the channel functions. For example, the Unisys A, B, and V systems use microprogrammed data link processors.

Maximum I/O Data Rate. The maximum speed at which data can be transferred to or from main storage.

COMMUNICATIONS

Maximum Number of Lines. Number of data communications lines supported by the system.

Synchronous. All equipment in the system is in step. That is, the data characters and bits are transmitted at a fixed time interval.

Asynchronous. This implies there is no regular time relationship as with synchronous. The time intervals may be of unequal length.

Protocols Supported. This entry indicates which of the common data communications protocols are supported. A protocol is a set of conventions on the format and contents of messages to be exchanged.

Network Architecture Supported. The standardized data communications network architectures supported by a system are listed.

PERIPHERAL EQUIPMENT

Most mainframe vendors offer a variety of peripheral equipment. Summarized in the comparison columns are disk drives, tape drives, printers, and additional peripherals if they are available from the vendor.

Disk Drives. This entry lists the minimum and maximum capacities of the disk drives available for the system.

Magnetic Tape Drives. Minimum and maximum transfer rates of tape drives available for the system are stated in thousands of bytes (KB) per second. Tape cartridge drives are also listed here.

Line Printers. Minimum and maximum speeds of printers available for the system are listed in lines per minute (lpm).

Other Peripheral Devices Supported. Listed here are other types of equipment available which can be attached to the system, including OCR, card equipment, plotters, and terminals.

SOFTWARE

All manufacturers, except the plug-compatible vendors, offer their own operating systems. Most of the vendors also offer data base management systems (DBMSs), other systems software, and applications software.

Operating Systems. The systems software which controls the overall operation of a multipurpose mainframe. Some vendors offer multiple operating systems for their mainframes.

Programming Languages. The major programming languages are Cobol, Fortran, Basic, and PL/1. Some systems use a proprietary language available from the vendor for the particular system.

Data Base Management System. The DBMS organizes data elements in some predefined structure and keeps track of the relationships among the data elements, thereby facilitating information retrieval and report generation.

PRICING AND AVAILABILITY

Purchase Price, Basic System. This entry provides a price range for a basic system and is not intended to represent all of the configurations possible. Prices are only intended to give readers an indication of whether the power they are considering falls into the low, medium, or high ranges. In some cases, systems will cross ranges depending on how they are configured. For a detailed breakdown, the reader is referred to the system reports indicated at the bottom of each column. These columns, however, will assist the user in screening what systems are available from the various manufacturers in equivalent ranges.

Competitively, system prices tend to cluster themselves. There may be some apparent discrepancies in systems screened, but this is generally attributed to what a manufacturer includes as part of the basic system price (e.g., an I/O processor). The reader is cautioned to use a price range only for the initial screening of systems.

Monthly Maintenance, Prime Shift. This normally includes manufacturer service for a five-day workweek. An additional charge is normally made for 7-day, 24-hour service.

Monthly Rental, 1-Year Lease. The manufacturer's charge for a basic system on a monthly basis. If maintenance service is not included, it is indicated.

Purchase Price of Memory Increment. Purchase price for the memory increment is listed under the MAIN STORAGE heading.

Date of First Delivery. The date when the first production model was delivered (or is scheduled to be delivered) to a customer.

Number Installed to Date. Shows approximately how many systems of each type have been delivered to customers.

Comments

This final entry on the comparison columns is used to explain or amplify the preceding entries and to provide other qualifying, pertinent information about each system.□

Mainframe Vendors

Listed below are the complete addresses and telephone numbers of the vendors whose mainframes are listed in the accompanying comparison columns.

Amdahl Corp.
1250 East Arques Avenue
Sunnyvale, CA 94086 (408) 746-6000

Control Data Corp.
8100 34th Avenue South
Minneapolis, MN 55440 (612) 853-8100

Honeywell Bull, Inc.
Deer Valley Computer Park,
13430 North Black Canyon Highway
Phoenix, AZ 85029 (602) 862-8000

International Business Machines Corp.
Old Orchard Road
Armonk, NY 10504
Contact your local IBM representative.

National Advanced Systems (NAS)
750 Central Expressway, P.O. Box 54996
Santa Clara, CA 94043-0996 (415) 962-6000

NCR Corp.
1700 South Patterson Boulevard
Dayton, OH 45479 (513) 445-4145

Unisys Corp.
P.O. Box 500
Blue Bell, PA 19424 (215) 542-4213 □

Mainframe Comparison Columns
SMALL-SCALE

MANUFACTURER AND MODEL	Control Data Cyber 180 Series	Honeywell Bull DPS 7000	Honeywell Bull DPS 7000	Honeywell Bull DPS 7000
MODELS	930-11, 930-31	10, 20	30, 40	50
SYSTEM CHARACTERISTICS				
Number of CPUs	1	1	1	2
Number of I/O Processors	Up to 30	4*	4 opt.	4 opt.
Plug-Compatible with	Not applicable	Not applicable	Not applicable	Not applicable
MAIN STORAGE				
Type	256K-bit CMOS	256K-bit CMOS	256K-bit CMOS	256K-bit CMOS
Cycle Time, nanoseconds	400	300	300	300
Access Time, nanoseconds	550	250	250	250
Minimum Capacity, bytes	8M	4M (10); 8M (20)	8M	8M
Maximum Capacity, bytes	64M	4M (10); 16M (20)	16M	16M
Increment Size, bytes	8M, 16M	4M, 8M (20)	4M, 8M	4M, 8M
Expanded Storage	Not applicable	Not applicable	Not applicable	Not applicable
CACHE STORAGE				
Type	Not applicable	Not specified	Not specified	Not specified
Cycle Time, nanoseconds	Not applicable	Not specified	Not specified	Not specified
Minimum Capacity, bytes	Not applicable	64K	64K	128K
Maximum Capacity, bytes	Not applicable	64K	64K	128K
Increment, bytes	Not applicable	Not applicable	Not applicable	Not applicable
CENTRAL PROCESSOR				
Relative Performance (MIPs)	1.8 (930-11); 3.0 (930-31)	0.65 (10); 0.86 (20)	1.6 (30); 2.18 (40)	3.8
Machine Cycle Time, nanoseconds	Not specified	150	150	150
Word Length, bits	64	32	32	32
INPUT/OUTPUT CONTROL				
Integrated I/O Channels	Not applicable	Not applicable	Not applicable	Not applicable
Other I/O Channels	5 to 10	4	4 to 8	4 to 8
Maximum I/O Data Rate, bytes/sec.	3M	1.25M, 2.5M	1.25M, 2.5M	1.25M, 2.5M
COMMUNICATIONS				
Maximum Number of Lines	Configuration dependent	3 to 255	3 to 255	3 to 255
Synchronous	38.4K bps	Not specified	Not specified	Not specified
Asynchronous	128K bps	Not specified	Not specified	Not specified
Protocols Supported	HDLC, X.25, HASP, 2780/3780	HDLC, X.25	HDLC, X.25	HDLC, X.25
Network Architectures Supported	CDCNet, SNA, DECnet	DSA	DSA	DSA
PERIPHERAL EQUIPMENT				
Disk Drives	414MB—2.44GB	100MB—1200MB	100MB—1200MB	100MB—1200MB
Magnetic Tape Drives	40KBS—1250KBS	40KBS—781KBS	40KBS—781KBS	40KBS—781KBS
Line Printers	300—2,000 lpm	650—1,200 lpm	650—1,200 lpm	650—1,200 lpm
Other Peripheral Devices Supported	Model 910 workstations	Terminals	Terminals	Terminals
SOFTWARE				
Operating Systems	NOS/VE	GCOS 7	GCOS 7	GCOS 7
Programming Languages	Basic, Cobol, Fortran, APL, Pascal, C, Lisp, Prolog, Cybil	Basic, Cobol, Fortran, APL, Pascal, GPL, PL/1, RPG II	Basic, Cobol, Fortran, APL, Pascal, GPL, PL/1, RPG II	Basic, Cobol, Fortran, APL, Pascal, GPL, PL/1, RPG II
Data Base Management System	IM/DM	I-D-S/II, DM 7	I-D-S/II, DM 7	I-D-S/II, DM 7
PRICING & AVAILABILITY				
Purchase Price, basic system, $	59,900 (-11); 125,900 (-31)	112,400 (10); 58,000 (20)	88,000 (30); 128,000 (40)	181,200
Monthly Maintenance, prime shift, $	350 (-11); 550 (-31)	491 (10); 230 (20)	320 (30); 415 (40)	525
Monthly Rental, 1-year lease, $ (including maintenance)	Not available	Not available	Not available	Not available
Purchase Price of Memory Incre., $	8,000 (8MB) 16,000 (16MB)	12,000 (4MB) 22,800 (8MB)	12,000 (4MB) 22,800 (8MB)	12,000 (4MB) 22,800 (8MB)
Date of First Delivery	3/87 (-11); 8/87 (-31)	1988 (10); 9/87 (20)	8/87	Fourth quarter 1987
Number Installed to Date	Not specified	Not specified	Not specified	Not specified
COMMENTS	Ref.: 70C-238MM-401	*Optional on Model 20; Model 10 includes 700MB disk & 1600 bpi tape drive Ref.: 70C-458ME-101	Ref.: 70C-458ME-101	Ref.: 70C-458ME-101

Mainframe Comparison Columns
SMALL-SCALE

MANUFACTURER AND MODEL	International Business Machines Corp. 9370	International Business Machines Corp. 9370	NCR Corp. 9800 System	NCR Corp. 9800 System
MODELS	9373 Model 20, 9375 Model 40	9375 Model 60, 9377 Model 90	9811, 9821, 9822, 9832, 9842, 9863, 9884	9800XP
SYSTEM CHARACTERISTICS				
Number of CPUs	1	1	1—8 (AP*)	2 (XP)
Number of I/O Processors	1	1	1—4 (DSP**)	2 (DSP)
Plug-Compatible with	Not applicable	Not applicable	Not applicable	Not applicable
MAIN STORAGE				
Type	1M-bit chip	1M-bit chip	64K-bit MOS	64K-bit MOS
Cycle Time, nanoseconds	Not specified	Not specified	120 (AP); 145 (DSP)	120 (XP); 145 (DSP)
Access Time, nanoseconds	Not specified	Not specified	360 (AP); 450 (DSP)	320 (XP); 450 (DSP)
Minimum Capacity, bytes	4M (9373); 8M (9375)	8M	2M—32M	4M
Maximum Capacity, bytes	16M (9373); 16M (9375)	16M	8M—64M	16M
Increment Size, bytes	4M or 8M	8M	2M or 4M	4M
Expanded Storage	Not available	Not available	Not available	Not available
CACHE STORAGE				
Type	Not applicable	Not specified	Not specified	Not specified
Cycle Time, nanoseconds	Not applicable	Not specified	Not specified	Not specified
Minimum Capacity, bytes	Not applicable	16K	4M	4M
Maximum Capacity, bytes	Not applicable	16K	16M	16M
Increment, bytes	Not applicable	Not applicable	2M or 4M	4M
CENTRAL PROCESSOR				
Relative Performance (MIPs)	0.5 (both models)	1.3 (9375); 2.6 (9377)	1 to 8	2.7
Machine Cycle Time, nanoseconds	90	90	145 (AP)	56
Word Length, bits	32	32	32	32
INPUT/OUTPUT CONTROL				
Integrated I/O Channels	1 (9373); 2 (9375)	2 (9375); 12 (9377)	Up to 128	Up to 36
Other I/O Channels	Not applicable	Not applicable	Not available	Not available
Maximum I/O Data Rate, bytes/sec.	1.5M to 1.9M	1.9M to 3M	14M aggregate	14M aggregate
COMMUNICATIONS				
Maximum Number of Lines	Configuration dependent	Configuration dependent	54	54
Synchronous	Not specified	Not specified	Not specified	Not specified
Asynchronous	75 bps to 19.2K bps	75 bps to 19.2K bps	18	18
Protocols Supported	BSC, HDLC, SDLC	BSC, HDLC, SDLC	DLC, BMC, TTY, X.25	DLC, BMC, TTY, X.25
Network Architectures Supported	IBM Token-Ring	IBM Token-Ring	NCR/CNA, SNA	NCR/CNA, SNA
PERIPHERAL EQUIPMENT				
Disk Drives	368MB—3.78GB	368MB—3.78GB	451.2MB—1.6GB	415.2MB—1.6GB
Magnetic Tape Drives	40KBS—1250KBS; 3M (cart.)	40KBS—1250KBS; 3M (cart.)	40KBS—1250KBS	40KBS—1250KBS
Line Printers	325—4,000 lpm	325—4,000 lpm	720—2,000 lpm	720—2,000 lpm
Other Peripheral Devices Supported	Terminals	Terminals	Terminals, MICR sorters, multiplexers, laser printers, communications processors	Terminals, MICR sorters, multiplexers, laser printers, communications processors
SOFTWARE				
Operating Systems	VM/SP, IX/370, VSE/SP	VM/SP, IX/370, VSE/SP, MVS/SP	VRX/XE	VRX/E
Programming Languages	VS Fortran, PL/1, Cobol, RPG II	VS Fortran, PL/1, Cobol, RPG II, APL2, Pascal/VS	VRX/E Cobol, NEATVS, C, IVS Basic	VRX/E Cobol, NEATVS, C, IVS Basic
Data Base Management System	SQL/DS	SQL/DS, DB2, IMS/VS-DB	NCR-DMS, Total	NCR-DMS, Total
PRICING & AVAILABILITY				
Purchase Price, basic system, $	31,000 (9373);65,000 (9375)	93,000 (9375); 190,000	58,960 to 340,580	132,500
Monthly Maintenance, prime shift, $	225 (9373); 280 (9375)	350 (9375); 550 (9377)	3,541 to 20,182	11,100
Monthly Rental, 1-year lease, $ (including maintenance)	3,100 (9373); 6,500 (9375)	9,300 (9375); 19,000 (9377)	Not available	Not available
Purchase Price of Memory Incre., $	10,000 (4MB) 20,000 (8MB)	10,000 (4MB) 20,000 (8MB)	8,425 (2MB) 11,800 (4MB)	30,000 (4MB)
Date of First Delivery	Third quarter 1987	Third quarter 1987	First quarter 1987	First quarter 1988
Number Installed to Date	Not specified	Not specified	—	Not specified
COMMENTS	Ref.: 70C-504MK-201	Ref.: 70C-504MK-201	*Application Processor; **Data Storage Processor; The 9800 architecture is designed to separate I/O and application logic processing with function-specific processors Ref.: 70C-653MM-301	The XP processor can be configured with 2 DSPs; the XP can also function as an AP in a 9832 or smaller system Ref.: 70C-653MM-301

Mainframe Comparison Columns
SMALL-SCALE

MANUFACTURER AND MODEL	Unisys Corp. A 1, A 4, and A 6	Unisys Corp. A 2, A 3, and A 5	Unisys Corp. 2200/200 Series	
MODELS	A 1, A 4, and A 6 Models F and K	A 2, A 3 Models D, E, F, and K; A 5 Models F and K	2200/201, 2200/202, 2200/203, 2200/204	
SYSTEM CHARACTERISTICS				
Number of CPUs	1, 2 (A 6K)	1, 2 (K models)	1—4	
Number of I/O Processors	2	1—2	1—4	
Plug-Compatible with	Not applicable	Not applicable	Not applicable	
MAIN STORAGE				
Type	256K-bit, 1M-bit DRAM (A 6)	256K-bit RAM	256K-bit CMOS	
Cycle Time, nanoseconds	Not specified	Not specified	431	
Access Time, nanoseconds	Not specified	Not specified	Not specified	
Minimum Capacity, bytes	12M, 24M (A 6K)	6M, 12M (A 5K)	8M	
Maximum Capacity, bytes	48M, 96M (A 6K)	48M	48M	
Increment Size, bytes	12M	3M	2M	
Expanded Storage	Not available	Not available	Not available	
CACHE STORAGE				
Type	Not specified	Not specified	Not specified	
Cycle Time, nanoseconds	25 (A 6K)	25 (A 5K)	Not specified	
Minimum Capacity, bytes	48K (A 6K)	48K (A 5K)	32K	
Maximum Capacity, bytes	48K (A 6K)	48K (A 5K)	32K	
Increment, bytes	Not applicable	Not applicable	Not applicable	
CENTRAL PROCESSOR				
Relative Performance (MIPs)	0.5, 0.8, 1.6	0.4, 0.6, 1.4	1.1, 2.2, 3.2, 4.1	
Machine Cycle Time, nanoseconds	Not specified	Not specified	108	
Word Length, bits	48	48	36	
INPUT/OUTPUT CONTROL				
Integrated I/O Channels	Not applicable	Not applicable	7 to 14	
Other I/O Channels	Up to 24 DLPs*	Up to 16 DLPs*	Up to 10	
Maximum I/O Data Rate, bytes/sec.	3.4M, 4.5 (A 6K)	3.4M, 4.5M (A 5K)	Not specified	
COMMUNICATIONS				
Maximum Number of Lines	16	20	Configuration dependent	
Synchronous	Not specified	Not specified	Not specified	
Asynchronous	Not specified	Not specified	Not specified	
Protocols Supported	3270, RJE, LU6.2	BDLC, X.25	Uniscope, X.21, X.25, 3270, UDLC	
Network Architectures Supported	BNA, SNA	BNA, SNA	DCA	
PERIPHERAL EQUIPMENT				
Disk Drives	122.8MB—1.1GB	122.8MB—963.6MB	170MB—515MB	
Magnetic Tape Drives	120KBS—470KBS	120KBS—470KBS	40KBS—1250KBS	
Line Printers	650—2,000 lpm	650—2,000 lpm	640—2,000 lpm	
Other Peripheral Devices Supported	Terminals, laser printers	Card equipment, terminals, laser printers	Terminals, laser printer, communications processors	
SOFTWARE				
Operating Systems	MCP/AS	MCP/AS	OS 1100 SBR 2	
Programming Languages	Cobol, Fortran, PL/1, Linc, Pascal, Basic, RPG, Algol	Cobol, Fortran, PL/1, Linc, Pascal, Basic, RPG, Algol	Cobol, Fortran, Pascal, RPG II	
Data Base Management System	DMS II	DMS II, InfoExec	UDS 1100, DMS 1100	
PRICING & AVAILABILITY				
Purchase Price, basic system, $	25,000—230,000	60,000—265,000	138,000—400,450	
Monthly Maintenance, prime shift, $	Not specified	453—710	665—1,590	
Monthly Rental, 1-year lease, $ (including maintenance)	Not available	5,942—12,225	5,754—16,685	
Purchase Price of Memory Incre., $	30,000 (12MB)	18,000 (3MB)	17,710 (2MB)	
Date of First Delivery	10/87, 9/88 (A 6K)	9/84 (A 3D) to 5/88 (A 5K)	12/86, 10/87 (200/203-204)	
Number Installed to Date	Not specified	Not specified	Not specified	
COMMENTS	*Data Link Processor	*Data Link Processor		
	Ref.: 70C-944YT-051	Ref.: 70C-944YT-201	Ref.: 70C-944YT-751	

Mainframe Comparison Columns
MEDIUM-SCALE

MANUFACTURER AND MODEL	Control Data Corp. Cyber 180	Honeywell Bull DPS 8000 Series	International Business Machines Corp. 4381 Series	International Business Machines Corp. 4381 Series
MODELS	840A, 850A, 860A, 870A	DPS 8000/81, DPS 8000/82 DPS 8000/83, DPS 8000/84	4381 Model Groups 11, 12, 13, and 14	4381 Model Groups 21, 22, 23, and 24
SYSTEM CHARACTERISTICS				
Number of CPUs	1, 2 (870A)	1—4	1, 2	1, 2
Number of I/O Processors	Up to 30	1—4	1, 2	1, 2
Plug-Compatible with	Not applicable	Not applicable	Not applicable	Not applicable
MAIN STORAGE				
Type	256K-bit CMOS	1M-bit DRAM MOS	64K-bit, 256K-bit MOSFET	256K-bit, 1M-bit MOSFET
Cycle Time, nanoseconds	384	Not specified	Not specified	Not specified
Access Time, nanoseconds	320	Not specified	Not specified	Not specified
Minimum Capacity, bytes	16M	16M—32M	4M—16M	8M—16M
Maximum Capacity, bytes	128M	128M—256M	16M—32M	16M—64M
Increment Size, bytes	16M, 32M	16M	Not specified	Not specified
Expanded Storage	Unified Extended Memory	Not available	Not available	Not available
CACHE STORAGE				
Type	Bipolar	Not specified	Not specified	Not specified
Cycle Time, nanoseconds	64	Not specified	120	120
Minimum Capacity, bytes	16K	256K	4K—128K	8K—128K
Maximum Capacity, bytes	32K	256K	4K—128K	8K—128K
Increment, bytes	16K	Not applicable	Not applicable	Not applicable
CENTRAL PROCESSOR				
Relative Performance (MIPs)	4.7, 6,7, 9.5, 17.1	2.75 (/81); 5.5 (/82)	1.5, 2.8, 3.7, 6.2	1.5, 2.2, 3.5, 6.1
Machine Cycle Time, nanoseconds	16	85	68 (12 & 14); 56 (13 & 14)	68 (21 & 22); 56 (23 & 24)
Word Length, bits	64	36	32	32
INPUT/OUTPUT CONTROL				
Integrated I/O Channels	24—34	Up to 64	6, 12 (Model 14)	6, 12 (Model 24)
Other I/O Channels	Not applicable	Up to 496 (logical)	6 optional	6, 12 (Model 24) optional
Maximum I/O Data Rate, bytes/sec.	3M	Up to 17.8M (aggregate per I/O processor)	3M	3M
COMMUNICATIONS				
Maximum Number of Lines	Configuration dependent	Configuration dependent	Configuration dependent	Configuration dependent
Synchronous	128K bps	64K—19.2K bps	Not specified	Not specified
Asynchronous	38.4K bps	Not specified	Not specified	Not specified
Protocols Supported	X.25 Mode 4, HASP, 2780/ 3780, 3270 BSC	HDLC, X./21, X.25	BSC, SDLC, X.25, X.21, 3725	BSC, SDLC, X.25, X.21, 3725
Network Architectures Supported	—	DSA	SNA, IBM Token-Ring	SNA, IBM Token-Ring
PERIPHERAL EQUIPMENT				
Disk Drives	1.3GB—2.4GB	157MB—5.4GB	317.5MB—5.05GB	317.5MB—5.05GB
Magnetic Tape Drives	120KBS—1250KBS	60KBS—1250KBS	60KBS—1250KBS	60KBS—1250KBS
Line Printers	200—2,000 lpm	900—1,600 lpm	125—4,000 lpm	125—4,000 lpm
Other Peripheral Devices Supported	Card equipment, terminals array processors	Terminals, communications processors	Card equipment, terminals, laser printers, MICR and OCR, communications processors	Card equipment, terminals, laser printers, MICR and OCR, communications processors
SOFTWARE				
Operating Systems	NOS/VE	GCOS 8	DOS/VSE, OS/VS1, MVS/SP, VM/SP, MVS/XA, VM/XA, VM/SP, HPO, IX/370	DOS/VSE, OS/VS1, MVS/SP, VM/SP, MVS/XA, VM/XA, VM/SP, HPO, IX/370
Programming Languages	Fortran, Cobol, APL, Pascal, Basic, C, Lisp, Prolog, Cybil	Cobol, Fortran, Basic, C, PL/1, RPG II, Pascal, GMAP, GPPS, Simscript, C, APL, Ada, Lisp	Ada, Algol, APL2, Basic, C, Cobol, DSL/VS, Fortran, Intellect, Lisp/VM, Pascal, PL/1, Prolog, RPG II	Ada, Algol, APL2, Basic, C, Cobol, DSL/VS, Fortran, Intellect, Lisp/VM, Pascal, PL/1, Prolog, RPG II
Data Base Management System	IM/DM, IM/VE	DM-IV, Interel	DB2	DB2
PRICING & AVAILABILITY				
Purchase Price, basic system, $	580,000—1,982,000	675,000—2,370,000	175,000—680,000	225,000—890,000
Monthly Maintenance, prime shift, $	2,200—5,680	850—1,600 (/81 & /82)	450—740	450—810
Monthly Rental, 1-year lease, $ (including maintenance)	33,740—92,130	45,000—87,850 (/81 & /82)	20,650—82,630	26,785—105,950
Purchase Price of Memory Incre., $	128,000 (16MB)	120,000 (16MB)	Not specified	Not specified
Date of First Delivery	4/86; 8/86 (840A)	12/87, 7/88	4/86; 5/86	First quarter 1988
Number Installed to Date	Not specified	Not specified	—	—
COMMENTS				
	Ref.: 70C-238MM-401	Ref.: 70C-458LT-401	Ref.: 70C-504MK-301	Ref.: 70C-504MK-301

Mainframe Comparison Columns
MEDIUM-SCALE

MANUFACTURER AND MODEL	National Advanced Systems (NAS) AS/VL Series	NCR Corp. V-8800 Systems	NCR Corp. V-8800 Systems	NCR Corp. V-8800 Systems
MODELS	AS/VL 40, AS/VL 50, AS/VL 60, AS/VL 80	V-8835, V-8845	V-8855, V-8865, V-8875	V-8885, V-8895
SYSTEM CHARACTERISTICS				
Number of CPUs	1, 2 (AS/VL 80)	1 (8835); 2 (8845)	2 (8855); 3 (8865); 4 (8875)	6 (8885); 8 (8895)
Number of I/O Processors	1	2 std., 4 opt.	2 std., 4 opt.	2 std., 4 opt.
Plug-Compatible with	IBM 4381 Series	Not applicable	Not applicable	Not applicable
MAIN STORAGE				
Type	1M-bit CMOS	64K-bit MOS	64K-bit MOS	64K-bit MOS
Cycle Time, nanoseconds	120	336	336	336
Access Time, nanoseconds	Not specified	370 (read)	370 (read)	370 (read)
Minimum Capacity, bytes	32M	4M (8835); 8M (8845)	8M (8855);12M (8865);16M	24M (8885); 32M (8895)
Maximum Capacity, bytes	256M	16M	32M (all models)	48M (8885); 64M (8895)
Increment Size, bytes	32M	4M	4M	4M
Expanded Storage	HSA, up to 768KB	Not available	Not available	Not available
CACHE STORAGE				
Type	Not specified	Not specified	Not specified	Not specified
Cycle Time, nanoseconds	50—60	Not specified	Not specified	Not specified
Minimum Capacity, bytes	32K—128K	32K (8835); 128K (8845)	64K (8855);160K (8865);256K	384K (8885); 512K (8895)
Maximum Capacity, bytes	32K—128K	32K (8835); 128K (8845)	64K (8855);160K (8865);256K	384K (8885); 512K (8895)
Increment, bytes	Not applicable	Not applicable	Not applicable	Not applicable
CENTRAL PROCESSOR				
Relative Performance (MIPs)	Not specified	1.5 (8835)	Not specified	Not specified
Machine Cycle Time, nanoseconds	Not specified	38	38	38
Word Length, bits	32	32	32	32
INPUT/OUTPUT CONTROL				
Integrated I/O Channels	12—40	Up to 32	Up to 64	Up to 128
Other I/O Channels	Not specified	2 opt.	2 opt.	2 opt.
Maximum I/O Data Rate, bytes/sec.	6M	2M	2M	2M
COMMUNICATIONS				
Maximum Number of Lines	IBM-compatible communi-	Configuration dependent	Configuration dependent	Configuration dependent
Synchronous	cations controllers	Yes	Yes	Yes
Asynchronous	—	Yes	Yes	Yes
Protocols Supported	—	SDLC, BSC, TTY, X.25	SDLC, BSC, TTY, X.25	SDLC, BSC, TTY, X.25
Network Architectures Supported	SNA	NCR/CNA, SNA	NCR/CNA, SNA	NCR/CNA, SNA
PERIPHERAL EQUIPMENT				
Disk Drives	2.5GB—7.5GB	425MB—1.6GB	425MB—1.6GB	425MB—1.6GB
Magnetic Tape Drives	3MBS or 6MBS (cartridge)	36KBS—1250KBS	36KBS—1250KBS	36KBS—1250KBS
Line Printers	OEM or plug-compatible	720—2,000 lpm	720—2,000 lpm	720—2,000 lpm
Other Peripheral Devices Supported	Terminals, communications processors	Card equipment, terminals, MICR sorters, laser printers	Card equipment, terminals, MICR sorters, laser printers	Card equipment, terminals, MICR sorters, laser printers
SOFTWARE				
Operating Systems	V MVS/SP, MVS/XA, VM/SP, VM/SF, VM/XA	VRX	VRX	VRX
Programming Languages	Pascal/VS, Cobol, PL/1, Fortran, Basic, APL/VS, Assembler	Cobol 74, VRX Fortran 77, Neat VS, Basic, RPG	Cobol 74, VRX Fortran 77, Neat VS, Basic, RPG	Cobol 74, VRX Fortran 77, Neat VS, Basic, RPG
Data Base Management System	IMS, or IBM compatible	Total	Total	Total
PRICING & AVAILABILITY				
Purchase Price, basic system, $	638,000—2,156,000	295,000; 530,000	633,000; 870,000; 1,106,000	1,668,000 (8885); 2,199,000
Monthly Maintenance, prime shift, $	712—3,408	20,625; 26,530 (annually)	33,750; 42,845; 48,565	72,845 (8885); 97,130
Monthly Rental, 1-year lease, $ (including maintenance)	Not specified	16,720; 27,520 (3-year rental only)	34,160; 45,290; 56,100 (3 year-rental only)	84,430 (8885); 111,790 (3-year rental only)
Purchase Price of Memory Incre., $	207,000 (32MB)	64,800 (4MB)	64,800 (4MB)	64,800 (4MB)
Date of First Delivery	Third & fourth qtrs. 1987	8/86	8/86	8/86
Number Installed to Date	Not specified	Not specified	Not specified	Not specified
COMMENTS		The V-8835 and V-8845 are the base models of the V-8800 family	The V-8855, 8865, and 8875 are combinations of the V-8835 and 8845 base models	The V-8885 and 8895 are combinations of the V-8835 and 8845 base models
	Ref.: 70C-638XM-101	Ref.: 70C-653MM-201	Ref.: 70C-653MM-201	Ref.: 70C-653MM-201

Mainframe Comparison Columns
MEDIUM-SCALE

MANUFACTURER AND MODEL	Unisys Corp. A 9 and A 10	Unisys Corp. V Series	Unisys Corp. 200/400 Series	
MODELS	A 9 Model NX, A 10 Models DX, FX, and HX	V 310-1, V 310-2, V 340, V 380, V 510, and V 530	200/401, 402, 403, 404, 405, and 406	
SYSTEM CHARACTERISTICS				
Number of CPUs	1, 2	1	1—6	
Number of I/O Processors	2—4	1, 2	1—10	
Plug-Compatible with	Not applicable	Not applicable	Not applicable	
MAIN STORAGE				
Type	64K (A 9); 256K (A 10)	256K-bit DRAM, CMOS	1M-bit DRAM, CMOS	
Cycle Time, nanoseconds	Not specified	Not specified	Not specified	
Access Time, nanoseconds	Not specified	Not specified	Not specified	
Minimum Capacity, bytes	12M; 24M (A 10HX)	5M—40M	16M	
Maximum Capacity, bytes	24M—96M	20M—160M	64M	
Increment Size, bytes	6M (A 9); 12M	5M—20M	16M	
Expanded Storage	Actual segment descriptor (ASD)	Not available	Not available	
CACHE STORAGE				
Type	Not specified	Not specified	Not specified	
Cycle Time, nanoseconds	Not specified	Not specified	Not specified	
Minimum Capacity, bytes	6K (A 10FX); 12K (A 10HX)	40K (V 530)	64K	
Maximum Capacity, bytes	6K (FX); 12K (HX)	40K (V 530)	64K	
Increment, bytes	Not applicable	Not applicable	Not applicable	
CENTRAL PROCESSOR				
Relative Performance (MIPs)	2, 3.1, 4.6, 8.4	0.91, 1.36, 2.18, 4.5, 8.37	2.4 (401) to 14 (406)	
Machine Cycle Time, nanoseconds	72.5	110; 48 (V 510/530)	80	
Word Length, bits	48	48	36	
INPUT/OUTPUT CONTROL				
Integrated I/O Channels	Not applicable	Not applicable	Not applicable	
Other I/O Channels	Up to 80 DLPs*	Up to 32 DLPs*; Up to 64 DLPs (V 380/V 530)	Up to 64	
Maximum I/O Data Rate, bytes/sec.	3M	8M; 16M (V 380/V 530)	3M	
COMMUNICATIONS				
Maximum Number of Lines	Configuration dependent	Configuration dependent	Configuration dependent	
Synchronous	Not specified	Not specified	Not specified	
Asynchronous	Not specified	Not specified	Not specified	
Protocols Supported	BDLC, 2780	Poll select, BDLC, Bisync	UDLC	
Network Architectures Supported	BNA, SNA	BNA	DCA, SNA	
PERIPHERAL EQUIPMENT				
Disk Drives	130M—3.4GB	252MB—1084MB	1.6GB—5.1GB	
Magnetic Tape Drives	120KBS—1250KBS	8KBS—1250KBS	200KBS—1250KBS	
Line Printers	650—2000 lpm	650—2,000 lpm	1,200—2,000 lpm	
Other Peripheral Devices Supported	Card equipment, terminals laser printers, modems	Card equipment, reader/ sorters, terminals	Terminals, optical discs, communications processors	
SOFTWARE				
Operating Systems	MCP/AS	MCP/VS	OS 1100, SX 1100 (as guest)	
Programming Languages	Cobol, Fortran, PL/1, Linc, Pascal, Basic, RPG, Algol	Cobol, RPG II, Fortran, Basic, Pascal, Algol, Linc	Cobol, RPG II, Fortran, Basic, Pascal, PL/1, APL, RPG II	
Data Base Management System	DMS II, InfoExec	DMS-II	DMS 1100, RDMS 1100	
PRICING & AVAILABILITY				
Purchase Price, basic system, $	250,000-962,000	160,000—1,770,000	177,951—952,065	
Monthly Maintenance, prime shift, $	1,378—1,595	1,150—3,100	Not specified	
Monthly Rental, 1-year lease, $ (including maintenance)	Not available for A 9NX 23,087—54,273	9,702—93,338	Not specified	
Purchase Price of Memory Incre., $	12,000 (12MB)	60,000 (5MB), 100,000 (10MB)	Not specified	
Date of First Delivery	1/87 (A 9); 9/86 (A 10)	9/85 to 3/88	Start 9/88	
Number Installed to Date	Not specified	Not available	Not applicable	
COMMENTS	*Data Link Processor, the A 10HX dual-processor can be partitioned to form two independent systems	*Data Link Processors		
	Ref.: 70C-944YT-251/301	Ref.: 70C-944YT-151	Ref.: 70C-944YT-801	

Mainframe Comparison Columns
LARGE-SCALE

MANUFACTURER AND MODEL	Amdahl 5990 Series	Amdahl 5890 Series	Control Data Corp. Cyber 180	Control Data Corp. Cyber 180
MODELS	Models 700 and 1400	5890-190E, -200E, -300E, -390E, -400E, -600E	Models 992-31 and 992-32	Models 994-31 and 994-32
SYSTEM CHARACTERISTICS				
Number of CPUs	2—4	1—4	1, 2	1, 2
Number of I/O Processors	2—4	1—4	Up to 20	Up to 40
Plug-Compatible with	IBM 3090	IBM 3090	Not applicable	Not applicable
MAIN STORAGE				
Type	256K-bit NMOS	256K-bit, NMOS	256K-bit SRAM, CMOS	256K-bit SRAM, CMOS
Cycle Time, nanoseconds	Not specified	280	Not specified	Not specified
Access Time, nanoseconds	Not specified	Not specified	Not specified	Not specified
Minimum Capacity, bytes	64M—128M	32M—128M	64M	64M
Maximum Capacity, bytes	256M—512M	256M—512M	256M	256M
Increment Size, bytes	64M	32M, 64M, 128M	64M	64M
Expanded Storage	Up to 1GB	Up to 512MB	Unified Extended Memory	Unified Extended Memory
CACHE STORAGE				
Type	Bipolar RAM	Bipolar RAM	Not specified	Not specified
Cycle Time, nanoseconds	Not specified	Not specified	Not specified	Not specified
Minimum Capacity, bytes	128K	64K—96K	32K	32K
Maximum Capacity, bytes	128K	64K—96K	32K	32K
Increment, bytes	Not applicable	Not applicable	Not applicable	Not applicable
CENTRAL PROCESSOR				
Relative Performance (MIPs)	63, 115	22 to 70	Not specified	Not specified
Machine Cycle Time, nanoseconds	10	15	16	16
Word Length, bits	32	64	64	64
INPUT/OUTPUT CONTROL				
Integrated I/O Channels	32—128	28—160	8—34	8—34
Other I/O Channels	Not specified	Not specified	Not specified	Not specified
Maximum I/O Data Rate, bytes/sec.	3M, 4.5M	3M, 4.5M	3M, 12M	3M, 12M
COMMUNICATIONS				
Maximum Number of Lines	Not specified	Configuration dependent	Configuration dependent	Configuration dependent
Synchronous	Not specified	Not specified	128 bps	128 bps
Asynchronous	Not specified	64K bps	38.4K bps	38.4K bps
Protocols Supported	SDLC, BSC, X.25	SDLC, BSC, X.21	HDLC, X.25, 3270, 3780	HDLC, X.25, 3270, 3780
Network Architectures Supported	SNA	SNA	LCN, CDCNet, SNA	LCN, CDCNet, SNA
PERIPHERAL EQUIPMENT				
Disk Drives	512MB—5.04GB	512MB—5.04GB	550MB—2.4GB	550MB—2.4GB
Magnetic Tape Drives	All plug-compatible devices	All plug-compatible devices	40KBS—1250KBS	40KBS—1250KBS
Line Printers	OEM or plug-compatible	OEM or plug-compatible	300—2,000 lpm	300—2,000 lpm
Other Peripheral Devices Supported	Communications processors	Communications processors	Terminals, communications processors	Terminals, communications processors
SOFTWARE				
Operating Systems	MVS/370, MVS/XA, VM/SP, HPO, UTS	MVS, MVS/SP1, MVS/SP2, VM/SP HPO, VM/SP, ACP	NOS/VE	NOS/VE
Programming Languages	Cobol, Fortran, PL/1, Basic, APL, RPG, all MVS/VM supported	Cobol, Fortran, PL/1, Basic, APL, RPG, all MVS/VM supported	Fortran, Cobol, APL, Pascal, Basic, C, Lisp, Prolog, Cybil	Fortran, Cobol, APL, Pascal, Basic, C, Lisp, Prolog, Cybil
Data Base Management System	IMS, DB/DC	IMS, DB/DC, all other IBM-compatible systems	IM/VE, IM/DM	IM/VE, IM/DM
PRICING & AVAILABILITY				
Purchase Price, basic system, $	Contact vendor	2,625,000—8,500,000	1,900,000—3,100,000	2,100,000—3,300,000
Monthly Maintenance, prime shift, $	Contact vendor	10,650—27,400	Contact vendor	Contact vendor
Monthly Rental, 1-year lease, $ (including maintenance)	Contact vendor	243,060—777,500	Contact vendor	Contact vendor
Purchase Price of Memory Incre., $	Not applicable	Not applicable	480,000 (64MB)	480,000 (64MB)
Date of First Delivery	Not applicable	6/87, fourth quarter 1987	8/88	8/88
Number Installed to Date	6/88	Not specified	Not applicable	Not applicable
COMMENTS		Ref.: 70C-035MM-101	Ref.: 70C-238MM-401	Ref.:70C-238MM-401

Mainframe Comparison Columns
LARGE-SCALE

MANUFACTURER AND MODEL	Honeywell Bull DPS 88 Series	Honeywell Bull DPS 90 Series	International Business Machines Corp. (IBM) 3090 Series	International Business Machines Corp. (IBM) 3090 Series
MODELS	DPS 88/861, /862, /862T, /891, /892, /892T	DPS 90/91, /92, /92T, /93, /94	120E, 150E, 180E, 200E, 280E	300E, 400E, 500E, 600E
SYSTEM CHARACTERISTICS				
Number of CPUs	1, 2	1—4	1, 2	3—6
Number of I/O Processors	1, 2	1—4	Not applicable	Not applicable
Plug-Compatible with	Not applicable	Not applicable	Not applicable	Not applicable
MAIN STORAGE				
Type	256K-bit MOS	256K-bit MOS	1M-bit NMOS	1M-bit NMOS
Cycle Time, nanoseconds	750	Not specified	Not specified	Not specified
Access Time, nanoseconds	225	225	Not specified	Not specified
Minimum Capacity, bytes	32M—64M	32M—64M	32M—64M	64M—128M
Maximum Capacity, bytes	64M—128M	128M—256M	32M—128M	128M—256M
Increment Size, bytes	16M	32M	32M (150 and 180 only)	64M—128M
Expanded Storage	Not available	Not available	64MB—1GB	1GB—2GB
CACHE STORAGE				
Type	Not specified	Not specified	Not specified	Not specified
Cycle Time, nanoseconds	Not specified	Not specified	Not specified	Not specified
Minimum Capacity, bytes	32K—128K	128K	64K—128K	192K—348K
Maximum Capacity, bytes	32K—128K	128K	64K—128K	192K—348K
Increment, bytes	Not applicable	Not applicable	Not applicable	Not applicable
CENTRAL PROCESSOR				
Relative Performance (MIPs)	2.75 to 26.3	10.8 to 36.7	7.5 to 31.2	46.9 to 79
Machine Cycle Time, nanoseconds	Not specified	Not specified	18.5	18.5
Word Length, bits	36	36	32	32
INPUT/OUTPUT CONTROL				
Integrated I/O Channels	Up to 256	Up to 64	16—64	38—128
Other I/O Channels	Not specified	Not specified	Not specified	Not specified
Maximum I/O Data Rate, bytes/sec.	3M	3M	3M, 4.5M	3M, 4.5M
COMMUNICATIONS				
Maximum Number of Lines	Configuration dependent	Configuration dependent	Configuration dependent	Configuration dependent
Synchronous	64K bps	64K bps	Not specified	Not specified
Asynchronous	19.2K bps	19.2K bps	Up to 256 bps	Up to 256 bps
Protocols Supported	BSC, HDLC, X.21	BSC, HDLC, X.21	SDLC, BSC, X.21, X.25	SDLC, BSC, X.21, X.25
Network Architectures Supported	DSA	DSA	SNA, IBM Token-Ring	SNA, IBM Token-Ring
PERIPHERAL EQUIPMENT				
Disk Drives	157MB—1.8GB	156M—3.6GB	729.8MB—7.5GB	729.8MB—7.5GB
Magnetic Tape Drives	52KBS—1250KBS	60KBS—7781.2KBS	60KBS—3000KBS	60KBS—3000KBS
Line Printers	1,200—1,600 lpm	900—1,600 lpm	125—4,000 lpm	125—4,000 lpm
Other Peripheral Devices Supported	Card equipment, terminals, communications processors	Card equipment, terminals, communications processors	Card equipment, terminals, page printers, MICR, OCR, communications controllers	Card equipment, terminals, page printers, MICR, OCR, communications controllers
SOFTWARE				
Operating Systems	GCOS 8	GCOS 8	MVS/SP, MVS/XA, VM/XA, VM/HPO, VM/XA	MVS/SP, MVS/XA, VM/XA, VM/HPO, VM/XA
Programming Languages	Cobol, Fortran, Basic, C, Pascal, APL, PL/1, GMAP, GPSS, Simscript, Lisp, RPG	Cobol, Fortran, Basic, C, Pascal, APL, PL/1, GMAP, GPSS, Simscript, Lisp, Ada, RPG II	Cobol, Fortran, PL/1, Basic, RPG II, Pascal/VS, Lisp, APL2	Cobol, Fortran, PL/1, Basic, RPG II, Pascal/VS, Lisp, APL2
Data Base Management System	I-D-S/II, DM-IV	I-D-S/II, DM-IV	IMS/VS-DB, DB2	IMS/VS-DB, DB2
PRICING & AVAILABILITY				
Purchase Price, basic system, $	1,750,000—4,510,000	3,550,000—7,600,000	715,000—4,100,000	5,600,000—10,344,000
Monthly Maintenance, prime shift, $	4,000—8,650	5,625—10,575	1,600—5,900	8,600—17,000
Monthly Rental, 1-year lease, $ (including maintenance)	86,400—218,400	246,875—521,875	59,590—414,000	479,170—912,000
Purchase Price of Memory Incre., $	260,000 (16MB)	360,000 (32MB)	270,000 (32MB)	540,000 (64MB)
Date of First Delivery	Fourth quarter 1986	Second quarter 1985	1/87; 10/87	1/87; 10/87
Number Installed to Date	Not specified	Not specified	Not specified	Not specified
COMMENTS	The Models DPS 88/862T and /892T are fully redundant systems	The Model DPS 90/92T is a fully redundant system		
	Ref.: 70C-458MM-701	Ref.: 70C-458LT-801	Ref.: 70C-504MK-701	Ref.: 70C-504MK-701

Mainframe Comparison Columns
LARGE-SCALE

MANUFACTURER AND MODEL	National Advanced Systems (NAS) AS/XL Series	Unisys Corp. A 12	Unisys Corp. A 15	Unisys Corp. A 17
MODELS	AS/XL 50, /XL 60, /XL 80, /XL 90, /XL 100	A 12E, A 12, A 12T	A 15 Models FX, HX, IX, JX, KX, LX, MX, and NX	A 17 Models F, H, J, L, N
SYSTEM CHARACTERISTICS				
Number of CPUs	1—4	1	1—4	1—4
Number of I/O Processors	1, 2	2—4	1, 2	1, 2
Plug-Compatible with	IBM 3090	Not applicable	Not applicable	Not applicable
MAIN STORAGE				
Type	256K-bit, 1M-bit NMOS	256K-bit DRAM MOS	256K-bit DRAM, MOS	256K-bit DRAM, MOS
Cycle Time, nanoseconds	Not specified	Not specified	Not specified	Not specified
Access Time, nanoseconds	Not specified	Not specified	Not specified	Not specified
Minimum Capacity, bytes	32M—128M	24M	24M	48M
Maximum Capacity, bytes	1G—2G	72M—144M	196M	288M
Increment Size, bytes	32M—64M	24M	12M	24M
Expanded Storage	960MB—1.92GB	ASD up to 144MB	ASD up to 192MB	ASD up to 288MB
CACHE STORAGE				
Type	Not specified	Not specified	Not specified	Not specified
Cycle Time, nanoseconds	Not specified	Not specified	Not specified	Not specified
Minimum Capacity, bytes	128K—1M	30K	48K—144K	48M
Maximum Capacity, bytes	128K—1M	30K	48K—144K	48M
Increment, bytes	Not applicable	Not applicable	Not applicable	Not applicable
CENTRAL PROCESSOR				
Relative Performance (MIPs)	Not specified	5.6, 8.2, 12.6	7.6 to 51.1	Not specified
Machine Cycle Time, nanoseconds	18	62.5	65	65
Word Length, bits	32	48	48	48
INPUT/OUTPUT CONTROL				
Integrated I/O Channels	16—128	Not applicable	Not applicable	Not applicable
Other I/O Channels	Not applicable	Up to 48 DLPs*	Up to 64 DLPs*	Up to 64 DLPs*
Maximum I/O Data Rate, bytes/sec.	3M, 6M	3M	8M	8M
COMMUNICATIONS				
Maximum Number of Lines	IBM-compatible communications controllers	Up to 32	512	512
Synchronous	Not specified	Not specified	Not specified	Not specified
Asynchronous	Not specified	Up to 19.2K bps	Up to 19.2 bps	Up to 19.2 bps
Protocols Supported	Not specified	Poll select, BDLC	TTY, X.25, X.21, SDLC	TTY, X.25, X.21, SDLC
Network Architectures Supported	SNA	BNA	BNA, SNA	BNA, SNA
PERIPHERAL EQUIPMENT				
Disk Drives	Can support all IBM 3090 devices	252MB—7.5GB	130MB—7.5GB	130MB—7.5GB
Magnetic Tape Drives	OEM or IBM compatible	120KBS—1250KBS	120KBS—1250KBS	120KBS—1250KBS
Line Printers	Terminals	650—2,000 lpm	650—2,000 lpm	650—2,000 lpm
Other Peripheral Devices Supported		Card equipment, terminals, communications processors, laser printers	Card equipment, terminals, communications processors, laser printers	Card equipment, terminals, communications processors, laser printers
SOFTWARE				
Operating Systems	MVS/XA, MVS/SP, VM/SP, VM/XA, ESA/370, AIX/370	MCP/AS	MCP/AS	MCP/AS
Programming Languages	Pascal/VS, Cobol VSII, Fortran, Basic, APL/VS, PL/1	Cobol, RPG II, Fortran, Basic, Pascal, Linc, Algol, APL	Cobol, Fortran, PL/1, APL, RPG II, Basic, Pascal, Linc, Algol	Cobol, Fortran, PL/1, APL, RPG II, Basic, Pascal, Linc, Algol
Data Base Management System	IMS or IBM compatible	DMS-II, InfoExec	DMS-II, InfoExec	DMS-II, InfoExec
PRICING & AVAILABILITY				
Purchase Price, basic system, $	3,050,000—12,690,000	795,000—1,900,000	2,940,000—8,475,000	3,132,000—8,995,000
Monthly Maintenance, prime shift, $	4,690—19,252	1,838—3,088	3,607—12,050	Not specified
Monthly Rental, 1-year lease, $ (including maintenance)	Contact vendor	43,592—172,606	172,941—489,882	Not specified
Purchase Price of Memory Incre., $	394,000 (64MB)	192,000 (24MB)	96,000 (12MB)	Not specified
Date of First Delivery	Second quarter 1985	9/86; 11/87; 6/88	Second quarter 1987	Second quarter 1988
Number Installed to Date	Not specified	Not specified	Not specified	Not specified
COMMENTS		*Data Link Processors	*Data Link Processors; Models JX, LX, and NX are partitionable systems	*Data Link Processors; Models J, L, and N are partitionable systems
	Ref.: 70C-638XM-301	Ref.: 70C-944YT-402	Ref.: 70C-944YT-501	Ref.: 70C-944YT-551

Mainframe Comparison Columns
LARGE-SCALE

MANUFACTURER AND MODEL	Unisys Corp. 1100/90 Systems			
MODELS	1100/91 Models II & II SV, 1100/92 Models II & II SV			
SYSTEM CHARACTERISTICS				
Number of CPUs	1—4			
Number of I/O Processors	1, 2			
Plug-Compatible with	Not applicable			
MAIN STORAGE				
Type	265K-bit RAM, NMOS			
Cycle Time, nanoseconds	360			
Access Time, nanoseconds	660			
Minimum Capacity, bytes	8M—64M			
Maximum Capacity, bytes	64M			
Increment Size, bytes	Not specified			
Expanded Storage	Not available			
CACHE STORAGE				
Type	Not specified			
Cycle Time, nanoseconds	60			
Minimum Capacity, bytes	64K—256K			
Maximum Capacity, bytes	64K—256K			
Increment, bytes	Not applicable			
CENTRAL PROCESSOR				
Relative Performance (MIPs)	5.5 to 32.6			
Machine Cycle Time, nanoseconds	30			
Word Length, bits	36			
INPUT/OUTPUT CONTROL				
Integrated I/O Channels	4—256			
Other I/O Channels				
Maximum I/O Data Rate, bytes/sec.	35.2M aggregate			
COMMUNICATIONS				
Maximum Number of Lines	Configuration dependent			
Synchronous	Not specified			
Asynchronous	Not specified			
Protocols Supported	UDLC, X.25, 3270, TTY			
Network Architectures Supported	DCA			
PERIPHERAL EQUIPMENT				
Disk Drives	17.2M—358.4M			
Magnetic Tape Drives	60KBS—1250KBS			
Line Printers	800—2,000 lpm			
Other Peripheral Devices Supported	Card equipment, terminals, optical discs, laser printer			
SOFTWARE				
Operating Systems	OS 1100			
Programming Languages	Cobol, Fortran, Algol, Basic, Pascal, PL/1, APL, RPG, Assembly, Mapper			
Data Base Management System	UDS 1100			
PRICING & AVAILABILITY				
Purchase Price, basic system, $	1,429,000—7,300,000			
Monthly Maintenance, prime shift, $	Contact vendor			
Monthly Rental, 1-year lease, $ (including maintenance)	Contact vendor			
Purchase Price of Memory Incre., $	Not specified			
Date of First Delivery	4/85, 1/89			
Number Installed to Date	Not specified			
COMMENTS	Ref.: 70C-944YT-701			