

Honeywell Series 60 Levels 66/DPS and 68/DPS

MANAGEMENT SUMMARY

Honeywell's Level 66/DPS and Level 68/DPS systems have evolved from the earlier Levels 66 and 68 family of processors that date back to 1974. There are essentially three major system groups represented, each characterized by a specific operating system. The Level 66/DPS, 66/DPS-440, and 66/DPS-520 all use the field-proven General Comprehensive Operating Supervisor, or GCOS. The Level 68/DPS uses the highly secure virtual memory Multics operating system. The Level 66/DPS/B3, 66/DPS/C3, and 66/DPS/C5 all use the CP-6 operating system, and were designed as a migratory path for Xerox-based systems users. Each system is capable of concurrently supporting batch processing, remote job entry, timesharing, and transaction processing.

The basic Level 66/DPS and 68/DPS systems are dual-processor units, expandable to six CPUs, four system control units, and four input/output multiplexers (IOMs). Each basic system has one system control unit (SCU) and IOM with up to 35 I/O channels. Processor performance upgrades, as well as additional memory, can increase system throughput dramatically. The Level 66/DPS-440 and -520 systems each have one CPU, SCU, and IOM with 18 channels. The CP-6-based 66/DPS/B3, /C3, and /C5 all have one CPU, SCU, and IOM with 27 channels. Memory on the Level 66/DPS starts at 256K words (one megabyte) and increases to 2048K words (eight megabytes) of MOS storage. The Level 66/DPS-440 and -520 both have 256K words, expandable to 512K words on the 440 and 1024K words on the 520. The Level 68/DPS has 512K words (two megabytes) of memory, and has a maximum of 4096K words (16 megabytes) of storage. Each of the CP-6-based processors has 3072K words (12 megabytes) of memory. The B3 is expandable ➤

The Level 66/DPS and 68/DPS systems represent the top end of Honeywell's large-scale processor family. The systems are designed to conform to Honeywell's Distributed Systems Environment, and offer performance ranging from the IBM 4341-1 up through the various 3033 models. Honeywell's evolutionary DPS 8 systems have effectively superseded the Level 66/DPS and 68/DPS product line.

CHARACTERISTICS

MANUFACTURER: Honeywell Information Systems, Inc., 200 Smith Street, Waltham, Massachusetts 02154. Telephone (617) 895-6000.

CURRENT MODELS: Level 66 Distributed Processing System (Level 66/DPS) with five performance levels; 66/DPS-440; 66/DPS-520; Level 68/DPS with four performance levels; and the CP-6-based 66/DPS/B3, 66/DPS/C3, and 66/DPS/C5.

DATE ANNOUNCED: Level 66/DPS, February 1978; Level 66/DPS-440, 66/DPS-520, April 1979; Level 68/DPS, November 1977; Level 66/DPS/C3 and /C5, 1978; Level 66/DPS/B3, June 1979.

DATE OF FIRST DELIVERY: Level 66/DPS, September 1978; Level 66/DPS-440 and -520, first quarter 1980; Level 68/DPS, September 1978; Level 66/DPS/C3 and /C5, third quarter 1979; Level 66/DPS/B3, first quarter 1980.

PRIOR MODELS: 66/05, 66/07, 66/17, 66/27, 66/40, 66/60, 66/80, 68/60, and 68/80.

NUMBER INSTALLED TO DATE: Approximately 1,100 (all models worldwide); 500 in U.S.

DATA FORMATS

BASIC UNIT: 9-bit bytes organized into 4-byte (36-bit) ➤



The large-scale Level 66/DPS (shown) and Level 68/DPS processors offer a wide range of performance as well as a choice of three operating systems. These systems are being replaced by the newer DPS 8 product line (Report 70C-480-11).

Honeywell Series 60 Levels 66/DPS and 68/DPS

CHARACTERISTICS OF THE LEVEL 66 AND 68 SYSTEMS

	Level 66/DPS	Level 66/DPS Models 440, 520	Level 66/DPS Models B & C (Xerox)	Level 68/DPS	DPS 8/70 (for comparison)
SYSTEM CONFIGURATION					
No. of central processors	2 to 6	1	1 to 6	2 to 6	1 to 4
No. of system controllers	1 to 4	1	1 to 4	1 to 4	1 to 4
No. of I/O multiplexers	1 to 4	1	1 to 4	1 to 4	1 to 4
No. of board slots	35 to 54	18	27	35 to 54	35 to 54
No. of network processors	1 to 4	1 to 2	1 to 12	1 to 4	1 to 8
Max. no. of lines	384	192	960	384	768
DCU6661	Yes	Yes	No	Yes	Yes
DCU6678	Yes	No	No	Yes	No
DCS6700	No	No	Yes	No	No
CENTRAL PROCESSOR					
Relative speed	1.0 to 6.7	0.4 to 0.7	0.8 to 6.3	1.1 to 6.7	1.7 to 5.6
No. of instructions	456 + 91 EIS	456 + 91 EIS	456 + 91 EIS	456 + 91 EIS	289 + 91 EIS
EIS instruction set	Yes	Yes	Yes	Yes	Yes
Cache memory	Yes	No	Yes	Yes	Yes
Size, bytes	8K to 32K	8K (520 only)	8K	8K	32K
Control storage for cache memory:					
Type/words per board	RAM/256 words	RAM/256 words	RAM/256 words	RAM/256 or 1024	RAM/256 words
Word size in bits	36	36	36	36	36
No. of words	2048	2048	2048	2048 or 8192	2048
Access time, nanoseconds	75	75	75	75	30
MOS MAIN MEMORY					
Minimum capacity, 9-bit bytes	1,048,576	1,048,576	12,582,912	2,097,152	1,048,576
Maximum capacity, 9-bit bytes	8,388,608	4,194,304	67,108,864	16,777,216	16,777,216*
Cycle time, nanoseconds	750	1400(440); 750(520)	750	750	750
Access time, nanoseconds	440	440	440	440	440
Words fetched per cycle	2	2	4	2	2
I/O CONTROL (PER IOM)					
Channel data rates, bytes per second	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
No. of unit record devices/controller	8	8	8	8	8
No. of disk drives/controller	32	32	32	32	32
No. of magnetic tape units/controller	16	16	16	16	16

*Maximum memory with GCOS 8, available only on DPS 8 systems. Maximum with GCOS is 8,388,608 bytes. Maximum with Multics-based DPS 8/70M and CP-6-based DPS 8/70C is 67,108,864 bytes.

➤ systems. The 66/DPS/B3, C3, and C5 are migration products of the Xerox Sigma 6, 7, 9, and 560 systems. They use a single-processor configuration with additional memory and processors added for increased performance. The smaller 66/DPS/B3 can be field upgraded to the top-end 66/DPS/C5. Honeywell has produced an array of system conversion aids to facilitate the various migration paths available.

The System Control Unit (SCU) is the principal interface between central system components. It provides complete system interrupt control which regulates communication between components and handles memory demands on a priority basis. Memory units and Input/Output Multiplexers (IOMs) are directly connected to the SCU. All processors are equipped initially with one SCU. The Level 66/DPS, 68/DPS, and CP-6-based 66/DPS systems (except the DPS-440 and -550) can be expanded to four SCUs.

The Input/Output Multiplexer (IOM) is connected to the System Control Unit and interfaces with all system peripherals and Front-End Network Processors (FNP). ➤

➤ override the ring protection scheme by denying execution or write access to a user program.

Storage protection on CP-6 systems is provided at both the segment level and memory page level. Segments can be read/write/execute protected. Pages can be write protected. CP-6-generated references are checked at both the segment and page levels. I/O transfers are checked at the page level only.

CENTRAL PROCESSORS

Both the Level 66/DPS and Level 68/DPS hardware architectures are memory-centered, with the processors and I/O multiplexer (IOM) modules utilizing a common memory subsystem and interface through a system control unit (SCU). The SCU is a free-standing unit in Level 66/DPS and 68/DPS systems, including the 66/DPS/B3, /C3, and /C5. It is an integrated unit in the 66/DPS-440 and -520 systems. This architecture is designed to further simultaneous and asynchronous execution for maximum throughput. To support the distributed systems environment, one or more integrated network processors (INPs) are an integrated part of the Level 66/DPS and Level 68/DPS systems. The INP controls all remote terminal interaction with Level 66/DPS and Level 68/DPS host systems. Connected to the central system via an IOM, the INP provides ➤

Honeywell Series 60 Levels 66/DPS and 68/DPS

CHARACTERISTICS OF THE LEVEL 66 AND 68 SYSTEMS

	Level 66/DPS	Level 66/DPS Models 440, 520	Level 66/DPS Models B & C (Xerox)	Level 68/DPS	DPS 8/70 (for comparison)
SYSTEM CONFIGURATION					
No. of central processors	2 to 6	1	1 to 6	2 to 6	1 to 4
No. of system controllers	1 to 4	1	1 to 4	1 to 4	1 to 4
No. of I/O multiplexers	1 to 4	1	1 to 4	1 to 4	1 to 4
No. of board slots	35 to 54	18	27	35 to 54	35 to 54
No. of network processors	1 to 4	1 to 2	1 to 12	1 to 4	1 to 8
Max. no. of lines	384	192	960	384	768
DCU6661	Yes	Yes	No	Yes	Yes
DCU6678	Yes	No	No	Yes	No
DCS6700	No	No	Yes	No	No
CENTRAL PROCESSOR					
Relative speed	1.0 to 6.7	0.7 to 1.0	0.8 to 6.3	1.1 to 6.7	1.7 to 5.6
No. of instructions	456 + 91 EIS	456 + 91 EIS	456 + 91 EIS	456 + 91 EIS	289 + 91 EIS
EIS instruction set	Yes	Yes	Yes	Yes	Yes
Cache memory	Yes	No	Yes	Yes	Yes
Size, bytes	8K to 32K	8K (520 only)	8K	8K	8K
Control storage for cache memory:					
Type/words per board	RAM/256 words	RAM/256 words	RAM/256 words	RAM/256 or 1024	RAM/256 words
Word size in bits	36	36	36	36	36
No. of words	2048	2048	2048	2048 or 8192	2048
Access time, nanoseconds	75	75	75	75	30
MOS MAIN MEMORY					
Minimum capacity, 9-bit bytes	1,048,576	1,048,576	12,582,912	2,097,152	1,048,576
Maximum capacity, 9-bit bytes	8,388,608	4,194,304	67,108,864	16,777,216	16,777,216*
Cycle time, nanoseconds	750	750	750	750	750
Access time, nanoseconds	440	440	440	440	440
Words fetched per cycle	2	2	4	2	2
I/O CONTROL (PER IOM)					
Channel data rates, bytes per second	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
No. of unit record devices/controller	8	8	8	8	8
No. of disk drives/controller	32	32	32	32	32
No. of magnetic tape units/controller	16	16	16	16	16

*Maximum memory with GCOS 8, available only on DPS 8 systems. Maximum with GCOS is 8,388,608 bytes. Maximum with Multics-based DPS 8/70M and CP-6-based DPS 8/70C is 67,108,864 bytes.

➤ systems. The 66/DPS/B3, C3, and C5 are migration products of the Xerox Sigma 6, 7, 9, and 560 systems. They use a single-processor configuration with additional memory and processors added for increased performance. The smaller 66/DPS/B3 can be field upgraded to the top-end 66/DPS/C5. Honeywell has produced an array of system conversion aids to facilitate the various migration paths available.

The System Control Unit (SCU) is the principal interface between central system components. It provides complete system interrupt control which regulates communication between components and handles memory demands on a priority basis. Memory units and Input/Output Multiplexers (IOMs) are directly connected to the SCU. All processors are equipped initially with one SCU. The Level 66/DPS, 68/DPS, and CP-6-based 66/DPS systems (except the DPS-440 and -550) can be expanded to four SCUs.

The Input/Output Multiplexer (IOM) is connected to the System Control Unit and interfaces with all system peripherals and Front-End Network Processors (FNP). ➤

➤ override the ring protection scheme by denying execution or write access to a user program.

Storage protection on CP-6 systems is provided at both the segment level and memory page level. Segments can be read/write/execute protected. Pages can be write protected. CP-6-generated references are checked at both the segment and page levels. I/O transfers are checked at the page level only.

CENTRAL PROCESSORS

Both the Level 66/DPS and Level 68/DPS hardware architectures are memory-centered, with the processors and I/O multiplexer (IOM) modules utilizing a common memory subsystem and interface through a system control unit (SCU). The SCU is a free-standing unit in Level 66/DPS and 68/DPS systems, including the 66/DPS/B3, /C3, and /C5. It is an integrated unit in the 66/DPS-440 and -520 systems. This architecture is designed to further simultaneous and asynchronous execution for maximum throughput. To support the distributed systems environment, one or more integrated network processors (INP's) are an integrated part of the Level 66/DPS and Level 68/DPS systems. The INP controls all remote terminal interaction with Level 66/DPS and Level 68/DPS host systems. Connected to the central system via an IOM, the INP provides ➤

Honeywell Series 60 Levels 66/DPS and 68/DPS

SOFTWARE PRICES

		Monthly License	Paid-Up License
Series 60 Level 66/DPS New Version of GCOS (Continued)			
SED6221	TSS Data Basic	110	22
SEL6209	COBOL-74 Subschema Translator	93	23
SEL6221	COBOL-74 Debug Option	153	27
Series 60 Level 66/DPS/B & /C			
SFS6120	Control Program-6 (CP-6) Basic System	—	—
SFS6121	Time-sharing, Remote Batch & Multi-Stream Batch Access Modes	1,000	—
SFS6122	Transaction Processing Mode	475	—
SFC6120	Local Front-End Communication Software	90	—
SFC6121	Remote Communications; required with DCS6700	100	—
SFD6120	Interactive Database Processor (IDP)	360	—
SFD6121	I-D-S/II Integrated Data Store/II	850	—
SFL6120	ANS FORTRAN	300	—
SFL6121	APL	325	—
SFL6122	BASIC	300	—
SFL6123	RPG-II	100	—
SFL6124	COBOL	212	—
SFP6120	Assembler	50	—
SFP6121	TEXT	290	—
SFU6120	Sort Merge	100	—
SFU6121	Forms Processor	150	—
Series 60 Level 68/DPS			
SGC6101	Multics Networking Tools	1,073	—
SGC6102	Multics Data Communications Software (MCS)	1,055	—
SGC6103	Inter-User Communications System (Electronic Mail)	292	—
SFS6106	Multics GCOS Environment Simulator	RPO	—
SFL6102	Multics FORTRAN	330	—
SFL6103	Multics BASIC	275	—
SFL6104	Multics COBOL-74	220	—
SFL6105	Multics APL	275	—
SGD6109	Multics Data Base Manager	717	—
SGD6110	Multics Relational Data System (MRDS)	1,155	—
SGD6111	Multics Integrated Data Store (MIDS)	220	—
SGD6112	Transaction Processing Tools	495	—
SGD6113	LINUS Query & Update Processor	1,100	—
SGL6101	Multics Fast FORTRAN	459	—
SGL6102	Multics PL/1	330	—
SGL6103	Assembly Language for Multics—ALM	275	—
SGL6104	RPG Report Generation System	275	—
SGP6110	Fast Access System for Time-sharing (FAST)	485	—
SGP6114	Access Isolation Mechanism	605	—
SGP6115	Random Password Generator	55	—
SGP6116	File Encryption Tools	110	—
SGU6101	Multics SORT/MERGE	121	—
SGU6102	Multics Metering & Tuning Tools	385	—
SGU6103	DEBUG	220	—
SGU6104	QEDX (Text Editor)	220	—
SGU6105	EDM (Text Editor)	110	—
SGU6107	Software Development Environment—Level II	290	—
SGU6108	Software Development Environment—Level III	193	—
SGU6109	WORDPRO Document System	633	—
SGU6110	List Processor Facility	165	—
SGU6111	Photo Composition	110	—
SGU6112	Artwork Tools	55	—
SGU6115	Limited Service System (LSS) Tools	110	—
SGU6116	ABBREV Processor	110	—
SGU6117	Search Rule Tools	110	—
SGU6118	Command Processor Tools	110	—
SGU6120	Event Management Facility	110	—
SGU6121	Command File Processor	220	—
SGU6122	System Information Tools	55	—
SGU6123	Active Function Library	55	—
Special Software, Level 66/DPS			
SEJ6001	Transaction Processing Executive II (TPE-II)	1,210	38,500*
SEL6012	LISP/66	—	2,310
SEL6013	PASCAL	—	5,198
SEL6014	Compiler B	—	3,465
SEP6001	TDS/TSS Load Generator System	347	—
SEU6001	HONEYEDIT	—	2,599
SEU6003	System Resource Monitor	—	4,400

*For SEJ6001 or SED6001, an annual software maintenance fee of \$1,925 or \$1,821, respectively, is invoiced one year after delivery. An upgrade to SED6001 from TOTAL 4H costs \$21,000, and from TOTAL Central, \$15,750.

Honeywell Series 60 Levels 66/DPS and 68/DPS

SOFTWARE PRICES

		Monthly License	Paid-Up License
Series 60 Level 66/DPS New Version of GCOS (Continued)			
SED6221	TSS Data Basic	121	22
SEL6209	COBOL-74 Subschema Translator	102	23
SEL6221	COBOL-74 Debug Option	153	27
Series 60 Level 66/DPS/B & /C			
SFS6120	Control Program-6 (CP-6) Basic System	—	—
SFS6121	Time-sharing, Remote Batch & Multi-Stream Batch Access Modes	1,000	—
SFS6122	Transaction Processing Mode	90	—
SFC6120	Local Front-End Communication Software	90	—
SFC6121	Remote Communications; required with DCS6700	90	—
SFD6120	Interactive Database Processor (IDP)	360	—
SFD6121	I-D-S/II Integrated Data Store/II	850	—
SFL6120	ANS FORTRAN	300	—
SFL6121	APL	325	—
SFL6122	BASIC	300	—
SFL6123	RPG-II	100	—
SFL6124	COBOL	212	—
SFP6120	Assembler	50	—
SFP6121	TEXT	290	—
SFU6120	Sort Merge	100	—
SFU6121	Forms Processor	150	—
Series 60 Level 68/DPS			
SGC6101	Multics Networking Tools	975	—
SGC6102	Multics Data Communications Software (MCS)	1,050	—
SGC6103	Inter-User Communications System (Electronic Mail)	265	—
SFS6106	Multics GCOS Environment Simulator	RPO	—
SFL6102	Multics FORTRAN	300	—
SFL6103	Multics BASIC	250	—
SFL6104	Multics COBOL-74	200	—
SFL6105	Multics APL	250	—
SGD6109	Multics Data Base Manager	717	—
SGD6110	Multics Relational Data System (MRDS)	1,050	—
SGD6111	Multics Integrated Data Store (MIDS)	200	—
SGD6112	Transaction Processing Tools	450	—
SGD6113	LINUS Query & Update Processor	1,000	—
SGL6101	Multics Fast FORTRAN	417	—
SGL6102	Multics PL/1	300	—
SGL6103	Assembly Language for Multics—ALM	250	—
SGL6104	RPG Report Generation System	250	—
SGP6110	Fast Access System for Time-sharing (FAST)	441	—
SGP6114	Access Isolation Mechanism	550	—
SGP6115	Random Password Generator	50	—
SGP6116	File Encryption Tools	100	—
SGU6101	Multics SORT/MERGE	110	—
SGU6102	Multics Metering & Tuning Tools	350	—
SGU6103	DEBUG	200	—
SGU6104	QEDX (Text Editor)	200	—
SGU6105	EDM (Text Editor)	100	—
SGU6107	Software Development Environment—Level II	264	—
SGU6108	Software Development Environment—Level III	175	—
SGU6109	WORDPRO Document System	575	—
SGU6110	List Processor Facility	150	—
SGU6111	Photo Composition	100	—
SGU6112	Artwork Tools	50	—
SGU6115	Limited Service System (LSS) Tools	100	—
SGU6116	ABBREV Processor	100	—
SGU6117	Search Rule Tools	100	—
SGU6118	Command Processor Tools	100	—
SGU6120	Event Management Facility	100	—
SGU6121	Command File Processor	200	—
SGU6122	System Information Tools	50	—
SGU6123	Active Function Library	50	—
Special Software, Level 66/DPS			
SEJ6001	Transaction Processing Executive II (TPE-II)	1,531	48,703
SEL6012	LISP/66	—	3,326
SEL6013	PASCAL	—	7,486
SEL6014	Compiler B	—	4,990
SEP6001	TDS/TSS Load Generator System	347	—
SEU6001	HONEYEDIT	—	3,743
SEU6003	System Resource Monitor	—	4,840

*For SEJ6001 or SED6001, an annual software maintenance fee of \$1,925 or \$1,821, respectively, is invoiced one year after delivery. An upgrade to SED6001 from TOTAL 4H costs \$21,000, and from TOTAL Central, \$15,750.

Honeywell Series 60 Levels 66/DPS and 68/DPS

EQUIPMENT PRICES

PUNCHED CARD EQUIPMENT (Continued)		Purchase Price	Monthly Maint.	Rental (1-year lease)*	Rental (5-year lease)*
CRF0005	Mark Sense Option for CRU1050	7,416	40	198	171
CCK0401	Retrofit Kit; upgrades PCU0121 to PCU0401	8,757	60	151	198
URA0050	Addressing capability for PCU0121 and PCU0401	4,253	4	131	107
URA0052	Addressing capability for CRU1050	7,569	37	241	220

DOCUMENT HANDLER SUBSYSTEMS

DHP0700	Document Handler Processor for DHU0800/DHU1600 Series; includes IOM	116,000	370	2,980	2,670
DHP0701	Document Handler Processor for DHU0803/0814 and DHU1600 Series; includes IOM channel	58,600	179	1,589	1,379
DHU0803	Document Reader/Sorter; 3 pockets; 830 dpm	31,000	289	859	816
DHU0814	Document Reader/Sorter; 14 pockets; 830 dpm	48,920	382	1,979	1,671
DHU1604	Document Reader/Sorter; 4 pockets; 1625 dpm	51,060	518	1,519	1,337
DHU1608	Document Reader/Sorter; 8 pockets; 1625 dpm	66,240	649	1,893	1,668
DHU1612	Document Reader/Sorter; 12 pockets; 1625 dpm	81,420	777	2,279	2,007
DHU1616	Document Reader/Sorter; 16 pockets; 1625 dpm	96,600	907	2,660	2,339
DHA6002	Addressing for second DHU0803 or DHU0814 document reader/sorter	8,900	28	242	210
DHF6001	Document Handler Channel for DHU1600 document reader/sorter	4,800	6	125	112
DHF6003	Document Handler Channel for DHU0800	4,800	6	125	112
DHF6004	Document Handler Control Console Channel and Adapter	6,160	67	179	155

DATANET 6600 FRONT-END NETWORK PROCESSORS

DCP6678	Processor; includes 128K bytes of memory, system support controller, direct interface adapter, and 6 channel interface bases	190,870	516	4,752	4,506
DCU6661	Processor; includes 64K bytes of memory, system support controller, direct interface adapter; up to 12 channel interface bases	48,005	261	1,722	1,444
DCM6603	Memory increment of 128K to 256K bytes for DCP6678, DCU6651, and Level 66/DPS INP	14,000	109	600	540
DCM6604	Memory increment of 256K to 512K bytes for DCP6678, DCU6651, Level 66/DPS INP, and Level 68/DPS INP	28,000	218	1,200	1,080
DCM6651	Memory increment from 64K to 128K bytes for Level 66/DPS INP, DCU6651, and DCU6641	10,500	82	444	400
DCM6652	Memory increment from 128K to 192K bytes for Level 66/DPS INP or DCU6651; requires DCM6651 and DCE6651	7,000	55	300	270
DCE6651	Performance Enhancement for Level 66/DPS INP and DCU6651; increases performance by 75 percent	37,300	65	1,181	969

OPTIONS FOR DATANET PROCESSORS

DCF6609	Channel Interface Base; accommodates all channel types except HDLC	1,501	8	45	42
DCF6611	Dual Synchronous Channel Package, EIA-RS-232-C	1,450	7	43	39
DCF6612	Dual Asynchronous Channel Package, EIA-RS-232-C	590	4	19	18
DCF6613	Automatic Call Unit, Dual Channel	1,180	4	33	31
DCF6614	MIL-STD 188C Synchronous Channel	1,501	8	45	42
DCF6618	Dual Binary Synchronous Channel Package	1,450	7	43	39
DCF6619	Broadband Channel	3,056	12	86	80
DCF6620	HDLC Voice-Grade Channel	2,573	11	74	69
DCF6621	Bisynchronous Broadband Channel	3,056	12	86	80
DCF6624	Direct Connect Capability, asynchronous	350	1	9	8
DCF6625	Direct Connect Capability, synchronous	480	1	14	12
DCF6627	Broadband Channel, CCITT V.35 to 50,000 bps	3,430	12	96	88
DCF6927	Universal Modem Bypass, Synchronous to Asynchronous; to 20.8K bps	415	11	26	21
DCF6607	Channel Interface Base	1,651	9	53	47
DCF6610	20mA Current Loop-Dual Channel Package	1,180	4	33	31
DCF6615	MIL-STD 188C Asynchronous Dual Channel	1,501	8	45	42
DCF6616	MIL-STD 188C Broadband Channel	1,501	8	45	42
DCF6617	MIL-STD 188C HDLC Channel	2,573	11	74	69
DCF6622	HDLC Broadband Channel	3,056	12	86	80
DCF6623	HDLC Channel, CCITT-V.35	3,430	12	96	88

SOFTWARE PRICES

Series 60 Level 66/DPS		Monthly License	Paid-Up License
SEC6002	Host File Transceiver for Level 6	\$ 11	—
SEC6003	GRTS-II HDLC Support	99	—
SEC6004	NPS BASIC System (Release DP1)	979	—
SEC6005	NPS HDLC Support (DP1/NT2)	99	—
SED6002	Standard Integrated Data Store/II (I-D-S/II)	462	—
SED6004	Interactive I-D-S/II	87	—
SED6005	GCOS Data Management-IV (DM-IV) Basic System	982	—
SED6006	GCOS Data Management-IV (DM-IV) Transaction Processor	1,247	—
SED6007	GCOS Data Management-IV (DM-IV) Query and Reporting Processor	396	—

Honeywell Series 60 Levels 66/DPS and 68/DPS

EQUIPMENT PRICES

PUNCHED CARD EQUIPMENT (Continued)		Purchase Price	Monthly Maint.	Rental (1-year lease)*	Rental (3-Year lease)*
CRF0005	Mark Sense Option for CRU1050	7,416	40	198	171
CCK0401	Retrofit Kit; upgrades PCU0121 to PCU0401	9,562	76	297	295
URA0050	Addressing capability for PCU0121 and PCU0401	4,253	4	140	129
URA0052	Addressing capability for CRU1050	7,569	43	279	261

DOCUMENT HANDLER SUBSYSTEMS

DHP0700	Document Handler Processor for DHU0800/DHU1600 Series; includes IOM	116,000	407	3,189	3,088
DHP0701	Document Handler Processor for DHU0803/0814 and DHU1600 Series; includes IOM channel	58,600	197	1,700	1,553
DHU0803	Document Reader/Sorter; 3 pockets; 830 dpm	31,000	318	919	899
DHU0814	Document Reader/Sorter; 14 pockets; 830 dpm	48,920	420	2,115	1,983
DHU1604	Document Reader/Sorter; 4 pockets; 1625 dpm	51,060	570	1,625	1,564
DHU1608	Document Reader/Sorter; 8 pockets; 1625 dpm	66,240	714	2,026	1,957
DHU1612	Document Reader/Sorter; 12 pockets; 1625 dpm	81,420	855	2,439	2,342
DHU1616	Document Reader/Sorter; 16 pockets; 1625 dpm	96,600	998	2,846	2,736
DHA6002	Addressing for second DHU0803 or DHU0814 document reader/sorter	8,900	31	259	236
DHF6001	Document Handler Channel for DHU1600 document reader/sorter	4,800	7	134	131
DHF6003	Document Handler Channel for DHU0800	4,800	7	134	131
DHF6004	Document Handler Control Console Channel and Adapter	6,160	74	192	180

DATANET 6600 FRONT-END NETWORK PROCESSORS

DCP6678	Processor; includes 128K bytes of memory, system support controller, direct interface adapter, and 6 channel interface bases	103,070	516	5,085	5,073
DCU6661	Processor; includes 64K bytes of memory, system support controller, direct interface adapter; up to 12 channel interface bases	36,605	261	1,843	1,724
DCM6603	Memory increment of 128K to 256K bytes for DCP6678, DCU6651, and Level 66/DPS INP	11,200	109	642	623
DCM6604	Memory increment of 256K to 512K bytes for DCP6678, DCU6651, Level 66/DPS INP, and Level 68/DPS INP	22,400	218	1,284	1,245
DCM6651	Memory increment from 64K to 128K bytes for Level 66/DPS INP, DCU6651, and DCU6641	8,400	82	475	461
DCM6652	Memory increment from 128K to 192K bytes for Level 66/DPS INP or DCU6651; requires DCM6651 and DCE6651	5,600	55	321	311
DCE6651	Performance Enhancement for Level 66/DPS INP and DCU6651; increases performance by 75 percent	29,840	65	1,264	1,173

OPTIONS FOR DATANET PROCESSORS

DCF6609	Channel Interface Base; accommodates all channel types except HDLC	1,501	8	48	47
DCF6611	Dual Synchronous Channel Package, EIA-RS-232-C	1,450	7	52	48
DCF6612	Dual Asynchronous Channel Package, EIA-RS-232-C	590	4	22	21
DCF6613	Automatic Call Unit, Dual Channel	1,180	4	40	38
DCF6614	MIL-STD 188C Synchronous Channel	1,501	8	54	51
DCF6618	Dual Binary Synchronous Channel Package	1,450	7	52	48
DCF6619	Broadband Channel	3,056	12	107	100
DCF6620	HDLC Voice-Grade Channel	2,573	11	91	85
DCF6621	Bisynchronous Broadband Channel	3,056	12	107	100
DCF6624	Direct Connect Capability, asynchronous	350	1	11	11
DCF6625	Direct Connect Capability, synchronous	480	1	15	14
DCF6627	Broadband Channel, CCITT V.35 to 50,000 bps	3,430	12	119	110
DCF6927	Universal Modem Bypass, Synchronous to Asynchronous; to 20.8K bps	415	11	28	28
DCF6607	Channel Interface Base	1,651	9	60	56
DCF6610	20mA Current Loop-Dual Channel Package	1,180	4	40	38
DCF6615	MIL-STD 188C Asynchronous Dual Channel	1,501	8	54	51
DCF6616	MIL-STD 188C Broadband Channel	1,501	8	54	51
DCF6617	MIL-STD 188C HDLC Channel	2,573	11	91	85
DCF6622	HDLC Broadband Channel	3,056	12	107	100
DCF6623	HDLC Channel, CCITT-V.35	3,430	12	119	110

SOFTWARE PRICES

Series 60 Level 66/DPS		Monthly License	Paid-Up License
SEC6002	Host File Transceiver for Level 6	\$ 14	—
SEC6003	GRTS-II HDLC Support	125	—
SEC6004	NPS BASIC System (Release DP1)	1,077	—
SEC6005	NPS HDLC Support (DP1/NT2)	125	—
SED6002	Standard Integrated Data Store/II (I-D-S/II)	584	—
SED6004	Interactive I-D-S/II	96	—
SED6005	GCOS Data Management-IV (DM-IV) Basic System	1,231	—
SED6006	GCOS Data Management-IV (DM-IV) Transaction Processor	1,578	—
SED6007	GCOS Data Management-IV (DM-IV) Query and Reporting Processor	436	—

Honeywell Series 60 Levels 66/DPS and 68/DPS

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*	Rental (5-year lease)*
PROCESSOR OPTIONS (Continued)					
MGS6001	Motor Generator and Control Unit; 31.3 KVA, 60 Hz, 208/440 VAC input	17,750	52	—	—
MGS6002	Motor Generator and Control Unit; 62.6 KVA, 60 Hz, 440/480 VAC input	21,000	63	—	—
MGS6003	Motor Generator and Control Unit; 62.6 KVA, 50 Hz, 380 VAC input	22,150	66	—	—
MGS6004	Motor Generator and Control Unit; 62.6 KVA, 60 Hz, 208 VAC input	21,000	63	—	—
For CPS6723, CPS6730, CPS6750					
PSS6700	Control Unit Power Battery Back-Up	12,000	39	—	—
DCE6700	Initial Synchronous Line Option	10,855	92	—	—
DCE6701	Data Communications Expansion Option	192,206	439	—	—
DCE6702	Data Communications Expansion Module	104,398	256	—	—
	16-User Expansion Feature for Level 66/DPS/B3; includes memory, communications, and addressing elements	188,320	—	—	—
	Additional Expansions	104,040	—	—	—
DCS6700	Data Communications System; includes 256K bytes of memory, direct interface adapter, and slots for multi-line communications processors (MLCP)	61,626	525	—	—
MEMORY OPTIONS					
CMM6021/22	128K words of main memory; max. of two; for CPS6650 only; up to 512K words	55,000	74	1,900	1,725
CMM6013/14	256K words of main memory; max. of two; for CPS6650 and CPS8802; up to 1024K words	110,000	157	3,876	3,519
CMM6023/24	256K words of main memory; max. of two; for CPS6650 only; up to 1536K words	110,000	140	3,800	3,450
CMM6025/26	256K words of main memory; max. of two; for CPS6650 only; up to 2048K words	110,000	140	3,800	3,450
CMM6015/16	512K words of main memory; max. of two; for CPS6650 and CPS8802; from 1024K to 2048K words	220,000	294	7,600	6,900
CMM6017/18	512K words of main memory; max. of two; for CPS8802 only; up to 3072K words	220,000	210	7,600	6,900
CMM6019/20	512K words of main memory; max. of two; for CPS8802 only; up to 4096K words	220,000	210	7,600	6,900
CMA6013/14	Addressing for CMM6013/14 memory; for CPS6650, CPS8802	28,400	77	862	775
CMA6015/16	Addressing for CMM6015/16 memory; for CPS6650, CPS8802	56,800	143	1,691	1,519
CMA6023/24	Addressing for CMM6023/24 memory; for CPS6650 only	28,400	68	845	760
CMA6025/26	Addressing for CMM6025/26 memory; for CPS6650 only	28,400	68	845	760
CMA6017/18	Addressing for CMM6017/18 memory; for CPS8802 only	56,800	143	1,691	1,519
CMA6019/20	Addressing for CMM6019/20 memory; for CPS8802 only	56,800	143	1,691	1,519
MASS STORAGE					
MSP0604	Integrated Single Channel Mass Storage Processor	39,000	108	1,275	1,053
MSP0607	Free-standing Single Channel Mass Storage Processor	44,000	123	1,440	1,190
MSP0608	Dual Channel Mass Storage Processor; one free-standing and one integrated module	62,500	168	2,039	1,683
MSP0609	Dual Channel Mass Storage Processor; two free-standing modules	62,500	168	2,039	1,683
MSU0400	Removable-Disk Mass Storage Unit, 100M bytes	16,500	122	647	548
MSU0402	Removable-Disk Mass Storage Unit, 100M bytes	20,805	113	703	612
MSU0451	Disk Mass Storage Unit, 200M bytes; requires MXF6002 IOM data rate expansion and includes rotational position sensing	27,047	113	922	768
MXF6002	IOM Data Rate Expansion Unit	23,720	45	580	516
MSK4025	Upgrade Kit from MSU0402 to MSU0451	6,242	—	273	236
MSF0006	Dual Access Feature for MSU0402/0451	2,070	13	70	61
MSF0007	Rotational Position Sensing Option for MSU0402/0451	2,025	13	69	61
MSF1023	Device Adapter for MSU0402/0451	11,475	32	342	276
MSU0500	Dual Fixed Disk Mass Storage Unit, 626 million bytes; includes disk and RPS	37,000	172	1,279	1,069
MSU0501	Dual Spindle Fixed Disk Drive; 1.1 billion bytes	49,650	197	1,683	1,401
MSK0501	Upgrade Kit; MSU0500 to MSU0501	12,650	25	350	301
MSF0011	Dual Access Feature for MSU0500	4,140	23	146	123
MSF1024	Device Adapter for MSU0500	20,000	30	607	524
MSF1034	Drive Expansion for MSU0500; required for more than 8 MSU0500's	12,690	14	335	308
MSF1037	Device Adapter for MSU0500	—	—	—	—
MAGNETIC TAPE EQUIPMENT					
MTP0610	Magnetic Tape Processor; max. 1 x 8; includes IOM channel; for MTU0400/0411 0412/0500/0610	29,400	147	997	860
MTF1141	Dual Simultaneous Channel; adds 2nd channel to MTP0610	44,352	149	1,412	1,220
MTU0410	Magnetic Tape Unit (75 ips)	12,410	89	416	389
MTU0411	Additional Magnetic Tape Unit for MTU0412 (75 ips)	11,473	112	386	336
MTU0412	Magnetic Tape Unit, Cluster of Two (75 ips)	22,946	226	772	672

Honeywell Series 60 Levels 66/DPS and 68/DPS

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*	Rental (3-Year lease)*
PROCESSOR OPTIONS (Continued)					
MGS6001	Motor Generator and Control Unit; 31.3 KVA, 60 Hz, 208/440 VAC input	17,750	65	416	403
MGS6002	Motor Generator and Control Unit; 62.6 KVA, 60 Hz, 440/480 VAC input	21,000	78	500	484
MGS6003	Motor Generator and Control Unit; 62.6 KVA, 50 Hz, 380 VAC input	22,150	81	526	512
MGS6004	Motor Generator and Control Unit; 62.6 KVA, 60 Hz, 208 VAC input	21,000	78	500	484
For CPS6723, CPS6730, CPS6750					
PSS6700	Control Unit Power Battery Back-Up	12,000	39	—	—
DCE6700	Initial Synchronous Line Option	10,855	92	—	—
DCE6701	Data Communications Expansion Option	192,206	439	—	—
DCE6702	Data Communications Expansion Module	104,398	256	—	—
	16-User Expansion Feature for Level 66/DPS/B3; includes memory, communications, and addressing elements	188,320	—	—	—
	Additional Expansions	104,040	—	—	—
DCS6700	Data Communications System; includes 256K bytes of memory, direct interface adapter, and slots for multi-line communications processors (MLCP)	61,626	525	—	—
MEMORY OPTIONS					
CMM6021/22	128K words of main memory; max. of two; for CPS6650 only; up to 512K words	55,000	74	2,135	2,114
CMM6013/14	256K words of main memory; max. of two; for CPS6650 and CPS8802; up to 1024K words	110,000	157	4,355	4,313
CMM6023/24	256K words of main memory; max. of two; for CPS6650 only; up to 1536K words	110,000	140	4,269	4,229
CMM6025/26	256K words of main memory; max. of two; for CPS6650 only; up to 2048K words	110,000	140	4,269	4,229
CMM6015/16	512K words of main memory; max. of two; for CPS6650 and CPS8802; from 1024K to 2048K words	220,000	294	8,539	8,463
CMM6017/18	512K words of main memory; max. of two; for CPS8802 only; up to 3072K words	220,000	210	8,539	—
CMM6019/20	512K words of main memory; max. of two; for CPS8802 only; up to 4096K words	220,000	210	8,539	—
CMA6013/14	Addressing for CMM6013/14 memory; for CPS6650, CPS8802	28,400	77	968	939
CMA6015/16	Addressing for CMM6015/16 memory; for CPS6650, CPS8802	56,800	143	1,900	1,841
CMA6023/24	Addressing for CMM6023/24 memory; for CPS6650 only	28,400	68	949	921
CMA6025/26	Addressing for CMM6025/26 memory; for CPS6650 only	28,400	68	949	921
CMA6017/18	Addressing for CMM6017/18 memory; for CPS8802 only	56,800	143	1,900	—
CMA6019/20	Addressing for CMM6019/20 memory; for CPS8802 only	56,800	143	1,900	—
MASS STORAGE					
MSP0604	Integrated Single Channel Mass Storage Processor	45,000	108	1,505	1,397
MSP0607	Free-standing Single Channel Mass Storage Processor	50,000	123	1,802	1,675
MSP0608	Dual Channel Mass Storage Processor; one free-standing and one integrated module	62,500	168	2,100	1,955
MSP0609	Dual Channel Mass Storage Processor; two free-standing modules	62,500	168	2,268	2,109
MSU0400	Removable-Disk Mass Storage Unit, 100M bytes	16,500	122	740	694
MSU0402	Removable-Disk Mass Storage Unit, 100M bytes	20,805	113	815	763
MSU0451	Disk Mass Storage Unit, 200M bytes; requires MXF6002 IOM data rate expansion and includes rotational position sensing	27,047	113	1,056	985
MXF6002	IOM Data Rate Expansion Unit	23,720	47	621	600
MSK4025	Upgrade Kit from MSU0402 to MSU0451	6,242	—	312	285
MSF0006	Dual Access Feature for MSU0402/0451	2,070	13	82	77
MSF0007	Rotational Position Sensing Option for MSU0402/0451	2,025	13	81	76
MSF1023	Device Adapter for MSU0402/0451	11,475	32	392	357
MSU0500	Dual Fixed Disk Mass Storage Unit, 626 million bytes; includes disk and RPS	37,000	181	1,336	1,248
MSU0501	Dual Spindle Fixed Disk Drive; 1.1 billion bytes	49,650	197	1,747	1,629
MSK0501	Upgrade Kit; MSU0500 to MSU0501	10,800	25	361	336
MSF0011	Dual Access Feature for MSU0500	4,140	23	163	152
MSF1024	Device Adapter for MSU0500	20,000	30	694	630
MSF1034	Drive Expansion for MSU0500; required for more than 8 MSU0500's	12,690	14	335	308
MSF1037	Device Adapter for MSU0500	—	—	—	—
MAGNETIC TAPE EQUIPMENT					
MTP0610	Magnetic Tape Processor; max. 1 x 8; includes IOM channel; for MTU0400/0411 0412/0500/0610	29,400	162	1,080	1,010
MTF1141	Dual Simultaneous Channel; adds 2nd channel to MTP0610	44,352	164	1,549	1,443
MTU0410	Magnetic Tape Unit (75 ips)	12,410	128	425	408
MTU0411	Additional Magnetic Tape Unit for MTU0412 (75 ips)	11,473	156	514	487
MTU0412	Magnetic Tape Unit, Cluster of Two (75 ips)	22,946	314	1,030	976

Honeywell Series 60 Levels 66/DPS and 68/DPS

► Manufacturing Applications

Honeywell Manufacturing System (HMS)
Inventory Record Management Module
Manufacturing Data Control Module
Material Requirements Planning Module
Master Production Scheduling Module
Statistical Forecasting Module
Capacity Requirements Planning Module
Automatically Programmed Tools (APT)

Distribution Applications

PROFIT (Inventory Control)
Point of Sale System

Management Science Application Programs

Mathematical Programming System (MPS)
BMDP Statistical Programs
SPSS Statistical Package
IMSL Math/Statistics Library
Project Management and Control System (PMCS)
GPSS Simulation System
Numerically Integrated Elements for Systems Analysis-
(NISA) (Structured Analysis)
Polo Finite (Structural Analysis)
Coordinate Geometry (COGO)
Concordance Generator Program

Financial Applications

General Ledger
Accounts Payable
Accounts Receivable
Payroll

Miscellaneous Application Programs

Individualized Mathematics Instruction/66 (IMS/66)
SCRIBE/66 Student Scheduling System
HCSS/66 (Hospital Computer Sharing System)
ROLIN (Rapid On-Line Information Network)
Employment Security Application Packages

EDUCATION SUPPORT

Large Systems Marketing Education Support

PRICING

EQUIPMENT: The following systems are representative of the different Level 66/DPS and 68/DPS configurations possible.

TYPICAL LEVEL 66/DPS-520 SYSTEM: Consists of a CPS6643 central processor with 256K words (one megabyte) of main memory, IOM with 18 channel slots, SCU, a CSU6601 console with 120-cps printer, one MSP0607 mass storage processor, one MSU0451 disk drive (200 megabytes), one MTP0610 tape processor with one 125-ips MTU0500 tape drive, one URP0600 unit record processor with one PRU1200 line printer (1200 lpm), a CRU0501 card reader (500 cpm), and one PCU0300 card punch (300 cpm). The purchase price is \$653,895, monthly maintenance is \$3,171, and the five-year lease price per month is \$16,194.

TYPICAL LARGE SCALE LEVEL 66/DPS SYSTEM: Includes a CPS6650 central system with two central processors, 1024K words (four megabytes) of main memory, performance level 3, one SCU, one IOM with 35 channel slots, 2 system consoles each with a 120-cps printer, one MSP-0609 mass storage processor, four MSU0500 disk drives (2.5 gigabytes), four MSU0451 disk drives (800 megabytes), one MTP0610 tape processor, four MTU0610 200-ips tape drives, one URP0600 unit record processor, one PRU1600 line printer (1600 lpm), one CRU1050 card reader (1050 cpm), one PCU0300 card punch (300 cpm), one Datamet

6661 FNP with four Channel Interface Bases. The purchase price is \$2,838,230, the monthly maintenance is \$11,062, and the five-year lease price per month is \$74,446.

TYPICAL LARGE SCALE LEVEL 68/DPS SYSTEM: Includes a CPS8802 dual-processor central system, 2048K words (eight megabytes) of main memory, performance level 4, one SCU, one IOM with 35 channel slots, 2 system consoles each with a 120-cps printer, and the same complement of peripherals as the above Level 66/DPS system. The purchase price is \$4,482,590, the monthly maintenance is \$12,805, and the five-year lease price per month is \$109,118.

SUPPORT: Honeywell offers six categories of support products for Level 66/DPS and 68/DPS systems. These products include data services, system engineering, software, education, publications, and supplies.

Data services consist of machine time for predelivery production and checkout, and for overload/peakload situations. Processor time costs approximately \$110.00 per hour, minimum, depending on the amount of memory. Charges for on-line peripherals vary from \$4.00 to \$12.80 per hour; for off-line peripherals, \$10.90 to \$29.10 per hour.

System engineering falls into one of five billable support categories, as described in the following table. Field engineering managers are responsible for the degree of skill required to perform the job:

	Hourly Rates (4 hr. min.)
Principal or senior technical consultant	\$98
Project supervisor or technical consultant	80
Technical specialist	72
Systems analyst/senior programmer	60
Programmer	42

Monthly charges are 140 times the hourly rates. These rates do not include supplies.

The GCOS operating system executive (OSE) is provided to Level 66/DPS users at no additional cost. All other facilities, such as job management, file systems, conversion aids, language processors, utilities, applications packages, communications software, system maintenance, and system performance analysis are separately priced.

Educational services include standard courses, advanced professional training, and self-instruction. Prices vary from \$90 to \$1,400 for all services except self-instruction. All self-instruction material except the self-instruction laboratory program can be purchased, while some can be rented. Fees for purchase of this material vary from \$11.00 to \$1,696. Rental prices, when available, vary from \$30 to \$100. Self-instruction laboratory program courses are available at \$40 to \$165 per student.

CONTRACT TERMS: Level 66/DPS and 68/DPS equipment is available for purchase or for rental under a 1-year, 3-year, or 5-year lease. The basic monthly rentals entitle the user to unlimited central processor usage per month with on-call remedial maintenance between the hours of 8 a.m. and 6 p.m. on Mondays through Fridays. For scheduled usage beyond this period, with on-call maintenance service, the user pays an additional charge which is a fixed percentage of the monthly maintenance charge. Alternatively, the user can obtain on-call maintenance service at standard hourly rates of \$45 per man-hour.

Honeywell's Distributed Maintenance Services provides users with remote testing and diagnostic facilities. DMS includes a Response Center for toll-free 24-hour a day contact with Honeywell; the Technical Assistance Center, ►

Honeywell Series 60 Levels 66/DPS and 68/DPS

► Manufacturing Applications

Honeywell Manufacturing System (HMS)
Inventory Record Management Module
Manufacturing Data Control Module
Material Requirements Planning Module
Master Production Scheduling Module
Statistical Forecasting Module
Capacity Requirements Planning Module
Automatically Programmed Tools (APT)

Distribution Applications

PROFIT (Inventory Control)
Point of Sale System

Management Science Application Programs

Mathematical Programming System (MPS)
BMDP Statistical Programs
SPSS Statistical Package
IMSL Math/Statistics Library
Project Management and Control System (PMCS)
GPSS Simulation System
Numerically Integrated Elements for Systems Analysis-
(NISA) (Structured Analysis)
Polo Finite (Structural Analysis)
Coordinate Geometry (COGO)
Concordance Generator Program

Financial Applications

General Ledger
Accounts Payable
Accounts Receivable
Payroll

Miscellaneous Application Programs

Individualized Mathematics Instruction/66 (IMS/66)
SCRIBE/66 Student Scheduling System
HCSS/66 (Hospital Computer Sharing System)
ROLIN (Rapid On-Line Information Network)
Employment Security Application Packages

EDUCATION SUPPORT

Large Systems Marketing Education Support

PRICING

EQUIPMENT: The following systems are representative of the different Level 66/DPS and 68/DPS configurations possible.

TYPICAL LEVEL 66/DPS-520 SYSTEM: Consists of a CPS6643 central processor with 256K words (one megabyte) of main memory, IOM with 18 channel slots, SCU, a CSU6601 console with 120-cps printer, one MSP0607 mass storage processor, three MSU0451 disk drive (600 megabytes), one MTP0610 tape processor with two 125-ips MTU0500 tape drives, one URP0600 unit record processor with one PRU1200 line printer (1200 lpm), a CRU0501 card reader (500 cpm), and one PCU0121 card punch (100-400 cpm). The purchase price is \$731,345, monthly maintenance is \$3,706, and the three-year lease price per month is \$23,117.

TYPICAL LARGE SCALE LEVEL 66/DPS SYSTEM: Includes a CPS6650 central system with two central processors, 1024K words (four megabytes) of main memory, performance level 3, one SCU, one IOM with 35 channel slots, 2 system consoles each with a 120-cps printer, one MSP0609 mass storage processor, four MSU0500 disk drives (2.5 gigabytes), four MSU0451 disk drives (800 megabytes), one MTP0610 tape processor, eight MTU0610 200-ips tape drives, one URP0600 unit record processor, two PRU1600 line printers (1600 lpm), one CRU1050 card reader (1050 cpm), and one Datanet 6661 FNP with four Channel

Interface Bases. The purchase price is \$3,036,278, the monthly maintenance is \$12,353, and the three-year lease price per month is \$102,706.

TYPICAL LARGE SCALE LEVEL 68/DPS SYSTEM: Includes a CPS8802 dual-processor central system, 2048K words (eight megabytes) of main memory, performance level 4, one SCU, one IOM with 35 channel slots, 2 system consoles each with a 120-cps printer, and the same complement of peripherals as the above Level 66/DPS system. The purchase price is \$4,680,638, the monthly maintenance is \$14,096, and the one-year lease price per month is \$148,537.

SUPPORT: Honeywell offers six categories of support products for Level 66/DPS and 68/DPS systems. These products include data services, system engineering, software, education, publications, and supplies.

Data services consist of machine time for predelivery production and checkout, and for overload/peakload situations. Processor time costs approximately \$110.00 per hour, minimum, depending on the amount of memory. Charges for on-line peripherals vary from \$4.00 to \$12.80 per hour; for off-line peripherals, \$10.90 to \$29.10 per hour.

System engineering falls into one of five billable support categories, as described in the following table. Field engineering managers are responsible for the degree of skill required to perform the job:

	Hourly Rates	Monthly Rates
Principal or senior technical consultant	\$125	\$17,431
Project supervisor or technical consultant	102	14,230
Technical specialist	91	12,807
Systems analyst/senior programmer	77	10,672
Programmer	54	7,471

Hourly charges are for a four-hour minimum. The monthly rates do not include supplies.

The GCOS operating system executive (OSE) is provided to Level 66/DPS users at no additional cost. All other facilities, such as job management, file systems, conversion aids, language processors, utilities, applications packages, communications software, system maintenance, and system performance analysis are separately priced.

Educational services include standard courses, advanced professional training, and self-instruction. Prices vary from \$90 to \$1,400 for all services except self-instruction. All self-instruction material except the self-instruction laboratory program can be purchased, while some can be rented. Fees for purchase of this material vary from \$11.00 to \$1,696. Rental prices, when available, vary from \$30 to \$100. Self-instruction laboratory program courses are available at \$40 to \$165 per student.

CONTRACT TERMS: Level 66/DPS and 68/DPS equipment is available for purchase or for rental under a 1-year, 3-year, or 5-year lease. The basic monthly rentals entitle the user to unlimited central processor usage per month with on-call remedial maintenance between the hours of 8 a.m. and 6 p.m. on Mondays through Fridays. For scheduled usage beyond this period, with on-call maintenance service, the user pays an additional charge which is a fixed percentage of the monthly maintenance charge. Alternatively, the user can obtain on-call maintenance service at standard hourly rates of \$125 per man-hour.

Honeywell's Distributed Maintenance Services provides users with remote testing and diagnostic facilities. DMS includes a Response Center for toll-free 24-hour a day contact with Honeywell; the Technical Assistance Center. ►

Honeywell Series 60 Levels 66/DPS and 68/DPS

► retrieve the desired data and process exception conditions such as no data qualifier and end of retrieval conditions. The optional DM-IV Procedural Language Processor (PLP) is an extension of QRP which provides a high-level, procedure-oriented language for use by application and system programmers. When using the QRP end-user facilities, the user need not be concerned with the data base structure or access methods.

The File Management Supervisor (FMS) provides powerful file management capabilities, including multi-level user catalogs, file sharing, and access control. The system employs a hierarchical, "tree-structured" design. A System Master Catalog lists the various user Master Catalogs, and each user may in turn define one or more levels of sub-catalogs. Users may permit general sharing of their files or specify individual users who may access them on either a read/write or read-only basis. Password access control can be imposed at any or all levels of the file structure. Security is also provided by the optional logging of file access attempts and by a time-sharing command allowing a user to encrypt his file using a predefined algorithm.

The Indexed-Sequential Processor (ISP) supports the widely used indexed-sequential file organization and access method, which permits mass-storage files to be accessed in either random or sequential fashion. For each logical file, ISP maintains a data file and an independent key file, which serves as an index. The key file can be placed on a faster random-access device to speed up to the access process.

The Unified File Access System (UFAS) provides automatic management for file processing, including record location and automatic blocking and deblocking. File organizations supported include sequential, relative, indexed, and integrated files. UFAS also includes facilities for error checking and initiation of error processing as defined by ANS COBOL-74, and file integrity protection for normal and abort processing.

Integrated Data Store (I-D-S/I and I-D-S/II) are enhanced versions of I-D-S, a data base management system originally developed by GE. I-D-S/II marks the beginning of an evolution of I-D-S toward conformance with the recommendations of the CODASYL Data Base Task Group. I-D-S/II is fully integrated with Honeywell's COBOL-74 compiler, and user interfaces are also implemented for FORTRAN. I-D-S/II is described in detail in Report 70E-480-01.

Management Data Query System (MDQS) is a data management system that permits interrogation of sequential, indexed sequential, or I-D-S/I file organizations. MDQS operates as a subsystem to GCOS in both batch and time-sharing environments, and is available in two versions: MDQS/II, a data based retrieval and report generation system, and MDQS/IV, a system that offers all MDQS/II capabilities plus data base creation and maintenance features.

TOTAL Central is a widely used proprietary data base management system that uses data set relationships to establish a network structure among records in different data files in an integrated and nonredundant manner. TOTAL Central's network structure provides the ability to directly interrelate a data record with up to 2,500 other data record types in the data base.

The TOTAL Central system design supports data dependence; only the data elements used by a program need be described for that program. New data elements and records may be added to the data base without affecting existing programs. The TOTAL system is described in detail in Report 70E-132-01.

The Shared Mass Storage (SMS) facility of GCOS allows up to four independent Level 66/DPS systems to share all their permanent (non-removable) mass storage devices,

thereby sharing the data base. The systems in a shared mass storage configuration share a common scheduling queue, allowing load leveling between the systems.

HEALS II: The Honeywell Error Analysis and Logging System is a software system that works in conjunction with TOLT, GCOS, and the Level 66/DPS fault recovery hardware. The Instruction Retry feature attempts to recover from transient errors such as incompleting operations, parity errors, and illegal procedures. The proper Error Analysis and Logging module is called in when a processor or memory module error is detected. After analysis and logging, either the faulted instruction is retried or normal GCOS fault processing procedures continue. The Error Reporting Program is initiated when a hardware error occurs, when the error log becomes half full, or at operator request. Each error record is printed, analyzed, and summarized, with summary data retained on an error summary file.

TOTAL ON-LINE TESTING: TOLT is a test and diagnostic system that runs under GCOS. Its objective is to improve the system's reliability and availability through the use of on-line preventative and corrective maintenance techniques. TOLT monitors and saves all error status information, makes periodic surveillance checks of various hardware modules, and calls in specific diagnostic tests and on-line troubleshooting programs.

MULTICS SOFTWARE

The Level 68/DPS computer system uses Honeywell's Multics operating system. Multics is a specially designed virtual memory operating system that offers remote terminal access as the primary means of entering the system, multiprocessing with dynamic reconfiguration capabilities, and a unique hardware-based ring structure that provides security for sharing of programs and data. It also has a tree-structured hierarchy for organization of user and system storage, and the availability of multiple programming environments and user interfaces within a single system. It accommodates batch and time-sharing applications, similar to GCOS, and is written primarily in PL/1.

Information in the Multics system's virtual memory is organized in variable-length segments. Each segment can contain either programs or data or can be a directory, i.e., a catalog of related segments represented in tree structure. Segments are directly addressable by a symbolic name. The Multics hardware uses a segment descriptor to determine the absolute address of the segment and its access attributes. Any word, character, or bit within a segment can be referenced by its location within the segment. Segments can reside anywhere in main memory and can alter their size independently of other segments.

Multics uses demand paging to determine which portions of a segment are to be present in main memory. Segments are automatically divided into fixed-size pages of 1024K words, and paging is performed automatically by the Multics hardware, so that only the currently accessed pages of a segment are required in main memory.

All input/output operations are performed automatically by Multics. The programmer is required to supply the symbolic name of the segment and the address of the desired item within the segment, or the relative address stated in the terminology of a higher-level language. A device-independent input/output system is available that permits interchangeable reading and writing on magnetic tapes, communication terminals, cards, printers, and storage system segments through the use of symbolic names. User output can be automatically queued for printer or punched card output. User-written input/output routines can also be accommodated by the system.

Controlled sharing of programs and data is facilitated by the Multics ring structure, a unique security scheme that is implemented as an integral part of the segmentation and ►

Honeywell Series 60 Levels 66/DPS and 68/DPS

► The TDS Transaction Manager controls and coordinates all activities during the processing of a transaction. It initiates each transaction control task which TDS processes and controls the communication between application routines.

The Data Base Manager controls all data base activities for on-line files assigned to TDS. The executive software also provides for dynamic allocation and deallocation of data base files to TDS for continuous, uninterrupted operation.

The TDS System Integrity Manager provides for fast, automatic recovery and restart after any type of application or system failure.

The TDS Message Manager is the executive software component that actually handles the communication interface with the terminal network supported by the Front-End Network Processor (FNP). The Message Manager provides both the physical and logical interface to the on-line network of terminals, handles the acceptance and delivery of input and output messages, and interfaces with any Level 66/DPS Front-End Network Processor running under the Network Processing Supervisor (NPS) or Remote Terminal Supervisor-II (GRTS-II).

TIME-SHARING: The Level 66/DPS Time-Sharing System (TSS), in connection with a Datnet front-end processor, provides time-sharing computing services to multiple users at remote terminals. The system resources allocated to time-sharing can be dynamically varied under operator control. The time-sharing executive, operating as a slave activity under GCOS, suballocates storage and dispatches the processor to the programs of individual time-sharing users. In multiple-processor systems, the time-sharing users' programs can simultaneously use as many processors as desired by the site. The executive also performs various services for the time-sharing programs, including I/O control, file creation, cataloging, storage protection, and resource accounting.

A separately priced Multicopy Support Option allows from two to four copies of the time-sharing executive to run on one Level 66/DPS system, thereby increasing the number of users that can be supported.

Level 66/DPS GCOS time-sharing users have a choice of six major programming languages: COBOL-74, Extended BASIC, Time-Sharing FORTRAN, Time-Sharing JOVIAL, APL, and Time-Sharing ALGOL. Time-sharing users can communicate directly with batch-mode facilities, permitting the development and testing of programs, data entry, control of batch program execution, and manipulation of results from remote terminals.

The Text Editor permits terminal users to create a body of text, edit it, save it, and print it in a specified format. TEX is an interpretive language that integrates the capabilities of the Text Editor with text processing, providing additional verbs and subroutine calls.

Interactive Integrated Data Store/II (I-D-S/II) provides the ability to interactively update and retrieve information from an I-D-S/II data base. Access is a conversational file management system for creating, deleting, and maintaining catalogs and files and for assigning passwords and accessing criteria. The FDUMP facility can be used for inspection and maintenance of permanent files. The LODT routine permits execution of experimental user subsystems, including trace analysis and debugging of user programs from remote terminals. The Time-Sharing Activity Report provides reports on the accumulated utilization of the time-sharing system resources.

The Time-Sharing system includes several user aids, including the HELP command to provide a detailed explanation of system error messages; a Command Loader for storing and accessing new subsystems; Command File Processing, a non-interactive processing mode in which user responses to

terminal input requests are obtained from a file; and Deferred Processing, in which a predefined input file is used for responses and the resulting dialog is directed to an output file.

LANGUAGES: The language processors available for use on the Level 66/DPS systems under GCOS are COBOL-74, FORTRAN IV, PL/1, GMAP, GPSS, BASIC, data-BASIC, SIMSCRIPT, PASCAL, Compiler "B," LISP, APL/66, and RPG-II.

The COBOL-74 compiler provides the functional modules specified for ANS COBOL-74, including the Debug, Sort/Merge, and Report Writer facilities. All modules are implemented on Level 2 except Report Writer and Inter-program Communication, which are implemented on Level 1. COBOL-74 uses ASCII as the standard internal code set and accommodates package decimal and 16-, 32-, and 36-bit binary standard numeric representations. Additional features include a communications facility that permits development and debugging of programs by remote users, support for the Data Manipulation Language specified by the CODASYL Data Base Language Task Group, support for relative and indexed I/O files, and alternative record key addressing for indexed sequential files. Program calls to programs written in other higher-level languages can be recognized and compiled.

FORTRAN is a full implementation of ANSI FORTRAN IV with extensions. The extensions include nonstandard returns from subroutines; optional code optimization; multiple entry points; switch test subroutines; memory-to-memory conversion; seven array dimensions; character type; generalized expressions as subscripts; extended TYPE, PARAMETER, and IMPLICIT statements; list-directed and direct-access I/O; mixed-mode arithmetic; quoted character constants; and Boolean functions. The FORTRAN processor compiles programs in local, remote job entry, or time-sharing mode and ensures compatibility between source programs developed in one environment and used in another. FORTRAN offers free-form format with or without line numbers. The compiler is also capable of handling argument validation for built-in functions and random file input/output functions. Both ASCII and BCD character sets are supported. An optional enhancement includes the Data Manipulation Language (DML) for support of DM-IV Data Manager-controlled data base files.

PL/1 is a block-structured language that allows both internal and external names. This feature facilitates the development and maintenance of modular PL/1 programs. All procedures are recursive and sharable. PL/1 utilizes the full ASCII character set defined in American National Standards Institute standard X3.4-1968. Both upper case and lower case letters can be used to form names up to 256 characters long. The BCD character set can be utilized through transparency features.

BASIC is a one-pass conversational compiler that operates under the GCOS Time-Sharing System. It implements the BASIC language plus several Honeywell extensions. Among the facilities included are built-in mathematical functions, a matrix operations package, string manipulations, BCD file input-output, subroutine CALL, and formatted printing and chaining.

DataBASIC is a version of BASIC employing the I-D-S/II file management system. DataBASIC is supported by both time-sharing and batch component subsystems. Time-sharing subsystems include Create, which reserves space for a data base of a size determined by user-supplied parameters; a component that analyzes and reports the percentage of space used in a data base, in detail or in summarized form; and a component that verifies the integrity of a data base, reports the quantities of various entities contained in it, and releases the space occupied by a data base. Batch subsystems include Load, a component that builds a data base from an external input file and/or a file produced by a

Honeywell Series 60 Levels 66/DPS and 68/DPS

► Each processor can operate with either the Remote Terminal Supervisor-II (GRTS-II) or the Network Processing Supervisor (NPS) software systems.

DATANET 6661 FNP: This processor (DCU6661) is also designed for use with Level 66/DPS and 68/DPS systems. It has 64K bytes of memory, expandable to 512K bytes, and a maximum of 12 Channel Interface Bases. The DATANET 6661 has two performance upgrades; the first one a 47 percent increase, and the second an additional 82 percent boost. The second performance increase includes the addition of a cache memory to the DATANET 6661. Up to four processors can be configured in a Level 68/DPS system, up to eight in Level 66/DPS systems, and a maximum of two in the DPS-440 and -520.

DATANET 6678 FNP: Another high-speed processor available for Level 66/DPS (except the DPS-440 and -520) and 68/DPS systems is the DATANET 6678 system (DCP6678). It has 128K bytes of memory, expandable to 512K bytes, and includes as standard a high-speed cache memory. Up to 12 Channel Interface Bases can be connected.

LEVEL 66/DPS/B AND 66/DPS/C COMMUNICATIONS PROCESSOR (DCS6700): The three CP-6 systems have a free-standing communications processor similar to the DATANET processors. The DCS6700 is based on a Honeywell Level 6 minicomputer (Model 6/47, CPS9566). Access to the host system is via a Direct Memory Access unit that connects to the host IOM. Data transfer rates up to 800K bytes per second are possible. Remote devices and additional communications processors are attached to the controller via a Multi-Line Communications Processor (MLC9103) each of which has a capacity of eight asynchronous or synchronous lines. The MLCP is similar in operation to the DATANET Channel Interface Base. The 66/DPS/B3 has a maximum of 80 lines using 10 MLCPs. The 66/DPS/C3 has up to 120 lines using 15 MLCPs. The 66/DPS/C5 can accommodate up to 200 lines via two communications processors and 25 MLCPs. Each DCS6700 has 256K bytes of memory, and can increase to 2048K bytes in 64K increments. Remote communications processors can be interfaced to each local DCS6700 and offer the same services as a local processor. Data is transferred between each communications processor using a high speed HDLC synchronous link. Unit record peripherals can be attached to any local or remote communication processor and are treated as a host-connected peripheral device.

The Channel Interface Base (CIB) and the Multi-Line Communications Processor (MLCP) provide the line interfacing arrangements necessary to accommodate terminals with various data transfer rates, bit orders, bits per character, information codes, character sets, message formats and communications control procedures. Terminals in the low, medium, and high speed ranges can be supported, with maximum of 72,000 bps possible. In addition, synchronous and asynchronous transmissions and any combination of half and full duplex modes are supported. Each CIB and MLCP can handle up to eight communications lines.

The CIB accepts up to four (except as noted) of the communications channels listed below, in any combination. The MLCP can accept up to eight channels and does not support any MIL-STD 188C communications:

- Channel Interface, Asynchronous 20mA Current Loop (DCF6610)—dual channel up to 9600 bps.
- Channel Interface, Dual Synchronous EIA RS-232-C (DCF6611)—dual channel package up to 9600 bps each.
- Channel Interface, Dual Asynchronous EIA RS-232-C (DCF6612)—dual channel package up to 9600 bps each.
- Channel Interface, Auto Call Units (DCF6613)—dual channel Auto Call Units.
- Channel Interface, Synchronous MIL-STD 188C (DCF-6614)—one channel up to 10,800 bps.
- Channel Interface, Dual Asynchronous MIL-STD 188C (DCF6615)—dual channel package up to 9600 bps each.
- Channel Interface, Broad Band MIL-STD 188C (DCF-6616)—one channel up to 72,000 bps.
- Channel Interface, HDLC MIL-STD 188C (DCF6617)—one channel up to 9600 bps.
- Channel Interface, Dual Bisynchronous (DCF6618)—dual channel package up to 10,800 bps each.
- Channel Interface, Broad Band (DCF6619)—one channel up to 72,000 bps.
- Channel Interface, HDLC Voice Grade (DCF6620)—one channel up to 10,800 bps.
- Channel Interface, Bisynchronous Broad Band (DCF-6621)—single channel up to 72,000 bps.
- Channel Interface, HDLC Broad Band (DCF6622)*—one channel up to 72,000 bps.
- Channel Interface HDLC CCITT, V.35 (DCF6623)*—one channel up to 72,000 bps.
- Channel Interface, Broad Band CCITT, V.35 (DCF-6627)—one channel up to 72,000 bps.

*This Channel Interface Option requires two options on the Channel Interface Base and Multi-Line Communications Processor.

SOFTWARE

The Level 66/DPS operating system is the General Comprehensive Operating Supervisor (GCOS), the Level 68/DPS uses the virtual-memory Multics operating system, and the Xerox-based Level 66/DPS/B3, /C3, and /C5 systems all use the CP-6 operating system.

LEVEL 66 GCOS: This integrated operating system has facilities for controlling concurrent local batch processing, on-line transaction processing, and time-sharing.

GCOS handles local and remote batch jobs in the same manner except for the input and output routines they use. User jobs can enter the system simultaneously from multiple local and remote terminals. Jobs entering the system are routed to a System Scheduler, which permits a large number of jobs (limited by available direct-access storage) to be queued in up to 50 installation-designated jobstreams. These jobs are initiated by assigned job class, by highest priority within the class, and on a first-in, first-out basis among jobs of equal priority.

Jobs are passed from the GCOS System Scheduler to the Allocation Queue according to their relative priorities. Each job is scanned for overall peripheral and main memory requirements, and jobs that exceed the configuration capabilities are deleted from the system. Jobs with resource requirements exceeding installation-established limits are initiated only with operator intervention. Installation resource limits may be dynamically altered during processing to permit biasing the system toward execution of small jobs.

Honeywell Series 60 Levels 66/DPS and 68/DPS

► ing those files to run on the Level 68/DPS. Conversion of 360 COBOL files has been fairly difficult, he told us, but PL/I programs are much easier, since Multics is written largely in PL/I. Security is a big consideration at the school, and Multics has provided them with greater security than their previous system.

Our last call was to a northeast government agency that uses a Level 66 Model 40 for batch and on-line applications. After evaluating several vendors, he replaced an IBM 360/40 with the Level 66. He is very pleased with the system, reporting that it typically has 99 percent up time. The only item he needs is a tape management system, and is presently evaluating the available packages. □

► track processing. The MSP0607 is a single-channel, free-standing unit. The MSP0609 is a dual-channel device, consisting of two free-standing units. The MSP0607 can be configured for up to 16 MSU0400/0402/0451 disk drives or 8 MSU0500/0501 drives, plus several mixed combinations. The MSP0604 is an integrated version of the MSP0607. The MSP0608 is an integrated/free-standing version of the MSP0609. CP-6 systems do not support the MSU0400 or MSU0500.

MSU0400/0402 MASS STORAGE UNIT: Provides formatted storage for 78 million 9-bit bytes (117 million 6-bit characters) on one Honeywell Type 4451 removable disk pack, whose 12 disks have 19 recording surfaces with 41 tracks, including 7 spares, per surface. There are 40 sectors per track, with 256 nine-bit bytes per sector. Each cylinder is composed of 19 tracks, and there are 411 cylinders per pack. Unformatted storage capacity is 100 million 9-bit bytes (133 million 6-bit characters).

MSU0451 MASS STORAGE UNIT: With twice the capacity of the MSU0402, this unit provides 156 million 9-bit bytes (234 million 6-bit characters) on one Honeywell Type 4451 removable disk pack. The 4451 contains 12 platters with 19 recording surfaces. The drive utilizes "Winchester" technology, employing top and bottom platters for protection. One of the remaining surfaces is used for servo control. Each data surface consists of 815 tracks including spares. Three are 40 sectors per track, with 256 nine-bit bytes per sector. Each cylinder is composed of 19 tracks, and there are 812 cylinders per pack. Unformatted storage capacity is 200 million 9-bit bytes (266 million 6-bit characters).

MSU0500 MASS STORAGE UNIT: This high-capacity unit has a formatted storage capacity of 626 million 9-bit bytes (940 million 6-bit characters) per dual fixed-disk unit. Each of the dual disk units uses a stack of 12 platters with 19 recording surfaces and 1,630 tracks, including 14 spares, per recording surface. The top and bottom platter are not used for data. One surface of the remaining 10 platters is used for servo control. There are 40 sectors per track, with 256 nine-bit bytes per sector. Each cylinder is composed of 19 tracks, and there are 16.30 cylinders per pack.

MSU0501 MASS STORAGE UNIT: This drive has about twice the capacity of the MSU0500, with a formatted storage of 1.1 billion 9-bit bytes (1,651 million 6-bit characters) per dual fixed-disk unit. Each disk unit contains 12 platters with 20 recording surfaces and 1,680 tracks per recording surface. Effective transfer rate is 983,000 9-bit bytes per second, and the average rotational delay is 8.3 milliseconds.

INPUT/OUTPUT UNITS

MAGNETIC TAPE UNITS: Honeywell offers a wide range of tape drives for the Level 66/DPS and 68/DPS systems. One MTP0610 magnetic tape processor can support up to 8 tape units in a single-channel configuration and up to 16 units if the optional dual/simultaneous con-

figuration is implemented. An optional switched channel feature offers a non-simultaneous data channel for increased connectivity to multiple IOMs and for switching the data transfer path of the single or dual simultaneous channel between IOMs. The MTP0610 offers dynamic code translation between ASCII and Series 60 6-bit code (MTF1145), between EBCDIC and Series 60 6-bit code (MTF1146), and between EBCDIC and ASCII (MTF1147). Built-in capabilities allow the microprogrammed MTP0610 to operate in both NRZI and PE modes, or PE and GCR modes.

MTU0410/0411/0412 MAGNETIC TAPE UNITS: These are 75-ips tension-arm tape drives. The MTU0410 is available in 3 configurations: 9-track, 800/1600 bpi, 60,000/120,000 bytes/second; 7-track, 556/800 bpi, 31,275/45,000 bytes/second; and 7-track, 200/556/800 bpi, 11,250/31,275/45,000 bytes/second. The MTU0411 is available in 2 configurations: 9-track, 800/1600 bpi, 60,000/120,000 bytes/second; and 7-track, 556/800 bpi, 31,275/45,000 bytes/second. The MTU0412 is a dual-drive subsystem consisting of two MTU0411 drives.

MTU0500 MAGNETIC TAPE UNITS: These are vacuum-column 125-ips tape drives. The MTU0500 drives are available in 4 configurations: 9-track, 800/1600 bpi, 100,000/200,000 bytes/second; 9-track, 200/556/800/1600 bpi, 25,000/69,500/100,000/200,000 bytes/second; 7-track, 556/800 bpi, 52,125/75,000 bytes/second; or 7-track, 200/556/800 bpi, 18,750/52,125/75,000 bytes/second. CP-6 systems support the MTU0500 for 7-track operations only.

MTU0600 MAGNETIC TAPE UNIT: This is a 200-ips tape drive, available in a single configuration: 9-track, 800/1600 bpi, 160,000/320,000 bytes/second.

MTU0610 MAGNETIC TAPE UNIT: This is a 200-ips tape drive, available in a single configuration: 9-track, 800/1600/6250 bpi, 160,000/320,000/1,250,000 bytes/second.

UNIT RECORD PROCESSORS: The three systems offered are the free-standing URP0600, the IOM-integral URP0602, and the URP0601 integrated processor which can be used with CP-6 systems. The systems perform identically and handle card readers, card punches, card reader/punches, and printers. Card devices can operate in four basic reading and punching modes: ASCII, EBCDIC, BCD, or binary. Maximum mixed configurations can include up to four card devices and three printers, with no more than two card readers, two card punches, or two card reader/punches. An all-printer configuration can include eight printers, of which a maximum of five can be PRU1100 printers, two can be PRU1200 printers, and three can be PRU1600 printers.

CRU1050 CARD READER: Reads 80-column punched cards, 51-column punched cards (optionally), or mark-sense cards (optionally). Reading is photoelectric, column by column, at a 1050-cpm rate. The reader has a 3000-card input hopper and a 2500-card output stacker.

CRU0501 CARD READER: Reads 80-column punched cards in the ASCII, BCD, or EBCDIC mode. Reading is via solid-state light emitting and sensing devices (photoelectric) on a column-by-column basis at 500 cpm. The reader has a 1000-card input hopper and a 2500-card output stacker.

CRU0401 COMBINATION CARD READER AND PUNCH: Reads 80-column cards serially by a photoelectric technique at 400 cpm and punches 80-column cards at 100 to 400 cpm, depending on the number of columns punched per card. The input hopper has a capacity of 1200 cards, and the output hopper capacity is 1300 cards. Not supported on CP-6 systems.

PCU0121 CARD PUNCH: Punches 80-column cards in Hollerith or binary code at a speed of 100 to 400 cpm, depending upon the number of columns punched in each

Honeywell Series 60 Levels 66/DPS and 68/DPS

➤ existing systems received software support under the previous policies until October 1, 1980.

USER REACTION

Datapro received 34 responses from Honeywell Level 66 and 68 users in its 1980 computer survey. Of these systems all but one were Level 66 processors. The one Level 68/DPS system used the Multics virtual-memory operating system, while all the Level 66 users were running on GCOS. The average system had been installed for almost four years, and ranged from one year to over six years. Purchased systems outnumbered leased systems by over two-to-one. Only four systems were rented. By far the most frequently reported applications were financial, payroll, and personnel. Every user developed some applications in-house, and more than half of them purchased outside software packages. Most systems were single processor units, and there were eight users operating with two or more CPUs. The most widely used programming language was COBOL. The number of work stations ranged from none to several thousand, and averaged (excluding the two users with a thousand or more) 87 per user. Most users said they would be expanding their data communications facilities in 1981 and had no major plans to replace their systems. Most of these same users, though, were well aware of the new DPS 8 systems and were giving them full consideration. By almost four-to-one the users indicated they would recommend Honeywell systems to their colleagues.

The results of the Datapro user survey on the Level 66 and 68 systems are presented in the following table:

	Excellent	Good	Fair	Poor	1980 WA*	1979 WA*
Ease of operation	12	18	2	1	3.2	3.4
Reliability of mainframe	21	10	2	0	3.6	4.0
Reliability of peripherals	7	20	5	1	3.0	3.2
Responsiveness of maintenance service	8	18	5	1	3.0	3.1
Effectiveness of maintenance service	6	19	4	3	2.9	3.1
Technical support:						
Trouble-shooting	5	13	10	5	2.5	—
Education	4	13	8	7	2.4	—
Documentation	3	15	11	4	2.5	—
Operating system	19	8	4	2	3.3	3.3
Compilers and assemblers	14	15	2	2	3.2	3.3
Applications programs	0	18	5	4	2.5	2.8
Ease of programming	5	24	3	0	3.1	3.3
Ease of conversion	7	15	8	1	2.9	2.6
Overall satisfaction	8	19	5	0	3.1	3.3

*Weighted Average on a scale of 4.0 for Excellent.

Datapro contacted several users around the country for their observations. We first called on a midwestern utility who uses not only Honeywell systems, but most other major vendors as well. Their Level 66 Model 60 is a dual-processor system with 512K words and is used exclusively for time-sharing applications. The GRTS-II data communications monitor was recently installed, and is working quite well, especially since they are operating with about 70 ports and several thousand terminals. Prior ➤

➤ **SYSTEM CONTROL CENTER:** Three different system control centers are available for the Level 66/DPS and 68/DPS: the CSU6601, a desk-top arrangement with 120-cps printer and a 12-inch 1920-character CRT (a 23-inch remote display is optional) and keyboard; the larger CSU6004 with the same features of the CSU6601, but with an optional 23-inch remote display unit; and the CSU6005, which has two 12-inch screens in the console with an option for up to two 23-inch remote displays. The keyboard, common to all consoles, is a solid state unit with an alphanumeric keyboard consisting of 26 alphabetic, 10 numeric, and 28 special character keys. The CRT displays 1920 characters in a matrix of 80 characters per line, 24 lines per display. The printer associated with the CSU6601 operates at 120 cps, and the CSU6004/6005 unit runs at 30 cps, with a 120-cps option.

The CSU6601 has several options, including the CSU6602 Auxiliary Console with 120-cps printer and keyboard, CSF6602 Auxiliary Keyboard Display Attachment Feature, CSF6603 Additional Keyboard Display, CSF6604 Large Screen Monitor (the 23-inch screen unit) and Monitor Drive, CSF6605 Ceiling Mount for 23-inch monitor, and CSF6606 Extended System Control Center.

PHYSICAL SPECIFICATIONS: Level 66/DPS and 68/DPS systems must be located in a room with raised floor or equivalent. The room ceiling must be 8.5 feet above the raised floor, with at least 8 to 12 inches between subfloor and raised floor. Power requirements must meet these specifications: a voltage of 208, 240, 440 or 480 VAC ± 10 percent for the motor generator set; 60 Hertz nominal with 60.5 maximum and 59.4 minimum frequency; three-phase wire with a maximum phase variation of 5 percent from the nominal; and 120/208 VAC, five-wire cable with ground for peripheral equipment (voltage variation is ± 10 percent).

A design temperature between 68 and 78 degrees F. with a relative humidity between 40 and 60 percent noncondensing is permissible, although a temperature of 73 degrees with a relative humidity of 50 percent is recommended. Once a temperature and relative humidity are selected, the temperature should not fluctuate more than ± 2 degrees F. or the relative humidity more than ± 5 percent.

INPUT/OUTPUT CONTROL

I/O CHANNELS: The Input-Output Multiplexer (IOM) coordinates all input/output operations between the system control unit, peripheral subsystems, and Datnet 6600 Series Front-end Network Processors (FNPs) and document processors. Data transfers between peripheral devices and memory are also handled by the IOM. All peripheral device operations are controlled by processor-prepared control word lists stored in reserved IOM positions in memory or in the IOM scratchpad memory

The IOM consists of the IOM central and a variable number of channels. The IOM central controls access to storage for each of the channels and can perform one storage access cycle at a time through the appropriate system control unit. The IOM central is time-shared by a number of channels operating concurrently.

The IOM contains scratchpad storage which provides high-speed servicing of data transfers through the data channels and reduces the number of data accesses required for control word retrieval and updating.

The PSI channels provide connection between the IOM and various peripheral controllers. Multiple logic channels (up to eight) can be assigned to a single PSI channel for concurrent multiple unit operation. The PSI channel can transfer data at up to 200,000 words (1,200,000 bytes) per second.

SIMULTANEOUS OPERATIONS: All IOM operations are performed asynchronously with program processing. Interference occurs only when two or more IOMs or processors attempt to access the same main storage module. ➤

Honeywell Series 60 Levels 66/DPS and 68/DPS

➤ system. Level 66/DPS processors operate under the full-scale multidimensional facilities of GCOS, which permits concurrent local and remote batch processing, on-line transaction processing, time-sharing, and interactive job entry and execution. GCOS supports up to 55 concurrent operations.

GCOS includes a number of data management software products such as Data Management-IV (DM-IV), an integrated set of software modules that supports concurrent access to common, shared data bases in both conversational and procedural modes. The File Management Supervisor manages allocation of physical file space and controls system and file access. FMS is also an integral part of GCOS system security. A Unified File Access System (UFAS) interfaces between the system's physical devices and logical data management with such functions as buffer management, blocking and deblocking, record location, error checking, and label processing. Additional programs include the DM-IV Query and Reporting Processor, which permits data base retrieval and report generation; a Text Executive Processor (TEX) for text processing, program execution, and program development; and the Time-Sharing Executive for management of time-sharing operations.

Network communications are handled by either the Network Processing Supervisor (NPS) or the GCOS Remote Terminal Supervisor-II (GRTS-II).

Both systems control remote communications activities such as time-sharing, transaction processing, remote job entry, and direct program access. NPS also offers store-and-forward message switching capabilities for larger networks.

GCOS has two maintenance packages to identify problems and minimize downtime. The Honeywell Error Analysis and Logging System (HEALS) detects problems in memory modules, runs a set of diagnostic routines, and prints the result on a summary sheet. The Total On-line Testing System (TOLTS) monitors system components, and calls in diagnostic tests on potential problems. It also has a remote testing capability for Honeywell maintenance engineers. Both systems run concurrently with normal operations and are invisible to users.

Numerous language processors are available with GCOS: COBOL-74, FORTRAN, BASIC, dataBASIC, PL/I, GMAP, GPSS, SIMSCRIPT, PASCAL, LISP, ALGOL, JOVIAL, and RPG-II. Languages available with Multics include PL/I, APL, COBOL-74, RPG, FORTRAN, BASIC, and the ALM assembler. Languages for CP-6 include COBOL-74, FORTRAN, APL, Interactive Data Processor (IDP), RPG-II, BASIC, PL-6, GMAP, TEXT, SPSS, BMDP, PASCAL, SPITBOL, LISP-F3, IMSL, and SLAM.

The Multics operating system is used exclusively on the Level 68/DPS. It uses virtual memory and concurrently supports batch processing, remote job entry (RJE), time ➤

➤ 66/DPS-520 has performance similar to the 4341-2. The Level 66/DPS systems range from 1.2 MIPS (million instructions per second) up to 5.2 MIPS, giving performance from the 4341-2 up through the 3033 Model U. The Level 68/DPS ranges from 1.2 MIPS to about 5 MIPS, just about the same as the Level 66/DPS systems. The CP-6-based Level 66/DPS/B3 has about the same performance as the System 370/158-3, and the 66/DPS/C3 and /C5 have slightly more power than the 4341-2. CP-6 system performance can range up to 6.3 MIPS.

CONTROL STORAGE: See system characteristics chart.

REGISTERS: The Level 66/DPS and 68/DPS processors include a large number of program-accessible registers:

Register Name	Length (bits)	Quantity per Processor
Accumulator	36	1
Quotient	36	1
Accumulator-Quotient*	72	1
Exponent	8	1
Exponent-Accumulator-Quotient*	80	1
Index	18	8
Indicator	14	1
Base Address	18	1
Timer	27	1
Ring Alarm	3	1
Pointer*	42	8
Address	24	8
Procedure Pointer** #	37	1
Temporary Pointer** #	42	1
Descriptor Segment Base #	51	1
Sement Descriptor Word Associative Memory*	88	16
Page Table Word Associative Memory* #	51	16
Fault*	35	1
Mode*	33	1
Cache Mode*	28	1
Control Unit (CU) History*	72	16
Operations Unit (OU) History*	72	16
Decimal Unit (DU) History*	72	16
Appending Unit (APU) History*	72	16
Configuration Switch Data*	36	5
Control Unit Data*	288	1
Decimal Unit Data*	288	1

*This register is not a separate physical entity but is a combination of its constituent registers and/or flags.

**These registers are not explicitly addressable, but are included because of their vital role in instruction and address preparation. Each is a combination of four registers located in the appending and control units.

Level 68 only.

ADDRESSING: All Level 66/DPS processors except the CP-6 systems use absolute addressing and several forms of indirect addressing. The CP-6-based systems use mapped addressing in two forms: basic and extended. Basic instructions use an 18-bit direct address. An address register combined with a 14-bit signed offset is the format for extended form. The extended mode yields a theoretical maximum address range of 2 trillion words.

The virtual-memory Level 68/DPS processors use two virtual addressing modes, absolute and appending, where addresses consist of a segment number and an offset or computed address. In either mode, the 18-bit computed address that is prepared for each main memory reference is combined with a segment number to form a 24-bit absolute address.

Under absolute addressing, all instructions must reside in the lower-order 262,144 words of main memory. Operands may reside anywhere in main memory through the use of an appended operand fetch. This may be accomplished by specifying register then indirect address modification in the instruction word and indirect to segment or indirect to pointer address modification in the indirect word; by specifying pointer register modification in the instruction word and ➤