Bull DPS 7000 Series

In this report:

Product Summary

Description
DPS 7000 Series computers are 32-bit-word, byte-oriented, EBCDIC-based machines, featuring one to four CPU boards and 8 to 64 megabytes of main memory. Relational databases, application development tools, and vertical market applications software packages are offered.

Strengths
The overall performance range of the series has grown with updated models having nearly double the clock speed and supporting up to twice the memory and additional I/O channels. High-end models support up to 96 gigabytes of on-line storage and duplicate key components for high system availability.

Limitations
High availability of 3XX models does not constitute complete fault tolerance.

Competition
Bull positions Models 2XX against IBM AS/400 models; Models 3XX against the IBM 4380 Series; and various models against the Digital 6300 Series. Other competitive systems are the IBM 9370; midrange models of the Unisys A Series; Digital VAX 8200/8300 Series; Control Data Cyber 900 Series; and NCR 9800 systems.

Vendor
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Price
$98,000 to $498,000.

GSA Schedule
Contact HFSI Division of Honeywell Incorporated.

Analysis

Update

Less than two years after first installing the French-made Bull DPS 7000 in the U.S., Bull revamped the entire model lineup, doubling the maximum memory, almost doubling the clock speed, and adding high-availability multiprocessor models. Anchored with a new entry-level package, these changes provide a greatly expanded performance range for the 7000 Series. Bull also introduced new vertical market software for school administration and land tax assessment applications.

Company

Bull recently made itself more of a household name, via a $20 million "Know Bull" advertising campaign. This expensive corporate identity campaign follows the resolution of a veritable corporate identity crisis that overcame the Honeywell computer business gradually—over nearly two decades.

Background

In 1962, Honeywell and NEC began a long-term technology agreement; Honeywell's relationship with Groupe Bull began in 1970. A 1987 buy-in by Groupe Bull made it an equal (42.5 percent) but dominant partner with Honeywell in a globe-encircling French-U.S.-Japanese partnership.

Beset by a major net loss in 1988, a series of layoffs, and successive reorganizations, Honeywell reduced its role in the company by selling off a 22.6 percent stake to Groupe Bull at the end of 1988. Honeywell Bull was then renamed to reflect its now majority (65.1 percent) owner, Groupe Bull.

The new U.S.-based organization is called Bull HN Information Systems, Inc., with HN briefly alluding to Honeywell and NEC's minority

stakes in the partnership—now revised to 15.6 percent and 15 percent, respectively. The new arrangement also increases NEC's control of the company. Groupe Bull's dominant interest in the U.S. business is 69.4 percent.

Note that Groupe Bull—strictly speaking, the holding company Compagnie des Machines Bull (CMB)—is itself 92 percent owned by the French national government. Only the remaining 8 percent is publicly traded on European stock exchanges.

Products of the combined companies range from CP8 Smart Cards to mainframes to large networks. Combined annual R&D investment of the partnership is 11.5 percent of total revenues (exceeding $600 million).

Groupe Bull has demonstrated the synergy of its global technology partnership in its top-of-the-line DPS 9000; the system has a Japanese CPU and French network, while the U.S. supplied the operating system and system integration. By contrast, the DPS 8000 is considered a U.S. product, the DPS 7000 a mostly French product, and the DPS 90 primarily a Japanese product.

On October 2, 1989 Groupe Bull agreed to acquire Zenith Display Systems (the leading U.S. manufacturer of laptop computers) from Zenith Electronics Corporation.

Financials

The U.S.-based Bull HN remains a sizable company with over 19,000 employees worldwide and operations in more than 28 countries. Bull HN's annual revenues—from the U.K., Italy, Asia, Australia, Mexico, Canada, as well as the U.S.—exceed $2 billion.

Groupe Bull overall has more than 45,000 employees and operations in more than 90 countries, and over 11,000 employees in the U.S. With consolidated revenues exceeding $5.3 billion (1988), Groupe Bull is the leading European-based supplier of information systems.

After accounting for Groupe Bull's increased stake in Bull HN, consolidated 1988 net earnings of Groupe Bull were $51 million, almost 35 percent over 1987. These profits continue the steady growth of the prior three years of "renewed profitability" (averaging $34 million)—all told a dramatic recovery after several years of substantial net losses ($187 million in 1983-84).

Bull HN is not publicly traded, so quarterly earnings figures for 1989 are not available. 1988

Figure 1.
DPS 7000 Power Range

THE DPS PRODUCT RANGE

TPS
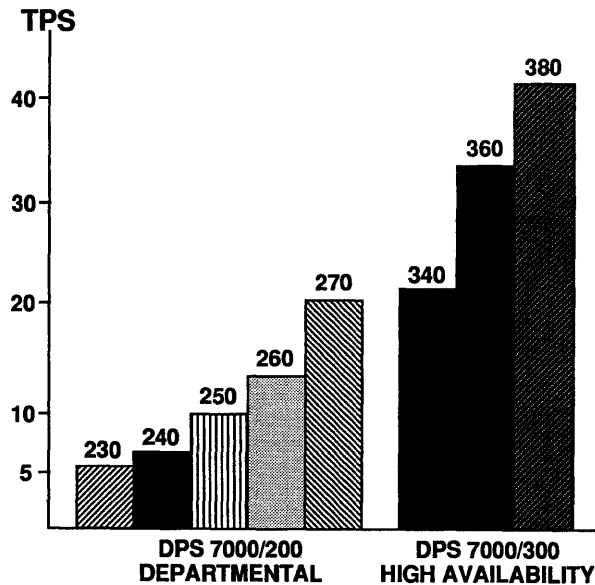
Debit/credit benchmark performance, by model.

Courtesy of Bull HN Information Systems.

annual revenues for Bull HN were $2.2 billion, however: 46 percent from North America, 31 percent from Italy, 17 percent from the U.K., and 6 percent from other countries.

Bull HN accounted for 41.6 percent of Groupe Bull's total worldwide revenues in 1988.

Product Strategy

Bull introduced the DPS 7000 Series of medium-scale mainframes in 1987, providing DPS 7/E users with more powerful processors, GCOS 7 operating system upgrades, and new applications software. The original DPS 7000 machines were positioned as "enterprise-wide" computers tuned for high-volume transaction processing, with the low-end model usable as a departmental satellite machine.

The 1989 upgrades expand the power range of the series in both directions, so the departmental-to-enterprise characterization still applies. Within the current Bull product line, the DPS 7000 Series is positioned above the DPS 6000 and below the DPS 8000 medium-to-large scale mainframes.

Both performance and price are stressed in the current DPS 7000 marketing strategy. The entry-level Model 230, packaged with disk and tape storage and its own four-line communications monitor, costs $40,000 less than the previous Model 10E (similarly equipped). According to Bull's measurements, other new 2XX models exceed the performance of the models they replace by 20 to 60 percent, with no increase in price. The 3XX models are priced about $25,000 to $180,000 lower than their predecessors (the 72, 82, and 92), while providing a claimed performance boost of 30 to 40 percent.

Following a pricing trend begun by IBM in 1986 (for the IBM 9370 superminis), Bull offered the DPS 7000 under a graduated pricing scheme for GCOS 7 operating system software. Most software products are now priced at four levels, corresponding to the power of the central processor.

At the corporate level, Groupe Bull's plan for strengthening Bull HN's profitability in the U.S. is to follow the strategy it claims succeeded in the United Kingdom and Italy: "a solutions approach to market demand and a reinforced reseller network." Part of the recent national advertising blitz has, in fact, been aimed at resellers. In addition, Bull HN is placing an increased emphasis on UNIX-based products.

Part of the solutions approach has been to increase the availability of development tools such as Mantis. In addition, all the base products now include the Cobol-85 compiler. Many GCOS AS/ASL products are available for 90- or 120-day trial periods.

Vertical Market Specialty Products

The most conspicuous aspect of Bull's solutions approach is vertical market software/hardware products. New vertical markets targeted in 1989 are educational administration and geographical information support for land tax assessment.

The Educational Information System (EIS) supports educational administration of kindergarten through twelfth grade with a combination of student, financial administration, and teacher information. The target market for this product includes school districts, counties, and educational consortiums with a total student population of 7,000 to 60,000.

The land tax assessment package, Datagrafix, is used not only for property tax assessment but

also for deed maintenance, title searches, and related geographic information applications. Targeted for tax assessors with 50,000 parcels or more, Datagrafix is based on workstations and support services provided by Geografix, along with mapping services and consultation available from Amerinet Inc.

Also available are older vertical market packages for the manufacturing and health industry markets, two established Bull niche markets.

Sales and Distribution Strategy

Largely gone is Bull's confusing practice of marketing completely different series of models in the U.S. and Europe. Standard models now include the 230, 240, 250, 260, and 270, plus the 340, 360, and 380. The 2XX models are variously called "compact" or "departmental," and the 3XX models are described as "high availability." All these models are manufactured by Groupe Bull in France.

Beyond the Model 380, however, four or five larger capacity "Aquila" models are being manufactured for the European market by Bull's technology partner NEC. Without U.S. technical support, importing these NEC models would not currently be reasonable.

DPS 7000 systems currently account for about 25 percent of Bull system revenues worldwide.

Apart from the overall price/performance focus, current sales efforts include specific inducements for base upgrades by installations using older Bull equipment. Level 64 and DPS 7 users are expected to regard the availability of Mantis, Oracle, and Pacbase as good reasons for moving to the DPS 7000, along with extra processing power and promised ease of migration. "Competitively priced" on-site conversion services and a special Mantis offer are being used to lure Level 62 and DPS 4 installations into the DPS 7000 camp. The new entry-level Model 230 is also expected to appeal to many installations as an initial base upgrade.

Competitive Position

Bull positions Models 2XX against IBM AS/400 models; Models 3XX against the IBM 4380 Series; and various models against the Digital 6300 Series. Other competitive systems are the IBM 9370;

midrange models of the Unisys A Series, and Unisys 2200 "midframe" models; Digital VAX 8200/8300 Series; Control Data Cyber 900 Series; and NCR 9800 systems.

Unlike some of its competition, the DPS 7000 was not engineered as a "downsized" model of a larger computer system, in which a mainframe architecture is repackaged like a minicomputer. The IBM 9370, for instance, brings the IBM System/370 architecture and operating systems down to the departmental level. Instead, the DPS 7000 is an upscaled version of the former DPS 7/E line, which from the first more than doubled the maximum power of its predecessor.

Like the downsized systems, however, the DPS 7000 can be installed in a regular office rather than in a raised-floor computer room environment, making it less expensive to operate.

Bull has performed competitive debit/credit benchmark tests demonstrating the superior price/performance of various DPS 7000 models compared specifically against models of the IBM AS/400, IBM 4381, and Digital VAX 6300. Such benchmark tests are interesting and useful, but one would nevertheless want to bear in mind a variant of Bull's own argument against MIPS measurements. Buying a computer system simply on the basis of maximum performance speed per dollar makes as little sense as buying a family car based only on that criterion. As Datapro user surveys regularly suggest, user satisfaction with a computer system is affected by a multiplicity of factors.

Strengths

The overall performance range of the series has grown. Updated models have nearly double the clock speed and support up to twice the memory and additional I/O channels. High-end models support up to 96 gigabytes of on-line storage and duplicate key components for high system availability.

The system CPU, I/O processors, and memories all use very-large-scale integrated (VLSI) complementary metal oxide semiconductor (CMOS) chips. As promised in 1987, Bull has now upgraded the original 256K-bit memory chips to 1M-bit chips. The new memory chips also have a faster response time of 130 nanoseconds, down from 300.

Central system packaging is compact, with CPUs board-implemented two to a box; i.e., Models 230 to 340 have one central system cabinet, and Models 360 to 380 have two cabinets.

All models come with one or more Service and Administration Processors (SPAs), which monitor all system components, support maintenance, and implement testing and diagnostic routines. All processor models, other than the entry-level Model 230, can also be outfitted with Datanet 8 front-end communications processors.

Model 270 has a transitional architecture. Like Model 340, the 270 has two CPUs; but like other 2XX models, its base main memory is only 8 megabytes and it does not include redundant backup of all key components.

Most models already have some built-in expansion potential beyond their specifications: All the memory boards can support 64 megabytes. With the 2XX models, the operating system currently limits the models to 32 megabytes, but Bull plans to increase this to 64 megabytes in 1990. The operating system for the larger 3XX models can already handle 64 megabytes, but Model 340 has arbitrarily been held back from using more than 32 megabytes.

Performance Benchmarks

As in its approach to large-scale systems, Bull places much market emphasis on measures of on-line transaction processing prowess. Formerly, Bull relied on the TP1 benchmark, which has the psychological advantage of giving results in impressively large numbers of transactions—per hour. Thus the original DPS 7000 Series (Models 10 to 50) handled maximum loads of 9,000 to 52,000 transactions per hour.

Having now shifted to the less controversial Debit/Credit benchmark, Bull still describes DPS 7000 models glowingly but in smaller numbers of from 5.5 to 42.0 transactions—per second. Figure 1 shows the comparative power of each model in terms of this newer benchmark.

(By way of comparison with Bull's medium-to-large scale GCOS 8 systems, the overall performance range from the entry-level DPS 8000/41 to the DPS 9000/94 is 18 to 1,010 transactions per second, again measured by the debit/credit benchmark.)

The debit/credit benchmark provides double-entry bookkeeping for a customer account in a banking-like application. Each test transaction realistically involves both in-memory processing and several I/O functions: reading a 100-byte message from a terminal, rewriting the account, writing history, rewriting the teller, rewriting the branch, and sending a 200-byte message to the terminal. This benchmark is nonproprietary and accepted by several vendors, though there is still room for debate about how a particular test was performed by the vendor. Note that jobs using long floating-point operands would have substantially slower performance. Jobs using Binary Coded Decimal (BCD) encoding also exact a performance penalty.

Bull does not provide or encourage millions of instructions per second (MIPS) ratings. A company spokesperson compared use of MIPS ratings to ranking race cars by the maximum rpm of their engines—at a stoplight. Before the current performance enhancements, however, published MIPS estimates placed DPS 7000 models in the range of 0.65 to 3.8 MIPS. With near doubling of the CPU clock speed and a debit/credit performance boost of 23 percent in the top-end Model 380 (versus the former Model 92), the maximum MIPS rating has presumably increased substantially as well.

Limitations

As noted, high availability of the 3XX models does not constitute complete fault tolerance. Note also that the 3XX systems provide redundancy only if properly configured with two extra I/O processor groups for cross-barring of mass storage, magnetic tape processors, and Datanet 8 processors.

Although the new performance range of the DPS 7000 line has grown, limited compatibility with larger Bull systems remains an issue, as it is for IBM and some other vendors. Larger Bull machines, which include the DPS 8000, 90, and 9000, are all ASCII-oriented, 36-bit-word machines that operate under the GCOS 8 operating system. Although GCOS 7 and 8 have some common file formats and can both support some new multiplatform packages such as Oracle, regular GCOS 7 applications cannot easily migrate to the larger GCOS 8 machines; they require substantial code rewriting and recompilation.

For both competitive and internal compatibility reasons, therefore, Bull HN and its corporate predecessors have for years stressed cross-product consistencies to facilitate transaction processing

Figure 2.
User Ratings of DPS 7000

From 1989 Datapro Computer Users Survey.

	Average Rating ▲	Range of Ratings
Ease of operation	8.3	
Mainframe reliability	9.2	
Peripherals reliability	8.8	
Mfr. maintenance service:		
Responsiveness	7.6	
Effectiveness	7.9	
Technical support:		
Troubleshooting	6.7	
Education	6.0	
Documentation	5.6	
Manufacturer's software:		
Operating system	7.0	
Compilers/Assemblers	7.7	
Application programs	5.5	
Ease of programming	7.6	
Ease of conversion	7.5	
Overall satisfaction	8.0	

Poor 1 — Excellent 10
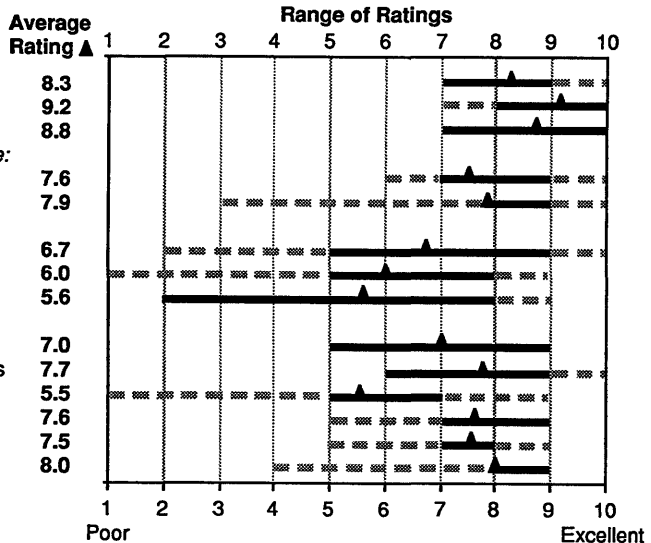
Note: Dashed-line extension of range depicts extreme high or low rating by a single respondent.
Average (▲) is the weighted mean of all ratings, not counting respondents who skipped category.

applications, a major marketing cornerstone. Hence Bull's Distributed Systems Architecture (DSA) is an open architecture that supports peer-to-peer networks and conforms to ISO's Open Systems Interconnection (OSI) model for interconnecting equipment from other vendors.

As IBM gradually evolves its three-level Systems Application Architecture (SAA), other vendors are also working on frameworks that improve design portability and data access across mainframe, minicomputer, and microcomputer environments. Bull HN's Integrated Information Architecture (IIA) and Bull SA's Blue/Green architecture are in the process of being merged, refined, and extended. The new architecture is due to be unveiled in 1990.

User Opinion

Among the over 400 mainframe users responding to Datapro's 1989 annual Computer Users Survey were nine Bull DPS 7000 users. All acquired their systems in 1987 or 1988, before the recent overhaul of the product line.

These installations support 40 to 325 users, averaging 134, including an estimated average of 58 local and 50 remote terminals.

Figure 2 summarizes the ratings from these Bull DPS 7000 users. Each rating, on a scale of 1 (Poor) to 10 (Excellent), represents the opinion of the individual respondent. Not every respondent

rated every category; in particular, only six respondents rated Education and Ease of conversion. For additional results and overall analysis of Datapro's 1989 Computer Users Survey, please refer to the survey report under the Computer User Ratings tab in this volume, starting on Page 70C-000EB-101.

In the category of Manufacturer's maintenance service (both responsiveness and effectiveness), Bull ranks lowest in this year's survey, as in last year's, when compared to several other major vendors.

Calls to a few of these survey respondents lend support to Bull's decision to beef up the GCOS 7 operating system as part of the recent product line enhancements. The 7.0 average survey rating of GCOS 7 was distinctly lower than other mainframe vendor operating systems, including Bull's own GCOS 8 (mean rating 8.8).

Site Profile

Here is an installation profile from a randomly selected survey respondent, a supermarket MIS director employing the system for accounting, billing, order processing,inventory, payroll, and personnel functions. To support 130 users, with both local and remote terminals, this installation purchased, in early 1988, a dual-processor DPS 7000 Model 72 with 16 megabytes of main memory. Secondary storage includes 8.8 gigabytes of Bull disk memory.

Overall satisfaction with the DPS 7000 system is rated 8. This user's favorite aspect of the system is its ease of operation, along with the vendor's maintenance responsiveness and effectiveness. This user's high rating of vendor maintenance (contrary to the average low rating by all respondents) was based on his satisfaction specifically with hardware maintenance.

Aspects of the system this user appreciates least are GCOS 7 and application programs acquired from Bull. (GCOS 7 gets a rating of 6; I-D-S/II, 8.) The problem with GCOS 7 is lack of vendor support, according to this user, who compares the support unfavorably to that Bull provides for the DPS 6 and DPS 8000. The problem with applications software, both for regular packages and for tools (program development tools, fourth-generation languages), is the limited selection of products available both from Bull and third-party vendors.

Concluding on an upbeat note, this user adds that the software shortage is considerably less severe now than it was two years ago, and that the change in the vendor's ownership has made Bull HN a much more positive company.

Cross-References

For additional information on Datanet 8 capabilities and prices, please refer to the DPS 8000 report under this tab, Page 70C-115JE-401.

Characteristics

Product Overview

Models
Basic U.S. and European DPS 7000 models, now standardized, are Models 230, 240, 250, 260, 270, 340, 360, and 380. Larger "Aquila" models are available in Europe.

Data Formats

Basic unit: Eight-bit byte plus one parity bit. The data paths are four bytes (32 bits) wide. Data is interpreted as binary, decimal, hexadecimal, or alphanumeric.

Fixed-Point Operands: Data bits are interpreted in groups of four (packed or unpacked decimal data) or eight (alphanumeric EBCDIC), or in strings of between 16 and 64 (binary digits). The strings can be interpreted as signed for fixed-point binary numbers.

Floating-Point Operands: Data can be represented as floating-point operands with single- (16-bit) or double- (32-bit) precision formats.

Instructions: The DPS 7000 supports 221 instructions. Operations include address computations and fixed- or floating-point decimal and binary operations on packed or unpacked data. Operands can be binary, fixed, or floating point; packed or unpacked decimal; and bytes, byte strings, or bit strings.

Internal code: EBCDIC.

Main Storage
Memory is organized into consecutively numbered byte locations. Four-byte blocks are always accessed regardless of operand size. Half-word (16-bit) operands must begin on even-numbered byte locations, and full-word (32-bit) and double-word (64-bit) operands must begin on byte locations divisible by four.

Storage Type: 1M-bit complementary metal oxide semiconductor (CMOS) chips.

Capacity: See Table 1.

Cycle Time: See Table 1.

Checking: Each data item stored in memory units and in the control store is accompanied by a Hamming code which permits the correction of single-bit errors and the detection of double-bit errors. Data paths, and particularly the bus, perform parity checks to ensure data integrity. All registers and calculation circuits include a key check.

Reserved Storage: The DPS 7000 protects every segment individually on the basis of its assigned protection levels rather than on the basis of its physical location in memory. Four privilege levels ("rings") and four corresponding protection levels can be assigned. Segments can be protected independently for three types of access: read, write, and execute. Meanwhile, each processor assumes the privilege level of the process it is currently executing. Security is enforced by automatic comparison of the processor's current privilege level with the read, write, or access protection level of a segment being addressed by the process.

Table 1. System Comparison

Model	Model 230	Model 240	Model 250	Model 260	Model 270
System Characteristics					
Date announced	June 1989	June 1989	June 1989	June 1989	June 1989
Date first delivered	June 1989	June 1989	June 1989	June 1989	June 1989
Field upgradable to	Model 240	Model 250	Model 260	Model 270	NA
Relative performance	1.0	1.3	1.9	2.5	3.8
Number of processors	1	1	1	1	2
Cycle time, nanoseconds	80	80	80	80	80
Word size, bits	32	32	32	32	32
Operating systems	GCOS 7-AS	GCOS 7-AS	GCOS 7-AS	GCOS 7-AS	GCOS 7-AS
Main Memory					
Type	1M-bit CMOS	1M-bit CMOS	1M-bit CMOS	1M-bit CMOS	1M-bit CMOS
Minimum capacity, bytes	8M	8M	8M	8M	8M
Maximum capacity, bytes	16M	16M	16M	32M	32M
Increment size, bytes	8M	8M	8M	8M	8M
Cycle time, nanoseconds	300	300	300	300	300
Buffer Storage					
Minimum capacity	256KB	256KB	256KB	256KB	2 x 256KB
Maximum capacity	256KB	256KB	256KB	256KB	2 x 256KB
Increment size	NA	NA	NA	NA	NA
Input/Output Control					
Number of channels:					
Byte multiplexer	NA	NA	NA	NA	NA
Block multiplexer	NA	NA	NA	NA	NA
Word	NA	NA	NA	NA	NA
Other	3	4	4-8	4-8	4-8

NA—Not Applicable.

Central Processors

DPS 7000 processors are 32-bit systems using very-large-scale integration (VLSI) complementary CMOS chips within the CPU, input/output (I/O) processors, and system memory. The CPU, packaged with 10 VLSI chips, has an internal transfer rate of 27 megabytes per second. See Table 1 for additional CPU characteristics by model.

The DPS 7000 uses firmware to perform some functions traditionally performed by software. These include task management, procedure calls, and data protection.

CPU Components

Major CPU components include a memory cache unit (MCU), a basic processor unit (BPU), and a control store unit (CSU). The MCU is a high-speed memory designed to reduce accesses to main memory and to reduce bus-access contention. The MCU contains portions of main memory and tries to anticipate what information will be referenced.

The CSU is a writable memory containing the microprograms that control the execution of all the functions implemented in the CPU. The unit contains 192 kilobytes of memory (in 16-bit words).

The BPU consists of functional units that break down parts of instructions and data types to perform specialized functions. The BPU includes two essential parts. The first part includes the Address Preparation Unit (APU) and the Data and Instruction Unit (DIU). The APU handles address preparation and interfaces with the memory cache. The DIU executes arithmetic and logic operations on all data types and interfaces with the CSU.

The second part of the BPU includes three functional units: an arithmetic and logic unit (ALU), a pilot unit (PIU), and a scientific unit (SFU). The ALU performs arithmetic and logic operations on decimal and fixed-point, 32-bit operands; but fixed-point multiply and divide operands are handled by the SFU. The PIU controls the sequencing of microprograms addressing the control store and implements bit testing and counters for microprogram loop control in addition to other functions. The SFU executes all floating-point instructions, plus the fixed-point multiply and divide functions.

Registers

The DPS 7000 systems use eight 32-bit Base Registers for internal address computation, sixteen 32-bit General Registers for data handling and indexing, four 64-bit Scientific Registers for floating-point data handling, one 32-bit Stack Register pointing to the stack associated with the running process, and one 28-bit Boundary Address Register holding the lowest absolute main memory address accessible by software.

Memory Management

Running under GCOS 7, the relative addressing mechanism is based on segmentation. Its aim is to make optimum use of memory space. Each program running under GCOS 7 on the DPS 7000 is executed as a collection of fully relocatable segments. As a program is being executed, its constituent segments may be moved

Table 1. System Comparison (Cont'd.)

Model	Model 340	Model 360	Model 380
System Characteristics			
Date announced	June 1989	June 1989	June 1989
Date first delivered	June 1989	June 1989	June 1989
Field upgradable to	Model 360	Model 380	NA
Relative performance	4.0	6.0	7.6
Number of processors	2	3	4
Cycle time, nanoseconds	80	80	80
Word size, bits	32	32	32
Operating systems	GCOS 7-ASL	GCOS 7-ASL	GCOS 7-ASL
Main Memory			
Type	1M-bit CMOS	1M-bit CMOS	1M-bit CMOS
Minimum capacity, bytes	16M	16M	32M
Maximum capacity, bytes	32M	64M	64M
Increment size, bytes	16M	16M or 32M	16M or 32M
Cycle time, nanoseconds	300	300	300
Buffer Storage			
Minimum capacity	2 x 256KB	3 x 256KB	4 x 256KB
Maximum capacity	2 x 256KB	3 x 256KB	4 x 256KB
Increment size	NA	NA	NA
Input/Output Control			
Number of channels:			
Byte multiplexer	NA	NA	NA
Block multiplexer	NA	NA	NA
Word	NA	NA	NA
Other	8-24	8-24	8-24

around memory from time to time to make room for other programs, and some of its segments may even be temporarily removed from memory and placed on disk.

To avoid having to split a frequently used routine between two segments, segments can vary in size. Machine instructions used in the GCOS environment refer to segment-relative addresses without reference to the physical location of the referenced operand. The absolute address is calculated as the instruction is executed using a segment descriptor and a displacement within the segment. High-speed registers assist in address development.

Task Management
The main processor is capable of recognizing and controlling a sequence of interdependent instructions as a task. A program can comprise a number of tasks, each capable of executing in parallel with the others (multi-tasking). This parallel execution of tasks requires a dispatching mechanism. On traditional machines, this mechanism required software intervention. On the DPS 7000, it is a built-in firmware function of the main processor.

Interrupts (Semaphores)
The DPS 7000 uses firmware-controlled semaphores to interpret external events such as physical input/output termination, peripheral interrupts, operator interrupts, and messages from terminals. Using semaphores, it also synchronizes the execution of competing processes, passes messages between processes, and controls competing demands for system services.

A semaphore is a group of words containing a counter and a pointer to an associated queue. When the semaphore counter is negative, all the resources associated with it are busy and processes are awaiting completion. When the counter is positive, all processes are satisfied and resources are free. When the counter is zero, all resources are busy but no processes are waiting. This mechanism can be used in any situation involving processes waiting for the completion of any operation. The semaphores replace interrupts. Hardware and software events are handled through semaphores, combined with a masking feature used when high-priority events occur.

Service Processors
All DPS 7000 processors include a Service and Administration Processor (SPA). The unit provides specialized maintenance channels to monitor the operation of all system components and supports testing and diagnostic routines that can be implemented locally and remotely through the unit's own operating system. SPA includes a 5¼-inch diskette unit that can be used as an I/O device, and a 20-megabyte fixed disk used for operating system administration.

Mass Storage
Table 2 describes Bull disk storage units currently offered for the DPS 7000.

Input/Output Units
Table 3 describes Bull tape and printer products currently offered for the DPS 7000.

Table 2. Mass Storage

Model	MSU4102
Cabinets per subsystem	1-2
Disk packs/HDAs per cabinet	4
Capacity	500MB
Tracks/segments per drive unit	711
Average seek time, msec.	20
Average access time, msec.	28
Average rotational delay, msec.	8.3
Data transfer rate	1.8MB/sec.
Controller model	MSS4102, MSS4104
Comments	Fixed

Terminals

Table 4 describes Bull terminals currently offered for the DPS 7000.

Communications

The DPS 7000 Series incorporates connectivity and peer-to-peer networking capabilities. Peer-to-peer capabilities are implemented using Distributed Systems Architecture (DSA), Bull's open networking architecture.

In addition to peer networking, the DPS 7000 systems permit micro-to-mainframe links. Personal computer users running MS-DOS can connect directly to a DPS 7000 machine. Through a personal computer, PC users can access PC functions and all DPS 7000 functions. Users can also download GCOS 7 operating system data to the PC for use with such software packages as Lotus 1-2-3 or Framework.

To handle networking and data communications functions, users can configure DPS 7000 Models 250 and up with one or two Datanet 8 front-end communications processors. Models 230 and 240 use the CNP 7 front end (and associated CNS 7 software) instead, if needed.

Using a Honeywell Bull DPS 6000 minicomputer, Datanet processors can handle line, protocol, and message management and, in general, manage the network load for the central DPS 7000 processor. Depending on DPS 7000 model, the Datanet front end can handle up to 1,600 terminals.

The Datanet 8 processors operate under the control of the Distributed Network Supervisor (DNS) software executive. These processors manage data communications traffic for GCOS 8 as well as GCOS 7 systems.

Features common to all network processors in the Datanet 8 Series include:

- Capability to interconnect systems using private networks that use High-Level Data Link Control data communications links

- Capability to connect to PDNs and to VANs, using the CCITT X.25 interface, and to most types of standard digital or analog, leased or switched data communications lines

- Capability to attach terminal devices

- System Control Facility for remote maintenance

- Console access for network management functions

- Integrated 5¼-inch diskette drive for executive software maintenance functions

- A visual display console (required)

Table 3. Input/Output Units

Magnetic Tape Units	Number of Tracks	Recording Density, Bits/Inch	Encoding	Tape Speed, Inches/Sec.	Transfer Rate, Bytes/Sec.
MTS4102 (GCR & 125 ips are optional)	9	1600/ 6250	PE/ GCR	25/75/ 125	40/120/200 PE, 156/468/781 GCR
MTU4104	9	1600/ 6250	PE/ GCR	125	200 PE, 781 GCR
MTS4370	9	1600/ 6250	PE/ GCR	25/75	40/120 PE, 156/468 GCR

Printers	Printing Speed	Print Positions	Horizontal Spacing, Chars./Inch	Vertical Spacing, Lines/Inch	Form Size, Inches
PRU4904 line	650 lpm	136	10	6 or 8	4 to 19 wide
PRU4902 line	900 lpm	136	10	6 or 8	4 to 19 wide
PRU4903 line	1,200 lpm	136	10	6 or 8	4 to 19 wide

Table 4. Terminals

Model	BDS 5	BDS 7
Display Parameters		
Max. chars./screen	2,000	2,000
Screen size (lines x chars.)	25 x 80	25 x 80
Symbol formation	7 x 8 upper/ 7 x 9 lower	10 x 14
Character phosphor	Green or amber	Green or amber
Total colors/no. simult. displayed	None	None
Keyboard Parameters		
Style	Typewriter or data entry	Typewriter
Character/code set	128 ASCII	128 ASCII
Detachable	Standard	Standard
Program function keys	10 standard	10 standard
Other Features		
Buffer capacity	NS	NS
Tilt/swivel	Adj. keyboard (7827)	Optional
Graphics capability	NA	NA
Terminal Interface	RS-232-C, RS-422A Asynchronous	RS-232-C, RS-422A Synchronous

NS—Not Supplied by vendor.
NA—Not Applicable.

Physical connections between Datanet 8 Series network processors and central systems are made through network processor channel options which include Peripheral Subsystem Interface (PSI) for DPS 7 and DPS 7000 systems or Direct Interface Adapter (DIA) channels for DPS 8, 8000, 88, and 90 systems. The options are determined by the central system. The network processor provides support for one to four connections to large systems or two connections to medium systems.

Datanet 8/10 is a single-processor system which provides support for a maximum of 31 data communications lines. The basic system includes 1 megabyte of central memory expandable to a maximum of 2 megabytes. A 5¼-inch diskette drive for executive software support is also included with the basic system. A second 5¼-inch diskette drive is optionally available. A console visual display terminal is required with each Datanet 8/10. In addition, a hard copy printer may be required.

Three RS-232-C asynchronous data communications ports are included with each 8/10. Data communications interface adapters and line interface module options enable expanding data communications ports to a maximum of 31 lines. These options accommodate line characteristics such as data transmission speed; asynchronous/synchronous operation; and physical interfaces such as RS-232-C, V.35, and X.21.

Datanet 8/20 is a single-processor system with cache memory and 1 megabyte of central memory. Datanet 8/30 is a single-processor system with cache memory and 2 megabytes of central memory. Datanet 8/10, 8/20, and 8/30 processors are fully upward compatible and can coexist with pre-DSA products.

For details on Datanet line options, please see the DPS 8000 report under this tab, Page 70C-115JE-401.

System Software

Update: The GCOS 7 operating system for Model 2XX configurations of the DPS 7000 Series is called GCOS 7-AS; the operating system for Model 3XX configurations, GCOS 7-ASL. Both versions provide virtual memory processing, but the ASL version additionally supports dynamic component backup for high system availability; i.e., it can automatically remove a defective key hardware component from operation and continue processing through the appropriate redundant component. The current ASL and AS version provide a sophisticated "paged-segmented" implementation of virtual memory.

All GCOS 7 base products now include the Cobol-85 compiler, the Operatorless Facility, and all runtime facilities (which run compiled programs without the compiler). The Production Base product and Multiframe Base product now include the IQS TPR Option, which enables more users to access queries. They also provide TDS support for Oracle (if configured), for Oracle Cobol production applications.

Datanet 8 is not needed or supported on smaller DPS 7000 systems (Models 230 and 240); the less expensive CNP 7 is used if needed.

GCOS Command Language (GCL)

GCOS 7 is built around a large set of menus, prompts, HELP text, and the GCL interactive command language. This interactive language lets users define and create command sequences. GCL combines the functions of a job control language and an operator control language.

The Command Management Function of GCL enables the system administrator to set up "environments," which are sets of commands and menus tailored to the needs of various user categories.

Virtual Memory

To put main memory to most efficient use, system code, user code, and data segments can be relocated automatically, and disk space is used for virtual memory. Resource allocation under GCOS 7 is flexible. Operators can mount tape and disk volumes on any available device. The operating system automatically recognizes the device and makes the mounted volume available to the executing job.

Job Management

The GCOS 7 job management system sets up priorities and determines when each job will be executed. A job scheduler uses a system of job classes and priorities to determine when each job will be executed. The system provides up to 16 user classes, 8 levels of scheduling priorities, and 10 levels of execution priorities.

In establishing CPU execution priorities, GCOS 7 uses four dispatching algorithms:

- Event-driven CPU-time by class

- Slicing CPU-time within a class

- Limiting CPU-time within a class

- Optimizing CPU and I/O-bound jobs in adjacent classes

As jobs flow through the system, job accounting information is collected at all stages. The system tracks job names, times, dates, memory and segment activity, and I/O activity. Such information can be edited for printing or used for billing or system analysis programs.

Data Integrity and Recovery

Several facilities contribute to data integrity and recovery. The File Salvage Facility ensures that file status and file control information is correct following an incident. The Before-Journal Facility restores file contents in case of hardware, software, program, or Transaction Driven System (TDS) transaction failure. The Checkpoint/Restart Facility establishes a program restart point. Used in conjunction with the Before-Journal Facility, the utility repositions files and starts jobs at the last restart point. The After-Journal Facility records file updates as they occur, making it possible to recover files in case of volume destruction. Deferred Updating delays updating files until a unit of processing is completed successfully.

The GCOS 7 Catalog contains information about files, projects, and users. The catalog enhances system security by controlling access to various files.

To assist in error detection and correction, GCOS 7 maintains a permanent log. When an error is detected (and corrected, if possible), the permanent log is updated. Operators and service personnel use the log for routine maintenance procedures and to monitor the status and error history of all system components. The log can be accessed by service personnel locally and remotely.

Programming Languages

GCOS 7 supports Cobol (including Cobol-85), Basic, RPG II, Fortran, PL/1, CPascal, GPL, and APL.

Database Management

GCOS 7 supports a number of database management systems, including network- and relational-model systems.

I-D-S/II: Bull's Integrated Data Store/II network-model database management system is tailored to large-volume transaction processing environments. An I-D-S/II utility helps in creating, administering, monitoring, maintaining, and validating the database. A dialog capability is provided, and the database can be accessed directly using Cobol verbs interactively.

Oracle: Bull also offers the Oracle relational database management system from Oracle Corporation. This product runs on numerous platforms—from microcomputers to mainframes—supplied by many different vendors.

IQS: With the Information Query System, a fourth-generation information retrieval language and development system, users can generate *ad hoc* information requests and perform "what if" analysis of business statistics. The package is designed for both experienced data processing professionals and for users with little programming experience who want direct access to information. The facility provides multiple views of information and lets users tailor views to the needs of individuals or specific groups. Simple or complex reports can be generated for printing or display.

IQS-Link is an extension that allows GCOS 7 data from IQS to be accessed by PC software packages.

IQS also includes a procedure-oriented processor for selection, retrieval, and formatting of information from these GCOS 7 data organizations: UFAS, I-D-S/II, and BFAS. IQS is designed for use as a programming language for users with varying degrees of computer knowledge. Queries built under this product can help satisfy end-user needs for information in an immediately usable form. It includes special report formatting capabilities and a HELP facility. An IQS processor option is available to update UFAS or I-D-S/II user-accessible data. The update option can be used in an interactive or batch environment.

Mistral: This information and document/text management system provides fast access to large quantities of relatively unstructured data. Typical applications are for document storage and retrieval in summarized or full-text format.

Data Management

File Access Methods: GCOS 7 provides the Unified File Access System (UFAS) and Basic File Access System (BFAS).

The main file access facility under GCOS 7, UFAS offers a single alternative to random, sequential, and indexed sequential files; users can access files without attention to these physical file characteristics. UFAS permits all record insertions to be handled totally within the main body of the file structure. This results in predictable performance over the life of the file, reducing the need for periodic performance-related file reorganization. UFAS also supports secondary indexing capabilities for indexed sequential files.

BFAS supports interaction with selected Bull and IBM environments.

Data Dictionary: This facility simplifies the standardizing of terminology and helps eliminate redundancy. The Data Dictionary also provides programmers with a detailed picture of an application as it passes through different stages of development.

Data Communications Software
Communications and networking configurations are available, for Models 250 and above, through the Datanet 8 Series of front-end network processors; smaller models use CNP 7 if needed.

At the software level, GCOS 7 provides the Transaction Data System (TDS), Terminal Network Support (TNS), Front-end Network Processor Support (FEPS), Virtual Communications Access Method (VCAM), Message Access Method (MAM), File Transfer Facility/6 (FTF/6), Remote Batch Facility/6 (RBF/6), Distributed Job Processing (DJP), Unified File Transfer (UFT), Transactional Context Restart Facility (TCRF) and Tempus-Link.

TDS: The Transaction Data System, a transactional monitor, controls user access to the I-D-S/II or Oracle database management system and to UFAS or GFAS files. Transaction programs are written in Cobol, C, or RPG II. Batch programs can be linked to TDS as though they were terminals. TDS handles messages entered by a user through a terminal, the initiation of a processing routine specific to that type of message, the processing of the message, and the response sent to the terminal.

A library of mostly user-written Transaction Processing Routines (TPRs) corresponds to the various types of messages accepted by the system. TDS can handle many transaction types in a single session. TPRs can be debugged interactively.

TNS: Terminal Network Support, working in conjunction with the CNP 7 or Datanet 8 Communications Controller, manages communication with networks.

FEPS: Front-end Network Processor Support helps the Datanet 8 front-end processor and its resident DNS software manage their interaction with GCOS 7. FEPS handles Datanet 8 requests, performs I/O channel control, executes buffer management, and checks Datanet 8 operations. It also controls administrative functions, statistics collection and journalization, and software loading and generation.

Access and File Exchange Methods:

- VCAM establishes logical connections between GCOS 7 communications-based applications and the communications network.

- MAM queues and dequeues the messages passing between the communications network and Cobol communications programs for user-written programs employing queued communications.

- Tempus-Link creates "virtual disks" for MS-DOS users. With available options, GCOS 7 application programs can access virtual disks, and PC programs can call routines that run on the GCOS 7 host.

- FTF/6-DSA exchanges UFAS/ANSI/ASCII files between a DPS 7000 and DPS 6 family systems.

- RBF/6-DSA accepts DPS 7000 job requests from a DPS 6 family system.

DJP: The Distributed Job Processing facility establishes communications between DPS 7000 systems through DSA networks. DJP supports remote batch job entry, message routing between systems, and the automatic chaining or initiating of remotely submitted jobs. DJP monitors submitted jobs and receives generated output. The DJP Pass Through facility lets interactive users start new interactive sessions at other DPS 7000s connected through the DSA network, without terminating their original sessions.

UFT: The Unified File Transfer facility moves information between two DPS 7000 systems through a DSA primary network. Data transfers can be initiated through a job or operator command.

TCRF: The Transactional Context Restart Facility restarts transactional applications on a backup system. The facility restarts TDS jobs in a short time without interrupting backup system operation.

Program Development
To facilitate applications development, the DPS 7000 features fourth-generation language capabilities and data dictionaries. Bull offers the following third-party software:

- Mantis, an on-line, fourth-generation application generator from Cincom Systems Inc. Mantis produces "production-quality" applications with structured, modular code and helps free developers from the details of TDS and GCOS 7 files and databases.

- IQS, a fourth-generation language with relational views.

- SQL, the industry-standard language (used with Oracle).

Additional Bull products designed to improve programmer productivity include the Interactive Development Facility (IDF), Interactive Program Checkout Facility (IPCF), and Full Screen Editor (FSE).

Figure 3.
DPS 7000 High-Availability Series
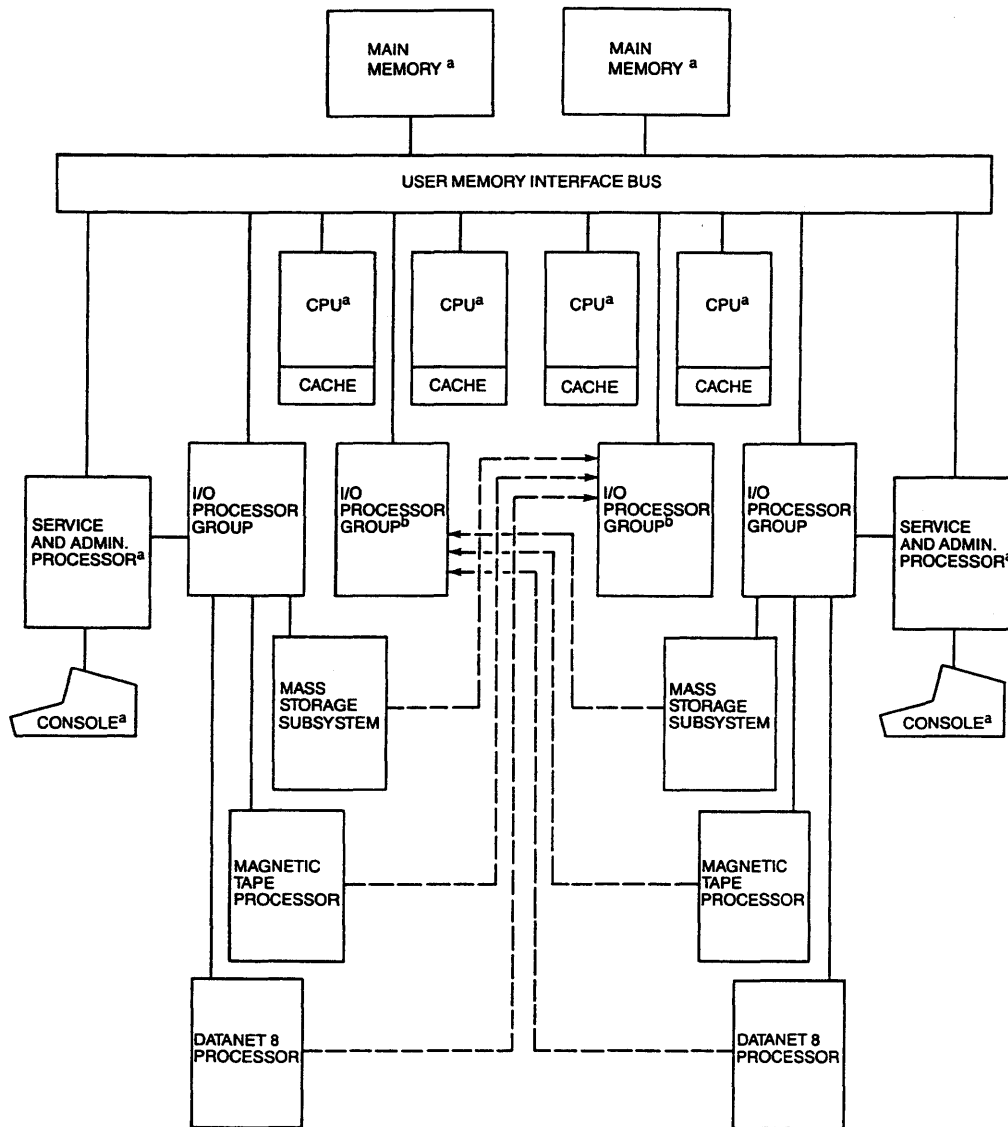
a Included with central processor subsystem
  (Model 340 = 2 CPUs, Model 360 = 3 CPUs, Model 380 = 4 CPUs)

b Necessary for the crossbarring of all DATANET 8 and peripheral subsystems

———— Redundant access paths

The Bull DPS 7000 Series has a maximum configuration of four CPUs with 24 I/O channels and 64 gigabytes
of on-line storage. Redundant central and peripheral subsystem components are illustrated.

Courtesy of Bull HN Information Systems.

System Management Tools
Several Bull products under this general category man-
age and control disk-space distribution and provide
monitors for hardware and software resources.

Multiple Backing Store distributes disk-stored virtual
memory over up to seven disk volumes, to better dis-
tribute storage load and optimize performance under
heavy disk-load conditions.

- General Access Control imposes concurrent file access restrictions.

- System Behavior Reporter monitors allocated hardware and software resources.

- Coupled Systems Support allows disk space to be shared dynamically by two GCOS 7 systems.

- Remote Maintenance System (RMS) enables off-site field engineers to troubleshoot hardware/firmware/software problems concurrently with user production, and to patch many software difficulties over the phone.

Utilities

Spooling functions are handled by the GCOS 7 Output Writer. This function automatically handles printed and punched output production, unit record resource sharing among competing activities, and the restarting or repositioning after an incident, all without the need for user intervention.

Sorting and merging functions sequence tape and disk files through various methods.

Code management is handled through Library Maintenance and Text Editing facilities. Libraries containing source, executable, binary, and shareable code can be created, managed, and deleted in both batch and interactive mode.

The Forms Management Utility simplifies forms creation, storage, and maintenance in transactional and interactive environments. Programmers can generate the forms by entering commands into the forms-generation utility. Forms Management Utility services are available through other GCOS 7 products such as the IQS productivity tool.

Volume and file management are aided by a variety of utilities that can operate in batch or interactive modes, supported by menus, prompts, and HELP text. At the volume level, utilities are available for preparing volumes, checking volume integrity, duplicating volumes, printing blocks of a volume, listing volume content, and saving or restoring volumes. Similar functions are also available at the file level. Additional file-level functions include the ability to create a file, compare two files, reorganize an indexed file, sort and load secondary indexes, process file groups, and allocate or deallocate file space.

GCOS 7 includes an extensive set of conversion aids to assist in migrating programs and files from Level 62 and IBM System 370 systems.

Applications Software

Bull supplies (or has acquired) several specialized DPS 7000 application packages for vertical markets.

Manufacturing Resource Planning: Honeywell (Bull) Manufacturing System/7 (HMS/7) is a manufacturing resource planning (MRP II) system for integrated inventory and production control. The package contains six application modules: Inventory Record Management, Manufacturing Data Control, material requirements planning, Master Production Scheduling, Statistical Forecasting, and Capacity Requirement Planning. HMS/7 can be integrated with the Bull Factory Data Collection system using the Host Application Interface for monitoring the shop floor.

Patient Care Management: Developed for the DPS 7000 Series, the Patient Care Management System is a component of the company's Comprehensive Hospital System, an on-line, modular hospital information product featuring an integrated database, productivity tools, patient care accounting, and financial management applications.

Patient Care Management supports patient admission, discharge, transfer and registration processing, patient scheduling, staff scheduling, order entry and results reporting, pharmaceutical processing, patient chart review, point-of-service billing, medication administration, and other functions.

Educational Administration: The Educational Information System (EIS) supports educational administration of kindergarten through twelfth grade with a combination of student, financial administration, and teacher information. Modular applications include an on-line, menu-driven database system that provides information within a district, region, or county. This product is geared to school districts, counties, and educational consortiums with a total student population of 7,000 to 60,000.

Land Tax Assessment: Promoted as a tool for tax assessment of 50,000 parcels or more, the Datagrafix package is used, additionally, for deed maintenance, title searches, and related geographic information applications. The system can overlay multiple geographic data sets—boundaries, roads, utilities, etc. Datagrafix is based on workstations and support services provided by Geografix, along with mapping services and consultation available from Amerinet Inc.

Operating Environment

Installation Requirements

Subject to environmental requirements as described below, the DPS 7000 can be installed in a normal office environment, i.e., without a raised floor. Peripherals add to the overall power and air-conditioning requirements, of course.

Configuration Rules

Table 1 indicates certain minimum and maximum bounds for main memory, number of channels, etc.

Figure 3 illustrates the basic configuration concept for backing up key components to achieve high system availability in Models 3XX.

Measurements

Following are the central system dimensions of DPS 7000 central systems:

Models	Width (in./cm.)	Height (in./cm.)	Depth (in./cm.)	Weight (lb./kg.) approx.
230-270	25.6/ 65	45.3/115	37.5/95	578/260
340-370	51.2/130	45.3/115	37.5/95	1,156/524

Temperature, Altitude, and Humidity Ranges

Following are the vendor's environmental specifications for the DPS 7000:

Temperature Range	
Normal Operating:	68° to 75° F (20° to 24° C)
Maximum:	50° to 90° F (10° to 32° C)
Relative Humidity Range	
(noncondensing)	
Normal:	45% to 55%
Maximum:	30% to 70%
Heat Output (Btu/hr.), approx.	
Models 2XX:	3.9K Btus/hr.
Models 3XX:	9.5K Btus/hr.
Power Consumption, approx.	
Models 2XX:	1.8kVA
Models 3XX:	4.2kVA
Voltage	
Single-phase:	120 V AC (±10%)
Two-phase:	208 V AC (±10%)
Frequency:	60 Hz (±0.5 Hz)/

Pricing

DPS 7000 hardware is normally sold rather than leased. The vendor can design custom leasing options.

GCOS 7 and supported software have a graduated pricing structure; i.e., both the initial license fee and the annual basic support fee are higher for larger processors. As indicated in the accompanying price list, however, the model groupings for the price gradations occasionally vary.

Note that the price list is somewhat abridged from the vendor's full price list. To simplify software price comparisons, Datapro has added one year of annual basic support to the initial license fee in those few cases where the vendor's price list showed the first year's support fee was not included.

Installations that find the graduated fee disadvantageous may prefer the flat-rate monthly license fee, which is also shown in the accompanying price list.

Support:

Bull offers six categories of support: data services, system engineering, software, education, publications, and supplies.

Data services consist of machine time for predelivery production and checkout, and for overload/peak load situations.

System engineering falls into one of five billable support categories. Field engineering managers are responsible for determining the degree of skill required to perform the job.

Maintenance

On-call remedial maintenance is performed between 8 a.m. and 6 p.m. Monday through Friday, excluding published holidays. For scheduled maintenance beyond this period, the user pays an additional charge which is a fixed percentage of the basic monthly maintenance charge. As an alternative to scheduled extended maintenance, the user can obtain on-call maintenance service at standard hourly rates charged per working hour.

Bull's Distributed Maintenance Services (DMS) is a term covering a variety of field engineering services, coordinated to ensure maximum availability of the system. DMS includes a Response Center headquartered in Atlanta, Georgia for toll-free, 24-hour-a-day contact with Bull; the Technical Assistance Center in Newton, Massachusetts, which coordinates all activities and provides remote testing and correction facilities; a Logistics Inventory Data System for rapid location of parts; Service Account and Field Engineering (FE) representatives; an Alert system to notify FE management of special problems; Remote Support Facility for remote troubleshooting and remote software and hardware correction; and tools for easy software updating by customers.

Education

Education services include standard courses, advanced professional training, multimedia self-instruction courses which allow customers to self-train as often as needed, site surveys to determine educational requirements, on-site classes, and clustered on-site classes to accommodate a group of users from an area.

Typical Configurations:

Note that in the following sample configurations for the DPS 7000 shown, the total purchase price is for principal items of hardware only and does *not* include maintenance or required software. (The operating system alone carries a price of $17,575 to $168,300.)

Please refer to the Equipment Prices and Software Prices that follow for additional hardware, software, and maintenance prices.

Small Configuration:

Entry-level package, including **Model 230** Central System with 8 megabytes of main memory, service processor, remote maintenance attachment, console CRT, and printer; 3 PSI I/O processor channels (2 standard and 1 high speed); magnetic tape subsystem with one 1600 bpi (PE) start-stop streamer unit; mass storage subsystem with 3 x 500MB disk units; communication controller with 4 lines; 1 printer interface.	$	98,000
PRU4904 Line Printer (650 lpm) plus power stacker		26,700
Total Purchase Price:	$	124,700

Medium Configuration:

Model 260 Central System with 8 megabytes of main memory, service processor, remote maintenance attachment, console CRT, and printer	$	115,100
CPF4101 first four I/O channels		24,900
CMM4104 additional 8MB memory		14,000
CMM4103 additional 16MB memory		28,000
1 MSS4102 Mass Storage Subsystem		41,400
5 MSU4102 Mass Storage Units (500MB)		69,500
2 Mass Storage Extension Cabinets (each with 500MB drive)		45,020
1 MSA4104 Address Extension		2,050
1 MTP4102 Mag. Tape Processor		39,200
2 MTU4104 Magnetic Tape Units (1600/6250 bpi, 125 ips)		49,800
2 PRU4902 Belt Printers (900 lpm) with interfaces and cables		64,920

1 Datanet 8/10 Network Processor	23,900
1 DCF8003 Console Printer	1,195
1 DCF8002 Console CRT	795
1 DCE8114 Host Connection	8,000
4 DCF8073 Int. Adapter w/AS/S Lines	8,000
1 DCF8052 Multiline Comm. Controller	2,700
Total Purchase Price:	**$538,480**

Large Configuration:

Model 380 Central System with 32 megabytes of main memory, service processor, remote maintenance attachment, console CRT, and printer	$	498,000
2 CPF4101 first four I/O processors		49,800
CMM4104 additional 16-megabyte memory module		28,000
4 MSS4102 Mass Storage Subsystems, each with 2 x 500MB units		165,000
8 MSU4102 500MB Mass Storage Units incl 2 add'l cabinets (MSF4121)		111,200
4 MSF4102 Dual Access		20,400
2 MTP4102 Magnetic Tape Processors		78,400
6 MTU4104 Magnetic Tape Units (1600/6250 bpi, 125 ips)		149,400
2 PRU4903 Belt Printers (1,200 lpm)		71,800
1 Datanet 8/10 Network Processor		23,900
1 DCF8003 Console Printer		1,195
1 DCF8002 Console CRT		795
1 DCE8114 Host Connection		8,000
6 DCF8073 Int. Adapter w/AS/S Lines		12,000
1 DCF8052 Multiline Comm. Controller		2,700
Total Purchase Price:		**$ 1,221,190**

Equipment Prices

	Purchase Price ($)	Maint. Price ($/Mo.)

DPS 7000 PROCESSORS

Note: In addition to details below, the following notes apply to all specified central systems.

Models 230-260 start with *CPU with 256K bytes of cache memory, 8M bytes of memory* one *SPA service processor with Remote Maintenance Adapter, one console CRT, one console printer.*

Model 270 starts with *two CPUs, each with 256K bytes of cache memory;* and (for the entire system) 8 *megabyes of memory,* one SPA with Remote Maintenance Adapter, one console CRT, one console printer.

		Purchase Price ($)	Maint. Price ($/Mo.)

All 3XX models have two CPUs, each with 256K bytes of cache memory, two SPA service processors with Remote Maintenance Adapters, two console CRTs, two console printers.

		Purchase Price ($)	Maint. Price ($/Mo.)
Model 230	Packaged entry-level system including 3 I/O processor channels (two standard, one high-speed); one 1600 bpi (PE) 25-/75-ips magnetic tape unit; mass storage system with 3 x 500MB disk units; 4-line communications controller.	98,000	510
Model 240	Includes 4 I/O channels (2 standard, 2 high-speed); communications controller (4 lines).	73,000	230
Model 250	Includes 4 I/O channels (2 standard, 2 high-speed); communications controller (4 lines).	100,000	320
Model 260	Requires a group of 4 I/O channels.	115,100	415
Model 270	Requires a group of 4 I/O channels.	197,100	525
Model 340	Dual CPU includes 16M bytes of main memory. Requires 2 I/O channels.	250,000	550
Model 360	Dual CPU includes 16M bytes of main memory. Requires 2 I/O channels.	360,000	640
Model 380	Dual CPU includes 32M bytes of main memory. Requires 2 I/O channels.	498,000	810

Processor Options

		Purchase Price ($)	Maint. Price ($/Mo.)
CMM410x	Additional Main Memory (per 8M bytes). Memory maintenance: $20 for 8MB, $25 for 16MB, $50 for 32MB.	14,000	20-50
CPF410x	Group of 4 I/O channels (all standard, or 2 standard and 2 high-speed).	24,900	8
CPF412x	Console Cables (per set).	230	NC
CPK4114	Upgrade from Model 230 to 240.	50,300	23
CPK 4115	Upgrade from Model 240 to 250.	30,000	90
CPK4112	Upgrade from Model 250 to 260.	40,000	95
CPK4110	Upgrade from Model 260 to 270.	110,000	110
CPK4127	Upgrade from Model 340 to 360.	110,000	90
CPK4128	Upgrade from Model 360 to 380.	110,000	170
CPK41xx	Central System Transformation Kits: from older Model 10-92 or 10E-50E to corresponding new model (with claimed 23% to 66% more processing power).	42K-165,000	NC-170

Mass Storage

		Purchase Price ($)	Maint. Price ($/Mo.)
MSS4104	Mass Storage Subsystem with 8 MSU addresses; includes two 500MB units and up to 30 meters of cable; requires one high-speed I/O channel port.	45,000	103
MSS4102	Mass Storage Subsystem with 8 MSU addresses; includes two 500MB units.	41,400	103
MSU4102	Additional 500MB Mass Storage Unit for existing cabinet; all cabinets hold four units.	13,900	40
MSF4121	Additional mass storage cabinet with one 500MB Mass Storage Unit.	22,570	77
MSF4112	I/O Channel Switches (manual and/or dynamic) with cables from 2.6 to 50 meters; price increases with length.	900	9
MSF4122.23	Dual Access for disk contents (four MSS4102 or MSF4121 disk devices).	5,100	48
MSK4107	High-speed interface mod kit for MSS4102 disk unit. Price increases with cable length (15 to 50 meters).	6,000-7,800	NC

Magnetic Tape Equipment

		Purchase Price ($)	Maint. Price ($/Mo.)
MTS4370	Magnetic Tape Subsystem including one drive: 25/75 ips, PE/GCR, 1600/6250 bpi, start-stop/streamer.	27,000	160
MTU0427	Additional Magnetic Tape Unit for MTS4370.	18,770	140
MTP4102	Single Channel Magnetic Tape Processor; includes System 7000 diagnostic interface.	39,200	50
MTU4101	ASCII to EBCDIC translator for MTP 4102 tape processor.	4,900	14
MTU4104	PE/GCR and 125-ips capability for MTP4102 (1600/6250 bpi, 781K bps).	24,900	200
MTF4475	Manual dual-channel switch for MTP4102.	7,004	22

Printers

		Purchase Price ($)	Maint. Price ($/Mo.)
PRU4904	Line Printer; 650 lpm.	23,000	185
PRF4904	Power stacker option for PRU4904.	3,700	NC
PRU4902	Line printer; 900 lpm; includes power stacker.	30,900	200
PRU4903	Line printer; 1,200 lpm; includes power stacker.	35,900	350
PRU7180 to 7182	Model 20, 80-column, 200/40 cps Matrix Serial Printer, ASPI Protocol.	795	8
PRU7185 to 7187	Model 21, 136-column, 200/40 cps Matrix Serial Printer, ASPI Protocol.	1,195	10
PRU7190 to 7192	Model 40, 100-column, 250/66 cps Matrix Serial Printer, ASPI Protocol, with color and bar code printing.	1,595	16
PRU7195 to 7197	Model 41, 136-column, 250/66 cps Matrix Serial Printer, ASPI Protocol, with color and bar code printing.	1,895	19
PRF4xx1	Single Auto Sheet Feeders for above Matrix Printers.	245 to 595	4 to 11
PRF4xx2	Second bin for Auto Sheet Feeder.	220 to 345	3 to 4
PRU726x	Model 85 Laser Printer, 15 ppm, ASPI Protocol, various RS-232-C cables.	6,950	83

		Purchase Price ($)	Maint. Price ($/Mo.)
Terminals			

The following display stations include monitor control units that can also be purchased separately. Cables not included in price.

		Purchase Price ($)	Maint. Price ($/Mo.)
HDS750x	Bull Display Station Model 5 (BDS 5): standard or data entry keyboard, 14-in. green or amber display; RS-232-C/RS-422-A asynchronous interface.	995	6
HDS780x	Bull Display Station Model 7 (BDS 7) with standard keyboard and 14-inch green or amber display; RS-232-C/RS-422-A asynchronous interface.	1,200	8

COMMUNICATIONS

Please see DPS 8000 report under this tab (Page 70C-458LT-401) for prices of Network Support Processors and Datanet options. DPS 7000 systems offer the same devices and options. Note that smaller DPS 7000 systems include a built-in communications controller, making external support unnecessary.

Note: Monthly maintenance prices shown for line/matrix printers and displays are 1/12 of annual fee for on-site maintenance; rate is lower for dispatch or mail-in maintenance. Fixed-rate repair and warranty service options are also available.

NC—No separate charge.
NA—Not applicable.

Software Prices

		Monthly License Fee ($/Mo.)	Init. Lic. Fee + 1st Year Basic Support ($)	Basic Support After 1st Year ($/Yr.)
GCOS 7-AS AND GCOS 7-ASL OPERATING SYSTEM				
SCS3522	GCOS 7-AS Production Base			
	Model 230	2,793	17,575	NA
	Model 240	2,793	28,575	NA
	Models 250/260	2,793	52,525	NA
	Model 270	2,793	93,600	NA
SCS3524	GCOS 7-ASL Multiframe Base			
	Model 340	3,493	113,548	NA
	Model 360	4,593	140,924	NA
	Model 380	6,793	168,300	NA
SCS3523	GCOS 7-AS Information Base			
	Model 230	2,478	11,211	NA
	Model 240	2,478	22,211	NA
	Model 250/260	2,478	38,881	NA
	Model 270	2,478	73,764	NA
SCS3519	GCOS 7-AS Add-On Transactional Option			
	Models 230/240	315	6,364	NA
	Models 250/260	315	13,644	NA
	Model 270	315	19,836	NA
SCS3510	Coupled Systems/Restart Support			
	Models 230/240	140	3,360	NA
	Models 250/260	140	4,200	NA
	Models 270/340/360	140	5,040	NA
	Model 380	140	5,880	NA
SCU3500	Control Tools and System Measurement			
	Models 230/240	207	4,968	NA
	Models 250/260	207	6,210	NA
	Models 270/340/360	207	7,452	NA
	Model 380	207	8,694	NA

		Monthly License Fee ($/Mo.)	Init. Lic. Fee + 1st Year Basic Support ($)	Support After 1st Year ($/Yr.)
SCC3507	Unified File Transfer			
	Models 230/240	50	1,200	NA
	Models 250/260	50	1,500	NA
	Models 270/340/360	50	1,800	NA
	Model 380	50	2,100	NA
SCC3510	Distributed Job Processing			
	Models 230/240	67	1,641	NA
	Models 250/260	67	2,010	NA
	Models 270/340/360	67	2,412	NA
	Model 380	67	2,814	NA
SCC3506	DPS 6 Communications			
	Models 230/240	125	3,000	NA
	Models 250/260	125	3,750	NA
	Models 270/340/360	125	4,500	NA
	Model 380	125	5,250	NA
SCS3515	Distributed Operation Facility—Multiconsole			
	Models 230/240	60	1,440	NA
	Models 250/260	60	1,800	NA
	Model 270/340/360	60	2,160	NA
	Model 380	60	2,520	NA
SCS3517	Distributed Operation Facility—Remote			
	Models 230/240	75	1,800	NA
	Models 250/260	75	2,250	NA
	Models 270/340/360	75	2,700	NA
	Model 380	75	3,150	NA
SCX3501	Communications Package			
	Models 230/240	376	9,185	NA
	Models 250/260	376	11,448	NA
	Models 270/340/360	376	13,738	NA
	Model 380	376	16,027	NA
SCX3502	Software Engineering Package			
	Models 230/240	798	18,861	NA
	Models 250/260	798	23,976	NA
	Models 270/340/360	798	30,691	NA
	Model 380	798	38,883	NA
SCD3500	I-D-S/II Database Manager			
	Models 230/240	471	11,304	NA
	Models 250/260	471	13,130	NA
	Models 270/340/360	471	16,956	NA
	Model 380	471	22,628	NA
SCC3517	Extended Cooperative Processing (XCP1)			
	Models 230/240	130	3,120	NA
	Models 250/260	130	3,900	NA
	Models 270/340/360	130	4,680	NA
	Model 380	130	5,460	NA
SCL3543	IQS Relational Option			
	Models 230/240	340	6,000	NA
	Models 250/260	340	10,200	NA
	Models 270/340/360/380	340	18,192	NA
SCL3524	IQS Update			
	Models 230/240	98	2,352	NA
	Models 250/260	98	2,950	NA
	Models 270/340/360	98	3,528	NA
	Model 380	98	4,116	NA
ACN0053T	Tempus-Link/Virtual Disk (1-5 users)	NA	3,000	NC
ACN0054T	Tempus-Link/Micro-Host Application (HAPI)	NA	1,120	120
ACN0055T	Tempus-Link/Host Access Method	NA	3,920	420
ACN0056T	Tempus-Link/Virtual Disk Extension, 6th through 10th user (additional charges for larger groups)	NA	2,000	NC
ACP0026P	Mistral V5 Extended	NA	50,400	5,400
ACP0027P	Mistral V5 Full Text	NA	10,080	1,080
ACP0028P	Mistral V5 Factual Data	NA	20,160	2,160

		Monthly License Fee ($/Mo.)	Init. Lic. Fee + 1st Year Basic Support ($)	Basic Support After 1st Year ($/Yr.)
ACP0029P	Mistral V5 Entry (5 users)	NA	28,000	3,000
SCD3530	Oracle Relational Database Management System			
	Model 2300	NA	21,000	2,520
	Model 240	NA	28,000	3,360
	Models 250/260	NA	42,000	5,040
	Models 270/340/360	NA	63,000	7,560
	Model 380	NA	83,000	9,960
SCL3911	Mantis			
	Models 230/240	NA	23,000	3,000
	Models 250/260	NA	28,750	3,750
	Models 270/340	NA	34,500	4,500
	Models 360/380	NA	46,000	6,000
SCL3501	Fortran Language Processor			
	Models 230/240	244	6,216	NA
	Models 250/260	244	7,320	NA
	Models 270/340/360	244	8,784	NA
	Model 380	244	10,248	NA
SCL3537	C Language Processor			
	Models 230/240	154	3,696	NA
	Models 250/260	154	4,620	NA
	Models 270/340/360	154	5,544	NA
	Model 380	154	6,468	NA
SCL3505	Pascal Language Processor			
	Models 230/240	247	5,928	NA
	Models 250/260	247	7,410	NA
	Models 270/340/360	247	8,892	NA
	Model 380	247	10,374	NA
SCL3503	GPL Language Processor			
	Models 230/240	344	8,256	NA
	Models 250/260	344	10,320	NA
	Models 270/340/360	344	12,384	NA
	Model 380	344	14,448	NA
SCL3507	APL Language Processor			
	Models 230/240	301	7,724	NA
	Models 250/260	301	9,030	NA
	Models 270/340/360	301	10,836	NA
	Model 380	301	12,642	NA
SCP3502	Interactive Program Checkout Facility			
	Models 230/240	99	2,000	NA
	Models 250/260	99	4,000	NA
	Models 270/340/360	99	6,000	NA
	Model 380	99	8,000	NA
SCD3502	Data Dictionary			
	Models 230/240	298	7,152	NA
	Models 250/260	298	8,940	NA
	Models 270/340/360	298	10,728	NA
	Model 380	298	12,516	NA
	Note: The following items are not applicable to Models 230 and 240.			
SNS7003	Basic DNS for Datanet 8/20 and Datanet 8/30	333	10,000	NA
SNU7001	Network Operator Interface	56	1,690	NA
SNE7001	Attached Processor Support	166	5,000	NA
SNC7003	VIP Terminal Support	100	3,000	NA
SNC7001	Primary Network Control	55	1,650	NA
SNC7011	X.25 Private Network Packet Switching	50	1,458	NA
SNC7012	X.25 Public Network/VAN/PAD	99	2,970	NA
SNC7004	BSC3270 Terminal Support	99	2,970	NA
SNC7020	BSC2780 Cobol MCS Support	72	2,145	NA
SNC7018	OSF/SNA Gateway (Remote)	305	9,150	NA
SNM7006	OSF/SNA Reverse Gateway	118	3,540	NA
SNS7008	DNS Package for Datanet 8/10	606	17,323	NA

		Monthly License Fee ($/Mo.)	Init. Lic. Fee + 1st Year Basic Support ($)	Support After Ist Year ($/Yr.)
	Note: The following two items are applicable to Models 230/240/250/260.			
SNC3506	CNS 7 Ethernet LAN Support	75	1,813	NA
SNC3507	CNS 7 ISO Access to DSA Applications	30	707	NA
SCC3522	TCP/IP with FTP and Telenet			
	Models 230/240	168	4,032	NA
	Models 250/260	168	5,040	NA
	Models 270/340/360	168	6,048	NA
	Model 380	168	7,056	NA

NC—No separate charge.
NA—Not applicable. ■