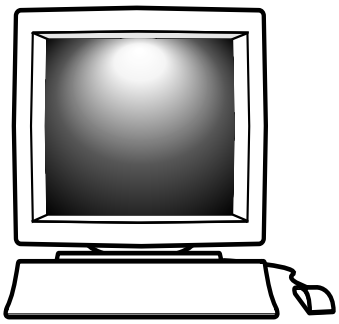
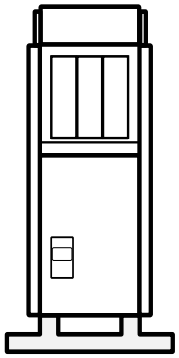
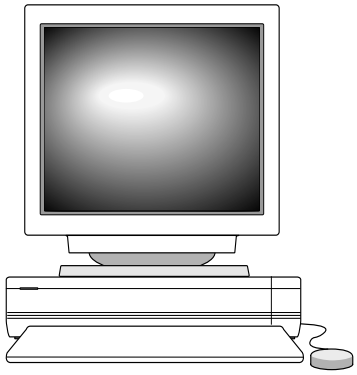
Alpha AXP Workstation Family Performance Brief - OpenVMS





DEC 3000 Model 500 AXP Workstation



DEC 3000 Model 400 AXP Workstation

INSIDE

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Alpha AXP Workstation Family Performance Brief - OpenVMS

Introducing Digital's Alpha AXP Workstation Family

This document presents the results of industry-standard benchmarks on the DEC 3000 Model 400 AXP™ and DEC 3000 Model 500 AXP workstations in the DEC OpenVMS™ AXP™ operating system environment. Both workstations are members of Digital's breakthrough 64-bit RISC architecture.

DEC 3000 Model 400 AXP Workstation

The DEC 3000 Model 400 AXP workstation is Digital's entry-level, desktop workstation, and it runs at a CPU clock speed of 133 MHz. This workstation allows for expansion of memory, storage, I/O, and graphics.

The DEC 3000 Model 400 AXP workstation satisfies the performance needs of technical users developing or deploying software and of commercial users doing financial analysis, network management, publishing, and database services.

DEC 3000 Model 500 AXP Workstation

The DEC 3000 Model 500 AXP workstation is the most powerful system in Digital's 64-bit Alpha AXP™ workstation family, and it runs at a CPU clock speed of 150 MHz. The DEC 3000 Model 500 AXP workstation uses advanced CPU, TURBOchannel, and graphics technologies. This workstation is available in a deskside or rackmountable configuration.

The DEC 3000 Model 500 AXP workstation is the system of choice for such high-performance technical and commercial applications as mechanical CAD, scientific analysis, medical imaging, animation and visualization, financial analysis, and insurance processing.

Digital's Alpha AXP Workstation Family Performance

The performance of the Alpha AXP workstation family was evaluated using industry-standard benchmarks. These benchmarks allow comparison across vendors.

Performance characterization is one "data point" to be used in conjunction with other purchase criteria such as features, service, and price. Features may include resource sharing with VMSclusters, multi-vendor integration with Network Application Support (NAS), and network management with DECmcc.

For more information on Digital's Alpha AXP workstation family, please contact your local Digital sales representative.

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Table 1 Digital's Alpha AXP Workstation Family Benchmark Results

Benchmark	DEC 3000 Model 400 AXP	DEC 3000 Model 500 AXP
SPECmark89	108.1	121.5
SPECint92	65.3	74.3
SPECfp92	112.2	126.0
LINPACK 64-bit Double-Precision		
100X100 (MFLOPS)	26.4	30.2
1000x1000 (MFLOPS)	70.8	79.9
Dhrystone V1.1 (instructions/second)	228,310.0	257,731.0
V2.1 (instructions/second)	249,625.6	281,214.8
X11perf (2D Kvectors/second)	564.0	636.0
X11perf (2D Mpixels/second)	27.4	31.0
DN&R Labs CPU2 (MVUPs)	179.4	197.5

Notes: The performance information in this report is for guidance only. System performance is highly dependent upon application characteristics. Individual work environments must be carefully evaluated and understood before making estimates of expected performance. This report simply presents the data, based on specified benchmarks. Competitive information is based on the most current published data for those particular systems and has not been independently verified.

We chose the competitive systems (shown with the Alpha AXP workstations in the following charts and tables) based on comparable or close CPU performance and coupled with comparable expandability capacity, mostly memory and disk. Although we do not present price comparisons in this report, system price was a secondary factor in our competitive choices.

The Alpha AXP performance information presented in this brief is the latest measured results as of the date published. Digital has an ongoing program of performance engineering across all products. As system tuning and software optimizations continue, Digital expects the performance of its workstations to increase. As more benchmark results become available, Digital will publish reports containing the new and updated benchmark data.

SPEC Benchmark Suites

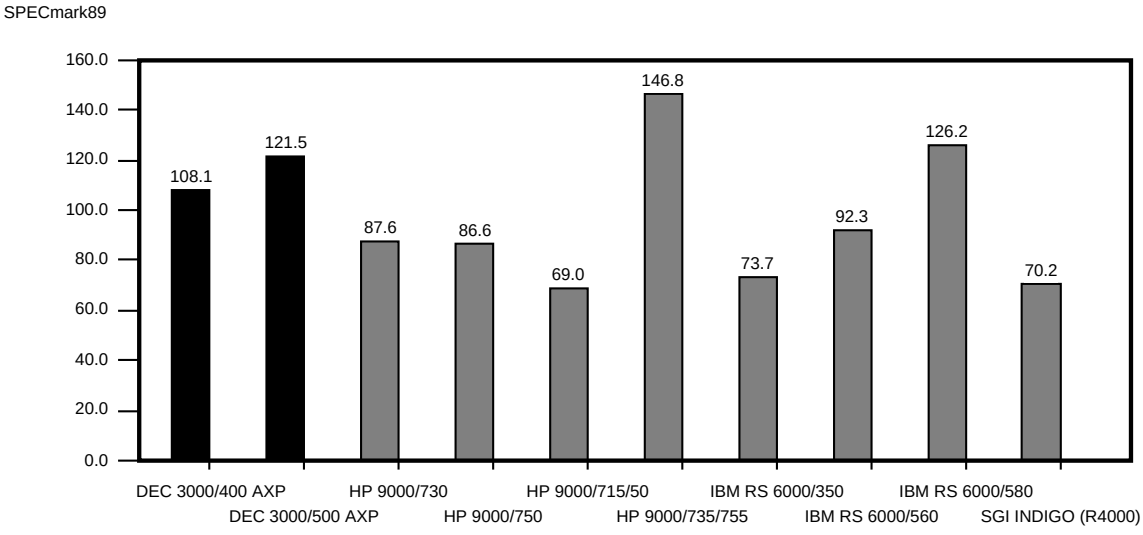
SPEC™ (Standard Performance Evaluation Corporation) was formed to identify and create objective sets of applications-oriented tests, which can serve as common reference points and be used to evaluate performance across multiple vendors' platforms.

SPEC Release 1

In October 1989, SPEC introduced SPEC Release 1, a benchmark suite that measures CPU-intensive, single stream performance of uniprocessor systems. SPEC Release 1 consists of ten portable programs similar to those found in technical environments. Four programs are written in C and primarily test integer performance. The remaining six programs are written in FORTRAN and measure floating-point performance. SPECmark89™ is the metric for this suite.

SPECmark89 represents the geometric mean of the ten benchmark SPECratios™. The SPECratio for a benchmark is the quotient derived from dividing the SPEC Reference Time by a particular machine's corresponding run time. The SPEC Reference Time is the time that it takes a DEC VAX 11/780 to run each benchmark (in seconds).

Figure 1 SPECmark89 Benchmark Results



SPEC CINT92 and CFP92

In January 1992, SPEC announced the availability of the CINT92 and CFP92 benchmark suites. CINT92, the integer suite, contains six real-world application benchmarks written in C. The geometric mean of the suite's six SPECratios is the SPECint92™ figure. CFP92 consists of fourteen real-world applications; two are written in C and twelve in FORTRAN. Five of the fourteen programs are single precision, and the rest are double precision. SPECfp92™ equals the geometric mean of this suite's fourteen SPECratios.

CINT92 and CFP92 have different workload characteristics. Each suite provides performance indicators for different market segments. SPECint92 is a good base indicator of CPU performance in a commercial environment. SPECfp92 may be used to compare floating-point intensive environments, typically engineering and scientific applications.

Figure 2 SPEC CINT92 Benchmark Results

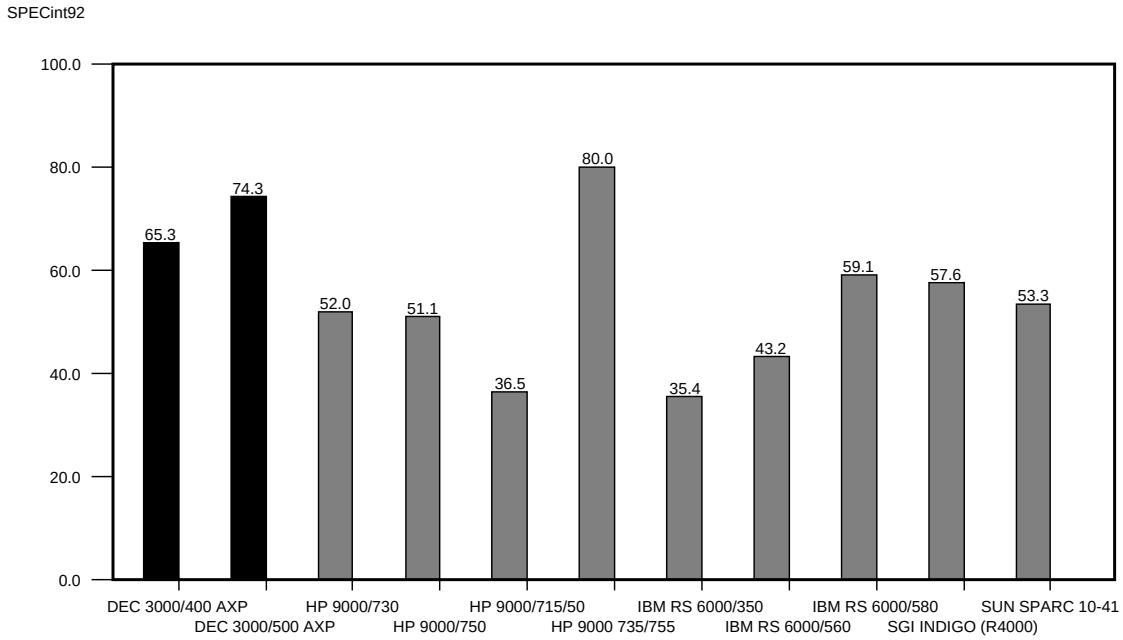
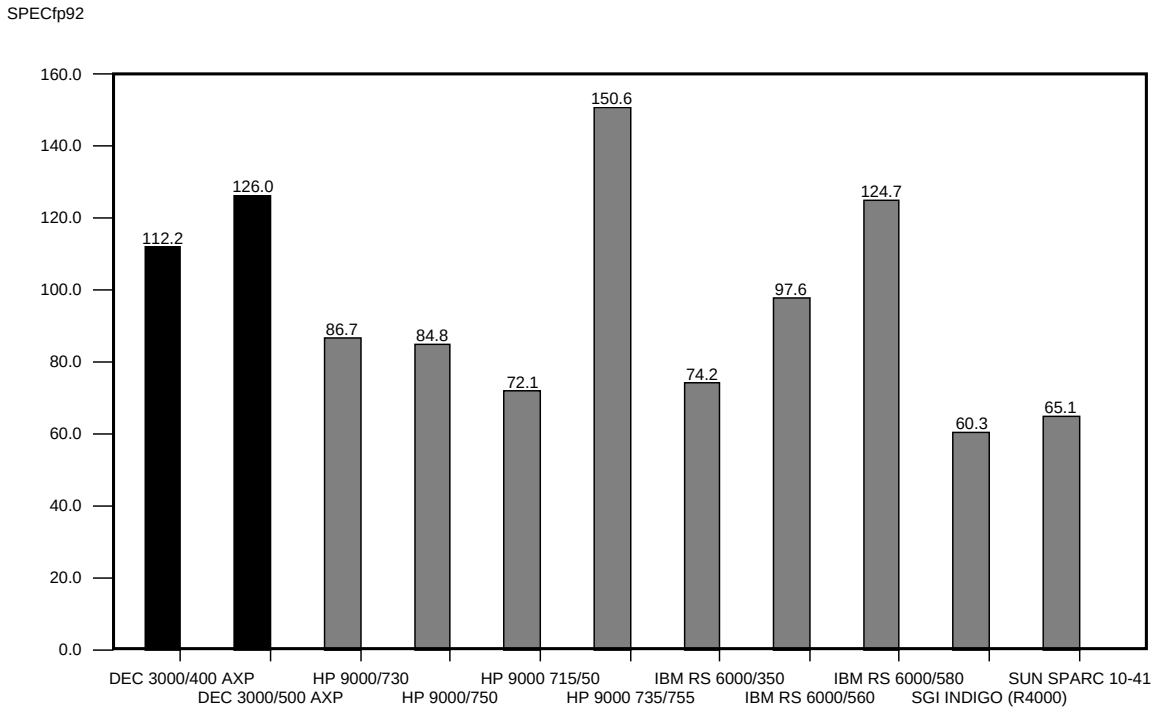


Figure 3 SPEC CFP92 Benchmark Results



LINPACK 100x100 and 1000x1000

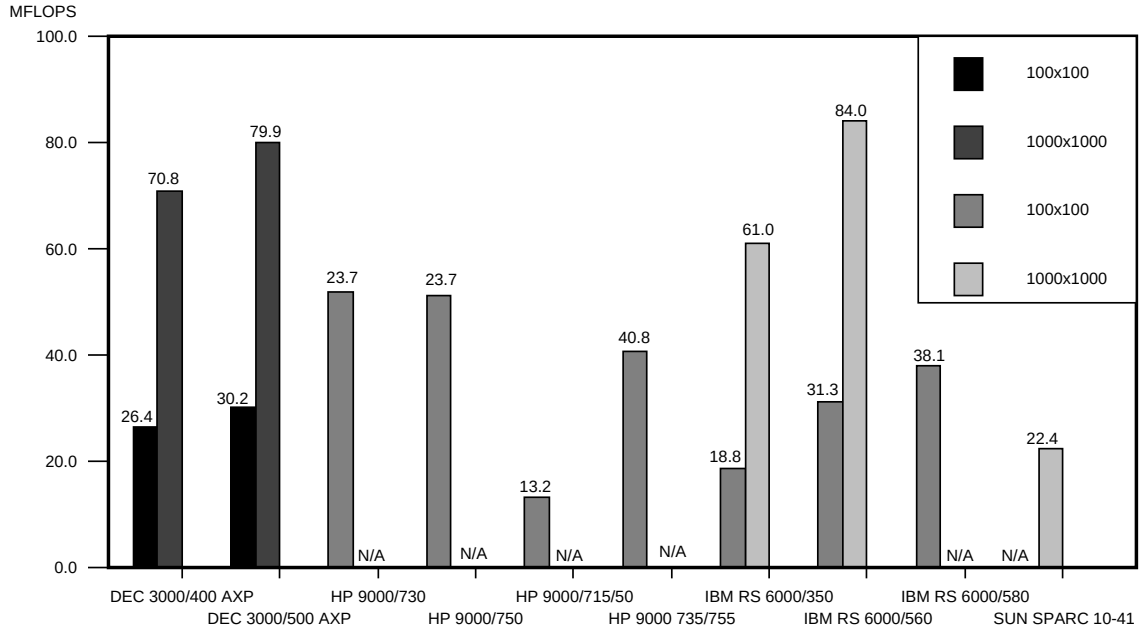
LINPACK is a linear equation solver written in FORTRAN. LINPACK programs consist of floating-point additions and multiplications of matrices. The LINPACK benchmark suite consists of two benchmarks.

1. 100x100 LINPACK solves a 100x100 matrix of simultaneous linear equations. Source code changes are not allowed so that the results may be used to evaluate the compiler's ability to optimize for the target system.

2. 1000x1000 LINPACK solves a 1000x1000 matrix of simultaneous linear equations. Vendor optimized algorithms are allowed.

The LINPACK benchmarks measure the execution rate in MFLOPS (millions of floating-point operations per second). When running, the benchmark depends on memory-bandwidth and gives little weight to I/O. Therefore, when LINPACK data fit into system cache, performance may be higher.

Figure 4 LINPACK 100x100 and 1000x1000 Double-Precision Benchmark Results



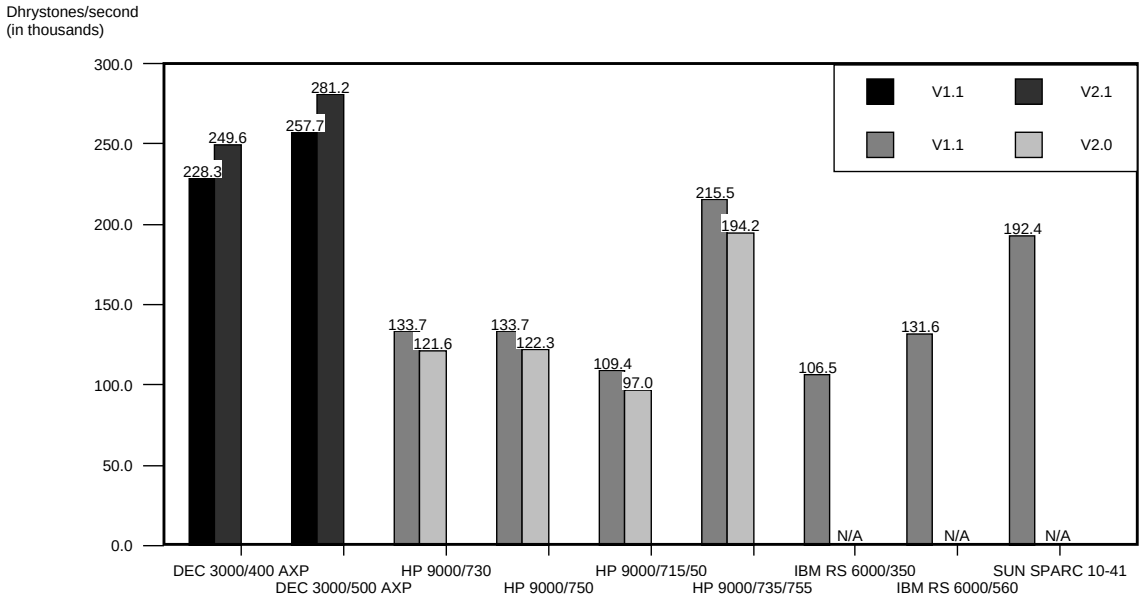
Dhrystone

Developed as an Ada program in 1984, the Dhrystone benchmark was rewritten in C in 1986. It measures processor and compiler efficiency and is representative of systems programming environments. Dhrystones are most commonly expressed in Dhrystone instructions per second and in integer MIPS (millions of instructions per second). For V1.1, one Dhrystone MIP equals the number of Dhrystone instructions per second performed by a DEC VAX 11/780 (1757 Dhrystone instructions/second).

Dhrystone V1 and V2 vary considerably. Version 1.1 contains sequences of code segments that calculate results never used later in the program. These code segments are known as "dead code." Compilers able to identify the dead code can eliminate these instruction sequences from the program. These compilers allow a system to complete the program in less time and result in a higher Dhrystones rating. Dhrystones V2 was modified to execute all instructions.

Note: The Dhrystone benchmark is small and fits completely in most system caches. Level of compiler optimization, as well as the particular hardware architecture, can affect results.

Figure 5 Dhrystone V1.1 Benchmark Results



X11perf Benchmark

X11perf tests various aspects of X server performance including simple 2D graphics, window management functions, and X-specific operations. Other non-traditional graphics include CopyPlane and various stipples and tiles.

X11perf employs an accurate client-server synchronization technique to measure graphics operations' completion times. X11perf tests both graphics primitive drawing speeds and window environment manipulation.

Table 2 contains the two most commonly requested performance metrics from X11perf tests for 2D graphics systems: X11perf *10-pixel line* tests and X11perf *Copy 500x500 from pixmap to window* tests. The *10-pixel line* results are shown in units of 2D Kvectors/second drawing rate, and the *Copy 500x500 from pixmap to window* are shown in units of 2D Mpixels/second fill rate (1 Mpixel equals 1,048,576 pixels).

Table 2 X11perf Benchmark Results

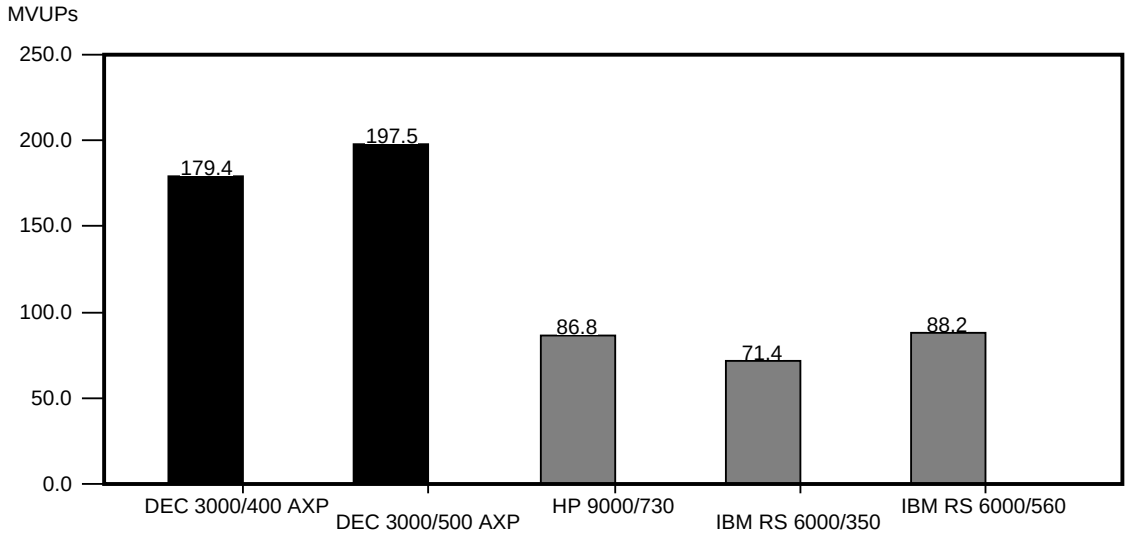
Workstation	2D Kvectors/second	2D Mpixels/second
DEC 3000 Model 500 AXP	636.0	31.0
DEC 3000 Model 400 AXP	564.0	27.4
HP 9000 Model 735/755 CRX	971.0	np
HP 9000 Model 730 CRX	908.0	38.1
HP 9000 Model 720 CRX	868.0	22.8
HP 9000 Model 715/50 C	860.0	np
SGI Crimson Elan (R4000)	389.0	9.3

np = not published

DN&R Labs CPU2

DN&R Labs CPU2, a benchmark from *Digital Review & News* magazine, is a floating-point intensive series of FORTRAN programs and consists of thirty-four separate tests. The benchmark is most relevant in predicting the performance of engineering and scientific applications. Performance is expressed as a multiple of MicroVAX II Units of Performance (MVUPs).

Figure 6 DN&R Labs CPU2 Benchmark Results



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References

System and Vendor	Sources
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DEC 3000 Model 500 AXP Workstation	All benchmarking performed by Digital Equipment Corporation.
HP 9000 Model 720	X11perf benchmark results from Workstation Laboratories, Inc., Volume 13, Chapter 11 (4/1/91).
HP 9000 Model 730	SPEC benchmark results reported by HP (11/10/92). Dhrystone and LINPACK 100x100 benchmark results reported in "HP Apollo 9000 Series 700 Performance Brief" (1/92). LINPACK 1000x1000 reported by Dongarra, J., "Performance of Various Computers Using Standard Linear Equations Software" (9/28/92). DN&R Labs CPU2 and X11perf benchmark results reported by Workstation Laboratories, Inc., Volume 16, Chapter 12 (3/1/92).
HP 9000 Model 750	SPEC benchmark results reported by HP (11/10/92). Dhrystone and LINPACK 100x100 benchmark results reported in "HP Apollo 9000 Series 700 Performance Brief" (1/92).
HP 9000 Models 715/50 and 735, and 755	SPEC, LINPACK, Dhrystone, and X11perf benchmark results reported in "HP Apollo 9000 Series 700 Workstation Systems Performance Brief" (11/92).
IBM RS 6000 Models 350 and 560	SPEC benchmark results reported by IBM (9/92). Dhrystone and DN&R Labs CPU2 benchmark results reported in Workstation Laboratories, Inc., Volume 16, Chapter 20 (3/1/92). LINPACK benchmark results reported by IBM (9/92) and Dongarra, J., "Performance of Various Computers Using Standard Linear Equations Software" (9/28/92).
IBM RS 6000 Models 580 and 980	SPEC benchmark results reported in *SPEC Newsletter* (9/92). LINPACK benchmark results reported by IBM (9/92).
SGI Crimson Elan (R4000)	X11perf benchmark results reported in Workstation Laboratories Inc., Volume 17, Chapter 21 (5/1/92).
SGI INDIGO (R4000)	SPEC benchmark results reported in *SPEC Newsletter* (9/92).
SUN SPARC 10 Model 41	SPEC benchmark results reported in *SPEC Newsletter* (9/92). LINPACK and Dhrystone benchmark results reported by SUN (11/10/92).