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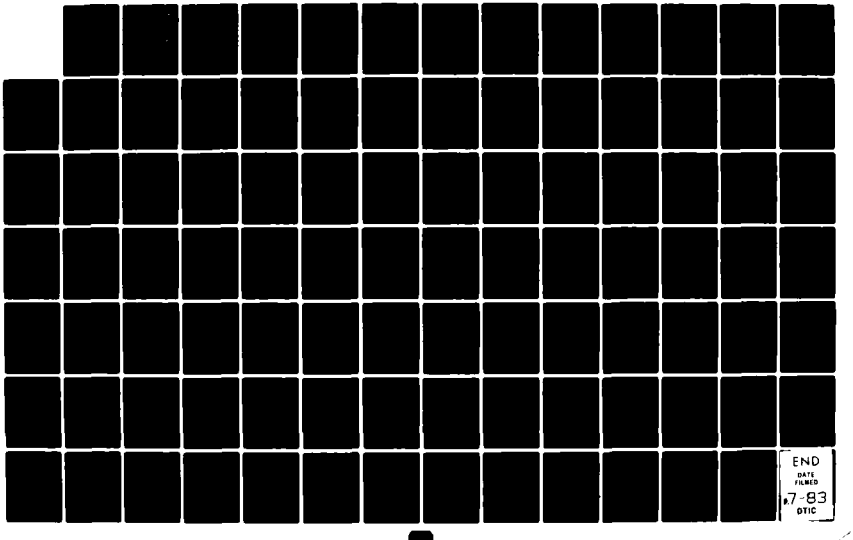

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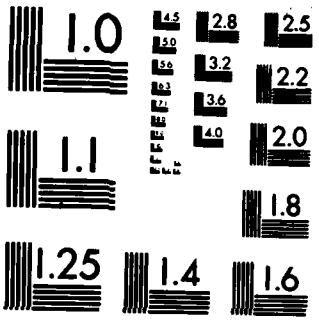

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Bethesda, Maryland 20084

SCIENTIFIC/ENGINEERING WORK STATIONS: A MARKET SURVEY

by

James R. Carlberg

JUN 16 1983

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DEPARTMENTAL REPORT

May 1983

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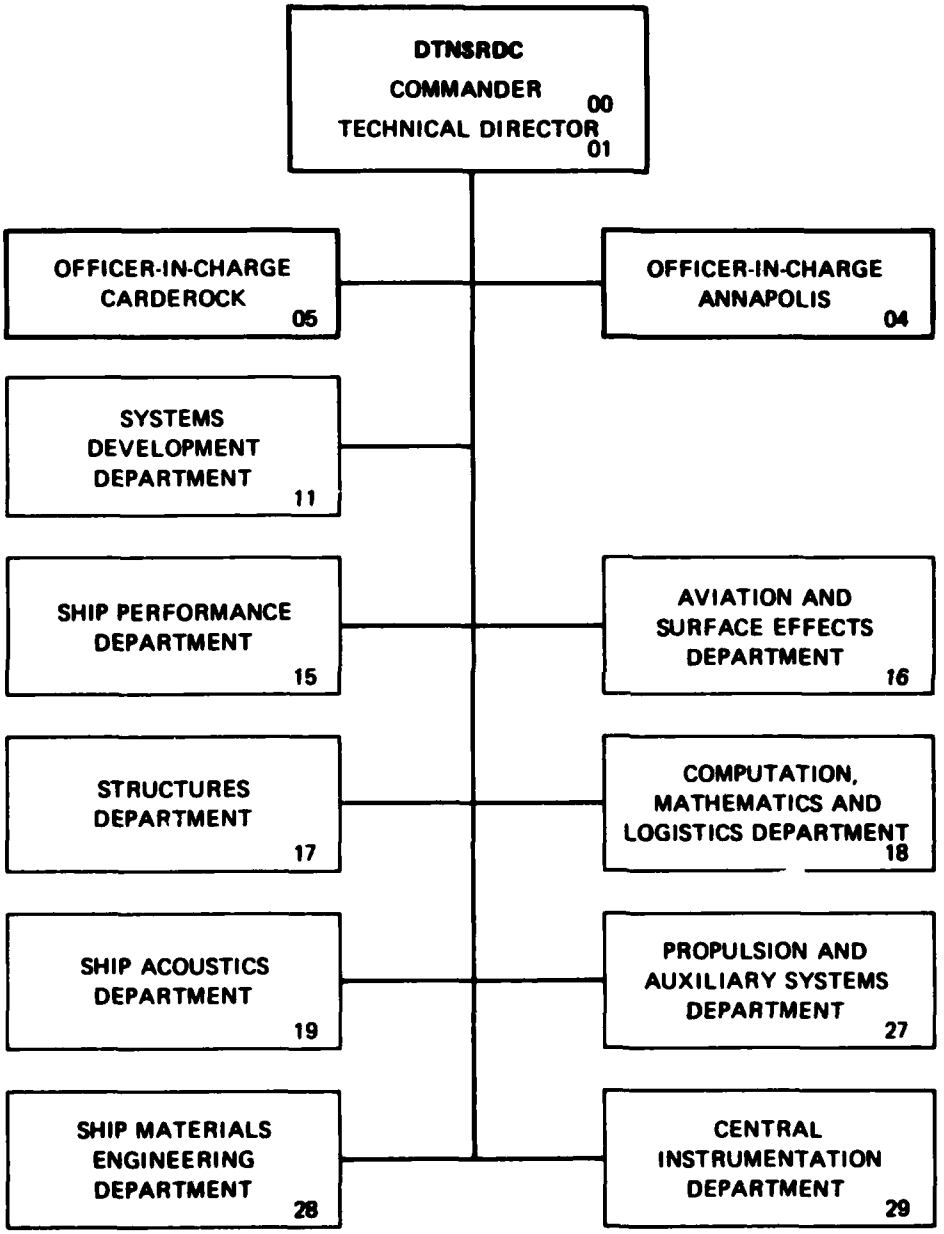

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> The David Taylor Naval Ship R&D Center (DTNSRDC), along with the white-collar segment of American business, is confronted with flat or declining productivity in the office, rising personnel costs, personnel ceilings and reductions, and a shortage of skilled workers, especially within the technical and scientific areas. Spurred by the development of powerful microprocessors and new software, designers of advanced intelligent work-stations are developing a new class tool for technical personnel. These

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workstations are growing as tools to increase the productivity of scientists, engineers and managers. Five aspects go into making an efficient, productive workstation. These aspects are a flexible processor, general purpose and application oriented software, sophisticated graphics, local area network communications, and data base management. This report documents the results of a market survey to identify systems that can potentially meet requirements for engineering workstations. Additionally, workstation application requirements for some of the Center's departments are discussed. System requirements are discussed and are presented as a functional description.

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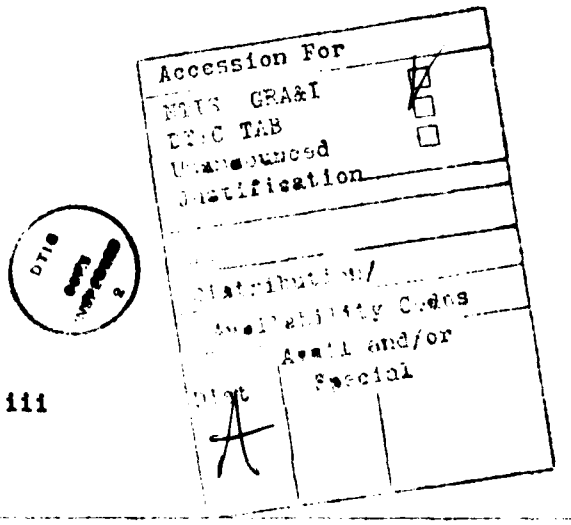

ABSTRACT

The David Taylor Naval Ship R&D Center (DTNSRDC), along with the white-collar segment of American business, is confronted with flat or declining productivity in the office, rising personnel costs, personnel ceilings and reductions, and a shortage of skilled workers, especially within the technical and scientific areas. Spurred by the development of powerful microprocessors and new software, designers of advanced intelligent workstations are developing a new class tool for technical personnel. These workstations are growing as tools to increase the productivity of scientists, engineers and managers. Five aspects go into making an efficient, productive workstation. These aspects are a flexible processor, general purpose and application oriented software, sophisticated graphics, local area network communications, and data base management. This report documents the results of a market survey to identify systems that can potentially meet requirements for engineering workstations. Additionally, workstation application requirements for some of the center's departments are discussed. System requirements are discussed and are presented as a functional description.

INTRODUCTION

DTNSRDC, along with the white-collar segment of American business, is confronted with flat or declining productivity in the office, rising personnel costs, personnel ceilings and reductions, and a shortage of skilled workers, especially within the technical and scientific areas. Yet as a critical RDT&E activity for Navy vehicles, the Center must continue to provide essential services and meet the challenge of increasing workloads for national defense regardless of these problem areas. In recognition of this situation, Center management has established the Technical Office Automation and Communication System (TOFACS) Program to plan and implement a Center-wide Office Automation System for improving office operations and personnel effectiveness of management, technical, administrative, and clerical personnel. The TOFACS program established a pilot office automation test-bed to test and evaluate various concepts, capabilities, and products among a limited number of users and codes at the Center. This effort has served to demonstrate the usefulness of the system capabilities in performing technical work and in better identifying user and system requirements needed for planning and specifying the eventual Center-wide system.

Spurred by the development of powerful microprocessors and new software, designers of advanced workstations are developing a new class tool for technical personnel. Intelligent workstations are growing as tools to increase the productivity of scientists, engineers and managers. The workstations are becoming easier to use, offering a growing variety of input devices besides the alphanumeric keyboard; sophisticated display capability both in CRT graphics and hard-copy output devices; and advanced software packages for language processing, as will as for color and graphics displays.

With increasing processing and I/O capability, intelligent workstations are well suited to handle the general-purpose and application-oriented software. Workstations can assist users with design, development, analysis, and simulation of problems. As work progresses, the workstation can provide documentation assistance which may range from figure generation to copy preparation. Newer software packages will also be proof-reading the operator's copy, pointing out poor English language usage and suggesting changes, and providing refresher information on grammatical usage.

Color and graphics software development will continue to make the workstation easier to use and a more powerful tool for the operator. Standardization of the structure of the graphics language is moving forward with the latest version of the Core system from the Graphics Standards Planning Committee of the SIGGRAPH group of the Association for Computing Machines (ACM).

Another aspect of enhancing the workstation is to provide efficient communications between stations not only along a common local network, but also between networks. By transferring text, program, and data files between workstations, local-area networks provide such automated services as data sharing, resource sharing, communications, and distributed processing within the office. These services can be supplied on an interoffice basis by transferring files between different networks or between remote mainframes and local networks. High-bandwidth communications are a necessity if users are to communicate at a rate limited only by their own capacity, not by the system's response time.

Effective management of data bases is another workstation aspect. Data base management systems hold the promise of improved productivity by simplifying interactions between man and the computer system.

Engineering workstations must also fit engineering environments. Most scientists, engineers, and managers possess relatively little space to devote to desktop processors, so workstations must occupy minimal areas. The workstation must ensure operator comfort.

Why is a workstation needed when a single time-shared system could perform equivalent tasks? The answer to the question is "because of response time." Most time-shared systems provide satisfactory response times as long as the number of users is small. But as more users are added, the time-shared system becomes overworked, and response time can be substantially slowed. The dedicated office workstation, having to shared peripherals, can operate as both stand-alone, desk-top computers for performing technical tasks, and as on-line terminals to remote host computers at the Center. As such, they will provide a convenient and economical way to off-load small-to-modest computational tasks from the host computers, while allowing fast response in performing these tasks and continued use of the larger processors through communication interfaces.

The functional requirements for engineering workstations on the center vary from one organization to another. While these requirements vary, they in general can be divided into six broad areas. These functional areas are

I. Input preparation

Prepare and verify input to programs before attempting long and expensive runs on a large computer system.

II. Program development

Develop and debug software locally where the programmer can directly interact with the workstation.

III. Program execution

Many programs can be executed programs locally while others can be executed remotely on a large central computer by sending program and or data to central site via a communications link.

IV. Output analysis

Examine results by paging through output and/or dumps at the workstation to verify results.

V. Output presentation

Present the output in forms of graphs, charts, or tables that best show the results.

VI. Documentation

Preparation of program or analysis documentation using output results as figures or view-graphs.

The computational requirements for engineering work stations on the center also vary from one organization to another. These requirements run the spectrum from a powerful calculator to a numerical analysis tool. Memory requirements can run from 64K bytes to greater than 10M bytes. Disk storage requirements and graphics requirements also very greatly. Systems to meet these requirements range in cost from $5K to $100K.

The cost of providing to the center's technical personnel workstations that meet all technical requirements would be prohibitive. To provide the greatest cost benefit, individual workstations should meet, as closely as possible, the needs of the user(s). Workstations must be flexible so that systems can be upgraded to meet new requirements and/or to take advantage of technological advances. Workstations should be compatible so that systems from different vendors can communicate and exchange software from one workstation be run on another workstation. Thus allowing a free flow of ideas and software from one group to another. Systems must be able to communicate with the centerwide office automation system. To achieve flexibility and compatibility, systems should have at least a 16 bit word length, use a common flexible operating system, and support a local network communications protocol that can be bridged to a master network.

This report documents the results of a market survey to identify systems that can potentially meet requirements for engineering workstations. Additionally, workstation application requirements for some of the center's departments are discussed. System requirements are discussed and are presented as a functional description.

BASIC APPLICATIONS

BACKGROUND

Engineering workstation applications were identified for several departments at DTNSRDC-Carderock. Richard Van Eseltine and Marybeth Marquardt of code 1843 research the applications of the Ship Performance Department, the Structures Department, and the Numerical Mechanics Division of the Computation, Mathematics and Logistics Department. The Systems Development Depart-

ment requirements were complements of Vancelle Jones of code 1103. The Aviation and Surface Effects Department applications were obtained from a meeting with Dr. Harvey Chaplin and Joseph Wilkerson of code 16.

SYSTEMS DEVELOPMENT DEPARTMENT

Systems Development Department (SDD) Information Systems Steering Group recommended obtaining a package with similar capabilities to the Hewlett-Packard Engineering Package or the Tektronix Engineering Package as two excellent examples of computer software for the "Engineer". Some SDD "Engineering Work Station" requirements are listed below:

A. Graphics capability
    1. x/y linear and logarithmic plotting
    2. Bar Graphs
    3. Circle graphs, Pie Charts
    4. Scales (eg. log-log/ semi-log scales/ probability scales)
    5. Use of coded symbology on graphs (eg. being able to use small triangles, circles, or squares, etc.-colored in or blank- on the data values or points of the graph.
    6. Storage of standard shapes and symbols used in flowcharting or block diagrams.
    7. PERT Chart capability
    8. Color capability
    9. Printing capability (Both hardcopy and viewgraph production)

B. Calculator function (eg. including all functions of the typical hand-held calculator)

C. Equation Composition (eg. being able to make an equation using all mathematical symbols for insertion into text and documents. Use of Greek letters and full array of Engineering symbols accessible via keyboard)

D. Statistics package (including linear regression, least squares fit, and other standard programs)

E. Data base management capability (similar to capabilities available in the SHARP DBMS providing easy data storage and retrieval)

F. Access to large computer, its software, and its hardware such as the CALCOMP printer

SHIP PERFORMANCE DEPARTMENT

The Ship Performance Department (SPD) plans and conducts research and development, fundamental and applied, on the hydromechanics characteristics of Naval vehicles, in areas such as:

Ship powering systems
Hull design
Propulsor characteristics
Submarine maneuvering
Propellers/thrusters
Seakeeping evaluation

AVIATION AND SURFACE EFFECTS DEPARTMENT (ASED)

The Aviation and Surface Effects Department (ASED) currently use Tektronix 4052's with which they are happy. They wish to retain the capabilities of the 4052's plus add the ability to tie into the center's office automation system. Their minimum criteria are as follows:

a. Fast stand-alone BASIC processor (64K byte).
   (Note: most of their personnel had to learn BASIC and already know FORTRAN).
b. User friendly graphics software.
c. Built in floppy disk or tape (300K byte)
d. Graphics copier or printer-plotter at each station.
   (Need not equal Tektronix quality at all stations, but hardcopy is a necessity).
e. Can function as terminal to host computers.
f. Compact: Entire system will fit on half a desk, or on a small table.

Computational accuracy is not important because assumptions in the input have greater inaccuracy.

Application programs that ASED would be interested in at least partially implementing at a workstation include two helicopter dynamics programs that require most of the resources of the Cyber 74 which must be run overnight. They are not currently satisfied with current situation. Output of one program is plotted by hand, and the other program's (time history analysis) plots are generated on the 4052.

As a final note, ASED has expressed an interest in having the office automation system have access to the library and financial management data bases. Access to the financial management is being implemented. Access to the library data is an important function for an engineering organization and is an important possible expansion of the system.

STRUCTURES DEPARTMENT

The Structures Department is responsible for developing improved methods for analyzing, designing, constructing, and maintaining structural elements of ships. This responsibility involves application areas such as ship vulnerability to weapons and accidental damage and the effectiveness of antiship weapon warheads. An engineering workstation would be helpful in preparing and verifying data for programs that require most of the resources of center computers and must be run overnight. Graphics is necessary in presenting the output. Programs of interest are as follows:

Axisymmetric/Planar Elastic Structures (APES) - finite element program for fracture and stress analysis.

BOSOR 4 - program for the analysis of stiffened shells of revolution.

GIST - two groups of programs

1) GIFTS - pre- and post-processing interactive graphics program (2D, 3D model generation)

2) STAGS - nonlinear analysis program.

ADINA - finite element program.

SUBVEM - submarine vulnerability analysis program.

COMPUTATION, MATHEMATICS AND LOGISTICS DEPARTMENT (CMLD)

Numerical Mechanics Division of Computation, Mathematics and Logistics Department (CMLD) performs research in numerical fluid dynamics, structural mechanics, and numerical analysis for solving problems in fields of continuum mechanics. This division also develops numerical tools, such as computer programs and data processing procedures for ship design. Their basic workstation requirements are for input preparation, program development program execution, output analysis, and output presentation. Programs of interest include the following:

STERN3D - program to compute flow development behind transom stern.

INMESH - mesh generation program.

XYZFS - program to compute the flow field and wave resistance about a hull.

Free Surface Boundary Integral Method.

Interactive Data Display System (IDDS) - interactive graphics program (2D, 3D, Contouring, Digitizing)

GPRIME/GGEN - interactive graphics program for automatic model/finite element generation.

The Pattern Recognition Research Group of the Computer Sciences Division of CMLD performs research in the field of pattern recognition and machine intelligence. Application areas include analysis and classification of acoustic transients, and the investigation of the cost effective uses of robotics in the construction of Navy ships. A workstation would be used in the following application areas:

spectral analysis
feature extraction
automatic classification
acoustic transient simulation
robot simulation

SYSTEM REQUIREMENTS

HARDWARE

Processor & Memory

Each engineering workstation must have sufficient computational and memory capabilities to handle applications programs, provide programmable control of all devices attached, execute interactive graphics, support all software requirements, provide interactive response better than the response the CDC 6600. Individual applications will dictate the precise processing and memory requirements. Some minimum requirements are as follows:

a. Word length 16 bits minimum
b. 32 bit arithmetic operations
c. Expansion capability to provide 32 bit hardware floating point arithmetic.

d. 256K bytes of error correcting read/write memory with expandibility to at least 2M bytes. Error correcting capability will be to detect all double bit errors and to correct all single bit errors.

e. Power up boot/self diagnostics so when power is applied the workstation checks out performance of the processor, memory, and controllers reporting problems to the user. Error indications must isolate the fault location. If the system is satisfactory, the operating system will be automatically initiated and ready to accept user commands.

A multibus system architecture is desirable.

Auxiliary Storage

Workstations must have disk capabilities though each station may not have its own disk but may share disks with other stations via a communications network. Each system must support a fixed disk with a storage capacity of at least 10 million (10M) bytes. This storage will be for the operating system, and for user programs and data. Access and data transfer speeds from disk will be great enough to maintain system response times at levels below the CDC 6600 system.

Each workstation must support dual removable floppy disks. Each floppy disk must have a storage capacity of 0.5M bytes. The floppy disks serve as the backup medium for the hard disk, archival storage for files the need not be on-line, and as an exchange medium for data and programs.

Each station should support a streaming tape. The primary purpose of the streaming tape is to provide a backup of the hard disk.

Graphics display

The graphics display is the workstation's primary output device to the user. The screen must have a antiglare surface that is easy to read so that a user can be working for hours without suffering from eye strain. The screen must be a flicker free bit-mapped display refreshed at least 50 times per second. The exact dimensions and display capabilities of the display are subject to the workstation application requirements. The minimum requirements are as follows:

a. Display all 96 standard ASCII characters.
b. Support color graphics.
c. Selectively enable individual lines and symbols.
d. 12 inch diagonal screen size.
e. Display addressability and resolution 512 x 390 points.
f. Alphanumeric display of at least 24 lines of 80 characters (highly desirable to be selectable between 80 char/line and 132 char/line).
g. 7x9 dot character matrix

Keyboard

The keyboard is the primary input device to control the workstation. The keyboard shall have a standard typewriter layout for letters and digits. The keyboard shall be able to supply all 128 ASCII codes plus 'BREAK' with at most 2 keys depressed. The keyboard must have auxiliary keypad with a minimum of 14 characters. Cursor control keys must also reside on the keyboard. A minimum of 4 soft function keys are required. A detachable keyboard is highly desirable.

Communications

Four RS-232C ports are required to connect the workstation to external computer systems, and to permit external devices to communicate with the system. The ports must be capable of at least 110 to 9600 baud asynchronous communications with programmable control of all defined functions (i.e. start/stop bits, data bits, parity, baud rate). One of the supported functions must include one start bit, seven data bits, one parity bit, and one stop bit. Expansion capability of additional RS-232C or RS-422 ports is required.

A high speed local area network interface is required. Support for a standard network such as Ethernet is highly desirable. The network support permits the sharing of program and data files, and to permit shared use of peripherals. A fully extended network is expected to include several separate local networks of no more than 20 terminals each. The local networks will be interconnected to a centerwide network by using a bridge or a gateway. Each

local network is expected to be confined to a single building or a small cluster of building. The network should support a cluster end-to-end cable length of at least 10,000 feet.

Peripheral Equipment

A printer/plotter is required for generating hardcopies of graphics and alphanumeric data generated by a program, from a selected file, or exactly as displayed on the graphics display. The printer/plotter must be capable of printing the character set supported by the display and keyboard.

The workstation must support a reproduction quality page printer. The page printer shall have changeable type fonts and accept a wide variety of paper and forms. The page printer shall print up to 132 character lines at selectable character spacings of 10 characters/inch, 12 characters/inch, and variable width spacing. Line spacing shall be available for 6 lines/inch, 8 lines/inch, and variable. The print fort shall include at least 96 ASCII characters in each font, and several fonts shall be available. One available font shall include standard mathematical symbols and the Greek alphabet. The fonts must be easily changed by the user (e.g., clip-in wheels, cones, or balls). The paper feeder shall tractor feed standard line printer paper up to 14 7/8 inches wide, and permit manual insertion and friction feeding of individual sheets and forms. The printing rate shall be at least 30 characters/second.

The workstation must be expandable to add data tablet, printer/plotter, digitizers, A/D converters, additional tape drives as the requirements arise.

Environment

The workstations shall be capable of operating in the standard office environment with no additional cooling. The work size may be dependent upon the application requirements. In general, the workstation including disks, shall occupy no more floor space than half a standard office desk. Many workstations will have to reside on desktop, and these stations should require at most half the desk space. The workstations shall operate on 110/120 volts, 60 Hz service requiring no more than 1000 watts. The workstations shall operate at a noise level of 55db or less.

SOFTWARE

Operating System

A multi-programming, multi-tasking disk operating system is required. The operating system shall have capabilities similar to UNIX (UNIX is an operating system developed by Bell Telephone Laboratories and there are many UNIX type systems commercially available). The operating system shall have a language interpreter which allows building command procedure sequences invoked via a single command, redirection of input and output data, password controlled system access, and extensive file management commands. A tree-structured file directory of named files is required. User definable access control locks locks on both read and write permissions for named files highly desirable. The operating system shall support concurrent execution of several independent programs. Each program shall be able to execute in scattered regions of physical memory with automatic loading and swapping from disk. The user shall be able to run programs that are longer in both the instruction space and data space than the physical memory. At least half of the code in the operating system must be written in a high level language, such as C or Pascal, to allow modification of the operating system. The operating system must have on-line documentation which can be examined by the user.

Higher Level Computer Languages.

The engineering workstation will be primarily used by scientists and engineers. Most scientist and engineers are familiar with FORTRAN, BASIC, or PASCAL. Most scientific application programs and library subroutines are in FORTRAN. C is a popular language with systems programmers. Thus, the workstation must support FORTRAN 77/66, BASIC-78, PASCAL, and C. These languages shall provide scientific programming capability for single precision real (at least 6 significant digits) and double precision real (at least 12 significant figures).

Utility Software

A linkering loader shall be supplied to permit maintenance and use of subroutine libraries. The linker shall provide for freely intermixing subroutines written in FORTRAN, PASCAL, C, and/or assembly language.

Utility programs shall be supplied to perform file system maintenance, perform operating system maintenance, and control network control functions. A two-dimensional cursor-based display screen based editor, and teletype based text editor suitable for programming shall be supplied. Text editing and formatting programs suitable for reference manual production shall be provided. A calculator program is required that includes all functions of a typical hand-held scientific calculator.

Data Base Management System

A Data Base Management System (DBMS) will allow users to define and query data bases. Individual application areas will determine the minimum number of items in the data base and the query response speed of the DBMS. The DBMS should be compatible with the high level languages so that programs can make queries into the data bases.

Libraries

Mathematical and statistical library that performs trigonometric, and matrix functions, logarithmic functions, integration, regression analysis, and data manipulation is required.

Graphics library to perform 2-D plotting is required with 3-D and color highly desirable. Supporting library to handle vector and alphanumeric data on the display screen is required. This library should include vector callable graphics routines. Routines to generate circle graphs, pie graphs, and bar graphs are desirable. The plotting packages in the library conform to the latest version of the Core system from the Graphics Standards Planning Committee of the SIGGRAPH group of the Association for Computing Machines (ACM). Supporting library to handle vector and alpha- numeric data on the display screen and printer/plotter.

Printer/Plotter Interface

The workstation shall be able to connect to a character line printer for alphanumeric hardcopy, and a digital plotter for graphics hardcopy through an RS-232C, IEEE-488 (GPIB), or other standard communication interface. Hardcopy

shall be obtained by both a keyboard selection by the operator to print/plot the contents of the display-screen, or a command to print or plot the contents of a file at a local printer/plotter. Background printing/plotting is desirable.

Data Communications Interfaces

The workstations shall be able to communicate to a host computer as an ASCII/TTY asynchronous terminal in a half- or full-duplex mode at speeds up to 9600 baud. X-on/X-off or programmable flow-control shall be supported. Also, the workstations must have the capability to communicate with the planned centerwide local area network. Desirable communication options include the following:

- Transfer of files between the workstation and computer, either asynchronously or synchronously at speeds up to 9600 baud. The computers used at the Center include the CDC 6700, Burroughs 7700, VAX 11/780(UNIX O/S), & PDP-11 series computers. Background file transfer is desirable.
- Emulation of the Digital Equipment Corp. VT-100 terminal, or the capability for the user to program the workstation to emulate other terminals.
- Local networking with as many as four (4) other workstations of the same type that are separated by no more than 400 feet between stations. The network software should provide multi-station access to shared resources, such as, files and peripherals. Transfer of files among workstations should be supported.

MARKET SURVEY

The market survey was intended to identify systems that can potentially be used as engineering workstations. All systems have at least a 16-bit word length. The emphasis was on systems using the 68000 microprocessor because of its 32-bit capabilities and its 16M byte address space. But many systems using the 8086 and the Z8000 were also surveyed because individual capabilities might make them acceptable as workstations. Systems with a UNIX like operating system were of primary interest, but other systems are included because of the availability of systems with CP/M or MP/M. Also, the

possibility exists that UNIX may be obtained from a separate vendor. The systems identified in the market survey are detailed with their features in the Appendix A. A manufactures directory is given in Appendix B.

Several additional systems are expected to be introduced on the market in the next year. Apple Computer should be introducing 68000 based systems (LISA and McIntosh). Western Digital is to introduce the Nu machine, a 68000 scientific workstation running UNIX. The Western Digital system can be supplied with a four-board Lisp processor form Lisp Machine, Inc. General Automation is readying for early 1983 a MC68000 system based on CIE Systems' products with UNIX System III.

Also, IBM is expected to make available a commercial version of its 68000-based micro currently offered for laboratory applications. IBM has entered a joint project with Carnegie Mellon University (CMU) to implement a network of 1000 workstations. The workstations will have 1M byte RAM, high resolution bit-mapped display, virtual memory operations and, optionally, a local mass storage. The network will be in keeping with IBM's token ring proposal to IEEE's 802 committee and that it would have a bandwidth of 4 Mbits/sec.

Most systems identified in the survey have been recently introduced on the market and many are lacking in one or more areas required for the workstation. Many of the hardware deficiencies will be overcome with future enhancements by vendors taking advantage of technological advances. For example, several companies are developing single-chip Ethernet data link controllers. When these enter the market, the cost of Ethernet interfaces will drop dramatically (from $1500 down to $500). This development should make easily available Ethernet interfaces to standard busses, i.e. Multibus. Some software deficiencies can be overcome with third party packages or with on-site development of software. Cost sharing agreements between a vendor and the government may also be an attractive way to develop systems that overcome deficiencies in off-the-shelf systems.

The "number crunching" capabilities of microcomputer systems is rapidly increasing. Intel and Motorola have introduced arithmetic coprocessors for the to perform floating point arithmetic. Sky Computer company has an array processor that directly plug into the Q-bus, the Multibus, and the Versabus.

The array processor handles 32-bit and 48-bit floating point real and complex numbers, preforms a 1024 point FFT in about 50 milliseconds, and costs about $6000.

One area of deficiency is the availability of graphics support. Nearly twenty of the surveyed systems had bit-mapped displays. Only four of these (Apollo, Digital Equipment Corporation, Forward Technology, and Sun) indicated they supported the Siggraph CORE graphics. Systems from BBN, Beehive, Hewlett-Packard, Daisy, and Digital Microsystem (while not necessarily CORE standard) are scientific and engineering oriented. BBN, Callan, Digital Equipment Corporation and Digital Microsystems do have Tektronix emulation packages which are widely used on the center. Also, MASSCOMP has a level of support provided by NBS Dataplot and PLOT10 software in addition to a graphics library. Wicat is supposed to be developing a graphics software board to allow vector drawing capabilities through FORTRAN. Fortune Systems and Convergent Technologies have graphic packages that are very business oriented.

Several very powerful micro-processor based graphics systems are available. Some of these systems are very workstation-like. The Chromatics CGC 7900 system uses a MC68000. These systems are generally intended for use as intelligent graphics terminals and they tend to lack the non-graphics support necessary. Communications support is usually to a host computer for graphics commands and data. Operating systems are in general directed toward the graphics support and need to be more flexible for the broad range of workstation applications. Prices for these graphics systems tend to be on the high end (over $25K) of the workstation scale making them expensive to proliferate. But for the application areas where graphics requirements intensive, a graphics system may be quite suitable. The survey includes one such graphics system, Chromatics. Others are available from Aydin Controls, Calcomp/Sanders, Florida Computer Graphics, Lexidata, Megatek, Ramtek, Tektronix, and others.

Support of proven local area network capabilities varied greatly. Systems that seem to have exceptional network support include Altos (Altos-Net), Apollo (Domain), Convergent Technologies (proprietary), Corvus (Omninet), Digital Microsystems (Hinet), Three Rivers (Ethernet), and Zilog (Z-NET). Additionally, Ethernet is supported by Callan Data Systems, Digital Equipment Corporation (though currently systems surveyed support DECnet), Fortune

Forward Technology, and the new Hewlett-Packard 9000 system. Hewlett-Packard will also be supporting the proposed IEEE 802 network standard. Apple computer has an agreement with 3Com Corp. to develop ethernet hardware for its soon to be released LISA and McIntosh systems.

UNIX was the best met requirement on these systems. Over 30 surveyed systems had UNIX or UNIX like systems. UNIX is emerging almost as a defacto-standard operating system for high-end 16-bit computer systems. Over 200 companies are currently marketing UNIX-based systems and they are expanding very rapidly. Examples of UNIX licensed systems include XENIX from Microsoft, ZEUS from Zilog, and Uniplus (UNIX with enhancements from the UC Berkley implementations) from Unisoft. UNIX-like systems include COHERENT from Mark Williams Co., IDRIS from Whitesmiths Ltd., REGULUS from Alcyon, UNIDOS (same as REGULUS) from Motorola, and UNOS from Charles River. UNIX-like systems are usually less expensive.

Many systems are too large to be considered desktop. Apollo, Convergent Technologies' AWS, Three Rivers' Perq and Zilog's System 8000 are examples of systems that require floor space which may not be readily available in all offices. These systems require larger offices or rooms that can be used as common work areas.

Several systems are of interest because architectures used to speed operations. A cache memory technique is used by MASSCOMP, and Plexus to increase execution of sequences of instructions. This technique is similar to that employed in DEC's 11/70 and VAX systems.

Many systems increase execution speed by using multiple processor architectures. Additional processors may be used as I/O processors, graphics processors, or parallel coprocessors. Examples of I/O processors include Convergent Technology for communications, CM Technologies for master bus control, Cromemco for interrupt processing, Apollo for virtual paging, and Plexus for both intelligent communications and I/O processors. Separate graphics processors are part of the architectures of Computhink, Convergent Technology's Turbo, Forward Technology, and MASSCOMP. Parallel coprocessors can include a coprocessor for floating point arithmetic as do Althos, Cubic, Digital Microsystems, Eagle, and Fortune. Cromemco and Tandy/Radio Shack use Z80 and 68000 combinations to maintain compatibility with their Z80 based systems. Dual 68000 architectures are used by MASSCOMP, MICRO DA SYSTEMS, and Parallel.

Several systems are or will be available on GSA schedules. Digital Equipment Corp. and Hewlett Packard maintain schedules for their equipment. Unicycle Corp., a local company, is anticipating a schedule that will include the ONYX System C8002, the Corvus Concept, and the Sun Workstation. Kramer Systems International of Silver Spring, Md. has the Fortune 16:32 available on GSA schedule. Other systems like Wicat, Convergent Technologies (through third parties) also may be on a schedule.

CONCLUSIONS

This survey has identified many systems that could be considered for use as engineering workstations. While all systems have potentials, at least 15 of these would be prime candidates because for their processor, graphics, networking, and software. While some of these prime systems have some deficiencies, the deficiencies are easily corrected. The systems of high interest included in table 1.

Table 1. Prime Candidates for EWS

Manufacturer	Problem
Apple	when 68000 system is marketed
Apollo	not desk top, cost
Callan	
Convergent Technologies	non-UNIX, highly business
Computhink	networking in question
Corvus	non-UNIX, question about graphics software
Digital Equipment	memory on Professional, auxiliary storage on the VAXstation
Digital Micro Systems	
Hewlett-Packard	9000 expensive, non-UNIX on others
IBM	when 68000 based system is marketed
Fortune	business oriented
Masscom	
Momentum	slightly larger than desktop, cost
Sun	systems not delivered
Three Rivers	not desktop, size
Wicat	
Zilog	

The availability of systems suitable for engineering workstations is rapidly expanding. With the new technology constantly entering the market, there is no reason to believe this trend will not continue. Prices will decrease and performance will increase. This survey represents only a "tip of the iceberg" of what will be available in the next six months.

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APPENDIX A

EWS SYSTEMS

Alcyon Corp

AWX Workstation

*processor

MC68000, 10MHz

*software

Regulus (UNIX System III-call compatible) claimed to require two-thirds less memory required by Bell Lab's UNIX. Motorola & Alcyon have entered a long-term technology-transfer agreement to enhance Regulus with graphics and network support and an intregral database-management system.

Alpha Micro

AM-1062, AM-1042, AM-1000W, AM-1000F

*processor

68000

*memory

512Kbyte std AM-1062 (exp to 8Mbyte), AM-1042 (exp to 3Mbyte)

128KByte expandable to 256Kbyte for AM-1000W, AM-1000F

*auxiliary storage

60 Mbyte Winchester expandable to 2.4 Gbyte for AM-1062

32 Mbyte Winchester expandable to 2.4 Gbyte for AM-1042

10 Mbyte Winc+(floppy or VCR backup) exp to 40 Mbyte for AM-1000W

1.6 Mbyte dual floppy exp to 40 Mbyte Winc+floppy for AM-1000F

*peripherals

supports a printer

*communications

3 serial ports for AM-1000's

2 serial ports expandable to 26 for AM-1042

2 serial ports expandable to 68 for AM-1062

*software

AMOS operating system (multi-user, multi-tasking and timesharing)

AlphaBASIC, AlphaPASCAL (4Q82), AlphaLISP (4Q82), Macro-assembler,

Word processing, utilities and diagnostics standard.

Optional languages FORTRAN and COBOL.

*cost

$10K for the AM-1000

Altos Computer Systems

ACS68000 (OEM market)

(Shasta General Systems will distribute this system under private label OEM contract; internally called 3216)

*processor

MC68000, 8Mhz

memory management with 4 68451 memory mgt. processors

multibus chassis

*memory

512K bytes RAM for base system

Baseline system expandable to 1M byte

up to 16M bytes RAM with expansion chassis

*mass storage

40M byte Winchester base system (Quantum Corp.)

80M bytes Winchester avail 1st quarter 83 - $16,500 (Quantum Corp)

Magnetic tape backup

*communications

Ethernet

Altosnet

*software

up to 16 users

UNIX System III or COS 68000 operating systems

languages-COBOL, FORTRAN, C, and Business BASIC

*cost

512K RAM, workstation, 40M byte disk- $14.5K

ACS8600

*processor

Intel 8086 and 8089

8087 Math chip (optional)

Multibus

Z80 for I/O

*memory

500K bytes to 1M bytes

memory management

error detection and correction

*auxiliary storage

Winchester - 10, 20, or 40 Mbytes expandable to 80 Mbytes

8 inch floppy - 500 Kbyte

tape drives

*communication

Async, bisync, & networking

Capable of handling network data rates up to 800 Kbaud

Ethernet

ALTOS-NET

*peripherals

A/D converters

digitizers

*software

4 operating systems- XENIX (UNIX), CP/M-86, MP/M-86, OASIS-16

*cost

$19K for 512K RAM, 40M byte hard disk, & magnetic tape backup

586

*processor

Intel 8086, 10 MHz

*memory

256K bytes expandable to 1M byte

*display (by early next year)

800 x 325 pixels

*auxiliary storage

dual 1M byte minifloppy

10M byte and 20M byte Winchesters available

*communications

6 RS-232 ports expandable to 10 ports

supports protocols 2780/3780,3270, SNA/SDLC, and X.25

communications board also offers auto-dial/auto-answer modem

Altos-Net interface

Ethernet interface

*software

Xenix

Altos' ABS/86 business package

other OS supported - MS-DOS, Pick, CP/M-86, MP/M-86, and Oasis-16

languages offered - BASIC, FORTRAN, Pascal, and C.

*cost

586-2 with 256K RAM, floppies $5K

586-10 also 10M byte Winchester $8K

Apollo Computer

Domain

*processor

dual 68000 based system

floating point

16 Mbyte addr space

*memory

0.5 - 1 Mbyte memory

virtual memory map (2nd 68000 handles page interrupts)

*auxiliary storage

1M byte diskette optional

34M and 68M byte winchesters optional

158M byte Winchester optional (Priam Corp. -- $16.8K)

*display

1000x800 pixel bit mapped (addr. 1000x1000)

controlled by local 8086 processor

Current screen refresh rate 30 frames/sec green phosphor now upgraded to include B&W non interlace at 60 frames/sec

color is planned

*keyboard

detachable with function keys

touch pad that works on heat from finger to control display cursor

*communications

local network consist of ring of nodes

0.5 Mbyte/sec bandwidth

nodes given names and node names must be entered in each system.

addr space for programs, files include node names so units can access other unit's files and peripheral equip.

(what about file security)

*peripherals

can be added to each unit via multibus (IEEE 798)

*software

UNIX like Operating System

Object oriented

Up to 15 concurrent applications/node

Each application can have a page shown on the screen

C ($1250), FORTRAN, Pascal

text editors- full screen and line (UNIX like)

Terminal emulator that can be used to connect to other systems.

example: connected to CDC then to VAX and attempted to CRAY but its access was down. Transferred file from VAX to Apollo.

self boot and diagnostics at turn on

data base management system called D3M ($2.5K) complies to CODASYL data base standards

will support Core package of subroutines developed by Siggraph

Application software handled by 3rd party so far CAD and NASTRAN have been implemented

DN 600 workstation

*processor

see above

*memory

.5M to 3.5M byte

*display

1M byte graphics processor that accommodates up to 2M bytes of display memory

19" color monitor with 1024 x 1024 resolution

palette of over 16M colors on 4, 8, or 24 color planes

*see above for communications, software, etc.

*cost

$60K

Apple Computer

LISA

*processor

68000

*memory

1M byte RAM

*auxiliary storage

1.7M bytes floppy

5M byte hard disk

*display

132 col. x 40 rows of characters for text

364 x 720 pixels for graphics

*communications

*software

*cost

starts at $10K

Artelonics Corp.

Series 750

*processor

Intel 8086

*auxiliary storage

Floppy

Winchester

*software

CPM-86 and MPM-86

multi-tasking

business graphics

work processing

Note: business and office automation

BBN Computer Corp.

Bitgraph

*processor

MC68000, 7 MHz

*memory

128K or 512K bytes RAM

*display

9" x 12" black and white display, 40 Hz interlaced

bit-mapped 1024 x 768 pixels

compatible with DEC VT52, VT1000, and Tektronix 4010 terminals

pointing device and mouse optional

*keyboard

VT100 compatible keyboard

*communications

3 RS-232C serial async ports, 50 to 19.2K bps selectable

RS-422 high-speed HDLC

*peripherals

Centronics-compatible printer optional

*software

BitGraph Source Code

MC68000 development tools optional

*cost

$5K for 128K system, $6,275 for 512K system

Beehive International

T1, T2, T4 MC68000-based workstation family due out in 1983
Designed as workstation cluster with T4 supporting up to 16 T1's & T2's.

T4

*processor

MC68000

*memory

128K bytes

*auxiliary storage

dual 5.25" floppies

up to 3 each 5.25" Winchesters (100M bytes) in an auxiliary enclosure

*display

14" screen

bit-mapped graphics

*communications

forthcoming local area network support

*software

UNIX

interactive word-processing and graphics package called "wordgraphics"

CAD/CAM

proprietary and third party engineering software

*cost

approx $6K

Cadlinc Inc

CAD-14 Graphic Computer

*processor

Motorola 68000, 8 MHz

user programmable timer

*memory

256k byte parity RAM

*auxiliary storage

optional disk support

*display

1024 x 792 pixel raster graphics display

bit-mapped graphics

mouse

*keyboard

detachable VT100-style keyboard

*communications

Ethernet

two serial I/O channels

*software

Multiprocess memory management allows 16 concurrent processes

EPROM-based monitor

Callan Data Systems

UNISTAR 100, UNISTAR 200

*processor

68000, 8 Mhz

Multibus compatible - six slot with 2 available (UNISTAR 100),
8 slot with 4 available (UNISTAR 200)

eight vectored interrupts

two-level (segment/page) memory management unit

*memory

256k bytes of dual port local memory, expandable to 1.28 Mbyte (UN 100)

768K bytes expandable to 1.75M bytes (UNISTAR 200)

*auxiliary storage

5.25 inch 600K byte diskette

5.25 inch 10M byte Winchester (UNISTAR 100)

5.25 inch 21M byte Winchester (UNISTAR 200)

*display

12" green phosphorus CRT with 25 x 80 characters

*keyboard

detachable

83-key (including numeric keypad) with 18 programmable function keys

Tektronix 4010-compatible graphics controller board available

*communications

Ethernet Interface with UNIX-based UNET (3COMCorp) software

2 RS-423 multiprotocol serial ports

16-bit parallel I/O port

*software

UNIX Version 7 operating system

languages- C and 68000 ASM standard, FORTRAN, Pascal, PLM, COBOL, BASIC, APL, Ada optional

Text processing includes document formatter, spelling program and full screen editor.

*physical

14.5" (h) x 20.5" (w) x 25.5" (d) with keyboard 19.25" (d) without

75 pounds

*cost

$9450 for 256K RAM, CRT, keyboard, 10M byte Winchester, & floppy

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Charles River Data Systems

Universe 68 Computer System

Models 68/05, 68/15, 68/17

*processor

Motorola 68000, @ 8 Mhz (12.5Mhz for 68/05)

32-bit arch

16 Mbyte addr space

32-bit VERSAbus

68/05 memory mapping/protection logic, VLSI floating-point co-processor (IEEE format) optional, calendar clock, boot/diagnostics, five slot enclosure

*memory

256 Kbyte std for 68/05 (in 256K, 512K, and 1M byte increments) with 32 bit x 1024 bit cashe memory

256 Kbyte std for 68/15

512K byte std for 68/17 expandable to 2M byte in 7" cabinet

*auxiliary storage

10M byte 5.25" Winchester with integral 1M byte floppy

80M byte disks are available

16M byte in 14" high package std for 68/15 and 68/17

*communications

IEEE 488 interface

Multibus board under development

RS 232/RS-422 available (110-9600 baud)

68/05 - 2nd 68000 character processor with 4 async ports, and extended communications bus.

*software

UNOS UNIX 7 like multi-processing/multi-user operating system

Support-PASCAL, FORTRAN 77, C, BASIC, & ASSEMBLER

CRT screen editor

DBMS

*cost

w/256Kbytes RAM, floppy & Winchester disk >$20K quantities >10 $16,860 ea including software

68/15 base price $19,200; $12,480 in quantities or 20

68/17 base price $21,200

68/05 base price $10K including 256K byte RAM, 10M byte Winchester, and 1M byte floppy

Chromatics

CGC 7900 Model 2 color graphics

*processor

MC68000

supports 24 card slots (14 user selectable)

*memory

128K bytes buffer RAM

32K bytes EPROM

*auxiliary storage

1M byte dual flexible disk drives optional

10M byte and 40M byte Winchesters optional

*keyboard

151-key with 21 lighted keys, 24 programmable function keys, and two-speed repeat on all keys

*display

19" color CRT

1024 x 768 viewable dot resolution

1024 x 1024 Bit map memory resolution

4 bit map memory planes std on Model 2

up to 256 Simultaneous displayable colors

8 bezel keys similar to function keys on kybd to enhance interaction between operator and display screen

Joystick and light pen optional

*communications

one RS-232C and one RS-449 serial ports with baud rates to 19.2 bps selectable from display or program.

parallel DMA port compatible to Digital Equip. Corp. DRV 11-B.

general purpose parallel port with polling and interrupt capabilities.

versatec printer interface

*software

IDRIS Multi-Tasking Operating System written in C optional

languages supported - BASIC, Pascal, C, and assembly language

graphics software includes generated vectors, concatenated vectors, incremental vectors, incremental x-bars and y-bars, polygons, circles, rectangles, and triangles. Up to 8 individually addressable windows.

graphics options include support for right angle rotation, mirroring, inversion of images, color swapping, patterning, soft zoom, and more.

*physical

size - 53" H x 22" W x 34" D, weight - 220 lbs.

Power - 105-125V, 60 Hz, 1000 watts

*cost

Model 2 - 128K RAM, 2 serial I/O ports, 4 refresh memory planes, IDRIS operating system - $22K

CIE Systems

680/10

*processor

68000 and 8085

Multibus

*memory

128K byte

*auxiliary storage

5.25" 500K byte floppy

5.25" 10M byte Winchester

*screen

12" green standard, amber optional

80 x 24 character format

*software

UNIX System III

REGULUS

PRO-IV

VERSADOS

*cost

$5.2K

680/30

*processor

68000

9 slot Multibus chassis

*memory

128K to 768K bytes

*auxiliary storage

1.6M byte 5.25" floppy (C. Itoh's YD-380T)

up to 10 ea of 10M byte 5.25" Winchesters supported (Nippon)

Streaming tape can be accommodated in optional enclosure

*communications

8 serial terminal ports

two parallel printer ports

*software

Bell's UNIX System III or Alycon Corp. Regulus operating systems

PRO-IV applications software

*cost

$6K in OEM quantities

680/20

see above

*cost

20M byte system with a maximum 512K bytes RAM - $5.6K in OEM quan

680/40 business system

see above

*cost

150M byte system with 1Mbyte main memory - $12K in OEM quantities

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CM Technologies

Complete family of 68000 systems and products.

CMT 68000

*processor 68000 single board computer w/64k dual port RAM

9 slot MULTIBUS card case w/serial I/O ports

CMS 16/DS2 - dual processor

Z80 controller of master bus

CMT 68000 cpu runs main prog. & is execution vehicle

11 Mbyte Winchester

dual-sided, double density floppy disk

Codata Corp.

3300

*processor

MC68000

Multibus

*memory

320K bytes parity RAM expandable to 1.5M bytes with memory management

*auxilliary storage

12M bytes 5.25" Winchester disk (Atasi Corp)

33M bytes 5.25" (Atasi Corp) and 84M bytes 8" disk drives (Fujitsu America) available

disk backup by either minifloppy disk (Tandon), 0.25" tape cartridge (Datum), or 0.5" tape drive .

*communications

2 serial ports

2 intelligent serial controllers may be added, each controller can handle up to 8 ports with individual speeds from 50-19,200 baud.

*software

UNISIS (Codata's superset of UNIX)

APL.68000 (APL interpreter) and BASIC-plus interpreter included

Languages supported - FORTRAN 77, RM/COBOL, Pascal, and SMC BASIC

*physical

8" (h) x 22" (w) x 14.5" (d), 38 lbs.

*cost

$13K - 320K RAM, 12M Winchester, 1M byte floppy, 2 serial I/O ports

UNISIS operating system - $800

Columbia Data Products

Models 1600-1, 1600-2, 1600-3

(IBM Personal Computer compatible)

*processor

8088

interrupt and DMA controller

counter/timer

8 IBM compatible expansion ports

*memory

128K bytes

*auxiliary storage

1600-1 dual floppies (640K bytes)

1600-2 & 1600-3

320K byte floppy

5M or 10M byte Winchester

*communications

two RS232 serial ports

Centronics parallel port

*software

operating systems- MS-DOS, CP/M-86, MP/M-86, or OASIS 16.

languages- BASIC, FORTRAN, Pascal, COBOL, and macro assembler

*cost

1600-1 - $2995; 1600-2 - $4995; 1600-3 - $5495

Computer Consoles, Inc.

Power 5 series

*processor

68000

9-slot VersaBus backplane

*memory

500K byte RAM

*auxiliary storage

35M byte Winchester (Priam Corp.)

20M byte cartridge tape (Electronic Processors Inc)

*displays

Zentec and in-house terminals available

*communications

local network allows up to 208 processors to be tied together for top of the line systems (Power 5/55)

*software

OfficePower software package contains proprietary PerPos operating system allows support of UNIX applications.

*cost

Power 5/20 - $19.6K (500K RAM, 35M Winc, 20M tape)

8-user office system - $32.4K (1M RAM, 35M Winc, 20M tape, OfficePower software)

Computhink (Now doing business under Momentum Computer Systems)

Hawk-32/4

*processor

68000, 8 MHz

proprietary bus

*memory

256K byte, 512K byte, 768K byte, or 1M byte 150 nsec RAM

*auxiliary storage

two SyQuest 3.9-inch Winchester removable cartridges with formatted capacity of 5M bytes per cartridge

*display

12" tilting video tube or fixed 15" graphics tube

video controller for 12" screen displays 25 lines by 80 columns

graphics processor board contains own 68000 (8 MHz), 256K bytes RAM bit mapped screen with screen area of 700K pixels

*keyboard

detachable with 101 keys, 7 indicator lights, 20 function keys, and separate numeric keypad

*communications

4 RS-232 serial ports at speeds to 19.2K baud

SASI bus port

*peripherals

200 cps dot matrix printer (Mannesmann-Tally)

*software

UNIX version 7 or UNOS (v. 7 compatible written by Charles River Data Systems that is targeted for real-time applications)

languages available - Pascal, C, Fortran-77, RM-Cobol, and Basic

Three data-base managers including Unify relational DBMS and three word-processing packages are in the works

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Convergent Technologies

IWS Workstations

IWS-110, IWS-120

*processor

Intel 8086 @ 5MHz. (dual 8086 for IWS-110 & IWS-120)

Multibus card slot configuration (IEEE-796)

High speed math board optional - implemented with Intel 8087 arithmetic processor. Performs arithmetic and transcendental operations (sq. root, trigonometric, and log/exponent) on integer data (up to 8 bytes); real data (single or double precision (chip capability 32-,48-,64-, or 80-bit)); and packed decimal data (?) (up to 18 digits).

External interrupt control logic for 8 priority levels of maskable interrupts. Four levels are used by the system, and four are available for user-generated interrupts. The levels may be expanded to 25 by cascading interrupt controllers through user-provided hardware residing in the Multibus card slots.

4 high speed DMA channels which operate at 3.3 Mbytes/sec.

real-time clock provides a maskable interrupt at line freq.

programmable timer provides a 16-bit timer with a clock rate of 19.5 Khz.

*memory

4K to 160K based on ROM/PROM

up to 1 Mbytes of read/write memory

*auxiliary storage

A floppy unit with controller and two disks (500K bytes each)

A mass storage base unit a Winchester controller (controls up to three drives) , non-removable Winchester (10, 20, or 40M bytes), a floppy controller, and one floppy disk (500K bytes).

A mass storage extension unit for one or two Winchester disk drives (20M byte or 40M byte).

*display

50 MHz. 15-inch video display (green phosphorus)

selectable 132 char x 34 line or 80 char x 34 lines

256 character set which provides user definable character fonts.

bit-mapped display with vector or raster mode (IWS-110 & IWS-120)

660 x 512 bit resolution

IWS-110 - integrates processor and memory with a video display in a desktop unit containing one Multibus slot.

IWS-120 - processor, memory, and graphics boards in floor standing enclosure with four Multibus slots. video display unit and keyboard rest on desktop.

*keyboard

detachable and connected to display via 5 ft. coiled cable.

98-key

14-key numeric pad

8-key status/control function pad

6-key cursor control pad

4-key page control pad

10 user definable keys

*communications (two serial communications channels)

RS-232C 50 to 19.2K baud with internal clock and
DC to 19.2K baud with external clock.

RS-422 or RS-232C

RS-422 50 to 615K baud with internal clock and
DC to 730K baud with external clock

RS-232C same as above

Both channels may be programmedys

*communications (two serial communications channels)

RS-232C 50 to 19.2K baud with internal clock and
DC to 19.2K baud with external clock.

RS-422 or RS-232C

RS-422 50 to 615K baud with internal clock and
DC to 730K baud with external clock

RS-232C same as above

Both channels may be programmed to support sync and async bit and byte-oriented protocolluding BiSync, ADCCP, SDLC, and HDLC.

Comm IOP Board (optional) - used in a master station to off-load the main processor by performing most of the functions required to handle the high speed local network. It provides two multi-drop lines; each line runs @ 307K baud and supports up to 4 cluster stations. Handles all polling of and acknowledgements to the cluster stations.

*peripherals

Centronics-compatible parallel printer interface

*software

CTOS operating system

languages - COBOL (ANSI '74), FORTRAN (ANSI '77), BASIC (ANSI '78), Pascal (ISO draft 5)

Editor

Linker/Librarian - link independently compiled modules and create and maintain object libraries.

Debugger

Data management facilities

Forms Facility - design screen forms, display them on the screen, and accept operator supplied data.

Sort/Merge facility - sorts multiple files of unordered records and merges multiple files of ordered records into one ordered file.

Font Designer - provides interactive facility for designing fonts to customize character set displayed on the video screen.

Word Processor

communications package - supported are: 3270 Terminal Emulator, 2780/3780 RJE Terminal Emulator, Asynchronous Terminal Emulator, and X.25.

AWS Turbo

-Enhanced AWS workstation with over 4 times the processing speed.

*processor

8086, 8Mhz

*auxiliary storage

630K byte 5.25" minifloppies optional

Winchester disks of 5, 10, or 16 Mbytes

*display

color option - 64 color with 8 displayable at one time, 15" display screen, 432 x 319 resolution

graphics processor with 128K bytes of display memory and 16K bytes of firmware. Split-screen capability allows users to move and scale multiple graphs and charts individually or simultaneously.

*software

Color Business Package - including access to graphics by programs written in COBOL, FORTRAN, BASIC, and Pascal.

*cost

$12,190 with 5M byte disk, $13,790 with 16M byte disk.

Corvus Systems

Corvus Concept

*processor

MC68000, 8 MHz

*keyboard

detachable

10 user programmable function keys

*memory

256 to 512 Kbytes of main memory, 64 Kbytes of dynamic RAM

*auxiliary storage

Winchesters in 6-, 11-, or 20-Mbyte versions (prices start @$3195)

*display

15" screen which can be used interchangeably in "portrait" (72 lines x 80 cols) or "landscape" (120 cols x 56 lines) orientations. The change in orientation is accomplished by automatically loading the appropriate software for the orientation at system boot up.

720x560 pixel bit-mappable requiring about 55K of main memory

*communications

2 ea. RS-232C interfaces

Omninet local network which supports up to 64 users and transmits @ 1 Mbit/sec at distances up to 4000 ft. on twisted pair cable. The network allows sharing disk storage and other peripherals. Omninet interface has its own processor to control the CSMA (Carrier Sense Multiple Access) network.

*peripherals

calendar/clock

4 expansion slots for connecting Apple peripherals and mass storage

*software

languages - Pascal and FORTRAN

CP/M emulation

Edwords (Corvus word processing)

Omninet (see communications) will be broadened next year to include IBM 2780/3270 emulation. A broadband gateway will permit Omninet links to networks for long-distance communication at up to 100 Mbits/sec. Corvus intends to provide gateway to X.25 packet-switching networks.

*cost

prices start at $4995

Cosmos Systems, Inc

(Wholly owned subsidiary of CM Technologies, Inc.—see below)
Sells to system integrators and OEM's

CMS16/UNIX

*Processor

Motorola MC68000, 8MHz

Chassis comes with a nine-slot card cage

Multibus/IEEE 796 compatible

Motorola's 68451 memory management chip

Self test, debugging. and Bootstrap EPROM

*memory

576K bytes ECC RAM base system (single bit correction, and double bit detection)

3M bytes RAM maximum in Chassis but optional extended chassis allows expansion to 16M bytes RAM

*mass storage

10M byte Winchester (Shugart Assoc.) base system

40M byte 8" Winchester available (Quantum Corp)

474M byte 14" drive also available (Fujitsu)

1.2M byte 8" floppies available (Qume, Corp.)

*communications

4 channel serial I/O

*software

UNIX version 7 with UC Berkley enhancements operating system

C, Pascal, FORTRAN, BASIC, COBOL supported

140 utilities

*cost

base system with 576K bytes RAM and 10M byte Winchester $20K

Cromemco Inc.

System 83

*Processor

Z80A (4 MHz) & MC68000 (8 MHz)

interrupt decoder gives 68000 Z80-style interrupts

external bus jumper selectable to be compatible with IEEE-696 standard for the S-100 bus.

*Memory (RAM)

256 Kbytes standard - expandable in 256- and 512- Kbyte increments

Each 16-bit data word has 6 bits appended to allow a modified Hamming-code detection-and-correction algorithm (detects 1- or 2- bit errors, corrects 1-bit errors). An error log on each card stores error locations.

up to 2 Mbytes in System One configuration

up to 4 Mbytes in the System Three configuration

*auxiliary storage

Dual floppies (390 Kbytes each)

Winchester available (5.5 Mbytes)

*communications (proposed)

1553B military standard for data busses on airplanes- packet switching, twin-axial cable, 255 users on each 2,000 meter cable segment @ 880 Kbaud. Z80's serial I/O IC implements the Synchronous Data-Link Control at each interface.

*software

CROMIX (UNIX like)

languages-BASIC, C, COBOL, Pascal, FORTRAN, PL/2, APL, LISP, RPG-II

*cost

System One - 256K RAM, dual floppies	$5,495
above with Winchester	8,495

(512K RAM instead of 256K add $1000)

Cubic Systems

CS-3

*processor

8086

8087 numeric coprocessor

12 slot multibus (seven slots accommodate optional equipment)

*memory

128K bytes of scratchpad, expandable to 512K bytes

*auxiliary storage

*keyboard

95-key, detachable

*display

20" color raster scan, 512 x 512

4096 colors from a palette of 16 million

*communications

RS-232C interface at 19.2K baud

two auxiliary serial ports

*software

imaging firmware to create and manipulate 2- and 3- dimensional vector drawings, allowing smooth shading, antialiasing and hidden-line and -surface removal.

*cost

starting at $10K

Cyb Systems, Inc

Multibox

*processor

MC68000

*software

UNIX Version 7

Daisy Systems Corp.

LOGICIAN - Electronic computer aid design. Sys. arch., logic design, data management, logic analysis & documentation.

*processor

8086, 8-Mhz

*auxiliary storage

10 Mbtye Winchester

1 Mbyte floppy

*display

1022 x 826 pixel

*communications

RS 232C 19.8K baud to host

parallel I/O port

*peripherals

printer plotter optional

*software

UNIX like operating system

Password protection & file access keys

Electronic systems description, analysis, modeling and simulation (circuit and logic). Can window into elements of the electronic design. Data base manager that maintains the integrity of the block interfaces between levels of design hierarchy.

note

While this system is too special purpose for EWS, it contains many capabilities that need to be included, i.e. design at several levels, analysis, modeling, simulation, and documentation.

Datamedia Corp

932

*processor

MC68000

*memory

128K bytes expandable to 2.1M bytes

*auxiliary storage

12M bytes of 5.25" Winchester storage expandable to 76M bytes

10M bytes of streaming-tape backup capability expandable to 80M bytes

*communications

6 terminal ports

2 printer ports

1 IEEE 488 port

2780/3780 protocol emulations

to be added-I/O micro to handle 3720 SNA/SDLC and X.25 emulations

*software

Pick operating system (see "Mini-Micro Systems", Sept 82, pp 32-42)

*cost

$15K

Digital Equipment Corp.

Professional 350

*processor

LSI-11/23

floating-point adapter

*memory

256K bytes RAM

*auxiliary storage

dual 5.25" 400K byte floppies

5M byte Winchester available

*display

12" green phosphor standard with 8 levels of intensity

color optional (256-color palette)

24 line x 80/132 column

bit-mapped graphics (240 x 960 pixels)

RS170 video output

*communications

serial async/sync up to 9600 baud

DECnet communications protocol

parallel interfaces optional

*peripherals

printer port (RS232)

printer options-LA50 Personal Ptinter, Letterprinter 100, or LQP02 Letter Quality Printer

*software

auto test when powered up

P/OS (RSX-11 subset)

BASIC-Plus 2, FORTRAN, Pascal, DIBOL

graphics software follows "Core Standard" as proposed by ACM's Special Interest Group on Graphics

communications software

VT52/VT102 terminal and VT125 graphics emulation

file transfer between stations with password protection

phone book with names and numbers, and line characteristics for automatic dialing of numbers or automatic connection with other computers

applications packages

*cost

$5K

Micro/PDP-11

*processor

PDP-11/23-Plus

22-bit addressing

7-slot LSI-11 bus

*memory

256K bytes parity memory

*auxiliary storage

dual 5.25" floppies (400K bytes each)

5.25" 10Mbyte Winchester

*communications

2 serial I/O ports

*software

see above

*cost

packaged system $10,225

VAXstation 100 (VS100) avail. April '83

*processor

M68000, 10 MHz

*memory

*auxiliary storage

*display

19" monochrome, 60 Hz refresh rate, non-interlaced

bit-mapped with 960 horiz. x 800 vert. pixels in landscape mode

3 button mouse

11" x 11" graphic tablet optional

*keyboard

Std. typewriter keys, separate 18-key numeric pad, user definable keys, and special control keys.

*communications

15M Hz fiber optic link to connect to VAX

DECnet communications protocol

*software

any application software that runs on VAX/VMS will run on VAXstation

multiple tasks

Siggraph Core-compatible software

(same graphics libr. as Professional)

Tektronix' 4015 and DEC's VT100 terminal emulation

*cost

$10,550

Digital Microsystems

DMS-5086

*processor

8086, 5 MHz

8087 optional floating point coprocessor

*memory

256K - 1M byte RAM with parity error detection

1K byte network buffer

*auxiliary storage

No auxiliary storage locally. Workstation has access to files at the network master. The master can have up to 92M bytes hard disk, floppies, and streaming tape as options

*display

15" P-39 green phosphor, nylon mesh antiglare CRT with 4.92 MHz 8086 controller, 16K ROM, 64K RAM (expandable to 128K)

dual orientation screen

vertical: 80 char x 66 lines

horizontal: 80 char x 26/24 lines (traditional)

132 char x 50 lines (spread sheet)

screen tilts 0 to 15 degrees

interlaced display refreshed at 64.5 Hertz

800 x 560 pixel bit-mapped format

point plotting, line drawing, and block area loading

emulation of Tektronix 4010

*keyboard

detachable keyboard with coil cord

30 programmable function keys

*communications

HiNet networking port (500K baud RS422 serial transmission with SDLC protocol, supporting up to 32 stations). Network consists of a master which "polls" all the stations on the network to give user access to files, programs or shared printer or shared peripheral.

3 RS-232C serial ports with software selectable baud rates to 9600 baud

8-bit parallel Centronics port

*peripherals

printers either local or at master

*software

CP/M 86

electronic mail

user name (and optional password) for disk access

optional password protection on network partitions

automatic function key assignment sent to station at log-in

OASIS 5.5 (single user) or OASIS M5.5 (multi-user)

*cost

$4,895 for workstation and 512K bytes RAM, $300 for HiNet software, $250 for CP/M-86

Master CPU's (Z80 based) with hard disks range from $9K to $13.5K depending on disk size (10M to 28M byte) Models DMS-3/xxxx and DMS-4/xxxx

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Dual Systems Control Corp.

DUAL/68000

*processor

MC68000 8Mhz

16 Mbtye direct addr space

192 device interrupts

7 vectored interrupt levels

Memory management allows concurrent use of mapped and non-mapped addr space

12-slot cabinet

IEEE 696/S-100 compatibility (24-line addr)

*memory

256 Kbyte of RAM with parity per board slot

*software

UNIX V7 configured by UNISOFT

Languages: C, FORTRAN, PASCAL, BASIC, COBOL

*cost

Dev. sys. with 32K nonvoltaic memory, 32 slots for EPROM,
serial I/O ports, 12 slot cab., and power supplies - $3685

Eagle Computer Inc.

BC-1610, BC-1630

*processor

Intel 8086 @ 8MHz

*memory

128 Kbytes std BC-1610

512 Kbytes std BC-1630

*auxiliary storage

two integral double-sided minifloppy drives BC-1610

10 Mbytes with integral floppy and hard disk for BC-1630

*display

12" green phosphorus standard (80 x 25 char format)

Color graphics available

*communications

BC-1630 contains async ports for up to 8 local or remote terminals.

2 RS232C serial ports with programmable async or sync communications.

*peripherals

Centronics-compatible parallel printer port

*software

operating systems available include CP/M, MP/M, Oasis-16, Xenix,
MS/DOS, and iRMX-86.

*price

BC-1610 w 128K RAM, dual minifloppies $5000

BC-1630 w 512K RAM, 10M disk (floppy+hard), async serial ports $9000.

Fortin Electronics

Fort 16

*processor

8086

*memory

512K byte RAM

*auxiliary storage

dual 5.25" 800K byte diskettes

dual 5.25" winchesters available (8M bytes each)

*display

12", 80 x 25 character format

*software

CP/M-86, XENIX, Micrel DBMS

BASIC, Pascal, FORTRAN, RPG, COBOL, PL/1

application packages

Fortune Systems, Corp

System 32:16

*processor

Motorola 68000

Proprietary bus, address width 20 bits.

Provision provided for Motorola math processor chip when it becomes available.

*memory

128Kbytes of RAM with parity and error correcting-expandable to 1Mbyte. 200ns cycle time.

*display

12-inch black and white or 13-inch color (16 colors)

80 char x 25 lines ; color - 132 x 60

128 char std (256 char optional)

bit mapped video (640 x 480)

attributes - overstrike, double underline, reverse video, blink, highlight)

Vector or line drawing package?

*auxiliary storage

1 to 4 5.25 inch floppies (720 Kbyte)

1 to 4 5.25 Winchester drives (5/10/20 Mbyte each) $3400

*keyboard

99-key, removable (standard typewriter, 15-key numeric pad, 9-key cursor, 16 programmable function keys & system level keys including help, cancel, and delete)

*communications

RS-232C asynchronous 2-4 ports up to 19,200 bps

high speed synchronous - 2780/3780, 3741, 2770, 2968

IEEE 488

Ethernet proposed

*peripherals

parallel printer interface

*software

Operating system - UNIX Version 7

languages - BASIC (SMC BUSINESS BASIC, C-BASIC, and M-BASIC filters), COBOL (ANSI 74 LEVEL2), FORTRAN-77, PASCAL (Extended ISO), C

sequential file updating, record locking, automatic system reconfiguration

Microsoft's - financial planning package (Multiplan)

File management - file protection, dynamic file allocation

Text editing

application packages - Business accounting, Data base management, word processing

*Physical Characteristics

Power - 115/240 VAC, 60 Hz, 130 watt

size -

	ht(")	d (")	w(")	weight(#)
Monitor	12.9	13.7	12.3	12
Keyboard	2.2	6.3	22.3	6
Processor	5.8	13.9	22.3	30

*Cost $4995 Single user system

*March deliveries expected

note: May be more applicable as a Managers work station

Forward Technology, Inc.

Gateway Scientific Workstation

*processor

MC 68000, 10MHz

Multibus card cage with 5 expansion slots

*memory

256K bytes ECC memory expandable to 1.5M bytes

*auxiliary storage

80M bytes of 8" Winchester expandable to 320M bytes

streaming tapes provide up to 45M bytes of backup storage

*display

15" B & W CRT displays 800 x 1024 pixels either vertically or horizontally

"mouse" type screen pointer

graphics controller containing 128K bytes of on-board RAM and is capable of driving 1K X 1K picture element bit-mapped display

up to 4 graphics monitors can be connected to 1 CPU

*keyboard

VT-100 compatible detachable keyboard

*communications

2 serial RS-232C ports

16 bit parallel port

cluster or node in Ethernet configuration (10 Mb/sec)

*software

XENIX (Microsoft's implementation of UNIX version 7)

size: approx 128K bytes

Languages - C, Basic, Pascal, and FORTRAN 77

Utilities - Editor, debugger, sort

supports ACM SIGGRAPH Core 2-D graphics software

*physical

dimensions - display 18"w x 18"d x 15"h

cabinet 17.8"w x 20.7"d x 12.7"h

weight - 45 pounds

temperature - 0 to 40 deg C (32 to 104 deg F)

power - 110 VAC, 60Hz, 8A

*cost

$11K - Processor, 256K RAM, display, keyboard, & graphics controller

$23K - above, UNIX, C and FORTRAN, graphics software, & Winchester

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General Automation, Inc

Zebra Family (1000, 2000, 1500, 2500)

*processor

MC68000, 10 MHz

Memory Management

5 interval timers

Multibus- 4 slots

startup self diagnostics

*memory

256K bytes RAM

*auxiliary storage

20M byte 5.25" Winchester expandable to 40M bytes (1000, 1500)

35M bytes 8" Winchester expandable to 70M bytes (2000,2500)

20M bytes 0.25" streaming tape

*keyboard

ASCII, function keys, numeric pad (optional)

*display

15" CRT (optional)

*communications

two RS423 async ports 50-19.2 baud rates

four RS232C async ports (optional on 1000 & 1500)

*software

XENIX (Microsoft implementation of UNIX version 7) (1000 and 2000)

Languages- FORTRAN 77, Pascal, C, BASIC, and COBOL

PICK operating system (1500 and 2500)

virtual memory allowing 8 billion bytes of logical addr. space

password access to system and files

BASIC

*physical

17.63"w, 6.88"h, 23.38"d (not including keyboard and display)

*note

Zebra 3000, 3500, 5000, 5500 are available as non-desktop systems.

Hewlett-Packard

HP 9836

*processor

Motorola MC68000, 8-MHz

Power/fail protection

Floating point firmware

Memory expansion to 2 Mbytes

I/O slots for memory or special interfaces

*keyboard

128 character ASCII

Numeric pad

10 shiftable function keys

Rotary control knob that can be used by system or user programs for text editing, cursor control, instrument calibration.

*memory

64 Kbyte R/W memory standard (16Mbyte addr space)

expandable in 256 Kbyte increments

*auxiliary storage

5.25" dual floppies (260 Kbytes each)

5.25" Winchesters available in 10/64/400 Mbyte versions

*display

12" CRT with non-glare cover

512 x 390 pixels

external color monitor available

*peripherals

printers, plotters, data tablets, & high speed disks available

*software

PASCAL, BASIC, HPL

FORTRAN and UNIX available in fall

*communications

HP1-B standard instrumentation interface for access to HP instruments (IEEE 488-1978)

Share data with other HP computers

RS-232C available

*cost

$8950

$11950 (disk BASIC)

Notes:

*from telcon with Rob Kirkland on 7/23/82

-Jack Allender of code 1930 has a VT 100 emulator working on the 1936A and has connected it to TOFACS (still some bugs)

-Also Kirkland knows of a 3rd party that is willing to write terminal emulator software including the VT 100.

9000 Series 500 (1 CPU), Series 600 (2 CPU's), Series 700 (3 CPU's)

*processor

32 bit

real-time clock

*memory

128K byte RAM with up to 2.5M bytes of ECC memory

*auxiliary storage

10M byte 5.25" Winchester drive

270K byte floppy

*communications

Ethernet support

IEEE-802 network support

*software

HP-UX operating system described as an HP-modified version of UNIX System III.

Muse technical word processing package

statistical programs

HP-Design mechanical engineering package

HP-FE II finite-element models

HPSPICE circuit simulation package

*cost

series 500 -

512K RAM - $23,105

1M RAM, 10M hard disk, 270K floppy thermal printer, and software - $64,565

Ikier Technology

Eagle Graphics Computer

*processor

Intel 8086

floating point optional

*auxiliary storage

Winchester

floppy

*display

1024 x 800 pixel

*software

languages - FORTRAN, BASIC, and assembly

*physical

48" x 22" x 24"

*cost

$25,000

Instrumentation Laboratory Inc
Pixel Division

Pixel 100/AP

*processor

68000

16-bit I/O control processors

*memory

1M byte 150 ns dynamic RAM

*display

8 terminals

Tilting non-glare 12 inch screen with gray phosphorus (green optional)

displays 25 lines x 80 cols, 9x9 dot matrix characters

Detachable keyboard

functions-reverse video, blinking, and bar graphics

*auxiliary storage

40M byte Winchester disk

dual 630K byte diskette drives

*communications

8 RS232 ports

2 Centronics-compatible parallel ports

supports SNA, BSC, and X.25 protocols

*software

Multi-user, virtual memory implementation of UNIX system III

version IV USCD p-System

Languages- C, Fortran IV, Ratfor, Basic are available

*cost

$19.9K (above description)

$12.825K (development sys with 2 terminals, 0.5M byte RAM,

20M byte Winchester)

note: appears to sell only to OEMs

Intellimac, Inc.

IN/7000K

*processor

68000, 10 MHz

Multibus

*memory

.75M byte 200 nsec

*auxiliary storage

16M byte storage (8 MB fixed + 8 MB removable)

expandable to 128 MB

*software

UNIX Version 7 (Unisoft, Berkley enhancement)

ROS (ADA)

languages - C, FORTRAN 77, COBOL, Pascal, LISP, and BASIC-Plus

*physical

3 ft tall in std 19" equipment rack

*cost

starts at $25K

Ithaca Intersystems, Inc

Graphos terminal

*processor

MC68000

*display

640 x 480 pixels

users are able to choose 256 colors from a palette of 32,768 colors

up to 16 windows with individual scroll, pan and zoom

supports tablets, mice, joysticks and trackballs

*communications

RS232 and RS422

HDLC

8/16-bit parallel

*peripherals

printers, plotters, and film recorders

*cost

$8K

Massachusetts Computer Corp (MASSCOMP)

MC-500

*processor

dual MC68000, 10 MHz

4K byte cache

floating point and array processor options

MC-500 processor bus (8M byte/sec)

Multibus for graphics, disk and tape (6M byte/sec)

STD+ bus for data acquisition and control processor

*memory

.5M byte ECC memory expandable to 6M bytes (16M byte addr space)

*auxiliary storage

1M byte 5.25" floppy disk

27M byte 5.25" Winchester with 80M and 166M byte available

0.25" and 0.5" Mag tape available

*display

Graphics processor - 68000, 8Mhz

monochrome

15 inch monitor

pixels - 800 x 600 x 2 x planes (dual frame buffers each with 2 planes expandable to 10 planes)

color

13 inch monitor

12 bit color map allows selection from 4096 colors

pixels - 640 x 480 x 2 x planes (minimum 6 planes to display 64 colors expandable to 10 planes for 1024 colors).

*communications

serial line

IEEE-488 available

parallel digital I/O

*peripherals

A/D converter at 1M samples/sec

D/A converter at 0.5M samples/sec

*software

UNIX System III - Berkley virtual memory enhancements
MASSCOMP Real-time enhancements
utilities and languages

virtual memory - user programs up to 1M bytes

languages -

C, BASIC, FORTRAN-77, and Pascal (distributed and supported)

Franz Lisp, SNOBOL-3, Motorola 68000 Assembler, APL
(distributed but not supported)

Data acquisition and graphics software

*cost

system with alphanumeric terminal (no graphics) - $25K

graphics workstation - $32K

MICRO DA SYS, INC

68K Miniframe

*processor (3 processors)

68000 main processor, 12 MHz

68000 virtual memory & number crunching co-processor

6809 I/O processor

virtual addr up to 4Gbytes

*auxiliary storage

Dual 8 inch double-sided floppy (2Mbyte total) $600

One Winchester/one double-sided floppy $5200

*display

CRT Televideo 920C $995

*communications

6 RS232

4 parallel ports (port - 8 bidirectional lines,
& 2 handshaking lines)

*operating system

UNIX V7 -- CBASIC, FORTH, LISP, APL
Microsoft-BASIC, FORTRAN, COBOL, PASCAL

*future

bus arbiter (for networking)

bus adapters

*cost starts @ $12K (256k RAM; 2M byte floppy; 6 RS232 ports;
4 parallel ports; DMA port; and UNIX.)

Momentum Computer Systems International

See Computhink

NCR Corp.

Tower 1632 (OEM)

*processor

Motorola 68000

IEEE-796 Multibus I/O subsystem

32K bytes ROM for system start-up and diagnostics

*memory

256K bytes RAM expandable to 2M bytes

*auxiliary storage

10M bytes Winchester expandable to 1 gigabyte

1M byte 5.25" floppy

streaming tape available

*communications

2 RS-232C ports

*software

UNIX System III

*cost

$12K

Onyx Systems Inc

C8002

*processor

Z8000, 4 MHz

*memory

256K byte (up to 1M byte), byte parity detect

*auxiliary storage

Z80A to control all mass storage functions

10M, 20M, 40M byte Winchester drives available (max 160M bytes)

10M byte cartridge tape for backup

*display

12' non-glare green phosphorus screen

DT/80 - 80 char x 24 lines

DT/132 - allows user to switch between 80 and 132 char/line
supports double-sized characters (height and/or width)

*keyboard

detachable with five foot coiled cord with jack

67 keys in standard type format, 18 keys in auxiliary numeric pad including 4 programmable function keys

*peripherals

printer options include low cost dot matrix, and high speed letter quality which can produce letter quality documents and charts and graphs.

*communications

RS-422 high speed link for computer networking

9 RS-232C ports (1 for serial printer)

8-bit parallel port (Cintronics)

*software

UNIX System III, OASIS

password log-on

languages: COBOL (ANSI 1974), BASIC (business oriented)

graphics software will be available in near future

*cost

$25K for 4 work stations, O/S, 40M byte disk

Parallel Computers

CPU (Continuous Processing Unit)

*processor

Motorola 68000, 10 MHz

self-diagnosing and user-serviceable

12 or 16 slot multibus chassis

*memory

256K byte expandable to 2M byte

*auxiliary storage

1M byte Floppy (Shugart)

hard disk ranging from 10M byte to 400M byte (5.25" and 8")

streaming tapes available (Data Electronics)

*communications

8 channel serial input/output processor

Ethernet

*software

XENIX (UNIX); 8-, 16-, 32-user systems

CP/M and UCSD p-System emulators also provided

languages - C, FORTRAN 77, Pascal, BASIC, and COBOL

*cost

start at $15.2K

$25K - $100K for 2 parallel processors and Winchester

Pixel Division

(see Instrumentation Laboratory Inc)

Plexus Computers, Inc

P/35, P/60

*processor

68000, 12 MHz

4K bytes of cache memory with 32-bit data path to main memory

multibus (IEEE 796)

*memory

512K bytes expandable to 2M bytes on P/35 and 4M bytes on P/60

*auxiliary storage

Intelligent mass storage 16-bit processor

22M byte 8" Winchester disks from NEC Information Systems available

72M byte 14" Winchester disks from Fujitsu America available

expandable to 145M byte at high range

0.5" streaming tape from Cipher Data Products

0.25 inch tape cartridge from Archive Corp

*communications

Intelligent communications 16-bit processor

supports up to 16 terminals using 2 communications processors (P/35)

P/60 supports up to 40 terminals

Centronics compatible parallel interface

*software

Western Electric's UNIX System III

languages - COBOL, BASIC, and C

*cost

P/35 - 512K RAM, 22M disk, 0.25" tape, single user - $13.5K (OEM quan)

P/60 - 512K RAM, 72M disk, streaming tape - $32,250

QL Corp.

68000 Desk-height Comp.

*processor

68000, 8 MHz.

16-Mbyte addr space

8-card chassis

*memory

256 Kbyte std, expandable to 3 Mbye in existing chassis

*auxiliary storage

Winchester (20Mbyte), additional 20 Mbyte optional

8 inch IBM compatible floppy

*display

eight color 14 inch CRT is std

full page and plasma displays are optional

Sage Computer Technology

Sage II

*processor

68000

real-time clock

*memory

512 Kbytes

*communications

2 RS-232-C interfaces

One IEEE-488

Centronics parallel-printer interface

*software

UCSD p-System, release IV.0

Sci-Com Computer Systems

Seiko Series 8600

*processor

Intel 8086, 5 MHz

14 vectored interrupts

3 interval timers

*memory

128K bytes RAM expandable to 512K bytes

*auxiliary storage

dual 640K byte 5.25" diskettes

10M byte 5.25" Winchester

*display

12" nonglare that tilts, and swivels; 24 line x 80 character; 10 x 14 dot-matrix; windowing and smooth scroll

*keyboard

100-key detachable

IBM Selectric-compatible with 10 top-row programmable, 18 key auxiliary pad, 5 special function keys

*communications

4 RS-232C ports, half- or full-duplex, 50 bps to 19.2 bps

Centronics compatible 8-bit port

optional CCITT-X.21 HDLC communications interface

*software

CP/M-86, MS-DOS, MBOS, Oasis-16, Unidol, and MP/M-86 supported (Unidol is described as a version of UNIX System III)

Languages supported - Business BASIC, FORTRAN, COBOL, Pascal, C, MBASIC, and CBASIC.

*cost

$5K to $15K

SUN Microsystems, Inc

SUN Workstation

*Processor

68000/68100 10Mhz

IEEE-796 bus or Intel Multibus

six slot card cage

Memory management supports up to 16 simultaneous process of 8 Mbytes of virtual memory for each.

Keyboard

*Memory

256 Kbyte expandable to 1.75 Mbyte

parity error detection

*auxiliary storage

12 Mbyte Winchester option (6 Mbyte fixed, 6 Mbyte removable)

84 Mbyte fixed option $13,900

tape controller interfaces to industry std 1600 bpi, 1/2 tape.

*display

17" display (1024 x 800 pixel), can display 2 pages of characters and graphics, including proportionally spaced characters, foreign alphabet, math symbols, lines, curves, and shaded areas.

color option-640 x 480 display with 256 colors (video output RS-170 compatible)

optional 'mouse' pointing device for positioning graphical input scheduled 4Q82.

*communications

2 high speed serial lines supported 50Kbaud sync and async

experimental 3MBit/sec Ethernet-1 available $1,500

10 MBit/sec Ethernet scheduled for 4Q82

PROM based VT-100 emulator and Tektronix 4014 emulator available

*software

UNIX version 7 distributed by Unisoft (includes vi) $1,500

Pascal and Fortran optional

Berkeley 4.2sd UNIX scheduled 1Q83 which allows a full UNIX system on workstations without local disks, accessing files over the network.

SIGGRAPH CORE standard of graphics routines are available.

*physical

desk top enclosure 19" h x 17" w x 17" d

power- 110 V, 3.5 A or 220 V, 2 A

typical configuration-clusters combining 5 to 10 workstations with fileserver, printer server, backup server, etc. giving each user a local processor while sharing peripherals.

SUPERSET

Note: This system looks too large for an office work station. But has a good capability.

SUPERSET PGM

*processor

48-bit word length

11+ digit decimal floating point precision

*memory

up to 393 Kbyte error correcting

*auxiliary storage

Winchester 29 Mbyte

*display

supports color (Chromatics, AED, etc) or high resolution monochrome (Tektronix, Megatek, etc)

*communications

5 RS-232C

Protocols supported - IBM 2780, DCT 2000, and other

*peripherals

plotters (Houston Instruments, Zeta, Calcomp, etc)

digitizing tablet (Houston Instruments, Summagraphics, etc.)

A/D converters

*software

Virtual memory FORTRAN programs up to 4Mbytes in size

Graphics - DISSPLA , INTERACT

* cost begins at $27K

Tandy Corp./Radio Shack

TRS-80 Model 16

*processor

Z80A - In the 8-bit mode, serves as the primary processor and the I/O controller. Operates similar to TRS Model II. In the 16-bit mode, serves as the I/O processor.

68000 - Serves as the primary processor in the 16-bit mode.

*memory (512 K bytes maximum)

128 Kbyte standard with the system expandable to 256 K on board by buying chip set ($499). Additional board with 128 K for $699 which is expandable to 256 K with chip set ($499).

*auxiliary storage

1.25 Mbyte 8 inch drive standard. Additional drives can be added for $799 each.

8.4 Mbyte, 8 inch Winchester (about $2500)

*display

80-char x 24-line green-phosphorus CRT with character graphics

Graphics enhancement containing 153,600 bits of refresh memory to maintain the display. $499

*communications

2-port serial interface standard. One port is an RS-232 with data rates up to 19.2 kbaud. The second is synchronous designed to support all IBM System Network Architecture communication protocols, including Bisync, HDLC and SDLC. For use as a workstation in IBM compatible environments.

Can serve as a network node in ARCNET (local-area network developed by Tandy) or in the Network III system. A $599 16-channel

multiplexed RS232 controller that connects as many as 16 terminals or computers in a star-type network configuration.

*software

TRSDOS operating system with multiprocessing (and I assume networking) will be available midyear 82.

Languages- BASIC, COBOL, FORTRAN

ARCNET

-rumors suggest that Charles River will supply UNIX-like software-

*cost

CPU, 128K memory, 1.25 Mbyte disk , 2 serial I/O ports--$4999

CPU, 512K memory, 2.5 Mbyte disk, 8.4 Mbyte Winchester, 2 serial I/O ports - $9993

Televideo Systems, Inc

Telesystem II (availability in March 1983)

*processor

68000

*memory

512K bytes RAM expandable to 1M bytes in 256K increments

*auxiliary storage

40M bytes 8" Winchester disk (Quantum)

80M bytes available with capacity of 160M bytes

17.5M bytes cartridge drive (Data Electronics)

*communications

16 serial ports (I assume RS-232)

RS422 port

Centronics compatible parallel port

*software

UNIX III

languages - COBOL, FORTRAN 77, C, and Pascal

*cost

$14K

Three Rivers Computer

PERQ

*processor

proprietary microprogrammed 16-bit CPU

microcode supports P-code

*memory

256K bytes RAM (A 1M byte RAM option available)

*auxiliary storage

14" 12M byte Winchester disk (24M byte optional)

double sided floppy available

*display

15" CRT with portrait orientation

768 point x 1024 line bit mapped display refreshed 60/second

on-screen cursor is positioned via a data tablet like device

*keyboard

60-key detachable

*peripherals

daisywheel or laser printers optional

speech synthesizer

*communications

RS-232 up to 9600 baud full duplex, line and protocol parameters programmable

Ethernet option allows up to 1024 PERQ's to be interconnected for resource sharing

GPIB interface (IEEE 488-1975 standard)

*software

PERQ operating system provides job management, virtual memory association, swapping, I/O services, window management, timekeeping, and PASCAL

security is provided with user login/password and multilevel file system security features

file system is hierarchical

*cost

basic system--$27K

Victory Computer Systems, Inc.

Factor

*processor

Motorola MC68000

Z80 dedicated I/O processor

VME bus, 16 MHz, 32-bit addr and data paths, 7 interrupt levels and 4 bus arbitration levels

16M byte address space

*memory

256K bytes dual-port (1M byte expansion boards available)

*auxiliary storage

5.25" or 8" floppy

5.25" or 8" fixed Winchester

5.25" removable Winchester

*communications

7 RS232C serial ports (19.2K baud)

RS422 serial port (800K baud)

parallel port (16-line Centronics-campatible)

Ethernet interface

*software

UNIX

languages - C, FORTRAN, and Pascal

protocols supported - HDLC, SDLC, 3780, and 3270

*physical

14" W x 19" H x 24" D

WICAT Systems

System 100, System 150 WS (Models 1, 3, 6)

*processor - Motorola 68000 at 8Mhz

multibus (except System 100)

memory management

7 vectored interrupt levels

floating pt hardware on 150WS mod 6 in Nov. 82

*memory

256 Kbyte std on System 100 expandable to 6 Mbyte in std cabinet

256 Kbyte std on System 150 models 1, 3 expandable to 1.5 Mbyte

512 Kbyte std on System 150 model 6 expandable to 1.5 Mbyte

memory additions- 128K ($825), 256K ($1625), 512K (TBA)

*console

Graphics board $900 (?software on card, accessible through FORTRAN, vector drawing?)

*auxiliary storage

System 100: Winchester 20 Mbyte std upgradable to 40 Mbyte ($895)

System 150 WS: Winchester 10 Mbyte std but can get 15M byte (slower) at no additional cost, 20 Mbyte but would require special accommodation.

5.25 inch floppy std (630 Kbyte)

*peripherals

System 100: Streamer Back-up tape

RS-232C compatible printers

150 WS: calendar clock ($75)

IEEE 488 Parallel port (July) ($300)

*communications

System 150 WS model 6: 5 RS-232C Serial interfaces std
1 Parallel port

System 150 WS mod 1,3: 2 RS-232C serial interfaces std
1 Parallel port

System 100: 16 RS-232C Serial interfaces
2 Parallel ports

(RS-232C's - up to 19.2 baud in async, up to 56K baud in sync)

*software

Multiuser control system standard

UNIX/V3 (150WS mod 1- $850; 150WS mods 3,6- $1300; 100 - $2400) includes- C, FORTRAN, and assembly

CP/M Emulator available

Other programming languages: PASCAL, COBOL, BASIC, APL, ADA, and LISP at extra cost

*Physical characteristics

power: 95-130 VAC, 47-440 Hz

size: system 150 WS - 16" h x 19" w x 16.5" d; weight 50#

MG8000 Graphics terminal available

monochrome graphics- 400x300 pixel resolution

simultaneous support of text and graphics (2 independent graphics planes for animation)

Optional touch pad

Zentec Corp

Series 2000

*processor

8 MHz 8086

8087 arithmetic coprocessor optional

Optional Multibus attachment for disks and printers

*memory

16 to 64 Kbytes of user memory

*auxiliary storage

5.25" 728K byte diskette (second optional)

up to 60 Mbytes

*display

12" screen

optional high resolution, multiple character sets and forms handling.

*peripherals

dot matrix printers @ speeds from 180 to 500 cps

near letter quality @ speeds from 100 to 125 cps

*software

UNIX with the C compiler is standard

optional languages-COBOL, FORTRAN, and BASIC (interpreter and compiler)

Capable of down-loading programs from main processor

*cost

$10K - $20K

Zilog, Inc.

System 8000

*processor

Z8001A, 6MHz

memory management (Z8010A)

10 board backplane, Z-Bus (32-bit bus with 8 Mbyte/sec bandwidth allows future implementation of high-speed 32-bit processor and peripheral controllers)

*memory

256K byte expandable to 1M byte (Models 10 and 11)

1M byte ECC memory expandable to 4M bytes (Model 21 and 31)

*auxiliary storage

18M byte 5.25" Winchester expandable to 36M bytes (Models 10 and 11)

1M byte minifloppy (Model 10)

17M byte .25" tape cartridge (Models 11, 21 and 31)

32M byte 8" Winchester expandable to 128M bytes (Model 21)

80M byte disk expandable up to 320M bytes (Model 31)

0.5" streaming tape optional

*communications

Z-Net II local area network interface option consisting of an Intelligent Communications Processor with 128K bytes of RAM and 32K bytes of PROM ($3950)

*software

Zeus UNIX operating system - 8 user capability (enhancement of version 7--UNIX System III will be implemented by Nov 82)

languages - C, FORTRAN 77, Pascal, COBOL, and BASIC

*cost

$13,950	Model 10
$16,950	Model 11
$29,950	Model 21
$37,950	Model 31

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APPENDIX B

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