Information Systems Program (ISP)

Workstations Strategies

Segment 4

Vendor Views and Strategies

INPUT®

Villa Street, Mountain View, CA 94041 (415) 961-3300

JUNE 1988

WORKSTATION STRATEGIES SEGMENT FOUR

VENDOR VIEWS AND STRATEGIES

INPUT®

1280 Villa Street, Mountain View, California 94041-1194 (415) 961-3300

Published by
INPUT
1280 Villa Street
Mountain View, CA 94041-1194
U.S.A.

Information Systems Program (ISP)

Workstation Strategies—Segment Four

UWS2 • 451 • 1988

Abstract

The world of the general business systems workstation is undergoing significant change. In previous segments of its Workstation Strategies series, INPUT has documented the shift to the PC as the new standard user workstation and has indicated the importance of planning the workstation environment with the intensity and completeness applied to the other levels of an information network.

INPUT has also alluded to the level of change yet to come in the workstation area. As the workstation becomes a full computer, many of the elements of an information network architecture are expected to change. Simply put, there will be new ways to build applications and networks—many of which will be better that the current approaches.

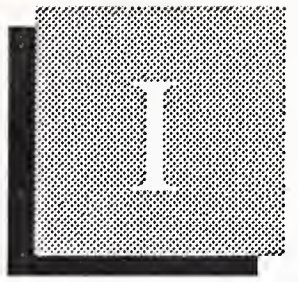
In this fourth segment INPUT takes a top-down look at the direction of workstation technology, and of how the key vendors are setting their respective directions. It is safe to say that the vendors see the workstation market as a changing and expanding opportunity and have a strong interest in pushing capabilities to the workstation level of the information network. This vendor response creates a new IS challenge that ranges from designing new application architectures to teaching the end user more about information technology. It also creates new opportunities for IS to manage the network while transferring more control to the end user.

This segment brings the series to a close and sets a challenge for information systems management to get ready to benefit from this exciting new technology—the Intelligent Business Systems Workstation.

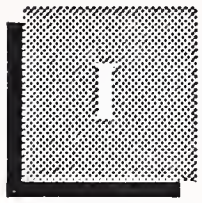
Table of Contents

Table of Contents (Continued)

Exhibits



Introduction



Introduction

This is the fourth in the INPUT research report series on workstation strategies, an in-depth look at the underlying trends in the area of general business systems terminals, personal computers (PCs), intelligent workstations, and their relationship to information networks. This fourth segment, *Vendor Views and Strategies*, takes a top-down look at the changes underway in workstation technology and how key vendors are working to influence the direction and its application of workstation technology.

The first three segments of the *Workstations Strategies* series describe the current trends within the business workstation environment and identify the critical issues involved in managing this evolving technology.

- Segment 1, *Overview*, provides the framework for the study, reports the demographics of the research, identifies the key issues, and provides an overview of the findings.

- Segment 2, *Current Workstation Environments*, provides a quantitative look at today's general business workstation environment and the changes in process. In particular, it highlights the progress being made in integrating the PC into the central information network.

- Segment 3, *Planning the Future*, addresses the opportunity and challenge provided by today's and tomorrow's workstation technologies, and looks at what information systems is or should be doing to benefit from the growing power and capabilities of workstation technology.

These three reports have documented a significant change that is underway in the general business systems area, a shift from the traditional dumb, or single-function terminal to a workstation that is a **computer in the full sense of the word.** Also reported is the dramatic change the personal computer has begun to have on the central information networks of larger organizations and the challenges that face today's information systems organization.

No study of the workstation area would be complete without a look at the views and plans of the workstation vendor community and the key changes taking place in workstation technology. Such a look is the focus of this segment.

Please note that the definitions used in the earlier segments continue to apply. Refer to Appendix A.

A Objectives

The rate of change in workstation strategy technology is great. In the short time since INPUT started this research, a number of major advances have been made. Examples are:

- The engineering workstation (e.g., Sun or Apollo) has begun to penetrate the general business area.
- The PS/2 has become established, and the clone manufacturers are beginning to "clone" it.
- OS/2 has been released and started the slow but inevitable replacement of MS/DOS.
- Digital Equipment has joined forces with Apple Computer to give both companies added entry to the general-business application area within large organizations.
- The importance of UNIX has grown more significant.
- Sun has created the first "chameleon" computer with its 386i workstation product line. It is a DOS or OS/2 workstation **by day** and a UNIX workstation **by night.**

INPUT predicts that the rapid rate of change in workstation technology and its ability to be integrated into the central information networks will continue. Change is being driven by the end users' quest for greater capabilities and the vendors' quest to expand a market.

In Segment 3, *Planning the Future*, INPUT concluded that the progressive IS organization is beginning to plan the future use of workstations as a separate and equal element of the information network. These organizations have recognized the shift in the role of the workstation from that of a terminal.

In Segment 4 INPUT's objectives are to take a top-down look at the major trends, tie the trends to vendor plans, and help information systems (IS) management grasp the implications for their organizations' plans.

The specific objectives are to:

- Identify and describe the major trends in workstation technology.
- Describe the product direction of vendors and how they are influencing the market.
- Draw relevant implications from the vendor directions for use by IS management.

B

Issues Addressed

The most significant underlying trend in the workstation area is the fact that workstations are placing more and more power and capability in the hands of the end user. In addition, the personal computer has become the symbol of "ease of use." Through the PC connected to the central information network, the end user has gained a freedom to access and use information that can only result in greater demands.

At the same time the workstation vendors continue to aggressively add more power and capability to the workstation at a pace faster than either can be applied. It will be common in 1989 for purchases of business systems workstations to be for computers with 4 to 8 M-bytes of memory and hard disks averaging 80 M-bytes or more.

This continuing explosion of workstation capability carries these underlying issues for IS management:

- Is the user ready for a workstation that is a multitasking computer?
- Are vendors building capabilities that go beyond those needed by the common end user?
- Which technology will win the race: the PC with OS/2 or the engineering workstation with UNIX? Or will both coexist, either on a cooperative or exclusive basis?

These issues underlie much of this final segment; however, there are no immediate answers. Prudent IS management will monitor these issues for the foreseeable future.

C

Methodology

Recognizing that workstation technology is undergoing immense change, INPUT decided to probe the plans and activities of major vendors of workstation technology. The research was designed to identify the key trends as viewed by vendors, to gain an understanding of how these vendors plan to influence the trends, and to help predict the ultimate form of the future business systems workstation.

The vendors researched were Apple, Digital Equipment, IBM, Sun Microsystems, and Wang Laboratories. The principal questions asked were:

1. What is the current workstation product line, including its features and competitive posture?

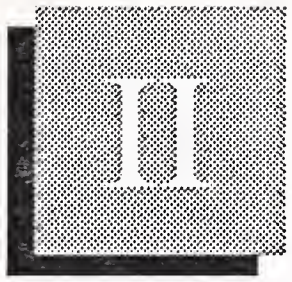
2. What is the focus of the firm's current workstation sales program in the general business systems area?

3. What types of applications seem most appropriate for IWS versus dumb terminal implementation?

4. What direction does your firm believe workstation technology and implementation will take in the general business systems area?

In the chapters that follow we will address:

- Trends in the Technology
- Market and Vendor Directions
- Future Implications



Trends in the Technology

II

Trends in the Technology

A Introduction

In the previous segments INPUT has reported that a major shift is well under way in the general business systems workstation area. No longer is the traditional dumb terminal the standard business application workstation. The personal computer (PC) or some other computer-based workstation is rapidly taking its place.

Key findings and conclusions from the previous segments include the following (refer to Exhibit II-1):

- The PC has become the common, and will be the usual workstation used by professionals.
- The PC is the dominant workstation used by executives and managers.
- The terminal has been relegated to use with existing applications, primarily for data entry by clerical users.
- The majority of PCs in large organizations are connected to the central information network.
- First the PC with DOS, and now the Macintosh and engineering workstation (e.g., Sun Microsystems and Apollo) with their graphic (icon-based) interfaces, have defined the standard man-machine interface for computing in the 1990s. A truly graphical interface will dominate in the early 1990s.
- Workstation technology is beginning to offer new ways to develop and implement applications. With the workstation becoming a computer, true three-tier computing becomes possible with an application distributed across all three levels.

EXHIBIT II-1

WORKSTATION STRATEGIES
PREVIOUS CONCLUSIONS

- The PC is the workstation of choice for professionals and management.
- The terminal is being relegated to clerical application support.
- The majority of PCs are already connected to the central information network.
- The PC has defined "ease of use," with icon interface setting the standard for the future.
- IWS supports new distributed application structures with full three-tier computing.
- As a computer, the workstation becomes a peer in the network.

- The importance of the workstation to the overall information network is changing. As a computer it becomes a peer and must be included in the technology plan as such. Many organizations are developing workstation strategies of an importance equal to the organizations' distributed and mainframe strategies.

The result as reported in the last segment is a major change in the way applications can and will be developed and the degree to which the workstation must now be considered as a critical and equal element of an information network strategy.

In this chapter we will look more closely at the trends in workstation technology and the resultant change in the user environment and types of applications.

The next chapter will look at the product directions of the market and key vendors (Apple, Digital, IBM, Sun, Wang).

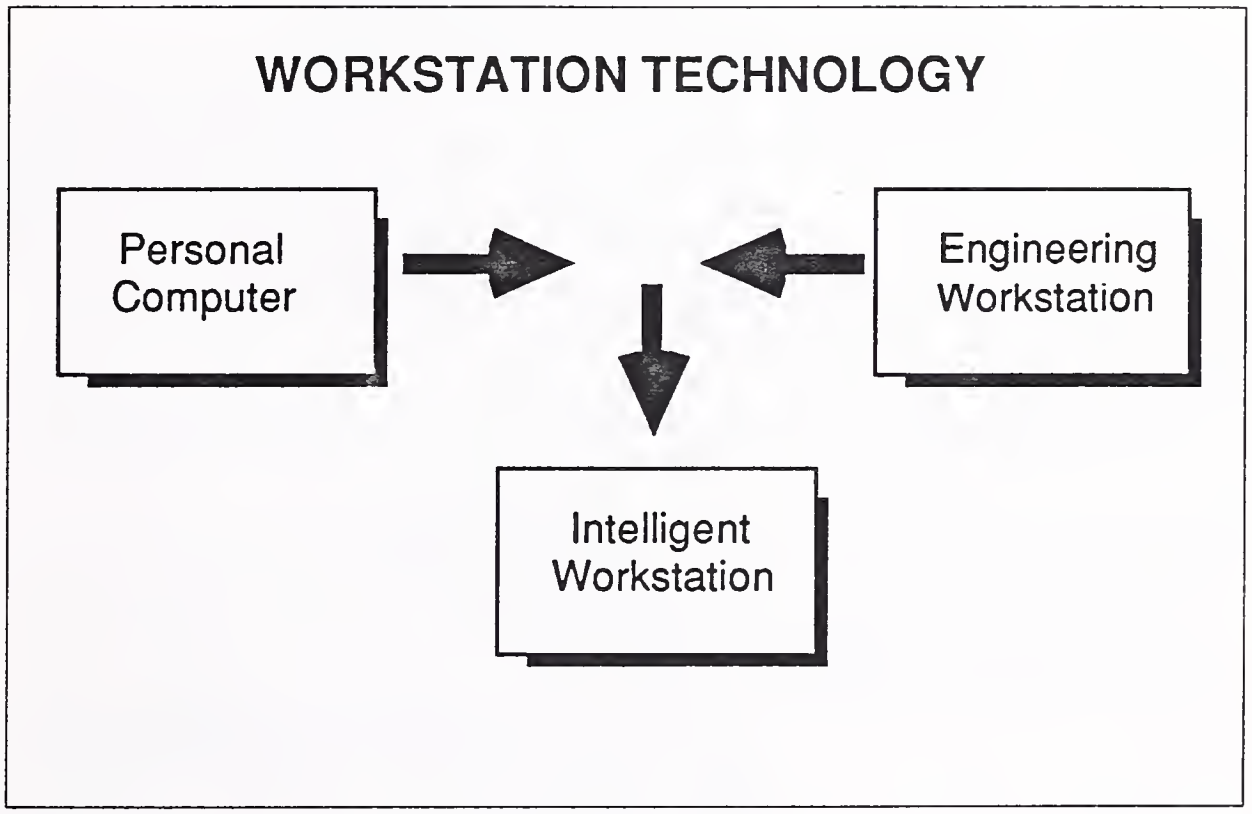
B

Workstation Technology Trends

Just a few years ago, the PC often entered a large organization through the back door as office furniture, and the engineering workstation was a specialized computer. By 1985 much had changed, with Information Systems setting PC standards and policy. In 1987, the PC became the most common workstation, and the engineering workstation began to infiltrate the general business systems area, providing a powerful and appealing alternative to the PC. Two technologies with different starting points are developing and converging on a key element of the information network—the business systems workstation.

As Exhibit II-2 indicates, a new workstation technology is in the development phase. The new technology will result from the evolution of and competition between the PC and engineering workstation technologies, creating the **intelligent workstation** (IWS) of the 1990s.

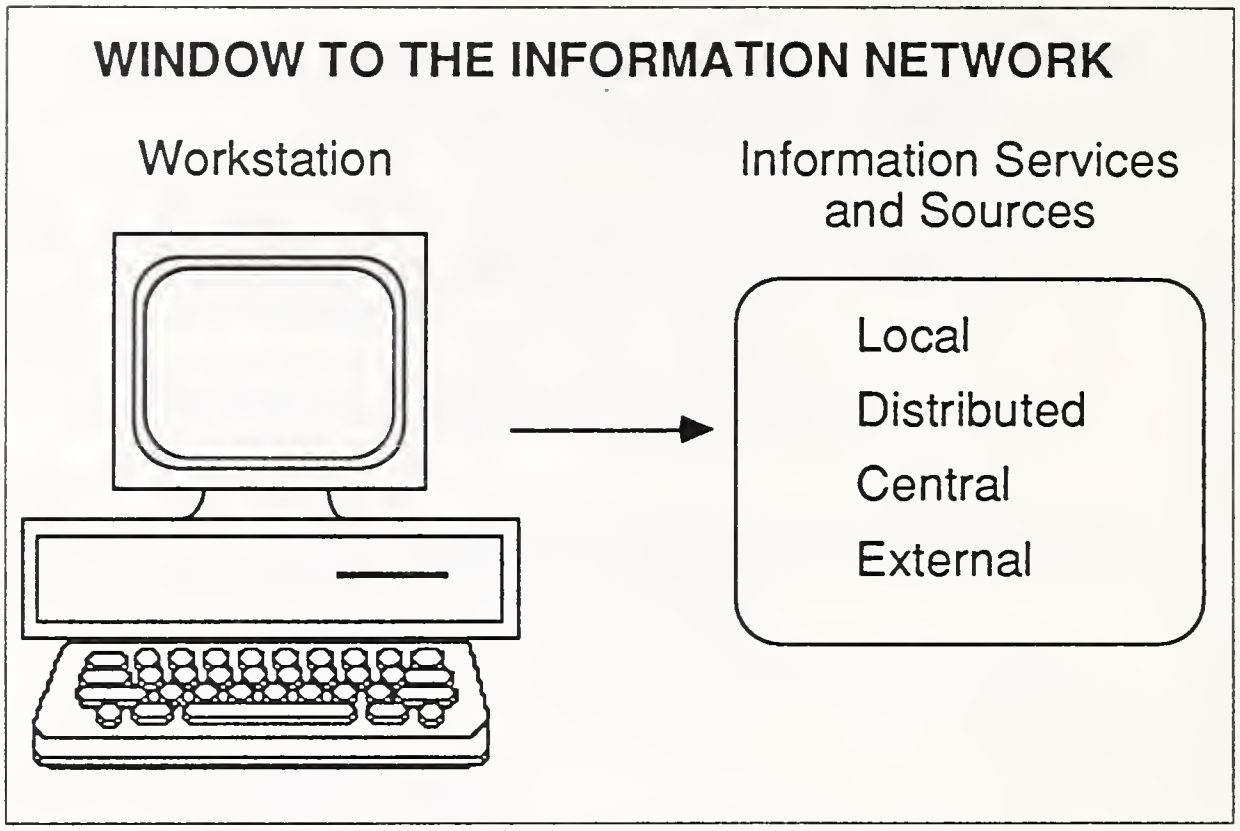
EXHIBIT II-2



In conceptual terms the goal of this intelligent workstation or IWS will be to provide a **single** window to the information network. As depicted in Exhibit II-3, the IWS will access internal (local, LAN, midrange, and mainframe) as well as external services through a single (seamless) user interface.

Reaching this point remains a few years away. However, major strides are being made as this report is written.

EXHIBIT II-3



To provide a concise look at the trends in workstation technology and a prediction of how this "convergence" will emerge, INPUT has identified the following key characteristics of the intelligent business systems workstation of the 1990s:

1. Power
2. Price
3. User Interface
4. Operating System
5. Communications
6. Connectivity
7. Acceptance

Exhibit II-4 highlights the status/direction of each of these characteristics for PC and engineering workstation technologies. In the next sections we will briefly describe the trends for each characteristic and comment on what the characteristic means for the intelligent workstation of the 1990s.

1. Power

Power of a workstation is defined in terms of processing capabilities, data storage capabilities, and the power of the software.

The PC and the engineering workstation converge on this characteristic from different bases. The PC until recently was limited to 640 K of memory and a single-process operating system. Today or very soon the PC will have (and require) 4 to 8 M-bytes of memory and be able to handle multiple concurrent processes.

EXHIBIT II-4

CONVERGING WORKSTATION TECHNOLOGY

Factor	PC	Engr WS
Power	Expanding	Adjusting
Price	Rising	Declining
User Interface	Improving	Evolving
Operating System	DOS-OS/2	UNIX and/or DOS
Communications	Expanding	Established
Connectivity	Focused	Flexible
Acceptance	Established	Emerging

The engineering workstation, on the other hand, started with reasonably high processing, software, and communications capabilities at a high cost. Improvements have permitted a version that is price-competitive in the business systems area.

The engineering workstation started life as a networked device and a "window" to the information network, whereas the PC started as an independent computer for personal use. The PC is playing catch-up while the more powerful engineering workstation has evolved to lower cost, lower power versions to be marketed for business applications.

To serve the requirements of the early 1990s, the IWS will have significant memory (at least 4 M-bytes), large and efficient hard disk storage (80 M-bytes will be typical), and an operating system that supports multiprocessing. The PC will have this soon, whereas the engineering workstation has these capabilities now.

2. Price

In the area of price there is a quick convergence taking place. The PC that will be required to take full advantage of OS/2 Extended Version and that will support the anticipated software and application environments costs from $7,000 to $10,000 today. This price level allows the business version of the engineering workstation to compete head-on with the PC on capabilities as well as price.

INPUT firmly believes that price will not be a deciding factor in the choice of future intelligent workstations. The only effect price will have over the next few years may be to delay purchase decisions while the unit price stays above a threshold of about $5,000 for a fully equipped (including software and communications capabilities) IWS. Once this level

reaches $4000 for the larger PS/2 and SUN-like workstations, INPUT believes the pace of adopting IWS technology will quicken and the replacement of current PCs will occur more quickly.

Further efforts by IBM, Sun, and others to create a lower-cost IWS, perhaps with narrower capabilities (e.g., diskless) are underway. Such an IWS could speed the replacement of terminals and first-generation PCs.

3. User Interface

The user now controls the type of man-machine interface that will be acceptable, and has indicated that a graphical interface will be the standard for the 1990s. Graphics has two aspects: first as the man-machine interface for controlling the workstation and the computing environments to which the workstation is connected, and second as the display mode for the output from applications.

In this regard the engineering workstation (e.g., Sun's new Open Look interface for UNIX-based workstations) and the Macintosh are well ahead of the MS/DOS environment. OS/2 and windows will change this; however, it will take time to replace the installed base of DOS personal computers.

The belief is that the icon-driven interface will be standard across workstation technology by 1990. There will be differences between vendors, but they will be much less different than in the current command-oriented operating system environment. MS/DOS and the PC are in a catch-up mode, but they will catch up, and the installed base is in their favor.

It must be noted that the icon interface and graphical-based output are both direct contributors to the growing power requirements of the IWS.

4. Operating System

The convergence in this area will take some time. There is a real-live battle brewing between DOS (OS/2) and UNIX and it is likely both will be winners. Obviously IBM will drive OS/2 as the SAA and SNA standard—the connectivity standard for a MVS and/or VM network. However, UNIX is dominating the technical world (scientific, engineering, and to a growing degree, manufacturing) and will secure some representation in the general business area.

The result, INPUT believes, will be a demand that IWS technology support *both OS/2 and UNIX* at the workstation and in its interaction with the network. Sun Microsystems is out in front with its 386i workstation, which is designed to speed Sun's penetration of business applications. One can also project that, if successful, the 386i will speed the introduction of UNIX to the more-capable business user. All of this is reason for

IBM and Microsoft to get OS/2 Extended Version to market as soon as possible.

A second aspect of the operating system topic is the application development capabilities that are being embedded or tightly linked to the operating system. OS/2 will come with an SQL-based DBMS capability as IBM sees this as a way to tie in the SAA capabilities. Sun is preparing an "office automation suite" of products under UNIX to help it into the office and, of course, the suite includes an SQL DBMS capability.

INPUT believes that this means that the idea of an integrated development environment, as originally conceived by Symphony and Framework, will come of age tied to the operating system of the intelligent workstation, and that the workstation environment will drive much of the direction of computing throughout the 1990's.

By 1990 the role of the IWS operating systems will have expanded to include some application tools, telecommunications control, and the user interface—much more than is controlled by DOS or UNIX today. These advances will increase the appeal to the end user and aid in the conversion to a higher-order operating environment.

5. Communications

Communications will probably fall third on the priority list, behind power and user interface. For the IWS to serve as the single window to the information network, it will have to have flexible and powerful communications capabilities.

The most critical trend in this area is the progress being made on standards for LANs (Ethernet versus Token Ring) and networks in general (OSI). Again the engineering workstation is in the lead. It was created with the capability of performing high-speed communications with multiple data sources. This is one of the primary reasons penetration of the business systems area has started.

Although much of the complexity of communications will be handled by the operating software, the power and connectivity must, and will, be in the IWS to support the various interfaces while hiding them from the user.

6. Connectivity

Connectivity has to do with fitting into the network and providing what the users want—a single interface to all information services. This is the ultimate objective and both the PC and the engineering workstation have progress to make. The PC is restricted by the power of DOS and awaits OS/2 Extended Edition, while the engineering workstation is hindered by its UNIX foundation.

Both technologies recognize the importance of this characteristic and are striving to overcome it. There is and will be a flood of software products designed to handle diverse communication and integration environments so the workstation can achieve the desired high level of connectivity and transparency.

Apple's new Macworkstation product is one example of such software products. It is designed to help the central IS group permit and manage the connection of Macintosh computers to a network using a variety of protocols (e.g., 3270, VMS). The principal function of Macworkstation is to permit users of Macs to build central processor applications using the comfortable Mac interface. The resulting applications can of course include the transmitting (downloading) of central processor data to the Mac for further processing with Mac-based tools.

7. Acceptance

The final proof is the level of acceptance and use of an information technology. The PC is the first information technology where the business end-user has controlled acceptance. And to some extent this controlled acceptance has also been true for the engineering workstation. From this point forward the interface to an organization's general information network will be defined and controlled by the experience and expectations of the end user.

Thus the speed in accepting IWS technology will be tied to the end user learning to make true use of the new, more-integrated capabilities. The burden falls to the vendors to develop the seamless interface and to information systems to set examples of how these capabilities can be effectively employed.

- The icon interface, as established by Apple, and as expected in OS/2 Presentation Manager, will be the environment.

- Competition will drive the price to a level (about $4000) where it becomes of little significance.

- Information systems will rethink their distributed strategies to incorporate the IWS.

- IS and the vendors will work to widen the window to the network; that is, to provide access to more services through a single window.

In the short term the engineering workstation has some advantages in that it is becoming an acceptable alternative. Meanwhile Apple with its desirable interface is finding opportunities. How much progress engineering workstations make depends on how soon OS/2 Extended Edition finds real acceptance.

8. Summary

Exhibit II-5 summarizes these characteristics by comparing the current workstations with the IWS of the near future.

EXHIBIT II-5

WORKSTATION TECHNOLOGY TRENDS—SUMMARY

Factor	PC	Engr WS	IWS
Power	640K-1 M-bytes	4 M-bytes	6-8 M-bytes
Price	$2-3,000	$4-5,000	$7-10,000
User Interface	Command	Icon	Icon
Operating System	DOS-OS/2	UNIX or DOS	OS/2 + UNIX
Communications	Add on	Integrated	Imbedded
Connectivity	Add on	Restrictive	Multiple
Acceptance	Established	Emerging	Evolutionary

INPUT believes that the intelligent workstation used in business systems environments by 1992 will have the following characteristics.

1. Power: 6 to 8 M-bytes of memory and at least 80 M-bytes of disk storage.

2. Price: $7,000 to $10,000 at 1988 prices but closer to $4,000 in 1992. This price includes the operating system and its ever-increasing imbedded capabilities.

3. User Interface: Highly graphical for both input and output, and totally icon based.

4. Operating System: Both OS/2 Extended Edition and UNIX will be supported.

5. Communications: By 1992 essentially all (compared to the current 60% to 65%) of PCs and other intelligent workstations will be connected to the central information networks of large organizations. The communications capabilities will be imbedded and essentially hidden from the user.

6. Connectivity: Connectivity capabilities will for the most part be imbedded in the operating software and the hardware itself. For example, the 3270 and SQL capabilities are to be part of OS/2 Extended Edition. The capability to connect to more than one

type of environment will exist at the workstation level; however, over time connections will be handled by the network, not the workstation.

7. Acceptance: The rate of acceptance of future IWS technology will be driven by improvements in the current cost premium versus today's PCs, progress by IS organizations in opening the window to all information services, and progress by IS and the end user in conceiving and developing applications that utilize the power of the intelligent workstation.

By 1992 INPUT believes there will be significant changes in the way many applications are built and that the IWS will be a common element in the solution provided.

C

Application Trends

Segment 3 of this series, *Planning the Future*, reported on the efforts and needs required to prepare for an intelligent-workstation-based information network. A few additional thoughts are appropriate.

Chapter III of Segment 3, *Workstation Based-Applications*, described the limited amount of thinking that has occurred to date about applications designed to utilize integrated workstation technology, began the process of characterizing such applications, and described the impacts that will occur to the application development process.

The vendor community recognizes that IS is not quite ready and is proceeding to push IS. Vendors are introducing capabilities as quickly as possible and are increasing efforts to sell directly to the end user.

There are also some potentials for conflict of vendor product strategy, and IS architecture strategy, as the move to an intelligent workstation environment progresses.

- The claims that the powerful workstation can do the job of the minicomputer are now frequent, just as were the previous claims about the superminicomputer replacing the mainframe. Nevertheless, there are instances where this replacement will occur.

  - The second-generation IBM PC brings the power and disk capacity required by an LAN server, making LANs a more viable alternative.

  - A powerful workstation can provide the processing capability required to distribute portions of an application from the mainframe, thus bypassing the need for a midrange processor in a distributed environment. (IS organizations that have not adopted a distributed processing strategy can now do so without a midrange computer.)

- Individual vendor product strategies may begin to converge, causing confusion for the buyer, IS, and the end user (for example, using a PS/2 versus a 9370 to control the nodes of an office systems network).

- Application plans will need to be reassessed, in particular concerning plans and new opportunities to distribute portions of an application to the workstation level.

Information Systems needs to be on top of the quickening evolution of workstation technology. It should currently be active in the following areas:

- Experimenting with OS/2 Standard Edition in preparation for Extended Edition and Windows.

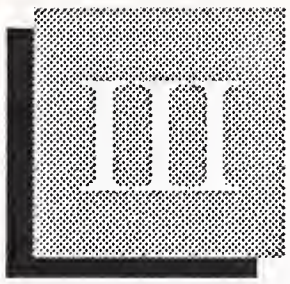
- Preparing end-user training to introduce the power of OS/2 and the concept of multiprocessing.

- Reassessing the currently used micro-to-mainframe communication capabilities and planning for a more integrated capability.

- Assessing UNIX and its ability to be integrated into the typical SNA-based network.

- Investigating in detail the workstation strategies of current vendors (mainframe, midrange, and workstation) to track progress and plans, and as an input to the required workstation strategy.

- Experimenting with the concept of distributing portions of an application, versus the entire application.



Market and Vendor Directions

III

Market and Vendor Directions

In this chapter INPUT surveys the workstation market and looks at five key vendors to gain a perspective on how their directions will influence the adoption of IWS technology.

A The Vendors

As part of the research for this series, INPUT studied the following companies:

Apple Computer
Digital Equipment Corporation
IBM
Sun Microsystems
Wang Laboratories

Each of these vendors represents a unique position in the workstation market. Although they are all leading companies, each comes at the workstation area from its own different perspective. Exhibit III-1 summarizes that perspective.

EXHIBIT III-1

VENDOR WORKSTATION PERSPECTIVE
VENDOR ORIENTATION

Vendor	Orientation
Apple	User Interface
Digital	Opportunistic
IBM	PC Integration
Sun	Power/Communications
Wang	Office Technology

- **Apple Computer** - Apple sets the example for man-machine interface and ease of use. Apple has set a new standard for the user interface, but sits outside the large business systems area and is searching for ways to open the door.

- **Digital Equipment** - Digital has become the premier midrange supplier but does not have a strategy that frees the workstation from the VAX environment. DEC is being opportunistic with an Apple partnership, working to broaden the appeal of the MicroVAX, and using connectivity products designed to secure the midtier position.

- **IBM** - Having a position of dominance, IBM is now developing and using the PS/2 product line to move the PC user up to an intelligent workstation that is tightly connected to the SNA world.

- **Sun Microsystems** - The new rebel, Sun, is using its power and communications capabilities to move into the business systems area and is hiding its preference for UNIX with a DOS product, the 386i workstation.

- **Wang Laboratories** - Wang's focus remains on the office and on text processing. Its workstations are, for the most part, intelligent but not flexible—they must connect to a Wang VS. New capabilities such as image processing and a clone PC are part of Wang's strategy.

B

The Workstation Market

It is not INPUT's objective in this study to forecast the size of the business systems workstation market; however, the research does support a number of observations and conclusions about the market that are of importance to IS management and that form a basis for looking at vendor directions.

INPUT quickly came to the conclusion that most of the vendors surveyed view the business systems workstation market as a major, in some cases new, and perhaps a final, frontier. It is obvious that Sun would see the market this way, as that is the basis of Sun's business; plus the business systems market opportunity certainly exceeds that of engineering. But without exception they all see an immense opportunity designed to offset slowing growth in mainframe and perhaps midrange market segments.

These vendors would characterize the general business systems workstation market as follows (see Exhibit III-2):

- A major opportunity to sell more-expensive "terminals." The price of a true Intelligent workstation is $7,000 to $10,000 today, versus a terminal or personal computer for under $3,000.

- A major opportunity to sell software that is more powerful, and more expensive, than existing personal computer software.

- A major opportunity to add immense amounts of computing power to customer information networks, and to do so a drop at a time, making each addition relatively easy to accomplish.

- A major opportunity to place significant power and freedom in the hands of the end user to peruse and use information from throughout the organization.

- The ideal opportunity to move the user to primarily a graphic mode, which in time requires more power.

- The best opportunity yet to shift major elements of the application development and application management processes to the end user.

Playing a major role in this relatively new market is critical to success in other segments. The principal vendors' plans all recognized the priority of the workstation area. Much of the future market growth will be controlled by success at the workstation level.

EXHIBIT III-2

BUSINESS SYSTEMS WORKSTATION MARKET
THE OPPORTUNITY

- Sell more-expensive workstations
- Sell higher-priced workstation software
- Add immense processing power to the network
- Provide increased processing power to the user
- Move computing to a truly graphic mode
- Move development and processing to the end user

C

Product Directions and Strategies

In this section INPUT takes a top-down look at the workstation direction and strategy of each of the vendors studied. The objectives of this brief review are to:

- Concisely understand how each is approaching the workstation market.

- Look for impacts and opportunities for IS to gain the best from the wealth of technology that is becoming available in the workstation area.

Each company will be reviewed in terms of its goals, strategy, and apparent product direction in the business systems, intelligent workstation market.

1. Apple Computer

Apple continues its aggressive efforts to understand and capture a portion of the business systems workstation market. Apple operates from a position that contrasts significant strengths (a preferable user interface and high product allegiance) and weaknesses (a unique operating environment with limited connectivity capabilities).

Progress mandates that Apple build alliances with third parties that already connect with the IBM SNA environment and develop products that connect the Macintosh to that environment.

Goals:

- Continue to be the standard for the man-machine interface.
- Gain legitimacy as a workstation vendor, not just a PC vendor.
- Gain a foothold in the business systems area as a general-purpose workstation.

Strategy:

- Get the Macintosh and, in particular, the Macintosh II tied into the product strategies of other leading computer vendors (e.g., Digital and Texas Instruments).
- Gain approval from managers of end-user computing in large organizations that Macintosh is a supported, if not the preferred, PC.
- Provide multiple ways to link the Macintosh into existing information networks (e.g., 3270 emulation, Ethernet connectivity, and Mac interface to central processor applications).
- Find and support a Mac spokesman within end-user computing groups.

Product Direction:

- Since early in 1987 Apple has been releasing its own and supporting the creation of third-party products designed to link the Macintosh into any type of information network. All are designed to allow the Mac

user to access and use the information network on an equal footing with the IBM PC user. Examples of these efforts are:

- Macintosh II Ethertalk Interface Card that permits a direct connection to Ethernet-based networks.

- A 3270 dial-up emulation capability from Simware, Inc.

- Macworkstation, which permits a central processor application to communicate with and use the Mac interface.

- In early 1988 Apple and Texas Instruments formed a program to support the Mac II as an artificial intelligence development workstation.

- Apple has turned to Digital Equipment to gain further "approval" in the general business systems environment and, in turn, to help Digital address its workstation acceptability problem.

2. Digital Equipment

Digital finds itself with great success in the middle range of business computing, but without a preferred workstation for business computing. The result could become resistance to VAX at the middle tier as integration grows and the business workstation becomes OS/2 based.

Digital's reaction to this situation is not clear except to add to the capabilities of DECnet, and to search for workstation partners.

Goals:

- Continue to penetrate the midrange with the VAX and MicroVAX.

- Build a flexible business workstation strategy. (Digital currently sells more workstations than do companies such as Sun, but all must connect to a VAX or DECnet.)

Strategy:

- Build relationships with business systems workstation vendors to assure their connectivity to DECnet.

- Assure connectivity between DOS-based workstations and DECnet.

Product Direction:

- The recent relationship with Apple is designed to assure that Macintosh users (a small but growing population in large organizations) can easily interface with DEC applications and through DEC to IBM-based applications.

- Maintain pricing and capability equivalency with the aggressive Sun and Apollo product lines for engineering workstations.

- Assure that DOS-based workstations can communicate with DECnet. The current approach is VMS Services for MS/DOS, which can run on an LAN or VAX. This approach simply allows the user of a VAX-based workstation to access and run a DOS application, but the application itself does not run on the VAX-based workstation.

3. IBM

IBM has ventured onto a crusade designed to establish the PS/2 as "the" business-oriented intelligent workstation. Although time and IBM's mass will make this happen, the degree of change from DOS-based IBM PCs (and clones) may hamper IBM's success and certainly slow the evolution.

The longer IBM and Microsoft take to get OS/2 Extended Edition in use the greater the opportunity for Apple, Sun, and others to offer adequate or better solutions.

Goals:

- Establish the PC (the PS/2) as the standard workstation of the large-organization information network.

- Create a man-machine interface that permits one access methodology (through SAA and SNA) to the entire suite of a network's information services.

- Restrict the opportunity for other workstation vendors to provide alternative access methodologies.

Strategy:

- Imbed in the PS/2 and its operating system (OS/2) major elements of the interface between the workstation and the network (e.g., data base manager based on DB2 and SQL, Presentation Manager, 3270 protocol, etc.).

- Include in OS/2 unique IBM capabilities that restrict the clone suppliers from an easy duplication.

- Make the preferred interface to OS/2 graphics-based.

- Make the PS/2 and OS/2 the common denominator for Systems Application Architecture (SAA).

Product Direction:

- Develop a two-tiered structure for OS/2 to ease transition.
  - Tier one (Standard Edition) is the replacement for MS/DOS and is designed to begin the transition and introduce the end-user to greater function in a personal computer.
  - Tier two (Extended Edition with Presentation Manager) provides the transition from a personal computer to an intelligent workstation "comfortably" linked to the business information network.
- Increase power and lower price on the 80386 versions of the PS/2 to speed the introduction of the power needed to fully use OS/2 as an intelligent workstation.
  - The next release of PS/2 will provide the power to serve as a full LAN server.
  - The next release may include a low-end PS/2 (perhaps diskless) that will provide a low- cost (under $2000) and tightly integrated entry-level IWS. This IWS would speed the move to such technology and complicate entry by Sun and clone manufactures.
- Introduce significant SAA capabilities in OS/2 Extended Edition.

4. Sun Microsystems

Sun is attacking the business systems workstation market with the same aggressiveness it applied to the engineering workstation market: product innovation, third-party software, and a better "window" to the information network. The result is a great deal of "noise" and testing of the water by IS and end users.

Sun's unstated goal seems to be to convince experienced end users of DOS that UNIX is a safe and better alternative. By convincing the end user, Sun believes it can generate the pressure on IS to increase the use of UNIX and make it a standard (that is accepted) within an organization's information network. Sun is making real progress in this regard.

In many ways Sun's challenge parallels that of Apple with its goal to get the Macintosh accepted as an approved standard. Sun's advantage is UNIX, a more common and perhaps more easily integrated technology.

Goals:

- Establish UNIX as an alternative, accepted operating system in the business systems area by converting the power user of DOS to UNIX.

- Use the business systems workstation market to broaden and balance Sun's business base.

- Establish the powerful intelligent workstation as the preferred window to the information network.

Strategy:

- Through Sun's relationship with AT&T, establish a stronger, more powerful, and user-friendly UNIX.

- Maintain leadership over the personal computer in product characteristics that are most important to the business workstation user: graphical interface, power, easy communications, and flexibility.

- Package its technology for the business user, as opposed to the engineering user.

- Market to both the knowledgeable user and the IS organization.

Product Direction:

- Drive the price of its entry-level workstation to the range of the middle range of the PS/2—under $5,000.

- Introduce a "suite" of office systems products that can be bundled into the business workstation and that interface with the standards (e.g., Lotus 1-2-3, dBase IV, SQL, Microsoft Word, etc.)

- Introduce the first workstation that is "comfortable" as both a DOS and UNIX workstation. The 386i series does this, supporting the goal of introducing UNIX to experienced DOS users (and hoping to do so before OS/2 gets into common use).

5. Wang Laboratories:

Wang's position parallels that of Digital. Wang has a successful office-systems-based, midrange installed base in large corporations using Wang VSs with integrated IWSs. But Wang has no real way, except as a modestly successful PC clone supplier, to provide an independent workstation window to the network.

Goals:

- Maintain and enhance Wang's image as the leading office systems vendor.

Strategy:

- Using the Wang VS technology and the departmental or work group computing concept, Wang's strategy remains:
  - Place a Wang VS between the workstation and the network.
  - Support connectivity (communication and integration) with anyone and everyone—to another processor (mini or mainframe) or the workstation (e.g., Sun, IBM, Macintosh). WangNet is a proven product in this regard.
  - Provide leading-edge text-processing technology.

Product Direction:

- Wang's proprietary workstations remain tightly linked to the VS architecture. For example, the Wang 4230 is an intelligent workstation that is essentially a tightly connected office systems workstation. It has local intelligence, does the processing, but does not have data storage capabilities.
- The second product direction is to provide IBM "clones."
- Establish a workstation-based leadership position in the emerging image-processing area with WISS (Wang Integrated Image Systems).
- Wang appears to believe that the future workstation will be a PC-like intelligent workstation; however, Wang's primary product direction does not mirror that.

6. Summary

Exhibit III-3 summarizes the direction/focus of each vendor's current workstation program.

- IBM and Sun are playing from strength and capable leadership (respectively).
- Digital and Wang continue to position based on midrange distributed processing capabilities, with the minicomputer controlling the "window" to the network, not the workstation.
- Having increased power with the Mac II, Apple is working feverishly to gain connectivity on all possible fronts.

EXHIBIT III-3

VENDOR COMPARISON

	Apple	DEC	IBM	Sun	Wang
Goal	Acceptance Interface Standard	Midrange Control	Integration	UNIX Acceptance	Office Systems Leader
Strategy	Connectivity Partners	Connectivity Partners	Imbedded Capabilities Standards	UNIX Std Power Flexibility	Connectivity
Product Direction	Integration	DECnet+ MicroVAX + Apple	PS/2 + OS/2	386i UNIX + DOSPC	WangNet + Clone

As the workstation continues to expand its role, and as the role of the midrange possibly plateaus (or declines) in the information network, this positioning will be of major importance.

Exhibit III-4 provides a comparison of each company's current (near-term) direction with the characteristics defined for the future IWS in Chapter II and Exhibit II-4. Again the strength of IBM and Sun are apparent.

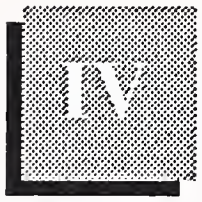
EXHIBIT III-4

WORKSTATION CHARACTERISTICS
A CURRENT COMPARISON

Factor	Apple	Digital	IBM	Sun	Wang	IWS-1992
Power	0	+	0	+	-	6-8 meg
Price	-	-	-	-	-	$4,000
User Interface	+	-	-	+	-	Icon
Operating System	-	-	0	+	-	OS/2+UNIX
Communications	-	-	0	+	-	Imbedded
Connectivity	-	-	+	0	-	Multiple
Acceptance	+	-	+	-	-	Evolutionary

+ = Advantage - = Disadvantage 0 = Even

Future Implications



Future Implications

This chapter will take a brief sojourn into the future. Over the next few years INPUT believes the following will evolve relative to workstations and their role in the large-organization business systems environment.

A Vendor Point of View

Controlling the workstation will control the access (window) to the network; thus this area of technology could become the most critical for vendors such as IBM and Digital, and could provide an increased opportunity for workstation vendors such as Apple, Sun, and Apollo.

- The evolving workstation technology and the success of the IWS will drive many other areas. For example,
  - Networking technology to control true three-tier computing
  - Application development tools that support distributed integrated applications
  - More-powerful and more-costly user productivity software
- A less capable, highly integrated IWS will become available, probably in a "diskless" format. It will use a single operating system and provide reduced communications flexibility. Whether it captures a major share versus the more powerful and flexible IWS (e.g., PS/2 Model 80 or Sun 386i) will depend on the willingness of information systems to put the capabilities to work.
  - Such a move is expected from IBM quite soon.
  - It will help the midrange vendors, such as Digital and Wang, who have such technology and would prefer the more integrated direction.
- The intelligent workstation market should grow to a size that will support the plug-compatible concepts that evolved with the dumb terminal (e.g., 3270). There will be room at the low end (under $2000) once it is established by IBM or others.

INPUT believes that vendors will continue to increase their focus on the workstation element of information technology, and that vendors' overall strategies will become workstation driven.

B

End-User Point of View

First and foremost, the fast-paced evolution in workstation technology means expanded capability and challenges for the end user.

- As the IWS becomes integrated into the network, the access to information and processing tools will grow, but so may the anxiety about using them. Whereas the standalone PC gave the ultimate in freedom, the connected IWS will first reduce that freedom, and second, will increase end-user reliance on IS.

- The power of the IWS and its new software will generate a new learning curve for all but the most skillful end user.

  - Using a PC and, in particular, a Macintosh proved a relatively easy learning experience.

  - Now the vendor is creating multiprocessing environments, integrated application tools, relational DBMSs, etc. The learning curve will have to include concepts and development disciplines that take time and experience to master.

  - The challenge to make all this power easy to use will only be partially met by the vendor and IS.

- Over the next three to five years INPUT believes that major portions of the applications development process will move into the end user's realm. That move is already underway and will be enhanced as the IWS technology is implemented.

Over the next few years the end user is going to be drawn farther and farther into the information systems realm. The freedom to access and use information will have a price.

C

Information Systems Point of View

IWS technology means major change to the traditional information systems environment. Much has already been reported in the previous segments of this series. A few additional projections and thoughts follow:

- IS organizations have an excellent opportunity to lead the way in adopting IWS technology by doing so themselves in the application development area. Much of what is done in application development, from CASE to program maintenance, can be done with PC-based tools on a connected PS/2.

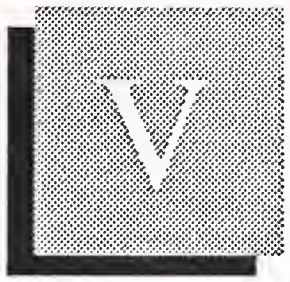
- As the corporate overseer of information technology, IS needs to be and is becoming knowledgeable about UNIX. It is in use in almost all organizations and will become more prominent. IS will learn to integrate UNIX into the central network over time.

- The distributed but integrated workstation-based application will become an accepted alternative by 1990. IS can begin to experiment now.

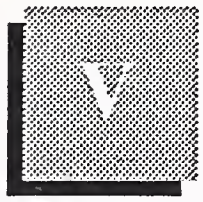
- Organizations without highly distributed networks will find IWS technology easier to adopt and a new type of distributed environment possible.

- IWS technology, in particular the software that supports it, will speed the implementation and use of LAN technology.

Workstation technology and its application will significantly impact the overall strategy of an organization's information systems program. And it will be the users' orientation to the network. IS management must be on the forefront in understanding and using IWS technology.



Conclusions and Recommendations



Conclusions and Recommendations

From the research reported in this segment, *Vendor Views and Strategies*, and the previous segments of the *Workstation Strategies* series, INPUT draws these final conclusions and recommendations.

A Conclusions

- The PC is quickly becoming the workstation of choice by the end user, but does not provide the capabilities (power, connectivity, operating system, etc.) needed to turn the PC into a full intelligent workstation. These expanded capabilities are being quickly developed, and are providing new alternatives.

- The primary workstation vendors are focusing their strategies on adding power and capabilities designed to greatly increase what an end user can do, and to more closely tie the user to that vendor.

- The vendors see a significant market opportunity in terms of controlling the window to the information network and the opportunity to sell hardware and software.

- The workstation (as the "window") will become the information network in the eyes of the user, who expects it to look the same no matter what information service is being requested or used.

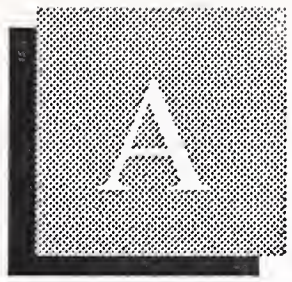
- Future IWS technology is expected to support UNIX and OS/2, giving the user a choice and broadening the connectivity alternatives and challenges.

- The alternatives for intelligent workstation technology will be quite diverse; thus careful planning and a carefully made choice will be required. The non-DOS-based vendors (that is, all but IBM) will make sure you know there is an alternative and that the alternative may be available sooner and offer more capability.

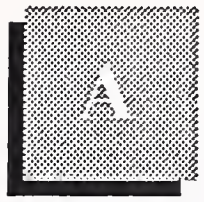
B

Recommendations

- Recognize the expanding future role of the workstation in the information architecture and network plan for your organization.
- Pay close attention to the workstation strategy of your primary vendors.
  - Are these strategies truly supportive of your IS architecture and strategy?
  - Will they support the concept of a single window to the information network?
  - Will they include an IWS that connects directly to the central network or is dependent on midrange technology?
- Investigate and experiment with the power of IWS technology derived from the engineering workstation in a business systems environment. This may prove to be a strong alternative.
- Begin to build a plan for truly distributed applications, identify a pilot, and launch it using today's capabilities or with OS/2 Extended Edition capabilities.
- Monitor the influx of UNIX and UNIX-based workstations into the business systems area. INPUT believes that UNIX will obtain a reasonable position in this area of information technology over the next five years and will be supported along with OS/2 by many of the IWS alternatives. IS needs to understand and be able to use UNIX.



Appendix: Definitions



Appendix: Definitions

In INPUT's 1985 report, *Intelligent Workstations: Connecting the End User,* the term **workstation** was defined as "an area where an information worker uses a microcomputer or terminal to perform tasks." In the past two years **workstation** has become commonly used to describe the terminal or microcomputer itself. INPUT often refers to the workstation as the "window into the network."

Also in that report INPUT defined the term **intelligent workstation** as shown in Exhibit A-1 and pictured the optimum intelligent workstation as shown in Exhibit A-2.

The "optimum" has yet to be achieved. The definition in A-2 reflects an earlier view and projects capabilities not perceived as necessary for the remainder of the 80s.

In Segment 4, *Vendor Views and Strategies*, we will see that the personal computer and intelligent workstation are on convergent paths. This may lead to a further refinement in the definitions.

To assure a common understanding for this report series, the following definitions will be used.

1. Workstation

A computer-oriented device that includes a keyboard and a visual display. It may also include a printer, mouse, and may or may not be capable of independent processing.

In this report the term **workstation** will include all of the other categories defined below.

2. Terminal

A workstation that is used in conjunction with a separate computer and is not capable of local, independent processing. It may include some local intelligence, such as that of the IBM 3270 family.

3. Executive Workstation

A workstation capable of some local processing, designed with exceptional ease of use in mind and often including a telephone to support voice as well as data.

This definition has not changed since 1985.

4. Personal Computer (PC)

A relatively (compared to a mini or mainframe computer) inexpensive computer originally designed for standalone single-user operation. Today's personal computers (PCs) are capable of a full range of communications capabilities.

In this report the term **microcomputer** is synonymous with personal computer or PC.

5. Intelligent Workstation (IWS)

An integrated multifunctional workstation capable of routine higher speed communications with mini and mainframe computers, and performing local processing. Although similar to PCs, the IWS typically will have greater graphics and integrated communications capabilities.

EXHIBIT A-1

INPUT DEFINES INTELLIGENT WORKSTATIONS 1985

- High Level, Multifunctional
- Supporting Graphics
- Transparent, Easily Used Applications
- Single User
- Local Processing, Local Memory
- High-Speed, Regular Communications
- Compatible
- May Support Voice

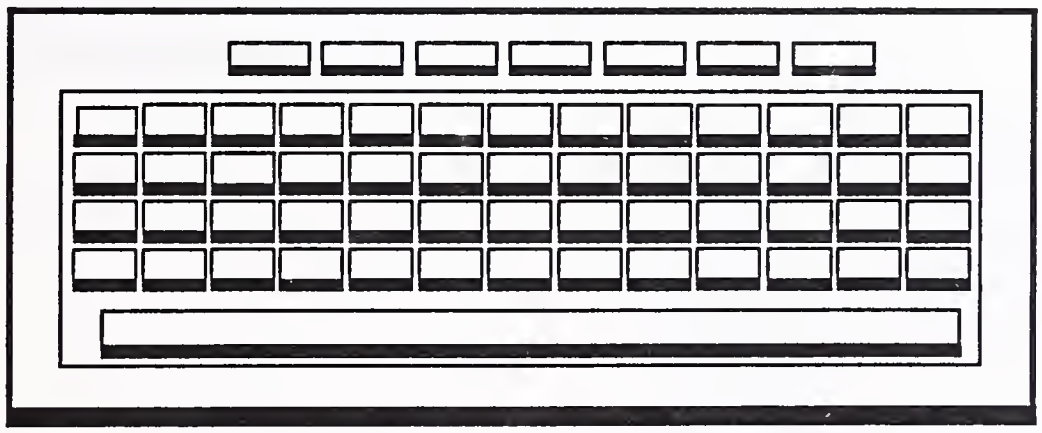
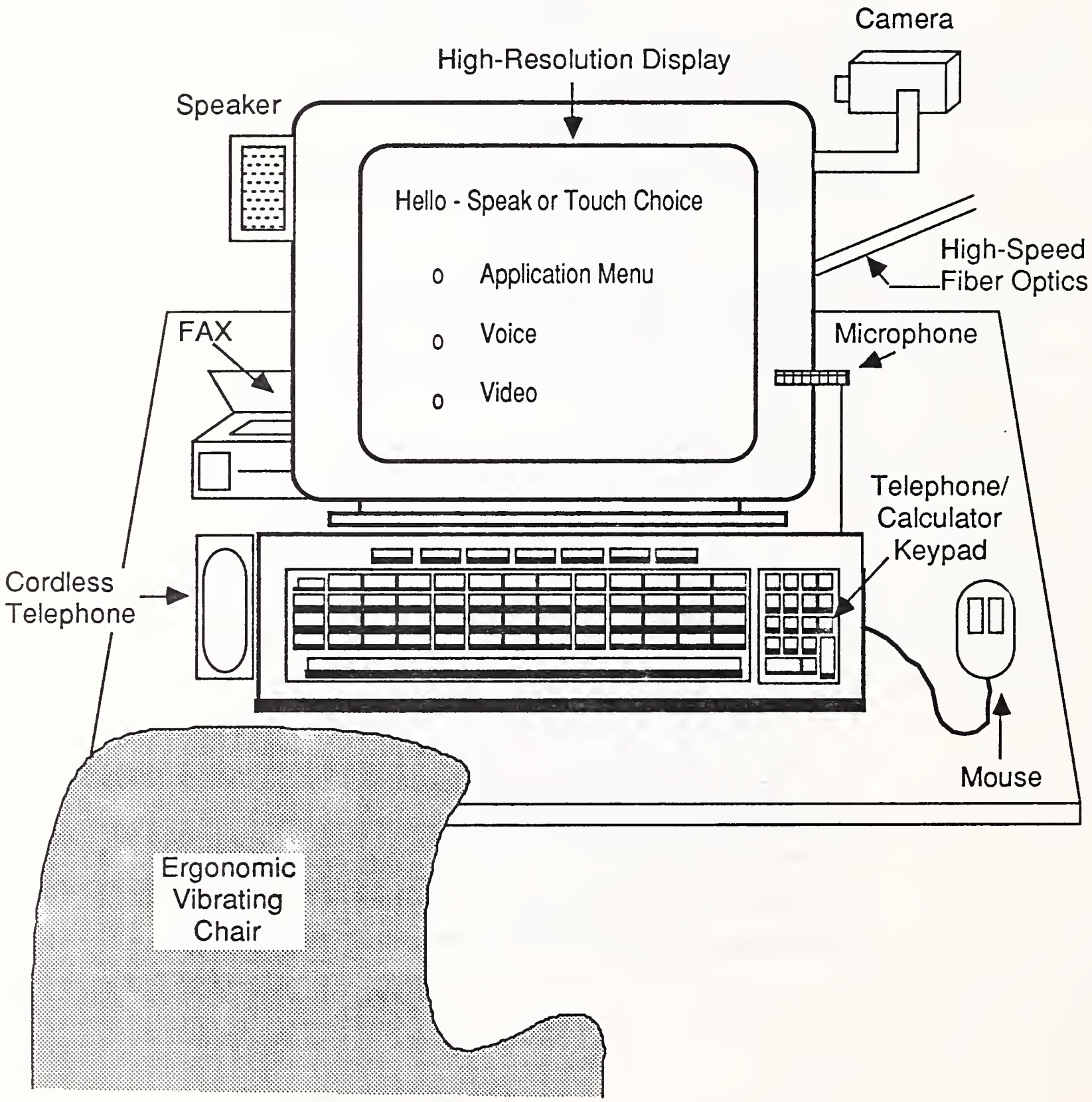


EXHIBIT A-2

THE OPTIMUM INTELLIGENT WORKSTATION
1985



About INPUT

INPUT provides planning information, analysis and recommendations to managers and executives in the information processing industries. Through market research, technology forecasting, and competitive analysis, INPUT supports client management in making informed decisions. Continuing services are provided to users and vendors of computers, communications, and office products and services.

The company carries out continuous and in-depth research. Working closely with clients on important issues, INPUT's staff members analyze and interpret the research data, then develop recommendations and innovative ideas to meet clients' needs. Clients receive reports, presentations, access to data on which analyses are based, and continuous consulting.

Many of INPUT's professional staff members have nearly 20 years experience in their areas of specialization. Most have held senior management positions in operations, marketing, or planning, This expertise enables INPUT to supply practical solutions to complex business problems.

Formed in 1974, INPUT has become a leading international planning services firm. Clients include over 100 of the world's largest and most technically advanced companies.

Offices

NORTH AMERICA

Headquarters
1280 Villa Street
Mountain View, CA 94041
(415) 961-3300
Telex: 171407
Fax: (415) 961-3966

New York
Parsippany Place Corp. Center
Suite 201
959 Route 46 East
Parsippany, NJ 07054
(201) 299-6999
Telex: 134630
Fax: (201) 263-8341

Washington, D.C.
8298C, Old Courthouse Rd.
Vienna, VA 22180
(703) 847-6870
Fax: (703) 847-6872

EUROPE

United Kingdom
41 Dover Street
London W1X3RB
England
01-493-9335
Telex: 27113
Fax: 01-629-0179

ASIA

Japan
FKI
Future Knowledge Institute
Saida Building,
4-6, Kanda Sakuma-cho
Chiyoda-ku,
Tokyo 101,
Japan
03-864-4026
Fax: 011-03-864-4114

INPUT®
Planning Services for Management