Management Systems at Westinghouse Furniture Systems:

Total Business Systems Implementation from A Management Perspective

by

Thomas H. Idema

Westinghouse Furniture Systems
4300 36th Street, S.E.
Grand Rapids, Michigan 49518-8829

I. ABSTRACT:

This paper describes the real world successful implementation of a totally integrated business systems plan from the management point of view. It covers manufacturing and office systems integration, systems development philosophy, technical computing in both quality and engineering areas, office automation, networking, data communications and the operational environment. Also discussed are standards for Total Quality measurements which have resulted in a cumulative up time of over 99% for the past eight years despite having grown from a distributed processing operation of one HP3000 Series III to an independent Business Unit which includes both Series 70's and Series 950's.

II. Introduction:

Westinghouse Furniture Systems, Grand Rapids, Michigan, is one of the world's leading producers of office furniture systems. A division of the Westinghouse Electric Corporation, the company represents the "future of the office" with the integration of technology into the workplace as part of its ultra-modern facility which functions as a "living laboratory" for both factory and office productivity. The Westinghouse Furniture Systems facility was dedicated by President Reagan in 1984 where the technologies of the future of the office were demonstrated to be world class and made a technological statement about the integration of technology, people and furniture to create an environment in which excellence can be achieved while maximizing productivity and quality.

We at Westinghouse Furniture Systems have approached systems integration and implementation to make a competitive contribution through the use of technology, but not for it's own sake. Technology is vital to our business as a means for us to operate more productively and to expand the limits of personal performance in a cost effective manner.

We operate in a highly competitive market environment in an attractive industry, but one where product differentiation is sometimes difficult and where execution and quality provide the margin necessary for success. The application of technologically

advanced systems has helped us provide this margin and that is why you will see words like, "accuracy, speed, timeliness, flexibility, responsiveness, and accessability" used throughout this paper.

Information Systems are strategic to our business with a mission to provide, "...quality information and administrative services that support Business Unit management in obtaining strategic and operating objectives in a cost effective manner." As such, our approach has been to integrate this mission with the overall strategy of the Business Unit which is "Customer Satisifaction through Total Quality Leadership." While the achievement of this goal is not without cost, we have been able to provide the systems described herein for approximately 1.4% of sales while reaping the generous dividends and payoffs associated with the networking and synergy gained as a result.

III. The Systems:

A. Manufacturing Systems Integration

1. Warehousing

The key to the system development and manufacturing systems integration is, of course, the computer and the development of on-line, interactive, integrated database systems which allow us to manage, control and plan our manufacturing activities. In the warehouses computer systems are utilized to control and optimize the storage of raw materials, purchased parts, and finished goods. Using Just-In-Time (JIT) methods along with various bar code equipment, our systems improve the productivity of material handlers by simplifying warehouse configurations, improving inventory control and optimizing the selection of carriers for shipping.

2. Manufacturing

On-line manufacturing systems, utilizing bar coded manufacturing instruction sheets telling each department what products to produce and in what quantities along with Hewlett Packard on-line data capture equipment, greatly enhances the accuracy of our production efforts. As product is manufactured and packaged, bar code readers and printers are utilized to label all cartons, skids, and pallets and update the manufacturing status of each customer order.

3. Shipping

The computer system automatically keeps track of all customer

orders and notifies our shipping department of those orders that have been completed. Bar coded tags are used to stage orders for shipment where the on-line shipping system utilizes bar code equipment to record product as it is loaded onto trailers. The system then automatically produces packing lists, bills of lading, carton content lists, and skid content lists as well as truck routings for more efficient deliveries. All of this paper work, needed by the carriers, is produced on-site in the shipping office and given to the drivers immediately prior to departure.

Once an order is shipped, the invoicing system is updated and appropriate invoicing is produced that same day. With direct interface to the on-line shipping system, the invoicing system provides increased accuracy and the timely generation of invoices and related financial reporting. Automated invoicing also improves the accuracy and productivity of our accounting staff.

Information is also maintained on-line regarding the performance of various carriers and is used to regularly chart an index of carrier quality.

4. Purchasing

The productivity of the purchasing function has been greatly enhanced with the implementation of an integrated purchasing system which allows the Production Planning Department and Materials Planning to directly enter their requirements into the on-line system which is integrated with the manufacturing and materials requirements planning systems (MRP). This along with normal purchasing requirements results in purchase orders being produced automatically for proper quantities and in a timely manner.

The requirement by some vendors for electronic purchase orders has also provided us with the opportunity to realize the advantages and benefits associated with EDI or Electronic Data Interchange. This standard has allowed us to take advantage of economies both internally, within the corporation, as well as with external vendors and selected customers.

5. Manufacturing Planning

Our automated manufacturing systems, (the AMAPS system from MSA), besides providing standard features such as bills of material, standard costing, process and routings, also include automated scheduling in which all orders that have been entered or modified are processed by a program that defines the factory's overall and current capacity and defines material availability. Once processed, the manufacturing and shippping date of an order can be determined and communicated to the customer in the form of

laser printed acknowledgments from our HP2680 laser printers. These systems allow us to control costs closely and accurately, keeping the manufacturing process as cost effective as possible.

Computer controlled cutsheet scheduling allows all orders scheduled for a given time frame to be aggregated and optimized for the cutting of bulk stock used in the manufacture of our products. In fact, the NC control for our million dollar automated cutting facility is provided by the same computer program which produces the pattern optimization and layout information.

B. Office Systems Integration

1. Order Entry

In office systems one of the most important applications is that of order entry. On-line order entry personnel utilize HP Vectra's with color screens to enter customer orders. The use of color aids us in the editing and validation of orders in an on-line, interactive manner to ensure order integrity and accuracy. This system provides the basis for the manufacturing and status tracking systems discussed earlier.

In conjunction with this system is a procedure designed to enter orders remotely which takes advantage of both networking and data highways. Remote order entry is designed for use by Westinghouse dealers, selected customers and sales personnel here, in Canada, and the United Kingdom. This application is designed to speed the entry of orders with the use of PC's, specially designed software and Westinghouse communications facilities.

2. Customer Service

Westinghouse Furniture Systems prides itself on customer satisfaction which is part of our strategic direction for competing within our market. As part of accomplishing this goal the Customer Service Department is equipped with on-line instant access to all orders and customer information through the Manufacturing Order Status System which ensures that customer inquiries and questions are handled both quickly and accurately.

For access to archived documents a Computer Aided Retreival or CAR system has also been provided for use within Customer Service Department. The Computer Aided Retreival system is part of the division's Records Management Program and utilizes the fast, accurate database management capabilities of computers and the cost and space-effective technology of micrographics to make information readily available to satisify customer needs.

4. Financial Applications

Financial systems include the standard ledgers and various other applications familiar to each of us from payroll to payables and receivables. These applications are part of our on-line systems as are labor, wage and cost reporting and the time and attendence system which uses Hewlett Packard's data capture time clocks. To facilitate financial control, all Business Unit budgeting and expense reporting is consolidated and reconciled with the use of the Cognos PowerPlan product.

5. Information Center

Our implementation of the Information Center concept is centered around the philosophy of obtaining, testing and qualifying various personal computers and their peripherals for the purpose of being able to recommend the very best configurations to enhance and improve the productivity of those individuals using the equipment. The impact of the personal computer on our organization is such that with our quarterly survey of use and utilization, our measured productivity gains have been so significant that since 1982 we have avoided having to hire approximately one hundred additional white collar staff members. At present our ratio of PC's to white collar employee is just over 1.1 to 1.

The Information Center or more properly called a "Technology Center" is staffed by people responsible for training our personnel in the use of the various hardware and associated software from spreadsheets and databases to graphics and desktop publishing. One of the favorite products of the IC staff was a quarterly newsletter covering all sorts of PC educational and technical subjects called the "TechNickle Journal."

Graphics provide our management reporting, executive and customer presentations with an "impact" that is lost with normal reporting methods. At Westinghouse Furniture Systems, graphics are utilized to prepare analysis of numerical data and production of visual aids for presentations which offer reduced cycle time, lower cost per visual, and less time commitment than manual methods.

6. Marketing Systems

Integrated marketing systems provide for on-line product quotes and discount analysis for our remote sales force using both Hewlett Packard and non-HP portable computers. To provide a timeliness in reporting we have made on-line reports available to our salesforce, including numerous daily, weekly, and monthly reports showing sales performance status, prospects, leads, and negotiation status which they may read and retrieve as they

access our systems remotely.

Our Telemarketing department has been responsible for a sizable sales volume as a result of being able to enter product inquiries and potential sales leads directly into a marketing database. This results in sales leads being qualified more effectively. Then, through HPMAIL, both sales and field administrative management are automatically notified of a potential customer interest and in which product areas. In addition, notification and mailing labels are also sent via HPMAIL directly to our Literature Distribution Center telling them which catalog informtion and sales brochures to send to the potential customer.

Another marketing system which has proven invaluable to us is an on-line 24-Hour Response Center through which we can locate and dispatch replacement parts to a customer site anywhere in the world within 24-hours using our integrated materials database.

Our Executive Information System or EIS provides daily on-line marketing and sales reports automatically to key staff and other management personnel. These reports are produced through our normal daily processing and specific copies are then distributed via HPMAIL to the mailboxes of the appropriate managers where they can then access the EIS report and take action as necessary.

C. Office Automation Systems

1. Electronic Mail

Electronic Mail has been a key communication facility within Westinghouse Furniture Systems since 1979. Today local, field, corporate, and international communications are computer stored and forwarded using HPMAIL independent of time, location or individual schedules.

2. Voice Message Exchange

Westinghouse uses Voice Message Exchange or VMX, a computer store and forward voice messaging system for brief, one-way, informational communications and thereby improving the effectiveness of business communications for those people who travel frequently or require confidential communications.

3. Message Center & VISCOM

Two unique systems utilized throughout our facility are VISCOM and our Message-Center. VISCOM, a Visual Paging System which utilizes several strategically places LED screens, is used to visually inform staff, managers, and visiting guests of urgent

messages or telephone calls, without audio interruptions in the workplace.

Our Message-Center, a computer controlled telephone support messaging system, is utilized to enhance the organization's image and effectiveness internally and externally. The message center improves communication by ensuring that no telephone message, whether for customer service or normal white collar staff is ever lost because someone may not be available at the time a call is received. This system has provided excellent service, while reducing staff work load and providing secretarial support.

4. HiTech Conference Rooms

All of our conference rooms are provided with a full set of audio visual devices from overhead projectors, VCR tape players, automtically concealed marker boards, special lighting controls, and a unique device called the Data Monitor. The Data Monitor is a conference cost clocking system used to assist in the control of conferences and meetings by computing and visually displaying what the meetings cost based on the hourly salary of the attendees.

5. Central/Distributed Word Processing

All word and document processing from memos to speeches are handled through our integrated Central and Distributed Wang word processing systems which are used to generate high quality documents quickly and accurately through a central automated dictation system. Printing is done with a central IBM 6670 laser printer and in distributed stations with HP Laserjet printers.

Optical Character Recognition (OCR) is also used in our Word Processing Department to directly input text into the word processing system. This increases speed of entry and reduces the chance of errors in the re-keying process for documents that have already be produced in printed form.

7. Teleconferencing

Freeze Frame and Full Motion Television Systems are used in specially designed conference rooms equipped with television cameras, video monitors and control console for reducing the cost and time of meeting with groups of people at off-site locations.

In addition, we have been experimenting with video telephones and remote video cameras which use normal phone lines to transmit video images and allow us to visually as well as verbally communicate with selected individuals and remote sites.

D. Systems Development

Systems development which is responsible for the major systems described herein have been developed largely by a combination of Westinghouse programming staff members and an augmented group of contract programmers which expands or contracts as project demands vary. This mix of employee and contract labor has allowed us to attack various projects and set priorities on a pay-as-you-go basis. This philosophy has also allowed us to justify project funding and schedules based on the needs of the business to implement specific systems projects.

All of our development has been done in COBOL for the simple reason that contract COBOL programmers are a readily available comodity, whereas contractors in other languages, or so-called third and fourth generation languages are not so accessable. On the other hand, Westinghouse has taken full advantage of the capabilities offered with integrated database systems using IMAGE, and of course, utilities such as those offered by Adager, Robelle, VESoft, and DISC's OMNIDEX and IMSAM. In addition to these packages, we also use HP's REPORT and INFORM for user ad hoc reporting and have done some work with Gateway System's package called Synergist to develop PC/Mainframe distributed applications, although this has not proven to us to be the way of the future just yet.

E. Technical Computing

Our Technical Computing Department is responsible for Engineering CAD/CAE functions which currently utilizes Tektronix workstations networked to dual HP 9000 model 550 computers. Anvil/5000 software is utilized to do all of our drafting and engineering design work. A series of large scale D and E size HP plotters and 3M aperature card production facilities are used for hard copy reproduction of computer stored drawings.

In the near future this will have been replaced by a series of HP 330 engineering work stations networked to an HP 9000 model 835 precision architecture computer using HP-UX.

One of the biggest benefits of using the technical computing arrangement that we have is the flexibility available which allows us to not only network to our HP 3000 business computers for bill of material updates but also to feed drawings directly to the manufacturing floor via on-line CRT's and to be able to feed numerical control information to various equipment for limited aspects of Computer Integrated Manufacturing (CIM), using IGES standards.

These technical computing systems also interface to our Quality Assurance systems to facilitate the design, development and testing of our products, assuring their quality and reliability.

F. Quality Assurance

Quality Assurance systems include an HP 1000 model A700 which, along with a third HP 9000 model 550, is used to administer our Statistical Process Control (SPC) programs. In addition, various other equipment, including HP 9816's and Vectra PC's are used to run instrumentation and color spectrometers throughout our manufacturing areas. Voice data entry systems, of a Westinghouse design and manufacture, are used with Quality Assurance systems where terminals and other data input devices are not readily available.

G. Marketing CADD

Wes-CADD/PC is a Westinghouse developed computer-aided drafting and design system producing full color two-dimensional designs which was built and expanded using AUTOCAD(TM). The System is utilized by clients, dealers and designers for systems furniture layout. Repetitive, time-consuming tasks are performed by the CADD system allowing both manager and designer to explore several alternatives to layouts in less time than it used to take to explore just one. In addition, bills of material can be automatically generated and others entered directly from this CADD system into the order entry system. Add on options include the Westinghouse Quick Quote and Remote Order Entry systems which directly interface to other Business Unit systems.

H. Networking/Communications

Where the use of database technology has been the key to the integration and overall cohesiveness of our total system approach, our networking and communications facilities have provided the structural backbone for this implementation and allowed us to construct and use data highways to link the vital elements of our business.

Externally, we have made extensive use of Westinghouse corporate facilities by linking our X.25 field support network with the Westinghouse packet switching network called WESPAC to achieve an economy of scale. Likewise, it is hoped in the near future that we will be able to use similiar facilities to link our HPMAIL to the corporate electronic mail system using X.400 protocols as part of the ISO standard.

In order to make the most effective use of the physical link between various corporate data centers and other facilities, we

use an INFOTRON 790 Statistical Multiplexer with leased 19.2 KB and T1 56KB lines along with a MICOM Protocol Converter which virtually lets anything at our facility talk to anything at the other end of the line. Imagine an HP 150 talking to a large IBM mainframe computer interactively with no special software and neither one realizing that the other device is not what they think it is.

Internally, all of our terminals and PC's are connected to our computer hardware via a MICOM Instanet 6600 data switch which allows us the flexibility of having any user choose which computer, (we have five), they need to be connected to for a given application.

Although our mainframe computer systems are physically networked using the HP 802.3 Local Area Network and use NS/3000, the real flexibility we have experienced has been with our Allen-Bradley broadband coaxial Local Area Network which is used to link all Business Unit personal computers to each other, to the main computer complex and to external electronic communication networks, maximizing the amount of information an employee can receive through the use of a personal computer.

Not only are the networked PC's able to share data and peripherals as a result of the broadband LAN, but we are also able to use some of the bandwidth for video which allows us to transmit from our factory or anywhere else within our complex to conference rooms or to our teleconferencing facility, live broadcasts of operations or special demonstrations.

I. Operational Environment

Our Data Center consists of three HP 3000 Series 70's and two Series 950 computers, twenty-seven Eagle disc drives and 14 7933 disc's, four 7980 tape drives and two 2680 laser printers. No third party computer hardware is used in our data center. The computer room is environmentally controlled, powered by an Emmerson 256 KVA Uninterruptible Power Supply (UPS) system, and protected by a Halon 1301 fire suppression system.

Within the Data Center our goal is to provide Total Quality Service to the Business Unit on a twenty-four hour a day basis as measured by availability, response time, and uptime. These three measures are the key elements in being able to evaluate the level and quality of service provided to our user community. Availability means that 90 percent of the time the on-line systems must be up by seven each morning; response time must average less than 2.3 seconds and uptime must be greater than 99.6 percent. Happily, we have been able to exceed these goals consistantly over the past several years. In 1987 availability

was 97 percent, response time was 2.2 seconds and up time was a remarkable 99.99 percent for the year. When you consider that these measures are for all machines over a 24 hour day, five days a week, (although we operate seven days a week, more often than not), they become all the more phenominal.

Other Data Center statistics are equally amazing. For instance, in averaging over 39 million lines of print our HP 2680 laser printers go through two and a half tons of paper each month...enough continuous form paper to stretch from Grand Rapids, Michigan to Orlando, Florida. These print lines do not include the thousands of pages of micro fische (COM) output that is produced each month or the print produced at our twenty-seven remote printers for product labels and wharehouse tags.

Our Data Center is managed by a highly trained professional staff consisting of one lead and three additional computer operators using excellent written procedures and Unison's Maestro and Spoolmate products. We also have a System Manager who is responsible for all systems and systems software, a Data Base Administrator who is responsible for all aspects of our data, it's integrity and recovery, an Electronics Technician who is responsible for the maintenance and repair of all of our terminals, PC's and related peripheral equipment, and a Senior Project Leader who is responsible for all of our communications and technical computing.

A year ago we experimented with the use of a HELP Desk to provide a focal point within MIS to channel all user requests for service and assistance. Although this test was well received and the results excellent, (both in concept and execution), we had to end it for lack of personnel to staff the operation adequately.

IV. Conclusion

The foregoing has covered a great number of subjects in a necessarily brief manner, but from a management standpoint it has had much to do with our competitive success, particularly in the areas of Total Quality Leadership and Customer Satisifaction. Systems reliability together with the interactive and integrated nature of our systems, including the success we have had in integrating the technologies, have been key elements in this overall achievement.

In this success, Hewlett Packard, as a company, has played no small role in that they have taken both a participative and proactive stance as a member of our team in making much of this possible. In addition, they have continued to provide us with a constant stream of new technologies from laser printers to

precision architecture computers to help us sustain our successes.

As a result we have accrued numerous benefits including being able to maximize customer satisifaction, achieve a more timely reporting of business critical data, with more accurate information and increased integrity. Among our personnel we have measured improved productivity and gained a true sense of job satisifaction. Our staffs are more knowledgable and information literate and we have seen better and more timely communication among our business professionals. And, we have been able to reduce our costs in both analyzing and communicating information.

Industry trends show that there is an accelerating use of computer and computer related technologies to improve the productivity of the white collar worker. There will undoubtedly be an ever increasing need to integrate these new office technologies into the office environment along with better ways to coordinate the need for information. Any technology that will reduce or eliminate the need for human intervention can successfully be utilized to support the business professional and permit the white collar or "knowledge worker" to perform those tasks that are uniquely human...think, plan, and innovate. This is the goal of the systems organization at Westinghouse Furniture Systems.

Biographical Data:

Thomas H. Idema

The Manager of MIS Technology Services for the Furniture Systems Division of the Westinghouse Electric Corporation since 1980, he has worked for both General Foods and Hewlett Packard since serving in the U.S. Marine Corps where he flew jets and served in the Vietnam War.

Tom graduated with a Bachelor of Public Administration degree with a major in City Management from the University of Mississippi. He obtained his Masters of Business Administration with a major in Management from Western Michigan University.

He has over eighteen years of management experience and has taught college level courses in both the systems and management fields for over fourteen years. Tom is a Certified Systems Professional and has been active in the systems field as a professional member of the Association for Systems Management and the Association for Computer Operations Management. In addition, he has been involved in the user group activities of INTEREX, the International Association of Hewlett Packard Computer Users, and is a past Member of the Board of Directors of that organization.

Westinghouse Furniture Systems

Westinghouse Electric Corporation is made up of twenty three strategic Business Units and is one of the world's largest producers of power machinery and equipment. The mega-corporation manufactures a wide range of products from Micarta, a hard surface laminate, to atomic reactors that drive the Navy's nuclear submarines.

Westinghouse Furniture Systems, one of the leading producers within the office systems industry, is dedicated to the pursuit of product excellence and efficiency through technological innovation. The centerpiece of this commitment is the "Westinghouse workplace," located in Grand Rapids, Michigan, which is a living laboratory, showcasing Westinghouse's complete office product line as it is used in a daily working environment by the employees. This "office of the future" and associated "factory of the future" heralded a new dimension in total workplace productivity that prompted President Ronald Reagan and former president Gerald R. Ford to personally preside over the dedication ceremonies in September, 1984.


Westinghouse Furniture
Systems

Characteristics of Business

- Highly Competitive
- Attractive Industry
- Differentiation Difficult
- Quality / Execution

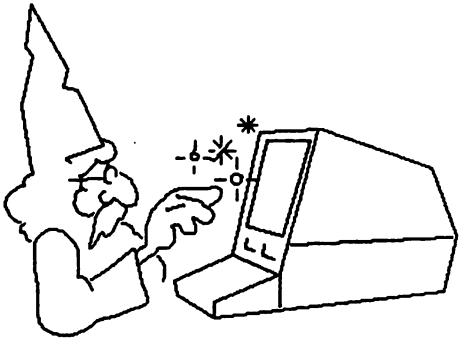
Management Systems at

Westinghouse Furniture Systems

Total Business Systems Implementation From

A Management Perspective

Information Systems:

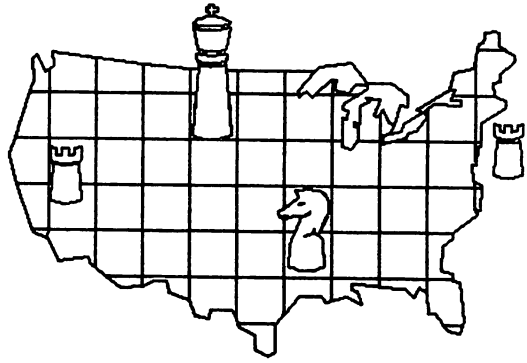


Mission:

To Provide quality information and administrative services that support Business Unit management in obtaining Strategic and Operating Objectives in a cost effective manner.

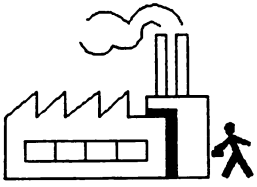
Information Systems:

Strategy:

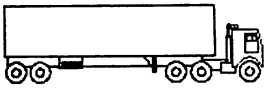


Total Quality Leadership

Manufacturing Systems Integration:

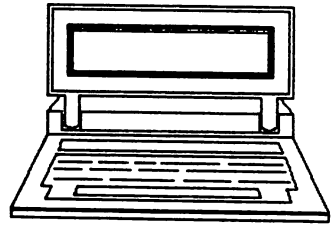


- **Warehousing**
- **Manufacturing**
- **Shipping**
- **Purchasing**
- **Manufacturing Planning**

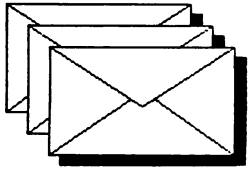


Office Systems Integration:

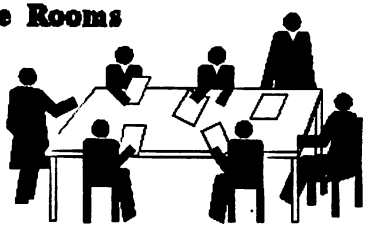
- **Order Entry**
- **Customer Service**
- **Financial Applications**
- **Information Center**
- **Marketing Systems**



Office Automation Systems:

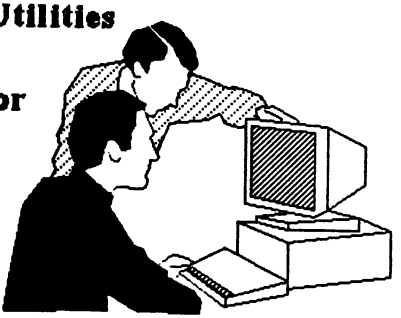


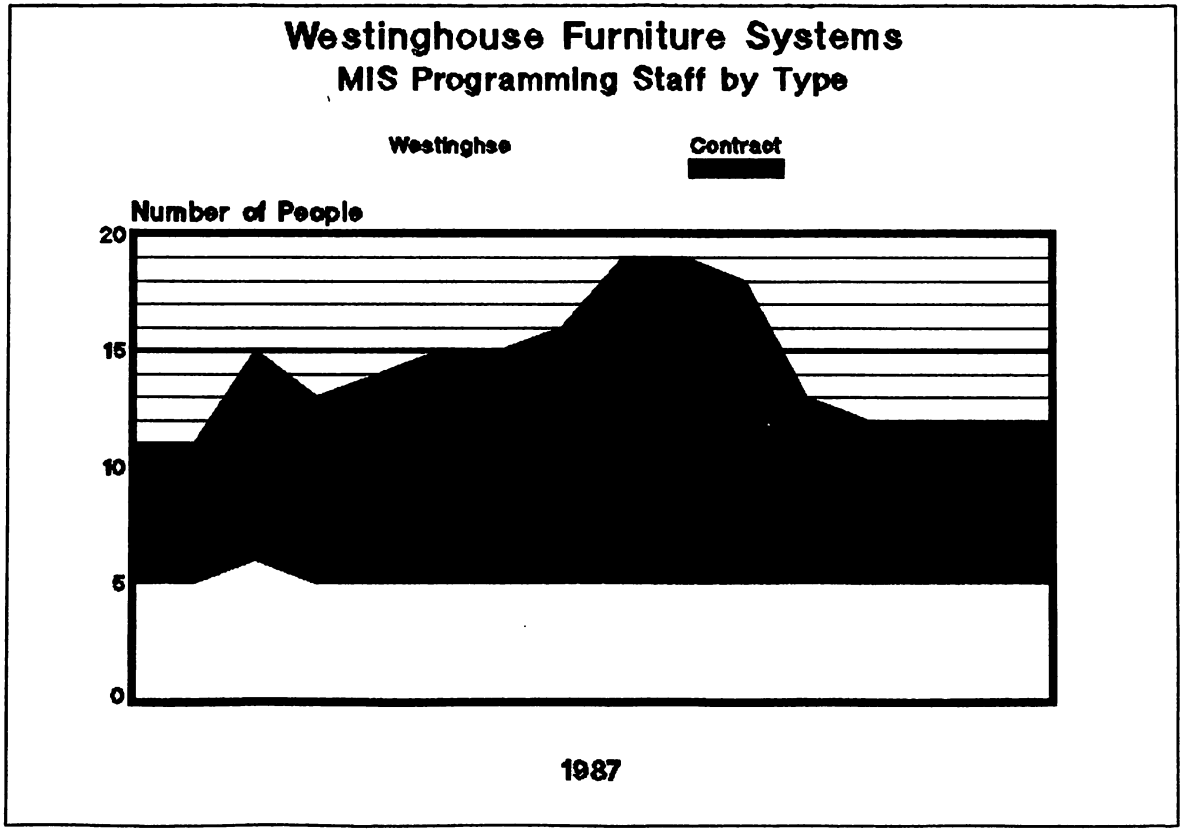
- **Electronic Mail**
- **Voice Message Exchange**
- **Message Center & VISCOM**
- **HiTech Conference Rooms**
- **Word Processing**
- **Teleconferencing**



Systems Development:

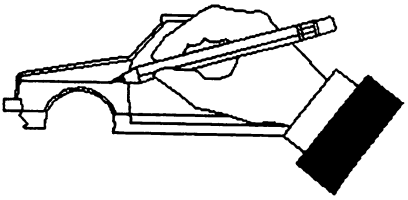
- Image Based COBOL Systems
- Third Party Software
- Third Party Utilities
- Contract Labor




Westinghouse Furniture Systems
MIS Programming Staff by Type
Westinghse
Contract
Number of People
20
15
10
5
0
1987

Technical Computing:

- **Engineering CAD/CAM**
- **Quality Assurance**
- **Marketing CADD**



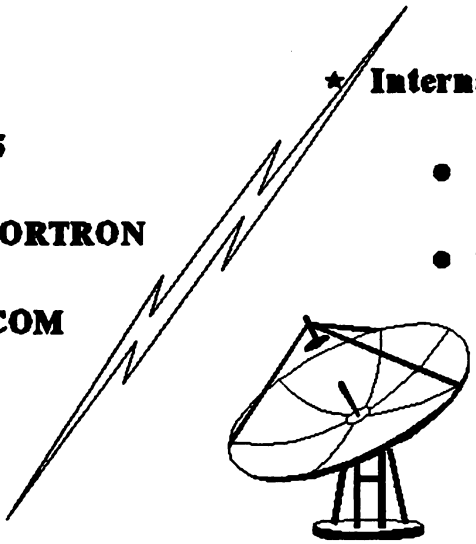
Networking / Communications:

★ **External**

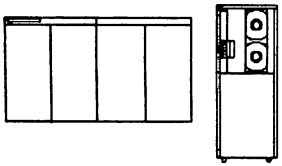
- **X.25**
- **INFORTRON**
- **MICOM**

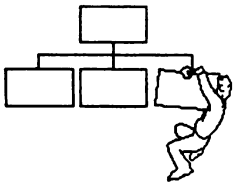
★ **Internal**

- **MICOM/PC**
- **Two LAN's**

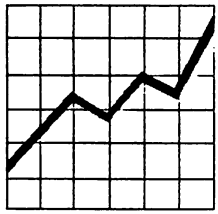


Operational Environment:

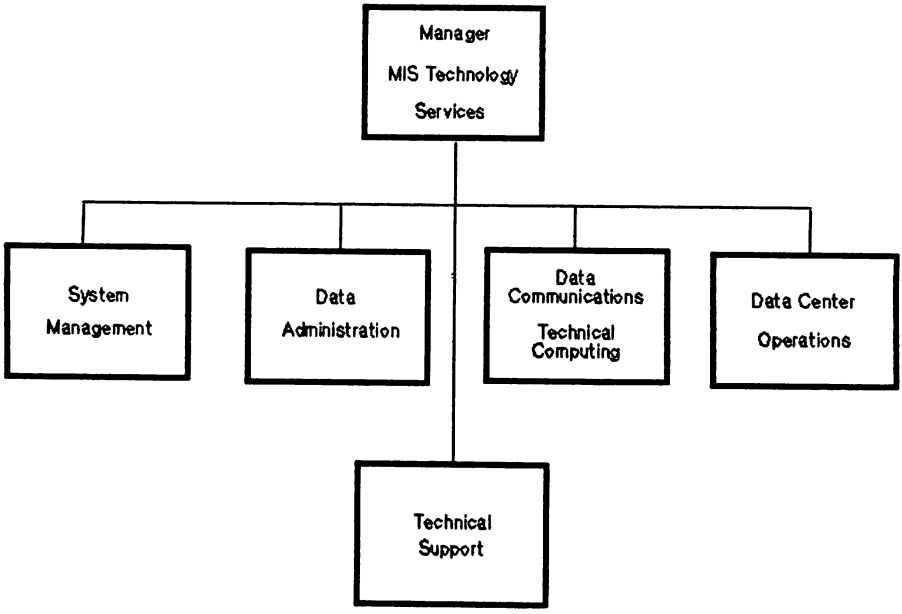


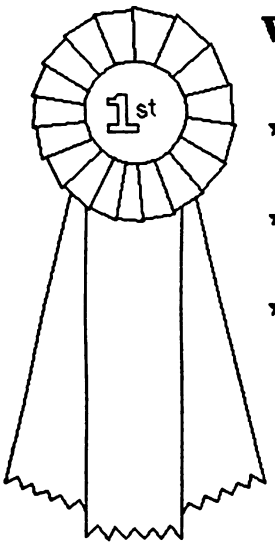


- **Equipment**
- **TQL Goals**
- **Staff**
- **Help Desk**



Westinghouse Furniture Systems
MIS Technology Services Organization

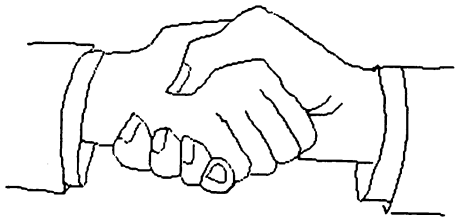




What Role Has All of This Played?

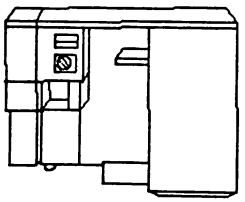
- ★ **Reliabillity, Productivity, Quallity**
- ★ **Interactive, Integrated Systems**
- ★ **Integration of Technologies**

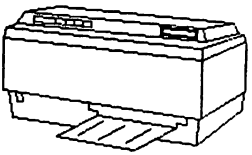
Hewlett Packard's Role:



★ **Participative & Proactive**

★ **Constant Stream of New Technologies**





- Maximize Customer Satisifaction
- More Timely Reporting
- More Accurate Information
- Increased Information Integrity
- Improved Productivity & Job Satisifaction
- Staffs More Knowledgable & Information Literate
- Better More Timely Communication
- Reduced Costs