The Butler Cox Foundation US★81 Study Tour.

Notes on visit to Wang Laboratories Inc.
on 28 September 1981

I. INTRODUCTION

Carl Masi (Vice president sales, Europe, Africa and Middle East) and John Cunningham (Executive vice president, field operations) provided an overview of Wang Laboratories Inc. The salient points of their presentations are contained in the 'overview' handout. Carl Masi emphasised that Wang was deliberately transforming itself from a product-oriented company to a market-oriented company.

II. OFFICE AUTOMATION STRATEGY

Fred Wang (Senior vice president, development) then spoke about Wang's office automation strategy. Most of his presentation is summarised in the 'development of technologies for increased communication' handout. Other interesting comments were:

1. Definition of office automation:

   "People using technology to manage and communicate information effectively".

2. Image processing (picture information) is an increasingly important area.

3. Audio processing - voice is a natural and a common way of exchanging information. Managers prefer meetings and using the telephone for exchanging information. But 70 per cent of calls do not connect at the first attempt, and 50 per cent of all telephone conversations are one-way conversations.

4. Networking, for sharing information, is a key technology for office automation.

5. Human factors technology is as important as the other five office automation technologies (data processing, word processing, image processing, audio processing and networking).

6. Wang has opened an International Telecommunications Centre in Brussels.

III. CUSTOMER ENGINEERING

Don Gangemi (Manager, world-wide customer engineering), outlined Wang's world-wide customer engineering operation. The aim is to provide on-site service within:

- Two hours for selected national accounts
- Three hours for other customers

(In the questions period at the end of the day Wang admitted that the three hour target will not be met in the United Kingdom for another six to eight months).

Twice a year Wang carry out a major survey of their customer base (including Europe). These surveys show a high level of customer satisfaction. Wang attribute this to the low attrition rate of their technical staff (10.2 per cent in 1981).

IV. MANAGING CORPORATE INFORMATION RESOURCES

Charlie Miller (Director of technical support for national accounts) spoke about the different information needs of people at different levels in an organisation (executives, managers, professionals, clerks and typists (see the 'managing corporate information resources' handout). He emphasised the following points:

1. The role of voice communications needs to be re-examined, particularly to minimise the interruptions caused by incoming calls. Wang's DVX product is designed to help in this area (see Section VIII).

2. Most communication is within an organisation.

3. The role of Wangnet is to interlink all levels in an organisation, and to improve the ability of people to interact with one another (irrespective of where they are located, or where the hardware and software facilities are).

4. The 'people' network is as important as the 'information systems' network.

5. A greater understanding of human behavioural patterns is required.

V. WANGNET

Bill Lampen (Marketing specialist for communications products) spoke about Wangnet (see the 'Wangnet: the corporate information resource' handout).

1. Wangnet is designed to transmit data, moving image video, and still video. Voice transmission is planned, but has not yet been implemented.

2. In the future there will be greater use of video and graphics devices.

3. Wangnet is based on cable tv (CATV) technology. It is a dual cable system (for transmitting and receiving), operating at 10 to 300 MHz. Devices are attached by breaking into the cable. Thus if one node fails the whole net fails.

4. The cable is laid out in a tree topology. At Wang, the main trunk is on the lift shaft; the branches for each floor can be added as required.

5. Wangnet is similar to, but not compatible with the Ethernet protocol. Wang believe that Ethernet is losing ground as the contender for the de facto local-area network standard.

6. Wangnet can be used as a transparent communications carrier (for example to interlink teletex devices). Wang's Brussels office is developing a teletex capability for Wang products.

7. Wangnet will be demonstrated at a world-wide press conference on 3 November. Wang says that there will be three Wangnet installations by the end of 1981.

8. All future Wang products will be compatible with Wangnet.

VI. ADVANCED SYSTEMS LABORATORY

Duke Sutherland spoke about the work of his advanced systems laboratory (see the 'Human factors and office automation' handout). Its role is to:

1. Examine the ways in which people work and communicate.

2. Focus on the utilisation of information in offices. (Office costs in the United States are projected to rise from $880 billion in 1980 to $1.5 trillion in 1990).

3. Examine the relationship between people, machines and facilities.

4. Determine ways of closing the technology gap (ie the gap between technological development and the use of technology).

The advanced systems laboratory has three programme areas:

1. Internal pilots, which test prototype products and provide feedback to R&D staff. They also identify implementation issues (training, learning curves etc).

2. Customer-base research, in particular assisting with behavioural research.

3. Development centre accounts, which provide a high-level interchange programme between Wang and its customers.

The advanced systems laboratory has produced the following:

1. An annoted bibliography of the way in which technology has been introduced into organisations during the past fifty years.

2. Methods for evaluating managerial work.

3. Methods for identifying the key communications patterns in offices.

4. The reasons given by information workers and managers for choosing a particular technology, and the impact that technology has had on their work.

5. The relevance of open plan offices to office automation technology.

Its findings are made available via workshops and seminars, and via published reports. Foundation members can, by request, be added to the mailing list for the reports.

VII. GENERAL DISCUSSION AND QUESTIONS

1. Wang have produced office automation guidelines (from the work of the advanced systems laboratory). Implementation plans depend very much on the existing organisational culture.

2. The emphasis given to the importance of voice communications would seem to be at variance with the initial exclusion of voice from Wangnet.

3. Unforeseen problems can arise when pilot projects, which have been tested in a 'mature' technological environment (such as the systems department), are moved into other areas of the business.

4. Initial office automation applications should have a high perceived value. (For example an electronic telephone directory with auto-dial facilities). Additional functionality can then be added in an evolutionary way.

5. Wang were not able to offer any clear-cut advice about cost justifying office automation equipment.

VIII. DIGITAL VOICE EXCHANGE (DVX)

The DVX product represents Wang's entry into voice processing. It is a telephone based, stand-alone, store and forward voice messaging system. It is designed for use in a business environment, where it is linked to a PBX. Messages are deposited in the DVX by dialling a pre-set extension on the PBX. The message sender creates a message, which he can listen to before 'sending' it to one or more extensions. When messages are accessed (by dialling the same pre-set PBX extension) they can be listened to and then lost from the system, and acted on (eg forwarded, replied to or saved). Various administrative functions are available, such as automatic notification of absence. The DVX commands are activated by use of the telephone touch-tone keys.

The average DVX message length is 55 seconds, compared with four minutes for ordinary telephone conversations.

The cost of the DVX ranges from $125,000 for a 200-user system, to $317,000 for an 800-user system.

IX. THE ALLIANCE PRODUCT

The Alliance product is based on the OIS 140 model III, and it is a prototype of the OIS 250 which will be announced on 3 November. It has taken a basic word processing system as used today by a secretary and added additional functions which will be of value to researchers, managers and (possibly) to the managing director. The added functions are:

- Document management
- Visual memory
- Time management
- Electronic messaging
- Personal computing.

Text documents can be retrieved by header, by key words or by the occurrence of words in the text. Visual memory is a form of database management for structured files. Time management is provided by an electronic calender and scheduling facility. The personal computing facility permits the Alliance product to be used as a personal microcomputer (for example, to run the Visicalc package).

Through the 'glossary by example' facility, Alliance permits a pre-determined sequence of commands to be initiated by keying a two-character code.

The Alliance product can also include an audio work station, which has autodial facilities, auto-answer facilities, and dictation facilities. With the dictation facilities, voice documents are stored in a digitised form and are displayed on the screen as a 'model' of the text (as a series of dashes) which can then be edited using standard word processing functions. Messages created via the audio workstation can then be distributed using the monitoring facility.

Alliance is based on existing hardware; the additional functionality is provided by software. It will be available in Europe 'during 1982' and will cost about $15,000.

X. ROUND TABLE DISCUSSION

1. Demand for colour terminals will increase. Colour is not difficult to provide from a hardware point of view, and will probably be available from Wang in about 18 months to two years time.

2. Image input (via high-speed facsimile) and image output (via laser printing) will probably be available within 18 months.

3. Wang are committed to compatability with IBM products (communication protocols and SNA).

4. Wang believe that IBM will announce a broadband local-area network in about six to twelve months' time. Wang will provide compatability via one channel of Wangnet.

Notes on presentations made by Computer Corporation of America on 29 September

I. CCA BACKGROUND AND PRODUCTS

(Presented by Jeff Holden of CCA).

Business Areas - Computer software systems, products and services.

Products
- The Comet electronic mail system
- Model 204 database management system
- Research and development projects primarily for US Government Defense departments.

The Comet system runs on PDP11 and large IBM mainframe machines and provides an electronic mailbox facility that allows users to create, distribute, store and retrieve messages. Comet is available as a package for in-house installation and as a time sharing service. The product is also available internationally (UK, Canada, Australia, Switzerland, France and Italy). The Comet package costs $60,000 for IBM machines and $40,000 for DEC machines.

The model 204 database management system runs on larger IBM mainframes (IBM4431 and upwards). The facilities provided include an interactive user language, high performance with large databases and a large number of users, and flexible data structures (see CCA handout). Model 204 costs $150,000 and may be installed together with Comet on larger IBM mainframes.

R & D projects include:

- A spatial database management system (SDMS), which uses colour graphics, three display screens (two being touch sensitive), a joystick, and other devices. The system is based on the concept of progressive 'zooming' to and from lower levels within the database and is highly developed with graphics colour pictures, text and multiple images to improve the human machine interface. CCA will make a videotape available via Butler Cox & Partners that shows the SDMS being used.

- Program visualisation, which uses sophisticated graphics as a systems designer/programmer aid.

- Distributed database access. This software development will allow interrogation of different types of databases, at different locations and running under different database management systems.

Jeff Holden concluded his presentation by summarising CCA's views and plans for new office automation products.

In essence, he expects database management systems to form the core of future developments. These database management systems will be linked, via electronic mail, to various data processing-type applications as well as word processing, telex TWX, viewdata, etc.

II. BECHTEL CASE HISTORY

(Presented by Susan Wintersteen, office systems co-ordinator).

Bechtel is the world's largest engineering and construction company. The company operates worldwide and is divided into nine, largely autonomous, operating divisions.

Susan described the development of office systems within Bechtel over the last two decades. These developments have left the company with a variety of unco-ordinated systems, devices and procedures which include:

- Approximately 700 word processing machines from eight vendors
- 245 copiers, which produce six million copies per month
- Large volumes of paper files
- Numerous personal computers installed on an ad-hoc basis
- Lots of meetings and lots of travel.

Bechtel's approach to these problems was to set up a central automated office technology group in 1980 in order to:

- Define what office automation means
- Develop an office automation strategy
- Develop a user-needs analysis methodology
- Prepare research papers (which can be made available to Foundation members)
- Educate and train managers and other staff
- Carry out pilot projects.

A key element in this approach was the establishment of an office systems advisory group consisting of 26 managers from the various operating divisions. This group meets regularly to formulate policies on education, applications, compatibility, measurement, implementation, organisation and control. These 26 managers have budgetary authority to install equipment within their separate divisions.

A number of pilot projects have been carried out, including :

- A Comet electronic messaging system with 81 users in numerous locations
- A Notepad system to provide electronic mail facilities to groups of people. This system currently serves 200 managers and professionals and is used primarily for group project information
- Four Axxa multifunction workstations, which are used on a trial basis
- Trials with the AT&T 'picturephone' meeting service for video conferencing
- Electronic blackboards
- Slow-scan video conferencing.

In general, these pilot projects were carried out in a non-scientific way without detailed analysis and cost benefit evaluation. However, Bechtel felt that the pilot projects had led to improved communications between managers and a decrease in phone calls, telexes and short memos. In particular, Comet was found very useful where time-zone differences were a factor in communications. A need for integrating voice communication with other forms of communication was also identified.

Bechtel's future plans include:

- Wang and IBM as preferred word processing vendors
- Expansion of the current data communications network to include a private satellite-based network based on SBS facilities
- Setting up five video centres in their major US locations
- Pilot projects involving Wang OIS, Wangnet site surveys, IBM5520, Displaywriters, personal computers, graphics, photo-composition, OCR and electronic message systems.
- Expanding the central office systems group.

In conclusion, Susan said that she anticipated successful corporate standardisation in about 75% of installations.

III. MANUFACTURERS HANOVER TRUST CASE HISTORY

(Presented by Dick Groppa, the Vice president of technical services).

MHT provide credit and non-credit services through 700 US offices and 100 other facilities in 40 countries.

He discussed the various social, business and driving forces associated with office automation and outlined the expected benefits. Particular emphasis was placed on increasing management and professional productivity (management and professional staff costs constituted 80 per cent of their office staff costs).

Dick then described the various stages of office automation from initiation (word processing, document generation), through expansion (timesharing, task mechanisation, electronic mail, database management systems), to integration (networks of facilities), and finally, maturity (process redesign, inter-organisation automation and alternative workstyle - 'technology is the users' agent').

At MHT, a central office automation group of ten people within the data processing area was set up in January 1978. This group has carried out a number of pilot projects including:

- Installing 22 word processing terminals in 11 areas with typists being reorganised into small work groups (a 20 per cent reduction in cost was measured on a high letter/memo-type workload). The main problems experienced resulted from relying on vendors' promises.

- Establishing a Comet electronic mail service, which is used by more than 900 people, 85 per cent of whom are managers or professionals. The system was found to be easy to use, and no management keyboard resistance was experienced. Over one-third of the users accessed other computer systems with their terminals as well as Comet.

(The first pilot project was installed in the data processing area and was a failure due to its being forced upon the potential users, and due to the large number - 700 - of staff involved in the pilot).

User managers were educated (in workshop sessions) and then used as 'change agents' in their areas. An office automation conference was sponsored and in-house bulletins were prepared and circulated.

Most users of the electronic mail service would not have retained their terminals if the electronic mail service was not available. The average user accessed the Comet system twice a day for a total of about 11 minutes.

A cost breakdown of the Comet system was approximately:

- Terminals	50%
- Mailbox	30%
- Communications	20%

The benefits of electronic mail were found to be an average saving of half an hour per manager (professional) per day, better informed managers, and the ability to communicate across locations and time zones. Comet electronic mail was found to be an inexpensive and effective way to introduce office automation to managers and professionals. The keys to successful office automation were given as:

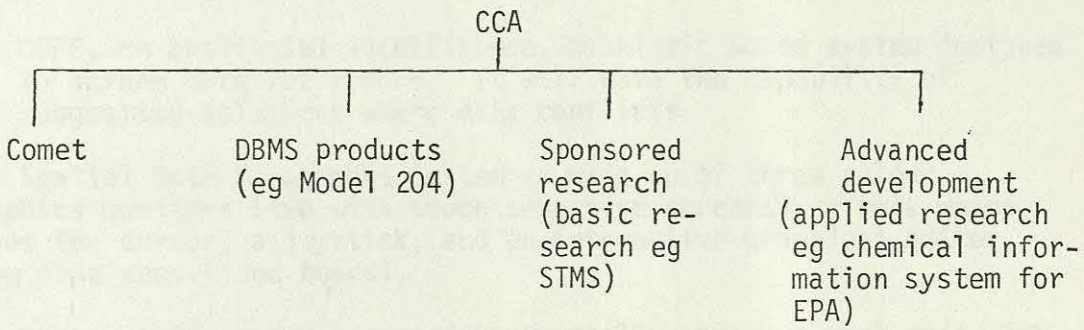
- The office automation group should be part of a central management services structure.
- The group should remain reasonably small (about ten people).
- The group should have a wide research brief.
- The group should not have an open mandate to install systems across the company.
- Users should be the driving force for office automation.
- Proven and standard technology should be used.
- Vendor independence should be maintained

Notes on Computer Corporation of America research and development presentation on Tuesday, 29 September 1981

(Presentation given by Diane Smith, a director of CCA Sponsored Research).

I. ORGANISATION

The CCA organisation structure is:



The basic research is primarily sponsored by the US Defence Department (mainly DARPA).

II. DISTRIBUTED DATABASE RESEARCH

This research currently concentrates on three main areas, namely:

- Multibase (a heterogeneous distributed interface)
- System for distributed databases (SDD-1) for the strategic air command
- Concurrent control studies (algorithms for new database management systems).

Diane expanded on multibase which is currently in year one of a three-year project. Multibase will be a software 'layer' product designed to access different databases, in different locations, running with different database management systems. It will also be intelligent enough to report any conflicts between database information.

(A distributed database product to access geographically distributed Model 204 database management systems is expected to be released soon).

III. MAN-MACHINE INTERFACES

Research in this area consists of three main potential products, namely:

- Spatial Data Management System (SDMS) - designed to make DBMSs more accessible to non-technical people.
- Program Visualisation, a graphics based systems designer/ programmer tool.
- COPE, an artificial intelligence, heuristic based system designed to screen data for errors. It will have the capability of suggesting solutions where data conflicts.

The Spatial Data Management System is made up of three colour graphics monitors (two with touch sensitive screens), a puck which moves the cursor, a joystick, and an interactive graphical editor (pen plus sensitised board).

The three monitors are arranged horizontally across a work unit with the left hand and centre screens being touch sensitive. The left hand unit is used as a 'worldmap' showing a high level of the database. A more detailed level may be selected by touching the relevant picture (icon) on the left hand screen (and/or by using the joystick), and viewing these on the centre screen.

Further detailed levels of the database may be displayed on the centre screen by touching the relevant icons and 'zooming' to lower levels. Relevant data may be marked for future reference.

The right hand screen (together with the interactive graphics editor) is used to create coloured icons and other graphics. The actual data in the database may be input directly or by communications to another computer. This tabulated data can be accessed at the lowest data level through the centre screen.

The main advantages of spacial systems over query languages were given as:

- Simple, natural motion through the database
- It forms its own data dictionary
- It encourages browsing

- Data placement can convey information
- Graphics can convey information
- it accommodates a range of data types.

The cost of SDMS (plus a VAX machine to run it) would be about £ one/third million for the prototype.

(Two other spacial systems have been produced, one by MIT and one by Centronics for running on a microcomputer).

Comparable (less sophisticated) products on the market include the Xerox star system and plato.

(Video presentation of SDMS is available if tapes are provided for copying).

Program Visualisation is a type of animation editor which allows systems designers/programmers to visualise the steps of a program being created or edited. This system will significantly reduce the amount of coding required as well as encouraging good program writing (clearer visualisation at the specification stage). Program Visualisation is a five-year project which is currently six months old. At present it is being developed using ADA (a military originated programming language) but could eventually be developed for most languages.

COPE was not discussed in further detail.

IV. ENHANCED DATABASE MANAGEMENT CAPABILITIES

Research in this area is made up of three components, namely:

- DBMS Component Architecture. This project is aimed at identifying those elements of DBMS architecture which could form an acceptable standard
- CODASYL Query Languages. Several such languages have been designed.
- ADAPLEX - ADA (Military Programming Language) is being combined with a database management system.

Notes on presentations made by Digital Equipment Corporation on 29 September 1981

(Digital will provide copies of the presentations made via Butler Cox & Partners Limited)

I. OFFICE PLUS : STRATEGIC IMPLICATIONS

Julius Marcus (Vice president - commercial products group) made a presentation based on one made to the Digital board. Office Plus will be announced on 29 October. It is Digital's response to the emerging office systems marketplace. Marcus emphasised that the Office Plus products are based on existing equipment, and they will be available at the time of the announcement.

He sketched the evolution of the data processing industry, showing how computer-based products were increasingly being aimed at individuals (rather than departments in corporations). Office Plus provides products at all three levels (personal, departmental and organisational), and these products provide facilities for integrating word processing, data processing, electronic mail and typesetting. All products are compatible with Decnet, and Decnet in turn provides links to other suppliers' products (particularly to IBM via SNA).

He showed how the Office Plus products could be configured in different ways to meet the various requirements of professional staff, secretaries, managers and clerks.

Office Plus is an extension of the distributed data processing concept, and builds on Digital's experience with networks, typesetting and terminals.

II. OFFICE PLUS CONCEPTS

(Presented by Art Laramee - Office Plus program manager).

The Office Plus concept addresses the needs of different people in different departments to access information according to their own needs. Access needs to be available through a common user interface in a way which can be used by non-specialist staff.

Different types of staff have different information and communication needs. Office Plus is designed to meet these varying needs in both large and small organisations. These needs are a combination of word processing, data processing and communications.

The key to Office Plus is what Digital calls work processing, which combines powerful word processing, interactive electronic mail, ad-hoc decision support tools, colourful business graphics, and access to information held on distributed databases. Thus, work processing is the ability to process work from a single work station. Office Plus terminals provide single terminal access and a common user interface to office applications.

III. OFFICE PLUS PRODUCTS

(Presented by Art Laramee and Dick Rislove - Commercial Product Marketing Manager).

Office Plus products have been designed to give the flexibility to meet the unique requirements of each organisation for a highly integrated modular office system, including:

- Word processing
- Combined word and data processing
- Electronic mail
- Document composition
- Information management and retrieval
- Universal communications.

1. Decmate - a single-user, stand-alone work station, used for word processing.

2. Decword - for multi-terminal word processing.

3. Decword dp and Dectype 300 - software products to provide word processing in a data processing environment.

4. Decmail - a software product which permits internal messages and documents to be created, edited, sent, received, filed, retrieved and archived, using interactive electronic mailboxes.

5. Decset - an integrated publishing system, with advanced text management and composition features. It accepts input from a variety of word processors and computers and provides output to a phototypesetter or a high-speed printer or a copier.

6. Information management access - a range of new products, including a Codasyl database management system, relational data access and business graphics. It includes Datatrieve - an information retrieval language, which, combined with the VT125, can produce black and white or colour business graphics.

7. Communications products - CXDX, Decnet and Internet. The first two permit word processing terminals to transfer documents to other word processors or to a host computer. They also allow a word processing terminal to act as a data processing terminal. Internet provides access to other vendors' computers (particularly IBM).

8. Gigi - a multifunction graphics terminal providing high-quality, eight-colour graphics.

IV. EUROPEAN STRATEGY

Hans Winter (European product marketing manager) said that the Office Plus products would be available in Europe about three to nine months after the US announcements. Country-specific products would be available to cater for the requirements of different European languages.

V. INTERNAL ELECTRONIC MAIL EXPERIENCE

(Presented by Claire Messier - Manager internal message and text programs).

Digital's definition of an electronic mail system is 'a computer-based message and filing system'. This definition excludes features and products that other vendors include in their electronic mail definitions (such as facsimile, store and forward message systems, communicating word processors, etc.).

Essential features of Digital's definitions are:

- Non-simultaneous communications
- Addressed by name (ie easy to use)
- Electronic filing cabinet
- Electronic mailbox.

Pilot system. Between January 1978 and August 1979, Digital ran a pilot system (based on Comet). It started with 40 users and finished with 750, and was designed to provide information about the behavioural implications of electronic mail.

Subsequently, Digital developed their own in-house electronic mail system which has been used exclusively within Digital since 1979, and now has 2,000 users. The cutover from Comet to the in-house system meant scrapping the existing database of stored messages. Users did not object, and this highlighted that electronic mail was used mainly for time-sensitive information. The Decmail product soon to be launched is similar to (but not identical to) the in-house system. Digital will cut over to Decmail for in-house use as soon as is practical.

In-house system experiences

1. Digital believes that electronic mail improves productivity by improving effectiveness, but cannot provide a cost-justification for electronic mail.

2. Organisations need to consider carefully who needs electronic mail, ie who communicates with whom.

3. User profile is:

Managers	45%
Professionals	25%
Secretarial/ clerical	26%
Other admin.	4%

4. There is no 'busy hour' as with the telephone system. Between the hours of 8 am and 5 pm, the number of simultaneous users per 100 mailboxes varies between 14 and 18.

5. User statistics per user per month:

	Now	Projected
Messages	11.2	75
Each message sent to	2.6 mailboxes	2.5 mailboxes
Log-ons	30	60
Connect time	4.9 hours	15 hours
Messages stored	310	300

6. Terminal profile:

38%	share a terminal
26%	own their own terminal but sometimes share
36%	always use their own terminal.

Screen terminals are more popular.

7. Mode of use:

38%	always use the command mode (experienced users)
25%	mostly use the command mode
13%	use the command mode and the menu mode equally
13%	mostly use the menu mode
12%	always use the menu mode (inexperienced users)

8. Positive aspects:

- Saves time
- Easy to use
- Reduces telephone traffic
- Reduces paper
- Access from any location.

9. Negative aspects:

   - Not enough users (even with 2000)
   - Editing features are awkward (Decmail's are better)
   - Busy telephone lines (95% availability is unacceptable; 99% is demanded).

10. Cost model:

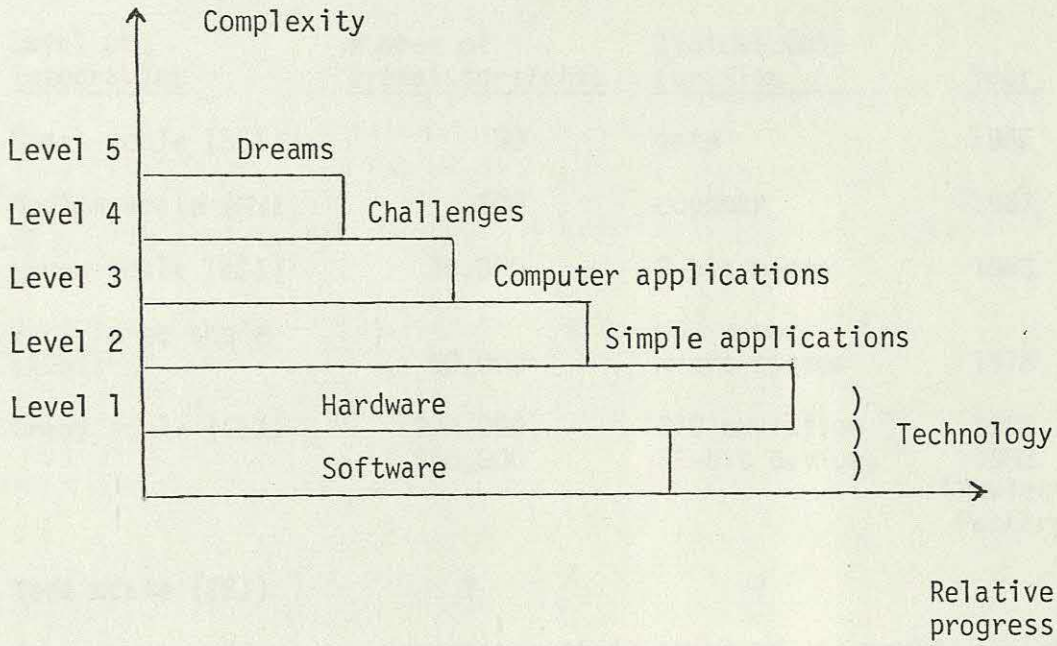
    Users pay for terminals and communications costs, and are recharged for system costs (flat fee basis, plus usage charges).

11. Peer pressure to use the system helps to overcome resistance to using a keyboard.

US★81

Notes on the presentation made by Professor Hoo-Ming Toong of Massachusetts Institute of Technology on 30 September 1981

I. FRAMEWORK



II. TECHNOLOGY

Professor Toong defined various 'buzz-word' terms (microprocessor, microcomputer, ROM, RAM, MOS, Bipolar etc.).

Hardware costs have declined steadily in the past 20 years ($20/bit in 1962; one cent/bit in 1978. Hardware functions which cost $750,000 in 1952, cost $2,000 in 1977 and $1.35 in 1981. The cost of the hardware is decreasing almost to zero, but software development costs and system design costs are increasing steeply, as illustrated below for a typical microprocessor application in 1975, 1980 and 1984.

Year	Hardware Cost	Memory	Lines of code	Man years to develop	Software Cost
1975	$100	3K	1K	0.5	$20,000
1980	$120	40K-45K	(13K(ASL) (3K(HLL)	6.5 1.5	$450,000 $100,000
1984	$250	0.5M	20K(HLL)	7	$875,000

Man years are based on ten lines of code per day. Man year costs are based on:

$40,000 in 1975
$70,000 in 1980
$125,000 in 1984

Chip technology has passed (and will pass through) the following stages:

Level of integration	Number of transistors/chip	Typical chip function	Year
Small scale (SSI)	50	gate	1965
Medium scale (MSI)	500	counter	1967
Large scale (LSI)	10,000	8-bit micro	1963
Very large scale (VLSI)	50,000	MOS memory micro system	1978
Grand scale (GSI)	200,000 450,000	370 emulation 32-bit devices	1982 1982 (Hewlett Packard)
Tera scale (TSI)	?	?	?

Japanese suppliers are increasing their share of the world-wide chip market.

For example:

1K & 14K chip markets were dominated by US vendors

16K RAMs: Japanese have 40% of the market

14K RAMs: Japanese have 60 to 70% of the market.

III. SIMPLE APPLICATIONS

Simple applications are ones where uni-processor microcomputers are used to perform parallel but independent tasks. Examples are found in automobiles (to control fuel systems and electrical systems), in energy control in oil fields, in cameras, in watches, in domestic appliances, in video games, in assembly-line automation, and in telephony.

IV. COMPUTER APPLICATIONS

Examples are the use of microprocessors in office systems, in personal computers, and in memories and device controllers for mainframe computers. At this level of complexity, microprocessors tend to be used to replace existing functions (ie mundane application of technology).

V. CHALLENGES

Professor Toong quoted the antiquated air traffic control system in the United States as an example of what he means by the 'challenge' level of complexity. The existing system is fully loaded. The problem is that the system is not modular. The challenge is to find a hardware architecture that is suitable for such an application.

A second example is provided by examining the 'wish list' of terminal features required in 1984. Most of the items on such a list (colour graphics, voice input/output, integrated database systems, 100M bytes of memory, etc.) are available today. The challenge lies in providing terminals that are compatible with each other.

In attempts to meet these challenges, MIT researchers are working on hardware architectures/structures that can support up to 60 processors, and that have software that can 'grow'.

VI. DREAMS

This level of complexity includes work on using computer-based technology to create artificial intelligence. Dreams can be real (if they can be fulfilled), or unreal (for example, a perfect model of the behaviour of the stock market).

Notes on the presentation made by Professor Michael Scott-Morton of Massachusetts Institute of Technology on 30 September 1981

THE EMERGING ROLE OF DECISION SUPPORT SYSTEMS

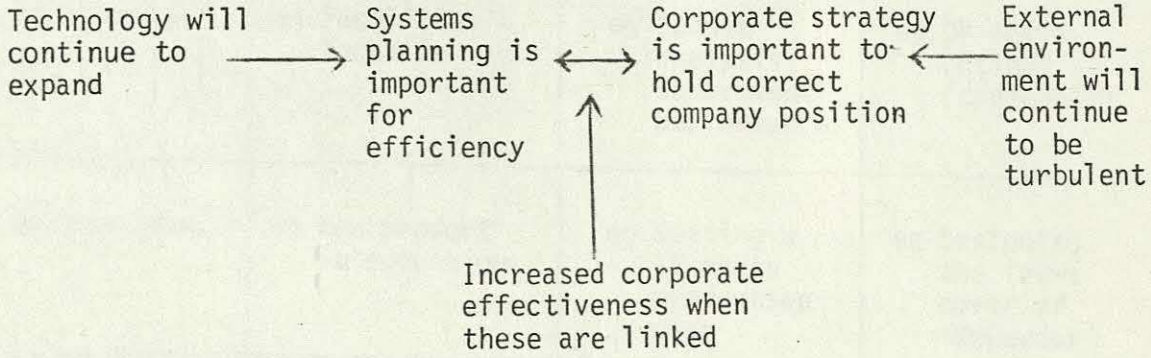
I. Professor Scott-Morton began his presentation by emphasising the difference between Effectiveness (doing the right job) and Efficiency (doing the job right).

He suggested that many data processing departments were concerned primarily with efficiency (the right level of equipment, running with high utilisation/performance) rather than the broader role of effectiveness in serving the company's real needs.

In terms of the impact of technology on a company's competitive position, there may typically have been no significant net effect in the past (all competitors may have used technology equally ineptly).

But the rate of technological change is increasing, and the nature of competition is changing in many businesses. As a result the rate of technological change may be faster than many data processing areas would like.

II. His basic premises can be shown by the following illustration:



As a result of these factors 'we need to think about where we are going'. For example, is there a written plan for developments more than 12 months ahead? If not, a 'red flag' may be appropriate.

III. Methods for organising an Information Plan. Information systems are complex, and multiple views of these systems are necessary for a more complete understanding. Michael Scott-Morton suggested the following views as being useful when preparing an Information Plan:

- By input only (ie budget items such as hardware/software)
- Functionally
- Organisationally
- Database oriented
- Transaction oriented
- Decision oriented.

Companies with successful information plans will typically examine three or more of these views.

IV. A decision focus may be assisted by considering the following matrix (developed by Bob Anthony):

	Strategic planning	Management control	Operational control
Structured	eg Facilities location	eg Budget analysis, department performance	eg DP applications (typically)
Unstructured	eg New product introduction	eg Setting a 12-month production plan	eg Designing the front cover of 'Newsweek'

In this way business activities can be analysed, although it is important to appreciate that the boundaries represent a gradual transition and do not form rigid categories.

When looking at this method of analysis it is interesting to note that many traditional data processing applications fall into the top right hand (operational control/structured) category. And many new applications are originated by data processing staff, thereby perpetuating

this tendency. By contrast, management problems are usually unstructured. But the question 'What should we do in the future?' is important if we are to develop an effective understanding of business needs and opportunities for using technology effectively. Michael suggested that the top three or four people in the information systems area should spend one to two days setting out the critical business areas (ie critical success factors) where they could be really successful. (Are these really in the structured/operational control category?).

(He described an operations research exercise to tackle a currency transaction problem where a combination of structured operations, research techniques and human (unstructured) vetting gave the best solution. He suggested that this may well be the case for many management support applications).

V. A decision support system may conceptually be described as linking managers' terminals by fast communications systems to computers and databases for decision support.

By extending the matrix analysis described above to the various business areas, opportunities for decision support systems can be identified more easily. For example:

	Strategic planning	Management control	Operational control
Marketing	New products introduced	Brand management	Media selection
Production	New facilities location	Setting production plan	Portfolio management
Finance	Impact of acquisitions	Setting budget levels	Cash flow management

VI. Characteristics of Decision Support Systems. From studies of twelve systems, the characteristics of decision support systems can be classified as follows:

- Type of application

  7 Information retrieval

  8 What if? applications

  9 Algorithms (operations research, scheduling systems etc.)

  (some systems having more than one type of application).

  3 of the systems were ad hoc and 9 institutional.

- Users

  7 Managers themselves — 5 assisted

  4 Senior managers — 8 middle managers

- Builder

  In two installations data processing staff were the key project staff, but in ten installations, data processing staff were ignored.

- Computer

  Five of the computers used were timesharing, five centralised data processing and two were local minis.

VII. In conclusion, Michael emphasised:

- the importance of the methods described for organising an information systems plan
- linking corporate strategy with the information systems plan
- systems staff and management attitudes need to change before effective support systems can be introduced
- a broader definition of information planners is needed to include data processing, word processing, communications and associated functions.

Much of the ground covered in this presentation is included in a book by Alistair Wesley called 'Decision Support Systems'.

Notes on the presentation made by Professor Andrew Lipman of Massachusetts Institute of Technology on 30 September 1981

I. INTRODUCTION

Professor Lipman called his presentation 'The development of computational media'. He described the work of his group as centring on the convergence of the broadcasting/motion industry, the publishing industry and the computer industry. In particular, they concentrated on using a TV screen as a display device. Their work was therefore concerned with areas such as videotex-teletext, videodiscs, frame-grabbing cable systems and frame-grabbing database systems.

The group had given considerable thought to the way in which text and graphics should be displayed on a TV screen. They had shown that, by using 'fuzzy edge' techniques, 125 characters could be displayed on a scan line. Much of their work was concerned with re-introducing colour into a predominantly black and white information environment. Thus they are working on man/machine interfaces that combine pictures, text and colour.

Use of videodisc technology is central to the work. A videodisc can hold 54,000 'pages' of information (which can be full colour pictures) on each side of the disc. Lipman's group have combined this technology with computer power to control the way in which the 'pages' are retrieved.

II. DEMONSTRATIONS

Demonstrations were given of the media room and a spatial database management system. The media room allows people to interface with a machine through a combination of voice commands (and responses) and gestures. The spatial database management system allows the user to 'drive' around a town, making multiple choices at different points in the route, and to 'home-in' on particular buildings to examine them in greater detail.

Professor Lipman also showed a videotape that showed how a combination of videodisc technology and computer technology could be used to create a personalised multi-choice maintenance manual.

Notes on presentations made by Intel Corporation on 1 October 1981

I. COMPANY OVERVIEW

(Presented by Dr Bill Davidow - Senior vice president and director of marketing).

Intel supply the basic tools for people who build systems (processors, memories, development systems, controllers etc.). Corporate objectives are:

- To be No.1 (or No.2)in their chosen business areas
- To be the technological leader
- To be the leaders in meeting delivery, reliability, quality and service needs of their customers
- Integrity and professionalism
- To be an asset to the countries (or communities) in which they operate.

Intel is a technology-based company, but it is becoming more involved in service and support. It has recently established its European field service headquarters in Swindon.

During the 1970s, Intel produced a string of semi-conductor 'firsts' that contributed to the dramatic changes in the semi-conductor industry:

- The number of transistors per chip increased from 1K to 100K
- Device complexity increased by 10^5 (Moore's law says that complexity doubles every year)
- Power consumption decreased by 10^5
- Device speed increased by 10^3
- Costs fell dramatically.

In the future, Intel will:

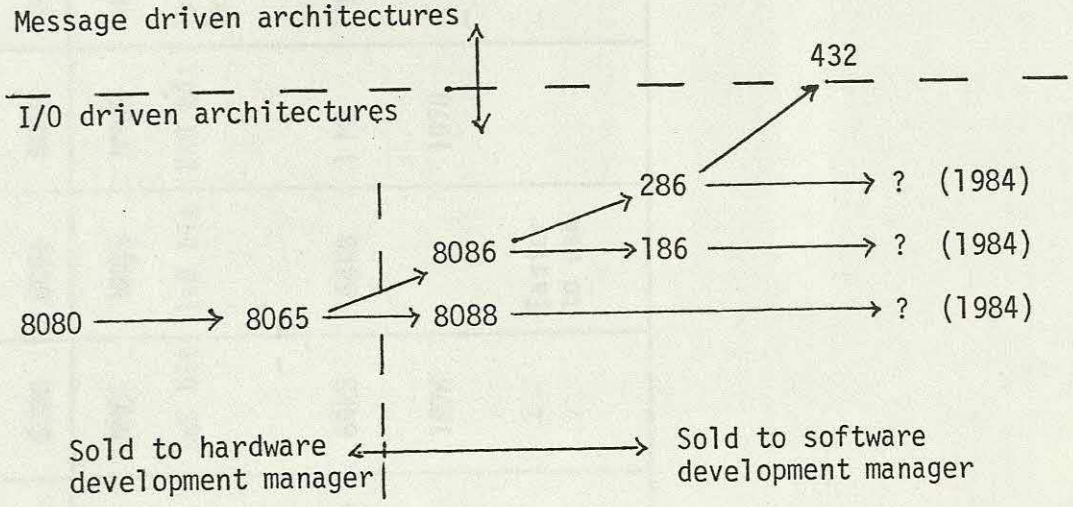
- Expand production capacity
- Provide a growth path for existing customers (via 'families' of products
- Address new markets (particularly telecommunications, with products such as codecs, filters).

Intel believe that an increasing number of functions will be provided in silicon. For example, operating systems are now available in ROMs, and Intel is investing in the development of programming languages and operating systems. Local-area networks will also be an important market.

II. INTEL PRODUCTS

(Presented by Bob Greene - Microprocessor technical marketing manager).

Intel's product development cycle was represented as an 'expanding universe', where product planning led to early introduction (ie earlier than competitors), which led to early acceptance of the product, which led to volume sales, which led to a wide range of software being developed, which led to even greater volumes, which meant more dollars for Intel, which led to more development, which led to a better product line, which led to expansion of the product, which led to future products. This process was illustrated by the evolution of Intel's processor family from the 8080 (introduced in 1974) to the 432 (announced in February 1981). The two figures below represent the main elements of this evolution.



	8080	8085	8088	8086	186	286	432
Technology	NMOS	NMOS	HMOS	HMOS	HMOS-II	HMOS-II	*
Architecture	1x8 bit	1x8 bit	2x8 bit	1x8 bit 1x16bit	Singleboard microcomputer including 8086-2	Singleboard microcomputer including 4 co-processors	Micro-mainframe
Address space	64KB	64KB	1 MB	1MB	1MB	16MB (real) 1GB (virtual)	*
Introduced	1974		1978		by mid 1982	by end 1981	Announced Feb. 1981
Performance improvement	-	Easier to use			2 x speed of 8086	5 x speed of 8086	*

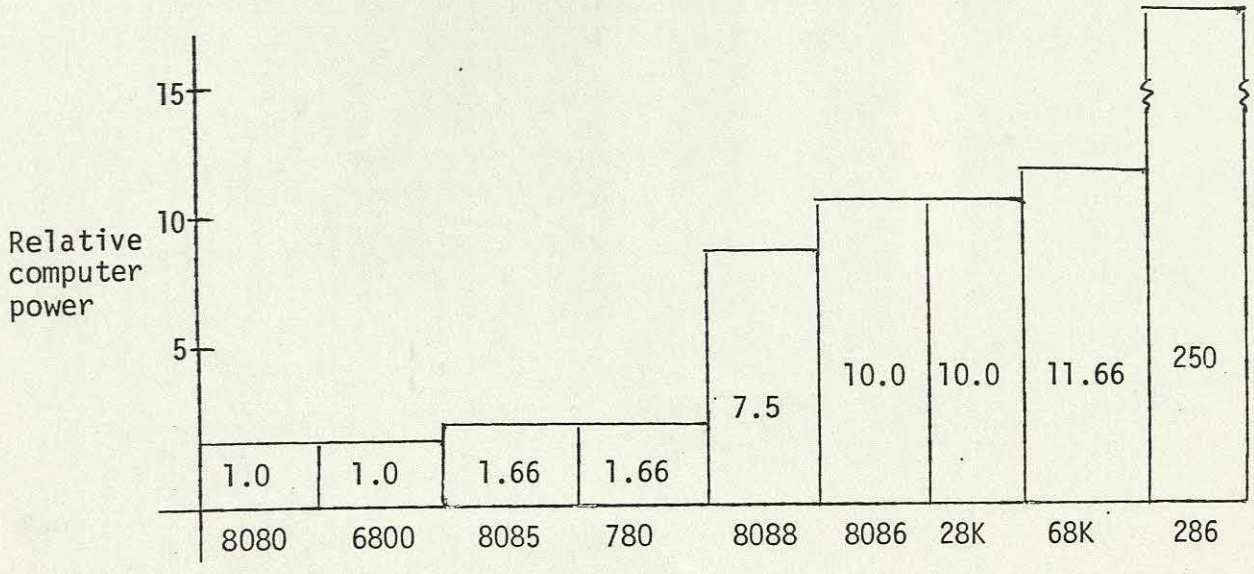
The 8086 introduced the concept of co-processors to provide functional partitioning. It consists of two co-processors - a 16-bit processor for internal working, and an 8-bit processor for communicating with the outside world. The 286 contains four co-processors, for interfacing with the bus building instructions, executing instructions and controlling addresses.

When the 286 is first powered up, it operates as if it is an 8086 (thereby providing compatability). Execution of a privileged instruction then causes it to switch to operating in native-286 mode.

Co-processors can be used to enhance a basic 8-bit or 16-bit processor with a numeric processor (NPX) or an I/O processor (IOX) or an operating system processor (OSX). The additional co-processors provide additional functions and instructions.

The 432 message driven architecture can be described in terms of an analogy. Instructions are processed by providing requests for another part of the system to perform a function (analogous to asking a broker to sell stocks on your behalf. The broker lets you know when the transaction is complete, and provides you with the proceeds). This architecture allows multiple 432 to be built into a system to enhance performance. It also provides functional redundancy and self checking facilities.

The relative computer power of various microprocessors is shown in the chart below.



III. DR GORDON MOORE

Dr Moore, Chairman of the board and chief executive officer of Intel answered questions and comments from the floor. He commented as follows:

- Intel is having to move more and more into areas that were previously its customers' domain
- Intel have not always found it easy to find the right people to listen to/talk with when trying to identify users' needs (eg local-area networks)
- The semi-conductor industry is becoming capital intensive (and therefore expensive to operate in)
- Moore's law will be valid to at least the end of this decade
- Applications chips (for example a graphics terminal controller) will be available by the end of the decade.

Notes on visit to Ford Aerospace
and Communications Corporation
on 1 October 1981

I. INTRODUCTION

Dr Rose, General Manager of Western Development Laboratories Division, presented an overview of Ford Aerospace and the activities of Western Development Laboratories.

Western Development Laboratories employs 4,200 people (90% in Palo Alto) and is engaged in providing satellites, earthstations, display systems and special projects for military and commercial customers. Most of their work is dependent on software, and he emphasised that one of the keys to their success was that they approached projects from a systems (and not a hardware) point of view.

II. SOFTWARE ENGINEERING OVERVIEW

Paul Sonnenblink, General Manager of Software Engineering, described the software engineering operation and outlined their approach to software standards and productivity. (See Software Engineering Operation handout).

III. SOFTWARE METHODOLOGY

Mike Evans, manager responsible for standards, procedures and control, described his group's role in establishing, training and controlling software standards. He detailed the serious problems experienced prior to the establishment of FACC's software methodology in 1977. He explained how the methodology is used to improve reliability, control costs and predict time scales. He stated that a combination of methodology and standards together with the right training and organisation were necessary for an effective overall improvement in software development. (See Software Methodology handout).

IV. DEVELOPMENT SUPPORT MACHINE (DMS) CAPABILITIES

Mel Brauns, manager responsible for software support and operations, described the features and applications of DMS in Western Development Laboratories. The DMS facilities are based on Unix. (See DSM Capabilities handout).

MANAGEMENT OVERVIEW

SOFTWARE ENGINEERING OPERATION

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PROLOGUE

- Tools, techniques, and methods developed over the past decade are now being used in business and industry today
- Their effective utility will largely depend on how well the user community absorbs and comprehends these tools, techniques, and methods

THE SOFTWARE PROBLEM

- Software represents the fastest growing portion of the aerospace and communications business
- There is a rapidly changing technology
- There is a world-wide shortage of software people with corresponding increased cost
- Productivity has been people limited
- Management of large software projects is difficult

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SOFTWARE IN TRANSITION AT WDL

- Programs are software intensive
  - Growth (6-year compound growth - 35%)
  - Technology based

- Minicomputer/microprocessor explosion
  - DACS (4GP)
  - Silkworth (32QP, 125SP)
  - Gold (7MP)
  - Courier

SOFTWARE IN TRANSITION AT WDL (Continued)

- Software development methodology
  - "TOP-DOWN" design
  - Structured programming
  - Software engineering tools
- Critical technical disciplines
  - Data-base management
  - Kernel technology
  - Computer networks
- Communications protocols
  - AUTODIN-2
  - 427M communications segment

SOFTWARE ENGINEERING DIRECTORATE FUNCTIONS

- To establish software policies, standards and procedures
- To establish and enforce a software inspection and assurance system
- To establish design and proposal reviews on programs containing significant software
- To provide software support to line directors
- To provide software technology, tools and aids for division use
- To propose and perform on major selected software programs

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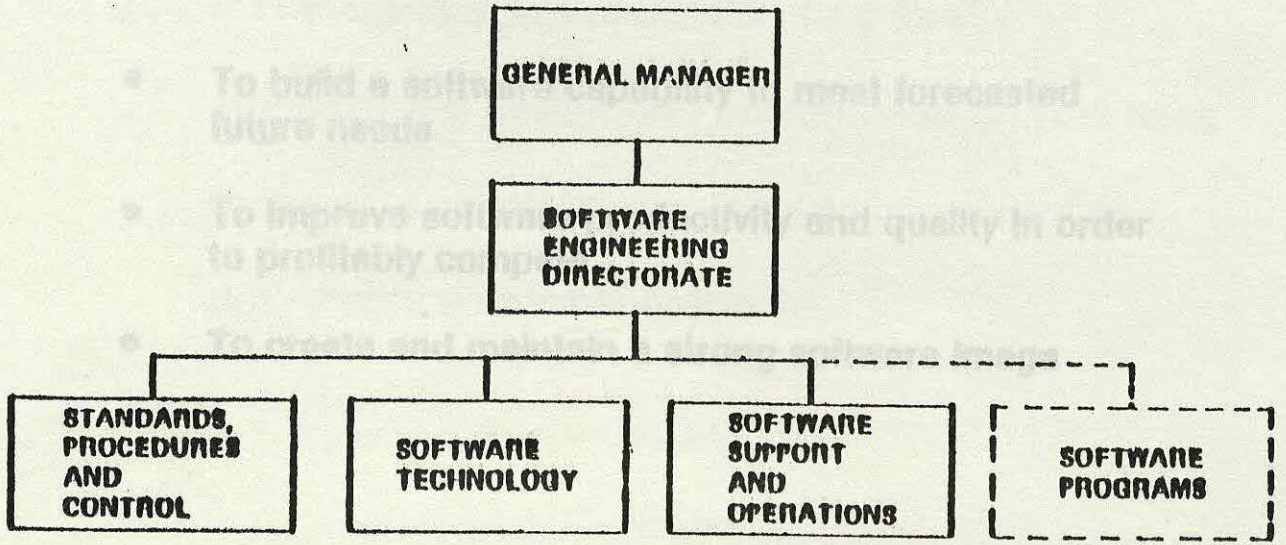
SOFTWARE ENGINEERING OPERATION



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OBJECTIVES

- To build a software capability to meet forecasted future needs
- To improve software productivity and quality in order to profitably compete
- To create and maintain a strong software image

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WDL SOFTWARE ENGINEERING POLICY*

(1) It is the policy of the division to utilize standardized design and implementation practices in the acquisition, management and control of deliverable computer software...

*Engineering Directive D-8.0

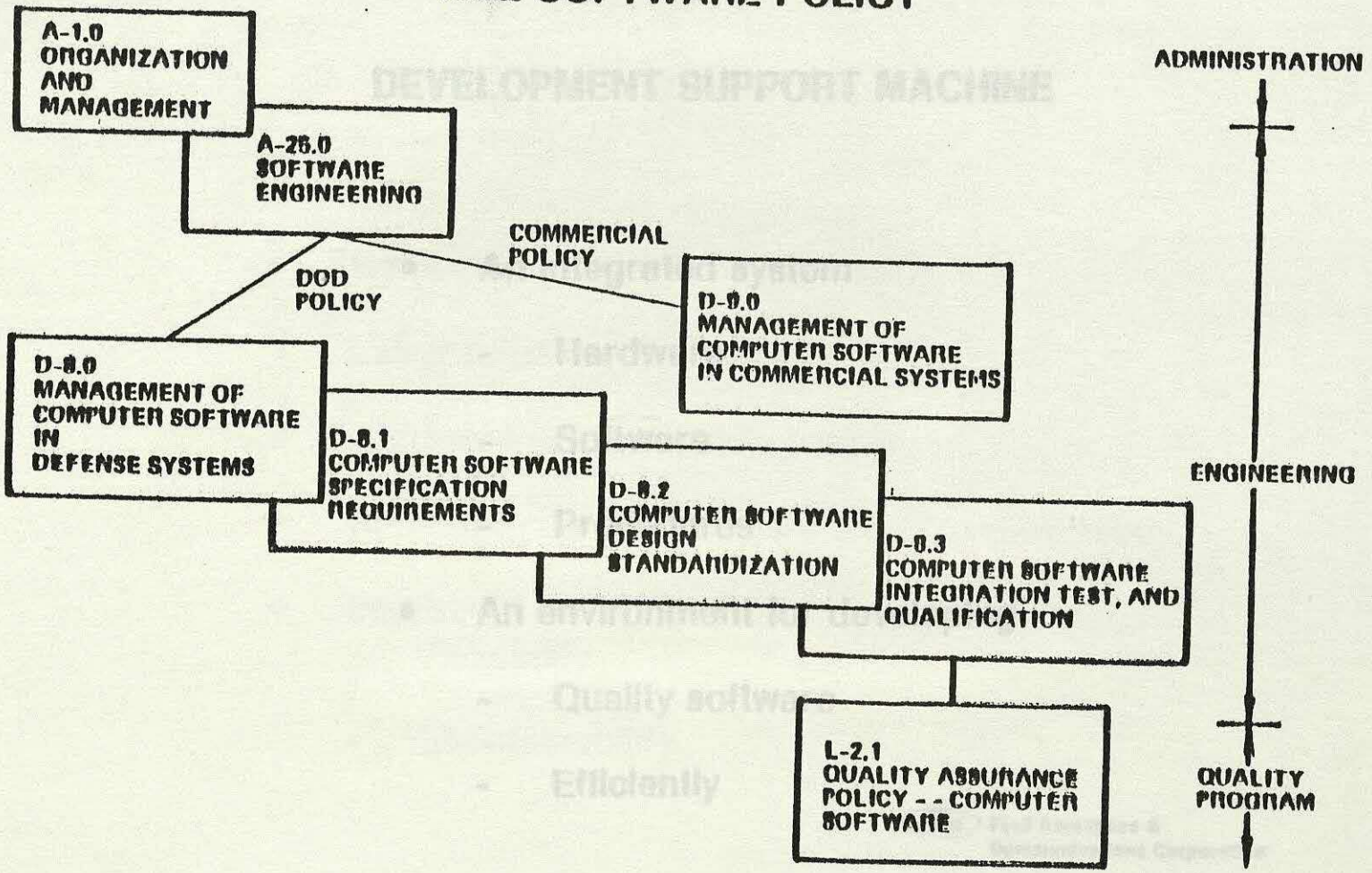
WDL SOFTWARE ENGINEERING POLICY

(2) Structure the work and provide automated support tools which promote a high level of management visibility, productivity, and public practice...

WDL SOFTWARE ENGINEERING POLICY

(3) Effectively utilize software technology assets across the entire spectrum of division programs with embedded computers...

WDL SOFTWARE POLICY



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DEVELOPMENT SUPPORT MACHINE

- An integrated system
  - Hardware
  - Software
  - Procedures
- An environment for developing
  - Quality software
  - Efficiently

WHY SHOULD WE USE A DSM?

- Software complexity is increasing
- Labor rates are increasing
- Hardware costs are decreasing
- Substitute cheap hardware for expensive labor
- Improve
  - Reliability
  - Productivity
  - Maintainability

SOFTWARE DEVELOPMENT PRACTICES

- SOFTWARE TOP DOWN DESIGN
- STRUCTURED PROGRAMMING
- PROGRAMMER'S NOTEBOOK
- UNIT FOLDERS
- SOFTWARE DESIGN WALKTHROUGH
- PROGRAMMING STANDARDS
- SOFTWARE DOCUMENTATION
- COMPUTER PROGRAM MAINTENANCE

PRODUCTIVITY

- Standard practices
- Modern programming techniques
  - Top down design and implementation
  - Structured programming
  - High order language (HOL) and hierarchical design language (HDL)
- Computer based tools and aids
  - DSM
  - Price-S
  - Software management system (MARS)
- Training
- Recruiting and retention

GENERAL COMMENTS

- "Software" includes "firmware"
- Policies cover all software, including non-deliverable
- Government and commercial are treated the same
- High quality software support tools such as DSM are a competitive necessity
- DSM or equivalent will become a necessity
- Full support of general manager is essential
- The program is working

Increasing Productivity Through Acceptance of Software Methodology Within the Project Organization

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Communications Corporation

THE SOFTWARE DEVELOPMENT PROBLEMS

- Software development is often treated as an art rather than an engineering discipline
- Methodology and standards alone will not assure a quality software development program
- Companies unknowingly lose productivity through ineffective training programs
- Software development training goals and objectives must be identified -- a training plan must be developed

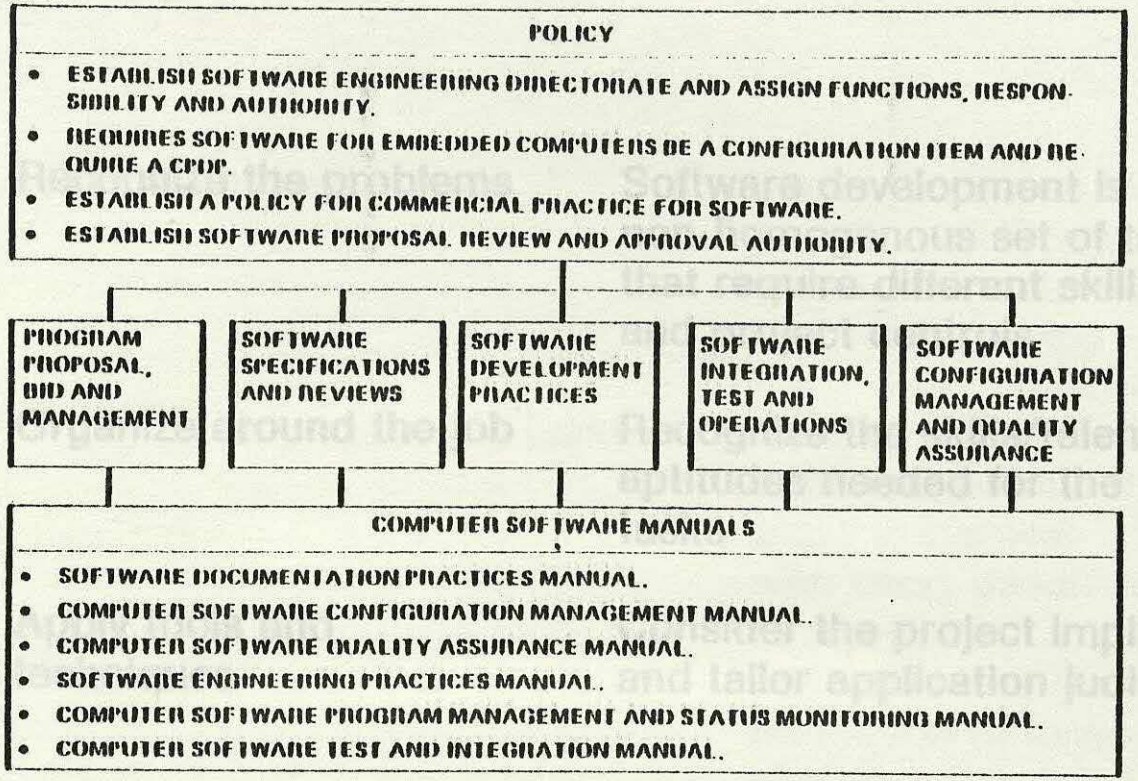
PRODUCTIVITY PROBLEMS

Failure To Plan Thoroughly Causes:

- Incomplete, inconsistent specifications
- Ill-defined test plans
- Loose design
- Faulty code
- Integration test failures

Resulting In:

- Loss of productivity/contract/budget overrun



(Ford) Ford Aerospace & Communications Corporation

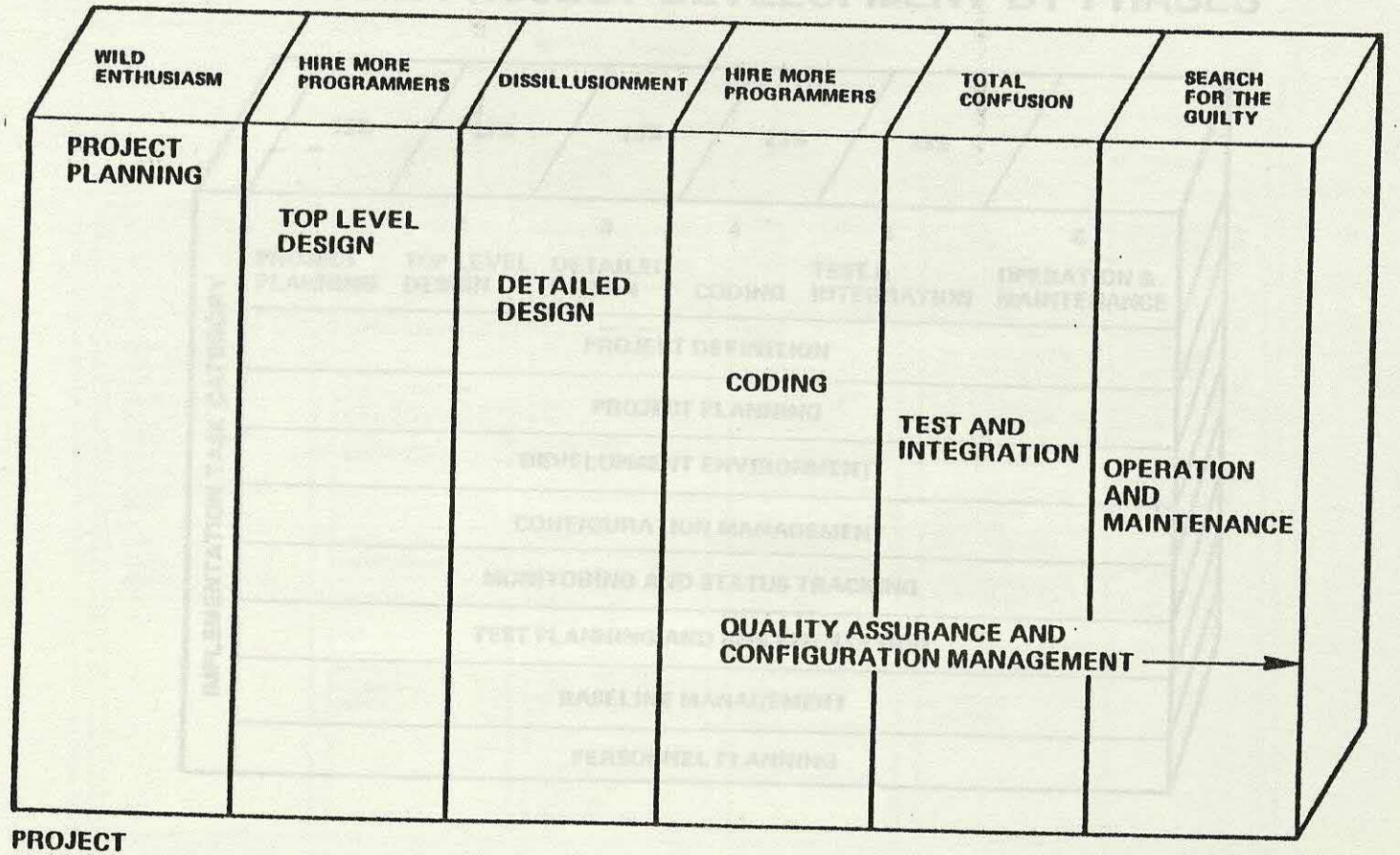
APPROACH

• Recognize the problems	Software development is a non-homogenous set of tasks that require different skills and project controls
• Organize around the job	Recognize the skills/talents/ aptitudes needed for the tasks
• Apply tools and techniques	Consider the project implications and tailor application judiciously

APPROACH

• Plan the program	Apply resources for planning early and identify all tasks and relationships
• Schedule and the tasks	Identify small work units and pursue the tasks in parallel with short deadlines
• Monitor and track status	Follow the implementation of tasks closely

STANDARD SOFTWARE DEVELOPMENT FLOW



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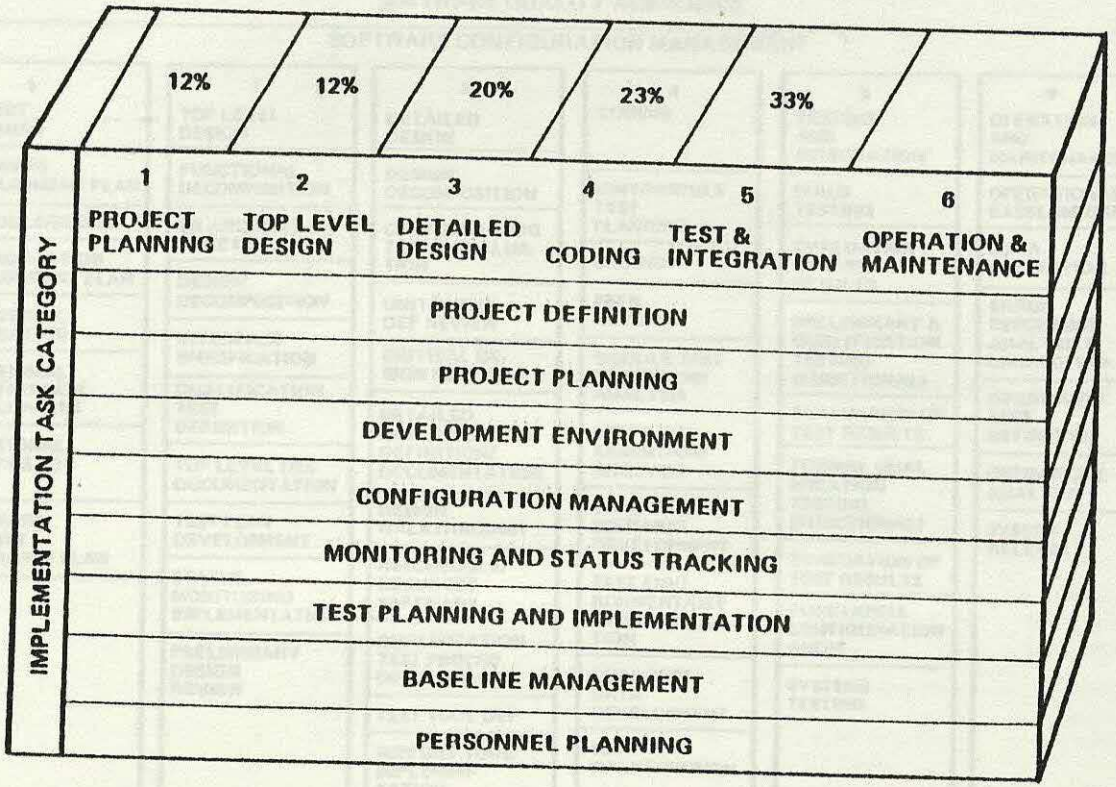
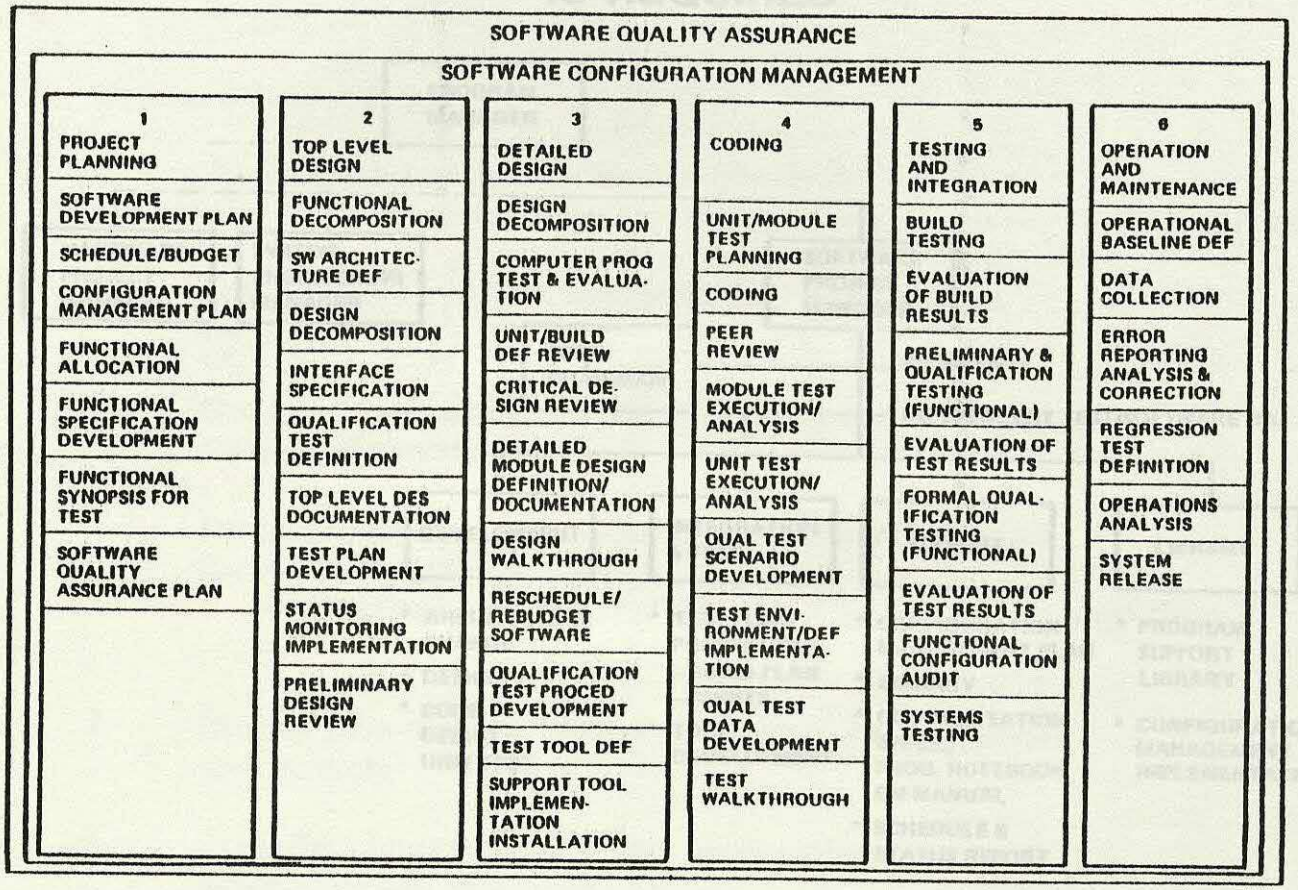
SEVERAL METHODOLOGIES - REQUIRE DIFFERENT DISCIPLINES

SOFTWARE PROJECT DEVELOPMENT BY PHASES



INTEGRATED SOFTWARE DEVELOPMENT METHODOLOGY



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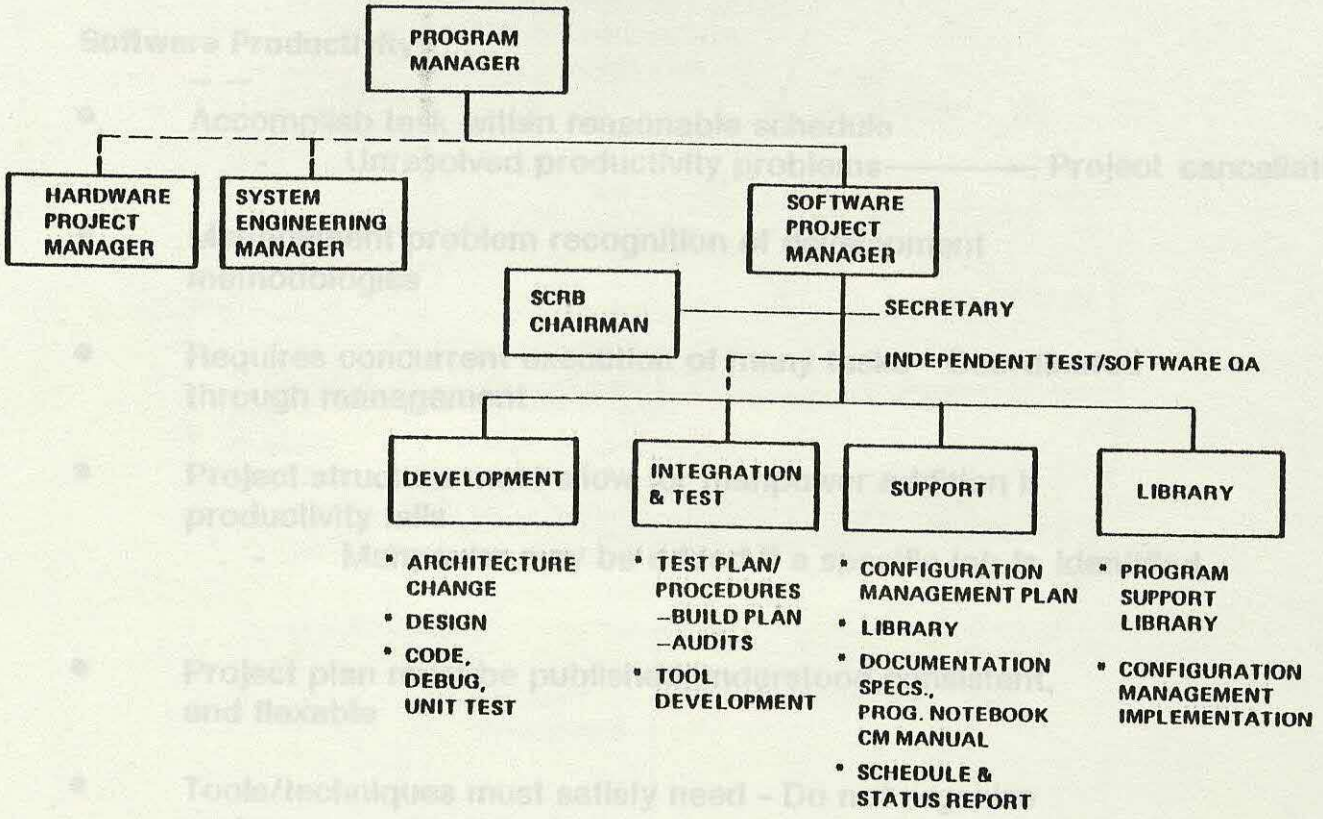
FUNCTIONAL ORGANIZATION PLAN IS REQUIRED



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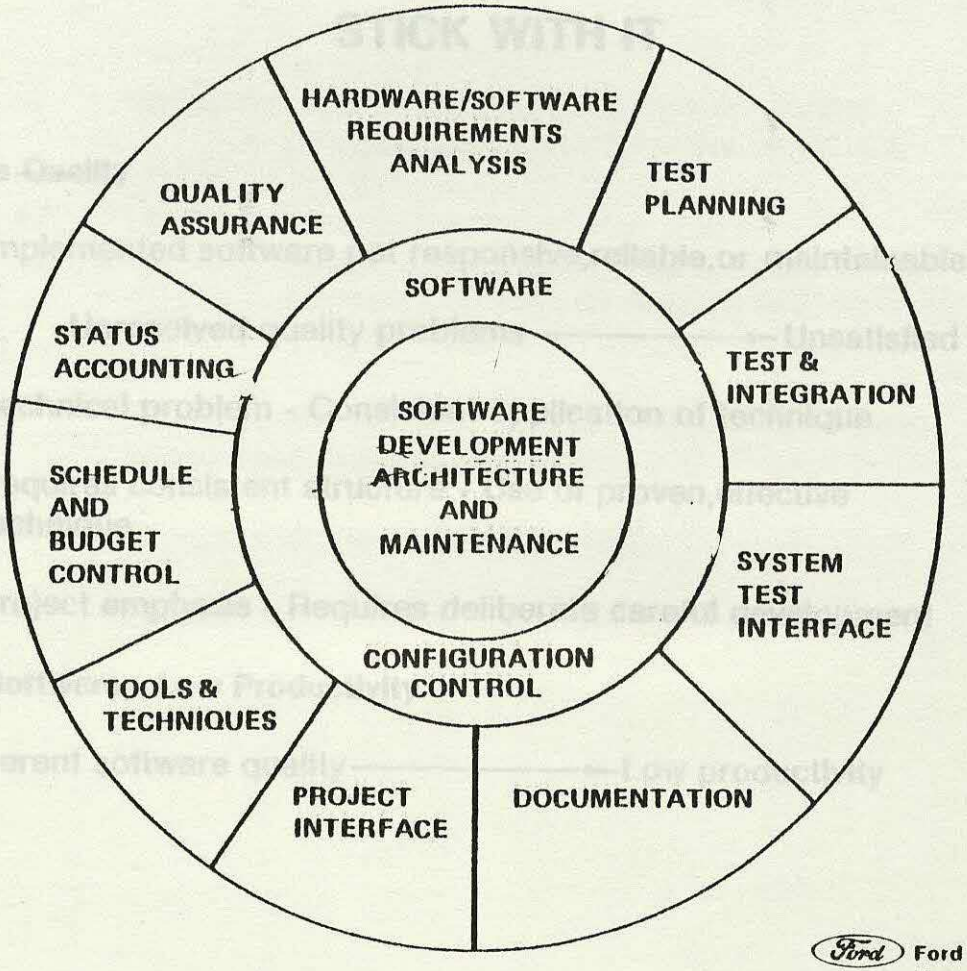
SOFTWARE MANAGER - ESTABLISH ENVIRONMENT TO GET WORK DONE - KEEP JOB MOVING

Software Productivity

- Accomplish task within reasonable schedule
  - Unresolved productivity problems ——→ Project cancellation
- Management problem recognition of development methodologies
- Requires concurrent execution of many tasks - Coordinated through management
- Project structure must allow for manpower addition if productivity falls
  - Manpower may be added if a specific job is identified
- Project plan must be published,understood,consistent, and flexable
- Tools/techniques must satisfy need - Do not organize project around tool/technique

COHESIVE PLAN AND ORGANIZATION IS REQUIRED



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SOFTWARE MANAGER ESTABLISH PROJECT STANDARDS STICK WITH IT

Software Quality

- Implemented software not responsive,reliable,or maintainable
  - Unresolved quality problems ——→ Unsatisfied customer
- Technical problem - Consistent application of technique
- Requires consistent structure - Use of proven,effective technique
- Project emphasis - Requires deliberate careful development

Quality Software - Low Productivity

- Inherent software quality ——→ Low productivity

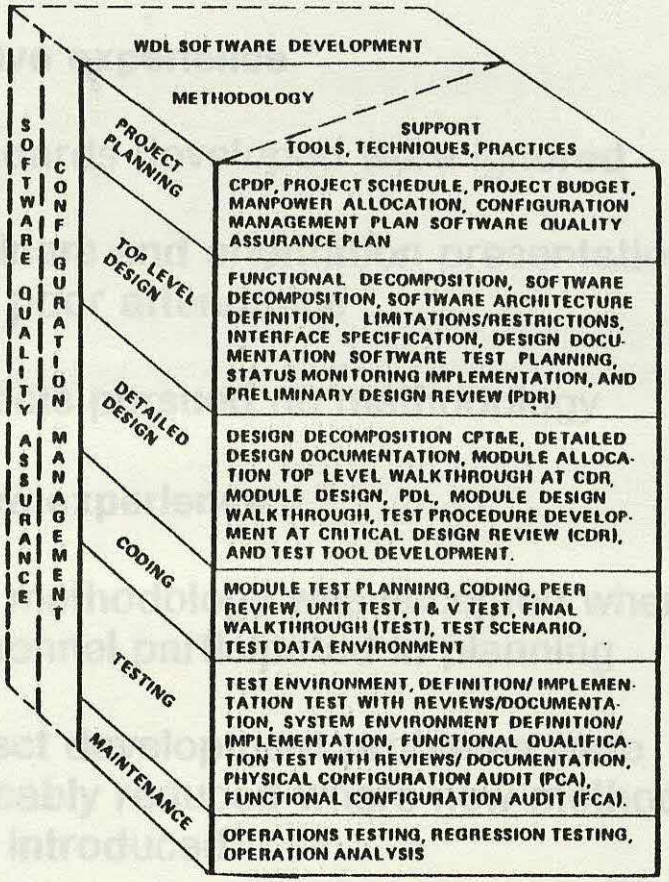
ORGANIZE TOWARDS PRODUCTIVITY

- Recognize specialization of software personnel
  - Designers,not coders testers or writers
- Organize towards maximum productivity
  - Assign development responsibility to high achievers off load all support responsibility
  - Support must keep up with development
- Have defineable responsibility - All personnel have known responsibility all the time
- Organization never lets job stop
- Project controls always applied

DEVELOPMENT SUPPORT MACHINE (DSM)

- Principal software development tool
  - Uniform tools with great target computer variety
  - Implemented on moderate-sized computer systems
- Important features
  - Projected communication (electronic mail)
  - Documentation
  - Program design, code and test
  - Automated configuration management
  - Allows flexible growth
- High productivity
  - Easy to use initially
  - Skill improves with experience

WDL SOFTWARE DEVELOPMENT METHODOLOGY
TOOLS, TECHNIQUES AND PRACTICES



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FORD AEROSPACE'S TRAINING EXPERIENCE

Negative experience

- Standards developed were ignored
- Seminars and orientation presentations had poor attendance
- Projects pursued no methodology

Positive experience

- New methodology was accepted when key personnel participated in planning
- Project development problems were noticably reduced where new methodology was introduced

TRAINING GOALS

- Techniques for facilitating software standards acceptance within the project organization
- Attitude of cooperation and support for both objectives and procedures utilized in the implementation process

TRAINING OBJECTIVES

- Focus on most influencial group as target audience
- Understand needs and frustrations of the group
- Develop a program that the audience can relate with

THE WORKSHOP PLAN

- Develop case study material with characteristic attitudes, problems, presented in a typical project environment.
- Present critical and controversial issues eg, ill-defined project requirements, loose organization plan, misplaced personnel, etc in the cases.

THE WORKSHOP APPROACH

- Offer selected readings and assign problems for group solution
- Offer classes during non-working hours ie, brown bag lunches and early evening case study presentations
- Emphasis on participation and creative solutions to case problems

WORKSHOP TOPICS

- Project definition - an analysis of requirements, software design, costing, and scheduling
- Project organization - techniques for centralizing design authority, assigning development responsibility, and management reporting
- Project planning - project standards, decomposition of design, and software management plan

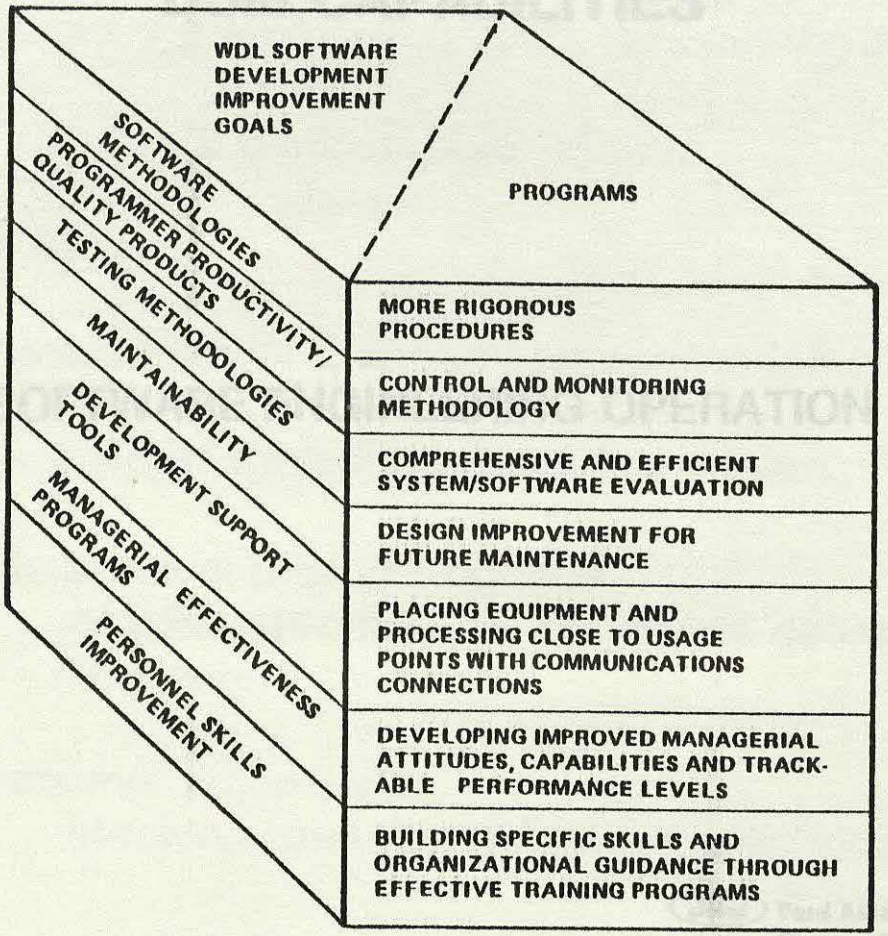
WORKSHOP TOPICS

- Development environment - test planning, environment definition, implementation of support environment and language selection
- Configuration management - centralized library and automated library structure

WORKSHOP TOPICS

- Monitoring and status accounting - design audits, requirements tracking, walkthrough and unit test
- Functional testing - component testing, integration, and test reporting
- Baseline management - functional, allocated, and product baselining
- Personnel planning - career planning, control of turnover/attrition rate

WDL SOFTWARE DEVELOPMENT IMPROVEMENTS PROGRAMS



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DSM CAPABILITIES

SOFTWARE ENGINEERING OPERATION

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MAJOR FEATURES OF DSM

- Programmer's workbench/UNIX timesharing system
  - PDP-11/70 minicomputer system
- Electronic mail
  - Reduce paperwork, speed communication
- Design support tools for system developers
  - Hierarchical design language
    - Machine-processible structured design tool
    - Replaces flowcharts
  - Documentation tools
    - Machine readable documentation aids

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MAJOR FEATURES OF DSM (Continued)

- Software configuration management tools
  - Source-code control system
    - Flexible, comprehensive, automated source text control
    - Facilities
      - Source data base
      - Auditing
      - Access control
      - Storage/retrieval
    - Source code formatters
      - Style & standards enforcement
    - Cross reference generators
      - Improve productivity during
        - Debugging
        - Maintenance

MAJOR FEATURES OF A DSM (Continued)

- Flexible source-code editing tools
  - Program creation editor
    - Prompting
    - Language-specific formatting
    - Flexible context editing functions
    - General-purpose text editor
  - Two-D screen editor
    - Full-page editing on CRT
    - Variable size/number screen windows
    - Easy cut/paste functions
    - Box-drawing functions

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MAJOR FEATURES OF DSM (Continued)

- Target machine Support
  - Power spectrum of the target machines:
    - Most target machines medium to large scale mini-computers.
    - DSM can support range of machines from micro-computers through very large general-purpose computers.
  - DSM can access target machine through terminal RJE (remote job entry)

UNIX FILE SYSTEM FEATURES

- No preallocation of space or extents
- No specification of file types
- No compression required
- No separation of cataloging and file management

UNIX FILE SYSTEM FEATURES (Continued)

- Systematic search and access of information in files by user and user programs
- Access permissions
- Manages disk space for operating system
- Convenient access to physical devices for I/O
- Hierarchical - pictorially represented as a "tree structure" of files and directories

COMMAND INTERPRETER - SHELL

- Command names
- Standard Input and output
- Redirected I/O
- Pipes and filters
- Asynchronous processes
- Command files

SOURCE CODE CONTROL SYSTEM (SCCS)

- Source text data base
  - Flexible
  - Comprehensive
  - Automated
- Facilities
  - Full source data base
  - Complete audit trail
  - Identification/reversibility of all changes
  - Data base access control
  - Management reports
  - Efficient storage/retrieval
  - Easy to use

SCCS DATA BASE CONTENTS

- Global information
  - List of programmers who may make changes
  - List of control flags
    - Program type
    - Module name
    - Allowed change numbers
    - Default version number
    - Keyword usage enforcement
    - Branching control

SCCS UTILITY FUNCTIONS

ADMIN	Data base administration
GET	Retrieve source
DELTA	Enter changed source
COMB	Combine two or more DELTAs
CHGHIST	Update DELTA comments
PRT	Print data base history
RMDEL	Purge erroneous DELTAs
SCCSDIFF	Report differences between releases

SCCS DATA BASE CONTENTS (Continued)

- Per-modification information
  - Statistics (per line)
    - Inserted
    - Deleted
    - Unchanged
- List of change (DELTA) serial numbers that were explicitly
  - Included
  - Excluded
  - Ignored
- List of modification requests for this DELTA
- Comments for this DELTA

DOCUMENT PREPARATION WITH MM

- Memorandum for file
- Programmer's notes
- Engineer's notes
- Released paper
- External letter
- Customized title

MM DOCUMENT STRUCTURE

- Parameter setting
  - Page width
  - Margins
  - Justification
  - Heading and list styles
  - Page headers and footers
  - Override default values
  - Define macros
- Beginning
  - Title
  - Author information
  - Organization
  - Abstract
  - Date

MM DOCUMENT STRUCTURE (Continued)

- Body
  - Document itself
  - Heading hierarchy (7 levels)
  - Automatic table of contents
  - Footnotes
  - Lists
    - Numeric
    - Alphabetic
    - Roman
    - Label
  - Displays
  - Equations
  - Figures
- Ending
  - Signature(s)
  - List of notations (eg, copy to)
  - Contents invocation
  - Cover sheet

SAMPLE DOCUMENT

```
.ND "05 JANUARY 1979"
.TL
 THIS IS THE TITLE
.AF "COMPANY NAME"
.AU "AUTHOR NAME"
.AS
 BODY OF ABSTRACT
.AE
.MT 4
.H 1 "FIRST LEVEL HEADING"
.H 2 "2ND LEVEL HEADING"
 TEXT . . .
.P
 NEW PARAGRAPH . . .
.H 1 "ANOTHER 1ST LEVEL HEADING"
.TC
```

Ford Aerospace &
Communications Corporation

TOOLS FOR DOCUMENT CONTROL

- MM
- SCCS
- DIFF, DIFFMARK
- PTX

DEVELOPMENT SUPPORT MACHINE (DSM)

- Principal software development tool
  - Uniform tools with great target computer variety
  - Implemented on moderate-sized computer systems
- Important features
  - Project communication (electronic mail)
  - Documentation
  - Program design, code and test
  - Automated configuration management
  - Allows flexible growth
- High productivity
  - Easy to use initially
  - Skill improves with experience

Ford Aerospace & Communications Corporation

Notes on presentations made by
Hewlett-Packard on 2 October 1981

I. HEWLETT-PACKARD IN THE COMPUTER BUSINESS

(Presented by Bill Shellooe - Worldwide major accounts manager).

An overview of Hewlett-Packard and its corporate structure was provided. The company is a high-technology company, with nearly half of its revenue coming from data products. Ten per cent of total revenue is used for R&D activities.

After IBM, Hewlett-Packard is the largest worldwide supplier of peripherals.

The manufacturers productivity network concept was introduced. This concept allows Hewlett-Packard to solve the systems problems of manufacturing companies in the four areas of:

- Operational planning and control
- Administrative and office services
- Factory and plant automation
- Computer-aided engineering.

(Copies of the slides used by Mr Shellooe will be made available via Butler Cox).

II. HEWLETT-PACKARD BUSINESS COMPUTER STRATEGY

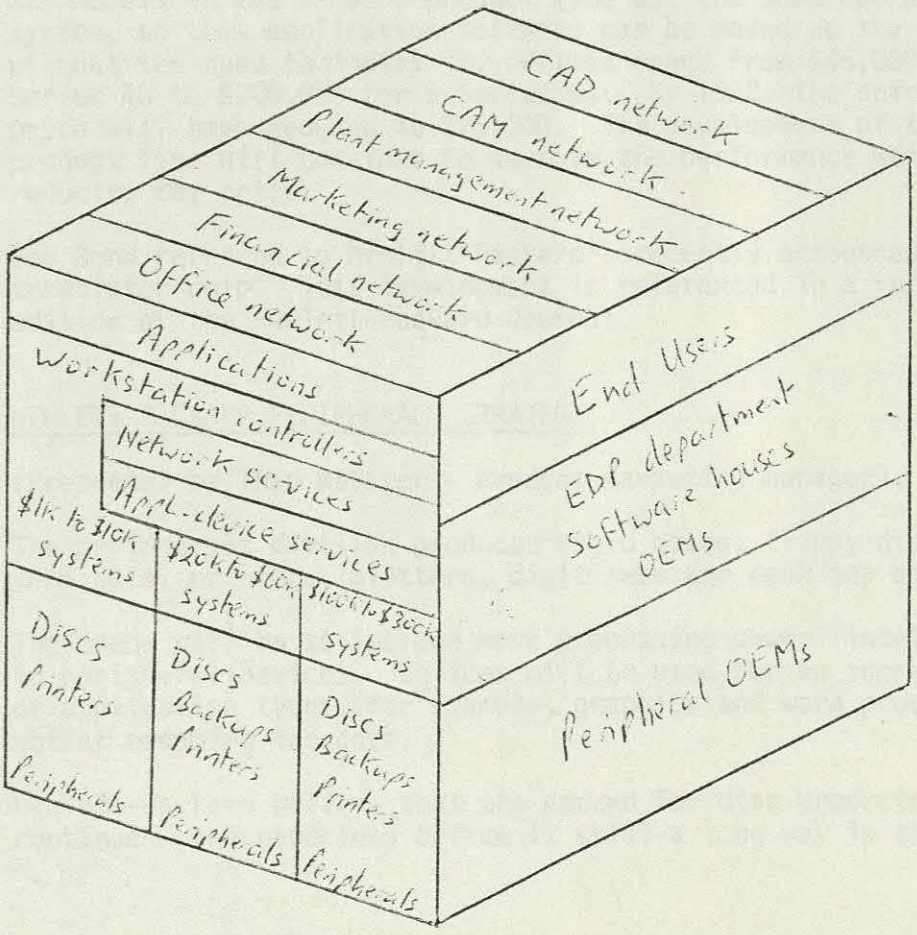
(Presented by Ed McCracken - General manager, business computer-group).

Hewlett-Packard believes that the computer industry has now passed the first inflection point on the 'S'-shaped learning curve, which means that the use of computer equipment will become ubiquitous. This inflection has been caused by:

- Reduced hardware costs (25% to 35% per year)
- Increased people costs (10% to 20% per year)
- Equipment which is easier to use (although there is still a long way to go).

Hewlett-Packard intend to make maximum advantage of the trend towards the ubiquitous use of computer equipment (a recent projection of the future performance of US computer suppliers shows them moving to fourth position from eighth). The company believes that people prefer (by about a factor of ten) to use computers that are under

their direct control (ie desk top computers) to using a departmental computer. If a departmental computer has to be used, this will be ten times preferable to using a centralised facility. Hewlett-Packard will therefore be concentrating on the desk top market and the small business system market, and its computer strategy can be represented as follows:



The strategy has a high emphasis on peripherals' technology (including work stations).

III. HEWLETT-PACKARD BUSINESS COMPUTER HARDWARE STRATEGY

(Presented by Bob Bond - Marketing manager).

Products in the HP 3000 product line were positioned relative to IBM products (price and performance). For example:

Series 40* is equivalent to IBM S/38

Series 44* is equivalent to 4331-62

Series 64* is equivalent to 4341-61.

(*These products are due to be announced in November 1981).

All models in the HP 3000 product line use the same operating system, so that application software can be moved up the range without the need to modify it. Prices range from $45,000 for a Series 40 to $200,000 for a Series 64. By 1982, the entry level price will have reduced to $25,000. The development of the 3000 product line will continue to improve the performance whilst reducing the price.

Bob Bond referred to Hewlett-Packard's recently announced 450,000-transistor chip. This development is referenced in a recent edition of the Hewlett-Packard Journal.

IV. HEWLETT-PACKARD PERIPHERALS STRATEGY

(Presented by Thad Webster - Product marketing manager).

The peripherals division produces rigid discs, floppy discs, tapes, terminals, printers, plotters, digitisers and desk top devices).

The trend will be to include more processing power (intelligence) in peripheral devices. Devices will be used for an increasing number of application types (for example, graphics and word processing), whilst reducing the cost.

Hewlett-Packard believe that the demand for disc products will continue - the paperless office is still a long way in the future.

V. MANUFACTURING SYSTEMS STRATEGY

(Presented by David Sohm, Manufacturing marketing manager, and David Bylund, Markets manager).

The roles of 'Operational Planning and Control' and 'Factory and Plant Automation' were described as shown below:

1. Operational Planning and Control consisting of:

   - Quality management
   - Production management (eg shop scheduling and tracking)
   - Materials management
   - Order processing
   - Sales/service support
   - Distribution
   - Cost accounting.

   At present Hewlett-Packard have software packages for production management and materials management which run on HP 3000 machines. Each of the packages are available in multilingual versions and cost $31,500 or less (depending on how many times the package is purchased). The next software priority is to produce an order processing package.

2. Plant and Factory Automation

   The existing HP 1000 product family was described as being real-time, flexible and able to connect to a variety of equipment including machine tools and other computers.

   Hewlett-Packard will introduce an electronic computer aided engineering product during 1982 which is likely to be a desktop machine.

   Plant and Factory Automation databases are expected to become the largest databases held in manufacturing-based companies.

VI. DATA COMMUNICATIONS STRATEGY

(Presented by Rosalie Tubes - Marketing development manager).

Hewlett-Packard's communications strategy is based on DSN (distributed systems network). DSN is the foundation of the manufacturing productivity network (MPN) concept. It interlinks equipment in all four quadrants of the MPN.

The DSN architecture will be based on international standards. In the short term this means providing X.25 and X.21 interfaces. For local-area networks it will mean adhering to the IEEE 802 standard. This standard is similar to (but not compatible with) Ethernet. The main differences concern the addressing scheme, the grounding of the cable and in the coding of information. Hewlett-Packard anticipate that their first local-area network products will be released in 1983.

In the longer term, the DSN architecture will conform to the ISO OSI seven layer model.

Hewlett-Packard will also provide compatibility with SNA via the SNA/3000 product.

VII. DATA TERMINALS STRATEGY

(Presented by Terry Eastman, Sales manager).

Hewlett-Packard sold some $200m worth of CRT display terminals during the last year, most of these being smart/intelligent terminals. Their data terminals strategy is to provide different terminals for different applications. Terminals are currently marketed in five product areas, namely:

- Data entry
- Text preparation
- Program preparation
- Data analysis (business graphics)
- CAD/CAM graphics.

Some terminals will have colour graphics facilities at an unspecified future date.

VIII. THE HP 125 PERSONAL BUSINESS COMPUTER

(Presented by Hal Elgie, General Systems Division).

The features of the HP 125 'Business Assistant' personal business computer were briefly described as:

- Word processing
- Hard copy graphics (plotter), but not screen graphics
- Visicalc package

- Floppy disc storage (maximum capacity 1.2MB on 8" floppy)
- Microsoft Basic
- Teletype communications
- Communications to HP 3000 machines
- Communications to IBM mainframes (using third party software running on the HP 125).

The HP 125 is aimed at 'knowledge workers'. Approximate US costs were given as:

Terminal + Dual 5" floppy disc drive	-	$6,250
Hard copy printer	-	$ 900 (minimum)
Graphics plotter	-	$2,500 or $5,300
Software costs - word processing	-	$ 500
- graphics	-	$ 200
- Visicalc	-	$ 200

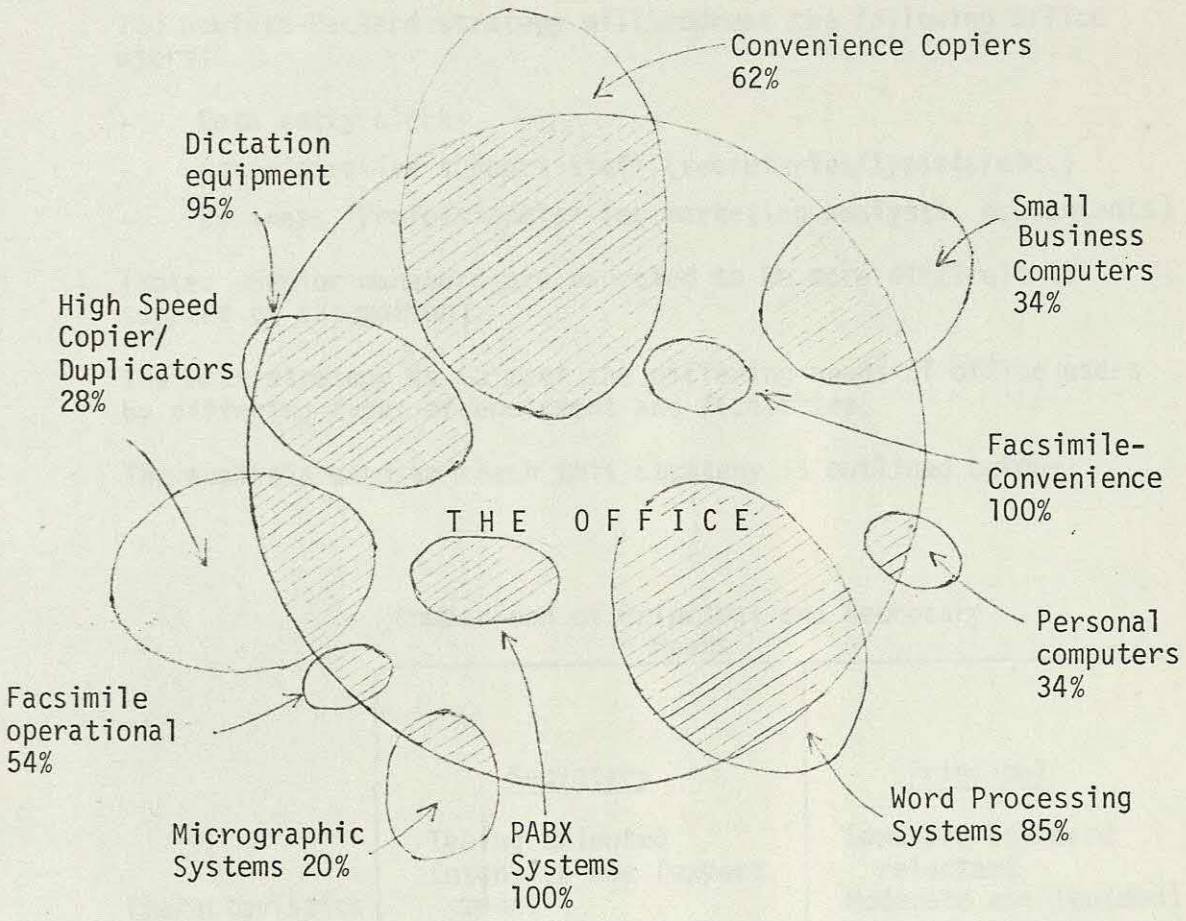
Foundation members were given the opportunity to see a demonstration of the HP 125 after the presentations.

IX. OFFICE AUTOMATION STRATEGY

(Presented by Ruan Pengov, Data processing products office manager).

1. Introduction

Office automation was described as a means to increase office productivity and reduce office costs. The integration of word processing, data processing, video, voice, graphics, facsimile etc. using flexible communications networks would be the tools of office automation. A schematic representation of current equipment usedin offices was given as shown below:



Note: White areas within equipment circles represent non-office use; percentages indicate office use. Size of circles indicates proportionate market share of office expenditures.

2. Strategy

The Hewlett-Packard strategy will address the following office users:

- Data entry clerks
- Administrative support staff (secretaries/typists/etc.)
- Business 'Professionals' (eg marketing analysts, accountants)

(Note: Senior managers are expected to be more difficult to support by automation).

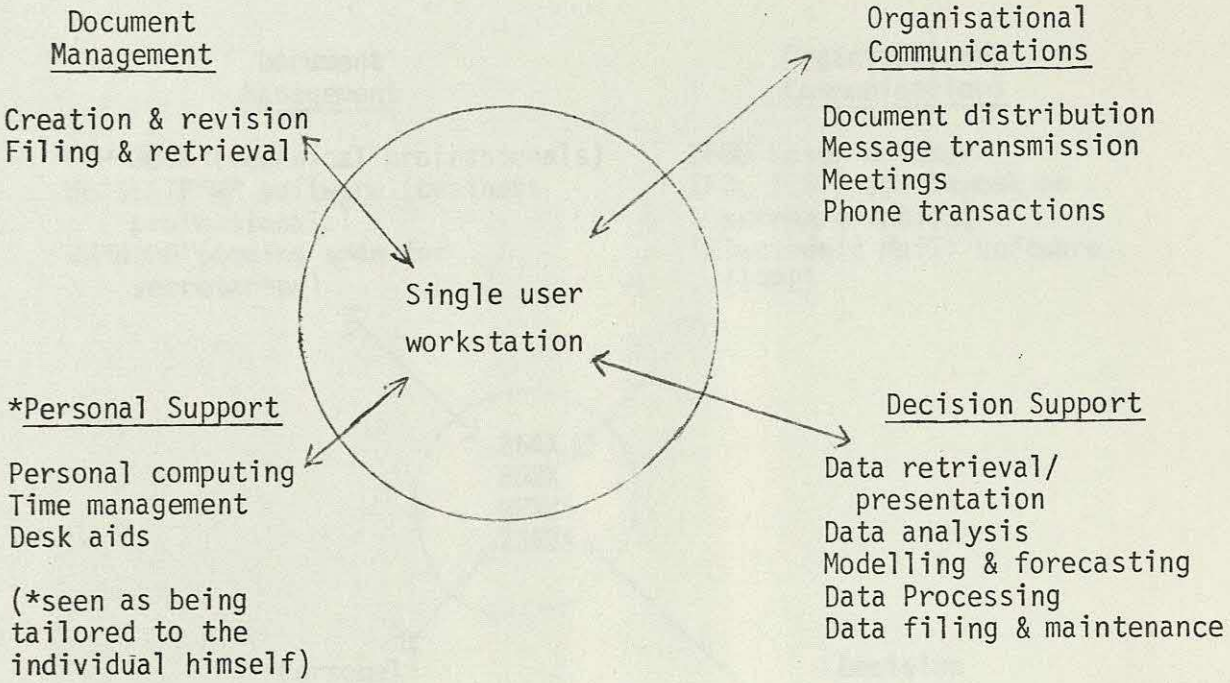
The main strategy is to meet the differing needs of office users by differing types of equipment and facilities.

The analysis used to reach this strategy is outlined below:

Comparison of Principal and Secretary Needs

	Secretary	Principal
Characteristics	Typing oriented Intensive use (expert mode) Learn through training Comprehensive formatting	Some are keyboard reluctant Moderate use (guided) Learn through use and deduction Simple text entry/ editing
Workstation terminal needed	Plotter/printer 'Joystick' Specialised WP keyboard WP intelligence	Small touch screen Simple, general purpose keyboard Portable? Voice? Flat display?

Professional/Manager Facilities Requirements

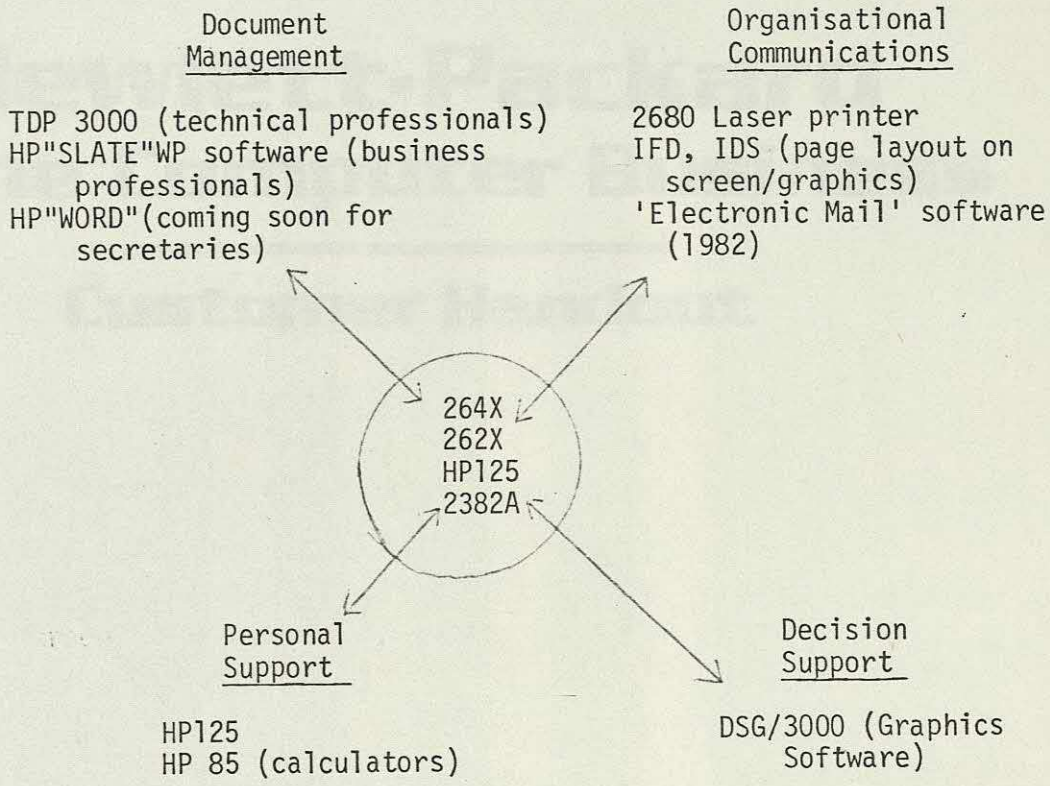


Within this overall picture the professional's requirement will vary significantly (eg a professional in the graphic arts department might require a full colour graphics terminal).

The Hewlett-Packard product strategy is to provide a number of different multifunctional (but compatible) products to meet the different user requirements. Conceptually this was shown as being met by a central core of HP 3000 family products, linked by a communications facility to the various devices and applications in user areas. This approach is seen as building on their existing strengths in distributed processing (and graphics).

3. Existing and some planned products

The way that some existing and 'almost ready' products fit into the professional requirements concept were illustrated as shown below:



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Hewlett-Packard
In the Computer Business

Customer Handout

NOTES:

HEWLETT PACKARD

IN THE COMPUTER BUSINESS

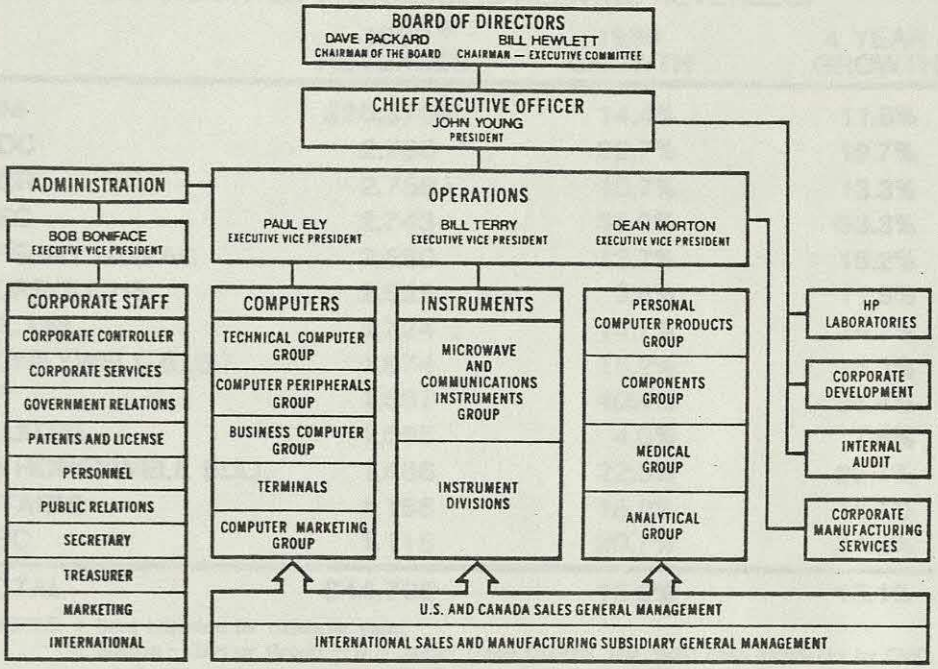
1

THE HP WAY
Business Related

- Pay As You Go – No Long-Term Borrowing
- Market Expansion and Leadership Based on New Product Contributions
- Customer Satisfaction Second to None
- Honesty and Integrity in All Matters

NOTES:

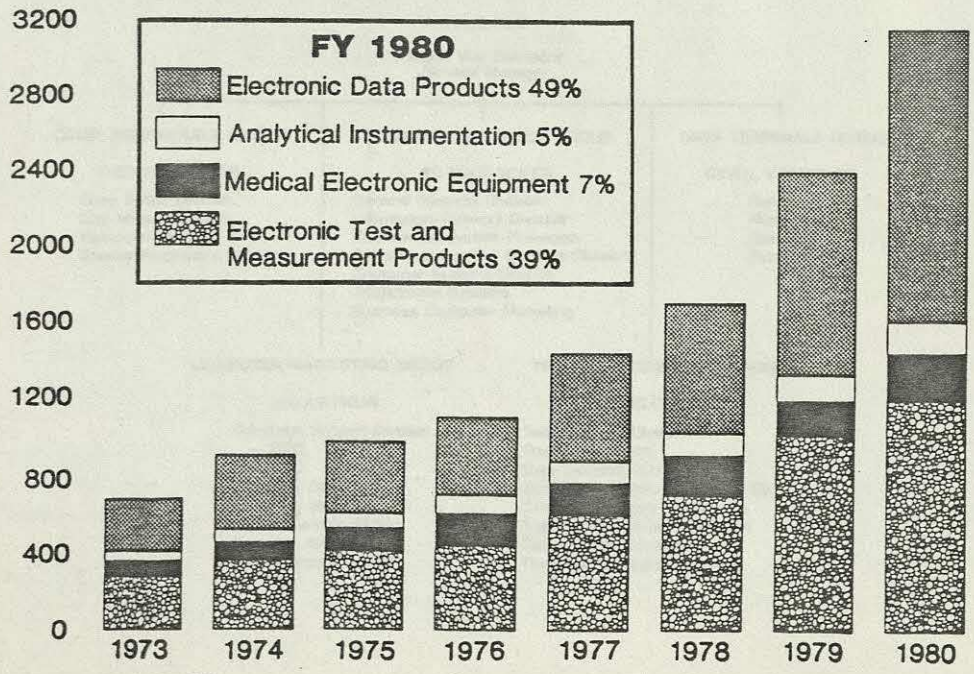
HEWLETT-PACKARD CORPORATE ORGANIZATION



3

MARKET DIVERSIFICATION AND GROWTH

(SALES IN MILLIONS OF DOLLARS BY PRODUCT GROUPS)



4

HEWLETT PACKARD

NOTES:

BILLION DOLLAR CLUB

(INFORMATION PROCESSING RELATED REVENUES)

	1980* REVENUES	1980 GROWTH	4 YEAR GROWTH
IBM	$20,970M	14.4%	11.8%
CDC	2,790	22.7%	19.7%
NCR	2,758	10.7%	13.3%
DEC	2,743	35.0%	33.3%
SPERRY UNIVAC	2,580	13.7%	15.2%
BURROUGHS	2,525	3.8%	11.9%
ICL Ltd.	1,724	14.7%	24.7%
HONEYWELL (U.S.)	1,674	15.2%	16.3%
HP	1,597	40.4%	36.4%
FUJITSU	1,585	4.0%	7.8%
Cii HONEYWELL BULL	1,486	22.3%	22.7%
HITACHI	1,158	15.2%	16.1%
NEC	1,115	20.7%	21.2%
TOTAL	$44,705	15.8%	15.1%

*NOTES: 1. Data adjusted for calendar year.
2. Source – Gartner Group, U.S. – Japan Trade Council, and 1980 data estimates by CMG.

5

COMPUTER GROUPS

PAUL ELY

Exec. Vice President
General Manager

COMP. PERIPHERALS GROUP

DICK HACKBORN

- Boise Printer Division
- Disc Memory Division
- Vancouver Division
- Greeley Peripherals Division

BUSINESS COMPUTER GROUP

ED McCRACKEN

- General Systems Division
- Information Network Division
- Commercial System Pinewood
- Boeblingen General Systems Division
- Computer Systems Division
- Applications Systems
- Business Computer Marketing

DATA TERMINALS DIVISION

CYRIL YANSOUNI

- Sunnyvale
- Roseville
- Grenoble
- Puerto Rico

COMPUTER MARKETING GROUP

JIM ARTHUR

- Computer Support Division
  - — CEO
  - — SEO
- Computer Supplies
- Marketing Services
- North American Sales
- European Sales
- Intercontinental Sales

TECHNICAL COMPUTER GROUP

DOUG CHANCE

- Data Systems Division
- Roseville Division
- Data Systems Grenoble
- Boeblingen Desktop Computer Division
- Desktop Computer Division
- Systems Technology Operation
- Cupertino IC Operation
- Technical Computer Marketing

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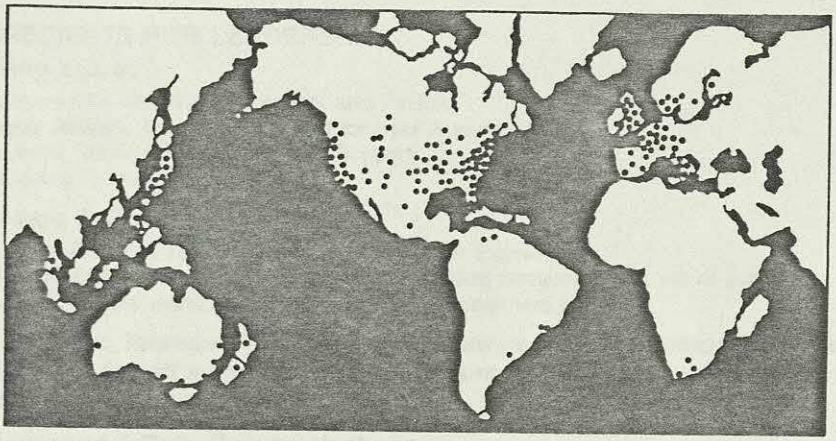
HEWLETT PACKARD

NOTES:

WORLDWIDE PRESENCE
FOR MORE THAN 100,000 CUSTOMER ORGANIZATIONS



- 180 Sales/Support Locations
  - U.S.
  - International
- 71 Countries
- 60,000 Employees
  - 6,000 Local Sales/Support
- 44 Manufacturing Divisions
- 5,000 Products

7

BUSINESS STRATEGY FOR HEWLETT-PACKARD COMPUTERS

MARKET FOCUS: Major emphasis for MANUFACTURING COMPANIES.

Provide solutions which increase productivity through:

- Computer Aided Engineering
- Factory Automation
- Planning and Control
- Admin/Office Automation

Specialized direct marketing programs for small manufacturers, independent distributors, universities and hospitals.

Use incremental marketing resources to pursue other opportunities in cooperation with OEM's, software suppliers and retail stores.

PRODUCT FOCUS: High quality small interactive computer's ranging from $2,500 PERSONAL COMPUTERS to $250,000 MULTI-TERMINAL SYSTEMS linked in networks.

- Real-time and computational systems for technical applications.
- Data base, transaction and office systems for business applications.
- Graphics and network resources for all applications.

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HEWLETT PACKARD

NOTES:

BUSINESS STRATEGY FOR HEWLETT-PACKARD COMPUTERS

INGREDIENTS FOR LEADERSHIP:

Lasting Value:

- Conservative Marketing Programs and Tactics
- Highly Reliable Systems Designed for User Application Uptime
- Superior Service and Applications Support
- On-going Product Enhancements

Software Solutions:

- Friendly Products Requiring Minimum Computer Expertise
- Manufacturers Productivity Network—an integrated comprehensive set of solutions customized and installed without computer programmers.

Technology: Increase value and performance through comprehensive technology for all system elements; CPU hardware, peripherals, terminals, and data communications.

Networks and Data Communications

Graphics

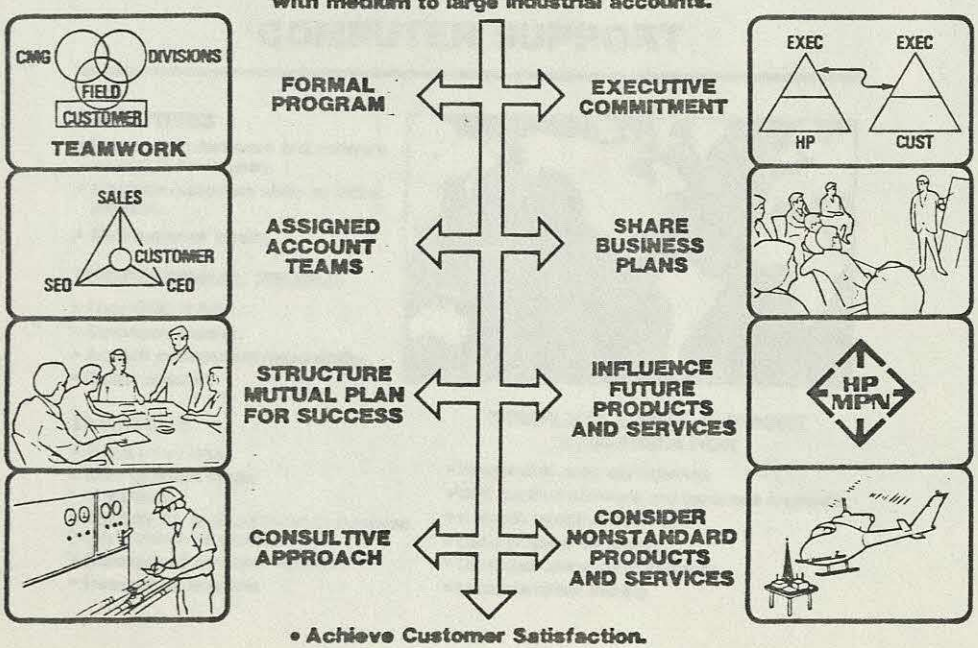
Value — Low Cost Manufacturing

Consultive Expertise

9

MAJOR ACCOUNT PROGRAM

Objective: Develop a "Working Partnership" on a worldwide basis with medium to large industrial accounts.



- **Achieve Customer Satisfaction.**
- **Earn the right to continued growth.**

The Butler Cox Foundation

10

US★81 HEWLETT PACKARD

NOTES:

WORLDWIDE FIELD ORGANIZATION

AREA COMPUTER MANAGER
220 Professionals

FIELD TACTICAL UNIT
- Customer Satisfaction
- People Development
- Business Performance

FIELD MARKETING MANAGER
- Recruiting
- Training
- Lead Generation

CONTRACTS & FINANCE REPRESENTATIVE
- Sales Finance
- Contracts
- Training

SYSTEMS ENGINEERING ORGANIZATION
55 Professionals

- Assigned Account Responsibility
- Phone-in Consulting Service
- On-Site SE Assistance
- Consulting Services
  - Performance
  - Implementation
  - Applications
- Customer Training
- Sales Support

SALES ORGANIZATION
75 Professionals

- Conservative Sales Tactics
- Consultive Approach
- Repeat Business Earned through Customer Satisfaction
- Lasting Value

CUSTOMER ENGINEERING ORGANIZATION
90 Professionals

- Assigned Account Responsibility
- Technical Specialists Backup
- Site Planning and Environment Surveys
- Installation
- Service Agreements
- Repair Center Service
- Assembly Exchange Service

11

COMPUTER SUPPORT

OBJECTIVES
- Provide best hardware and software support in the industry.
- Maximize customers ability to utilize products.
- Earn customer loyalty.

PROFESSIONAL PEOPLE
- Over 4000 in field.
- Continuous training.
- Account management responsibility.
- Career oriented.

STRATEGY
- Focus on up time.
- Offer complete range of services.
- Flexibility for each customer to purchase only services he needs.
- Standardized services worldwide.
- Personalized attention.

COMPLETE LOCAL SUPPORT ORGANIZATION
- Responsible area management.
- Well qualified software and hardware engineers.
- In-depth technical back-up.
- Local problem escalation.
- Optimized spare parts inventory.
- Local customer training.

US★81

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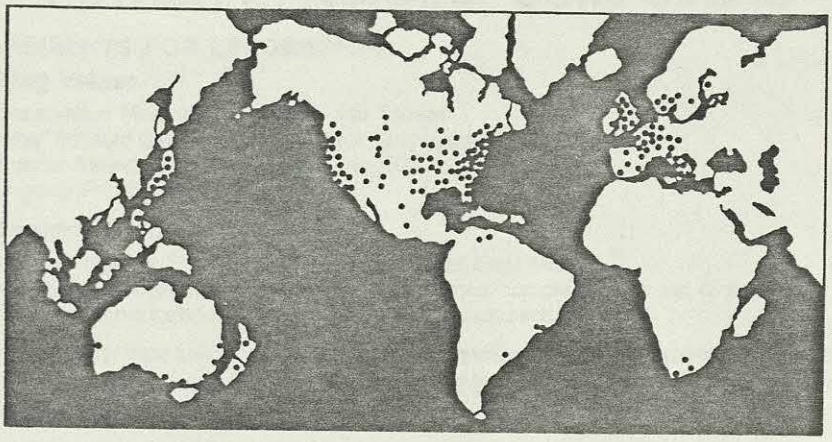

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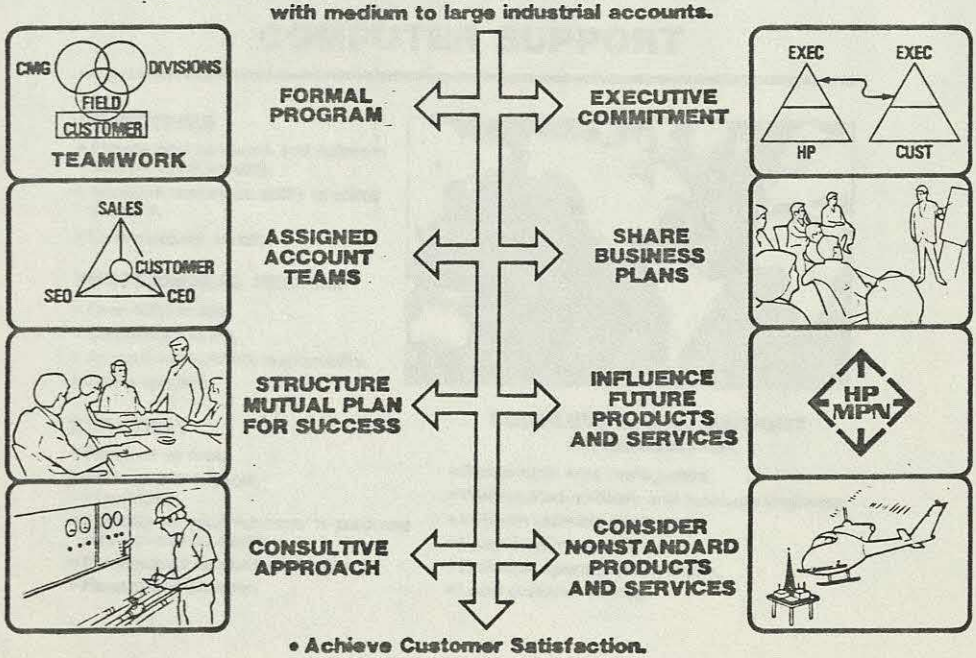

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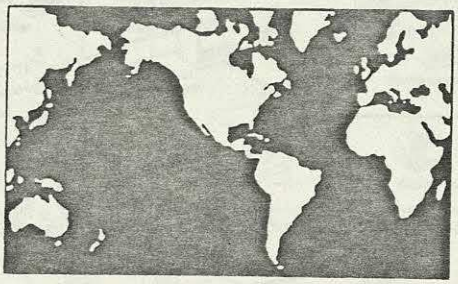

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HEWLETT PACKARD

NOTES:

Manufacturer's Productivity Network

QUALITY AND PRODUCTIVITY THRU LINKED SOLUTIONS

OPERATIONAL PLANNING & CONTROL SYSTEMS

- Materials Management
- Production Management
- Cost Accounting
- Quality Management
- Sales/Service Support
- Distribution
- Order Processing

ADMINISTRATIVE & OFFICE SERVICES

- Financial Management
- Personnel & Payroll
- Document Management
- Decision Support
- Word Processing
- Electronic Mail

HP MPN

FACTORY & PLANT AUTOMATION

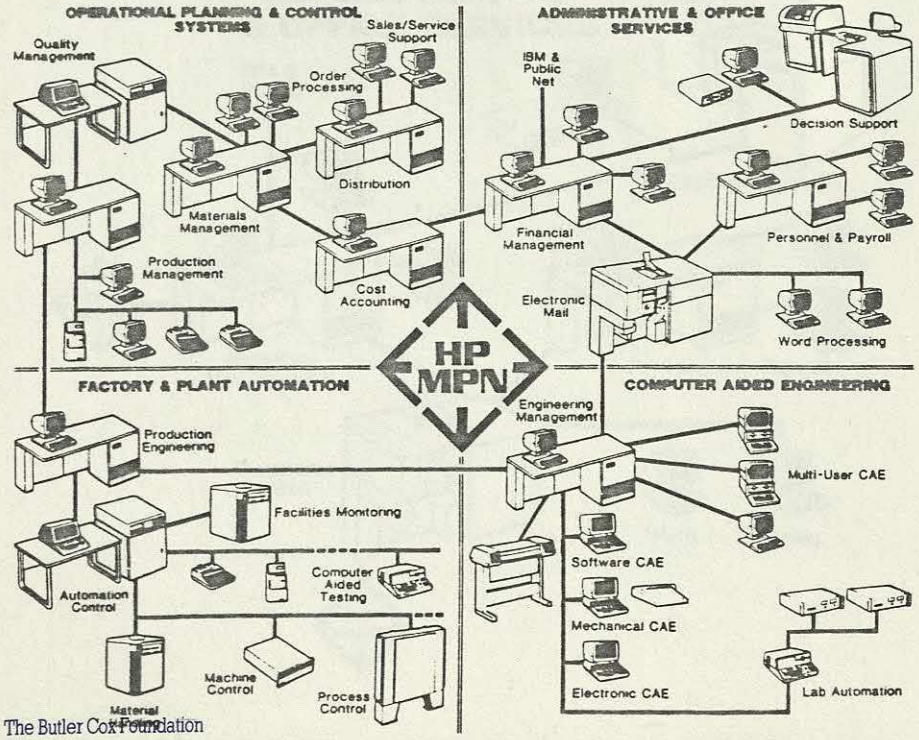
- Production Engineering
- Automation Control
- Facilities Monitoring
- Material Handling
- Machine Control
- Process Control
- Computer Aided Testing

COMPUTER AIDED ENGINEERING

- Engineering Management
- Electronic CAE
- Mechanical CAE
- Software CAE
- Laboratory Automation
- Microprocessor-Based Design

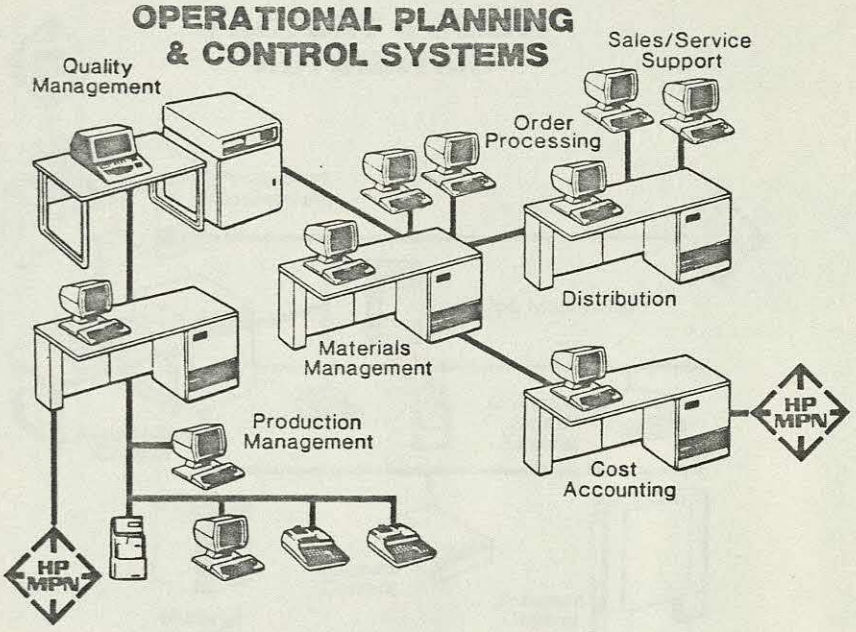
13

MANUFACTURER'S PRODUCTIVITY NETWORK



US★81
HEWLETT PACKARD

NOTES:



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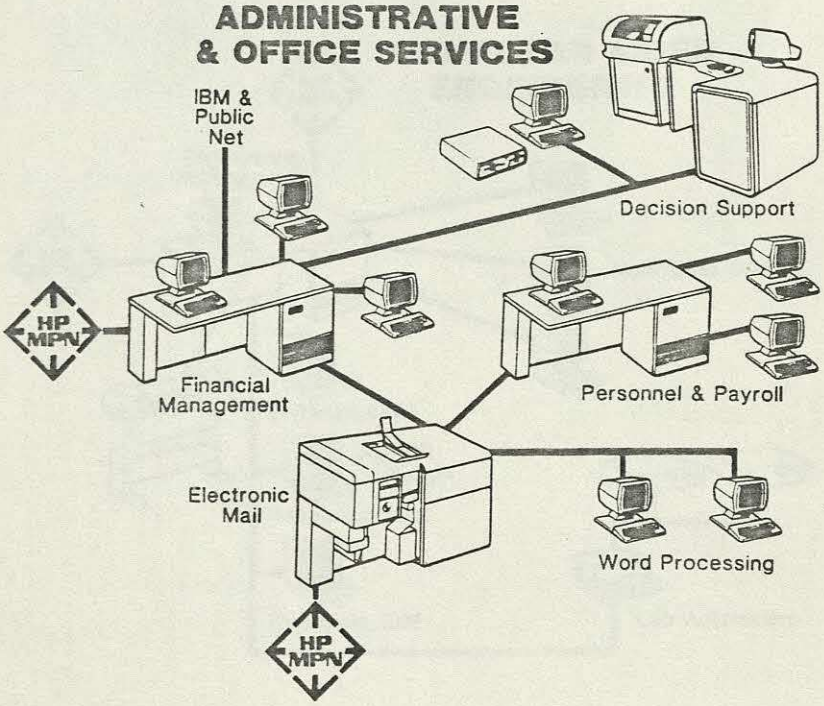
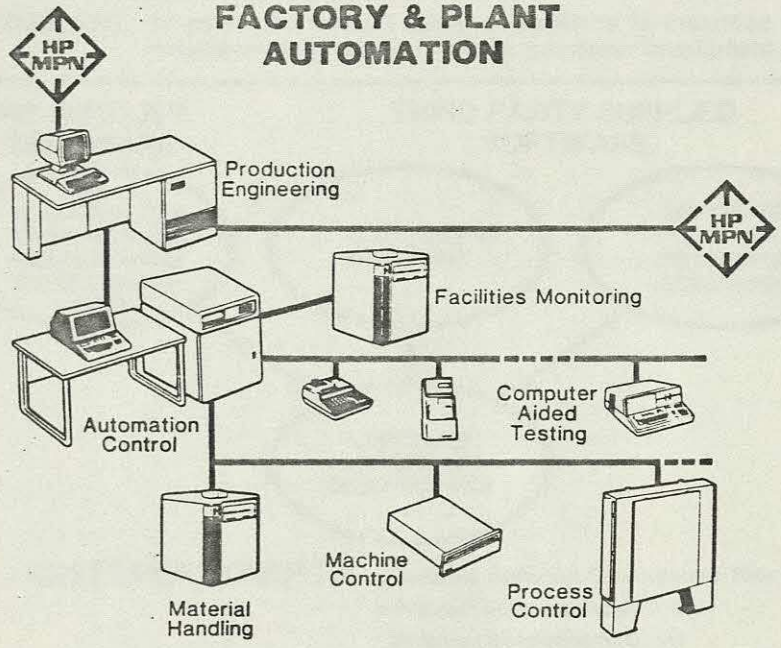


16

US★81 HEWLETT PACKARD

NOTES:



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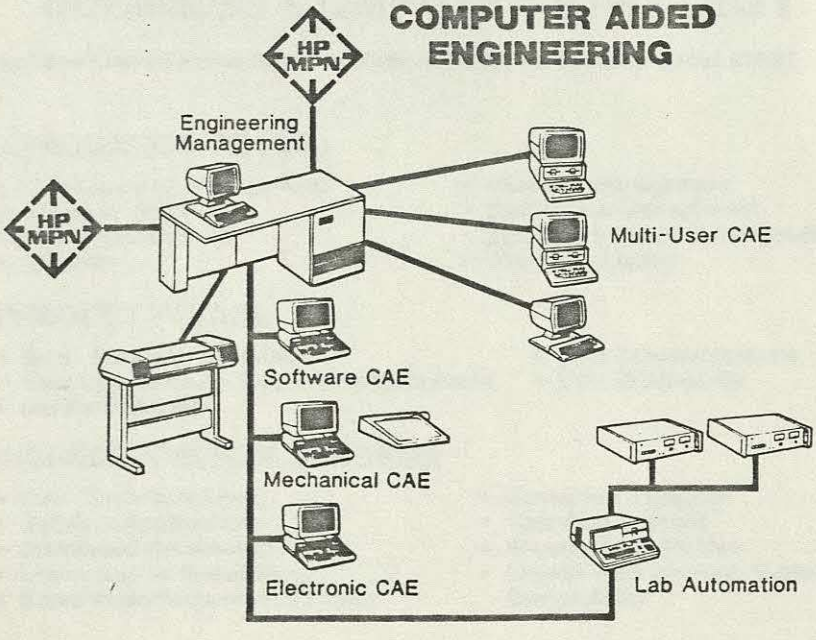
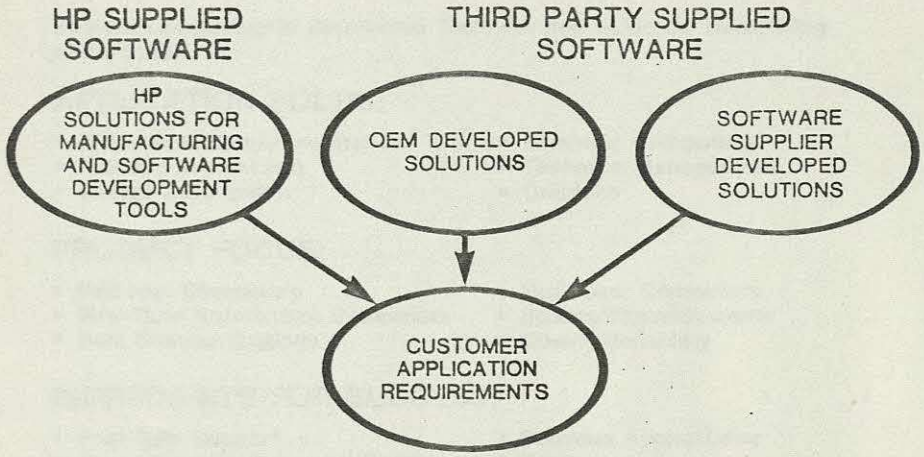


18

NOTES:

THIRD PARTY PROGRAM

OBJECTIVE: To make the widest range of solutions to maximize the usefulness of our customer's computer investment.



CUSTOMER BENEFITS:
- Reduced Software Development Time
- Reduced Implementation Cycle
- Reduced Maintenance Costs
- Reduced Risk with Proven Software

19

BUSINESS COMPUTER STRATEGY

Achieve Leadership in Small to Medium Business Systems under $100K

APPLICATION FOCUS:

- Manufacturing Management
- Business Analysis
- Office Applications
- Graphics
- Financial Management
- Distribution Management
- EDP Applications Development
- Word Processing

PRODUCT FOCUS:

- Small Business Systems
- Multi-User Medium Size Business Systems
- Quality/Reliability
- Data Communications
- User Productivity

INGREDIENTS FOR SUCCESS:

- Data Communications
- Software Applications
- Distributed Processing
- Leadership In Networking
- Broad Price/Performance Family
- Consultive Expertise
- Post Sale Support
- Friendly/Easy To Use
- Growth Path Through Systems Compatibility

NOTES:

TECHNICAL COMPUTER STRATEGY

Achieve Leadership in Distributed Technical and Scientific Computing under $100K

APPLICATION FOCUS:

- Measurement/Instrumentation
- Industry Automation
- Design Automation
- Scientific Computing
- Technical Management
- Graphics

PRODUCT FOCUS:

- Personal Computers
- Real-Time Automation Computers
- Data Communications
- Multi-User Computers
- Boards/Boxes/Systems
- Quality/Reliability

INGREDIENTS FOR SUCCESS:

- Post Sale Support
- Broad Price/Performance Family
- Leadership In Networking
- Friendly/Easy To Use
- Software Applications
- Technology
- Consultive Expertise

21

DATA TERMINALS STRATEGY

Achieve Leadership in the Computer System Terminal Support Area

APPLICATION FOCUS:

- Data Entry/Retrieval (Transaction Processing)
- Design/Automation (CAD/CAM)
- Word Processing
- Increased Operator Productivity
- Graphics (Data Display/Analysis)
- Increased System Performance

PRODUCT FOCUS:

- Low to Medium Cost Data Processing Terminals
- Word Processing Terminals
- Graphics Terminals
- Quality/Reliability

INGREDIENTS FOR SUCCESS:

- Data Communications
- Full HP Systems Compatibility
- Distributed Intelligence
- Post Sale Support

NOTES:

PERIPHERALS STRATEGY

Achieve Leadership in a Broad Range of Low to Medium Cost Computer Support Peripheral Products.

APPLICATION FOCUS:

- Graphics
- Data Storage & Retrieval
- System Support

PRODUCT FOCUS:

- Input/Output Devices
  - — Printers
  - — Plotters
  - — Discs
  - — Magnetic Tape Drives
  - — Digitizers
- Quality/Reliability

INGREDIENTS FOR SUCCESS:

- HP Systems Support
- Post Sale Support

23

INSTRUMENT STRATEGY

Maintain Leadership in Electronic Test/Measurement Instruments and Systems.

APPLICATION FOCUS: Emphasis on Automation

- Scientific, Research, and Engineering Measurements
- Production Test, Measurement and Control
- Sensor Based Data Acquisition
- Electronic System Check-Out and Monitoring
- Maintenance and Calibration

PRODUCT FOCUS: Comprehensive Product Line

- Versatile, Automatic, High Performance Instruments
- Enhanced Value Through Computer System Compatibility
- Complete Test and Measurement Systems
- Quality/Reliability

INGREDIENTS FOR SUCCESS:

- Technically Superior Instrumentation
- Instrument/Computer System Compatibility
- Consultive Measurement Expertise
- Post Sale Support

US★81

Notes on presentations made by
Amdahl Corporation on 5 October 1981

I. INTRODUCTION

(Presented by John C Lewis, President).

Amdahl reached their eleventh anniversary as a company during the Butler Cox Foundation visit.

As a company Amdahl have aimed their products at the large computer user market and this will remain their main area of interest.

II. FINANCIAL UPDATE

(Presented by Douglas Levick III, Senior Vice President and Chief Finance Officer).

1. The current Amdahl position was summarised as:

Systems installed	550
Customers	300
Employees	4,700
Foreign subsidiaries	12
Manufacturing locations	6
Revenues	$411 m
Profit	$ 26 m
Assets	$410 m
Equity	$250 m
Stock market value	$600 m

2. In terms of strategy, Amdahl are aiming at three main markets, namely:

   - Processors and control program software - market worth $5.5 billion and growing at 15% per annum.

- Communications - market worth $0.9 billion per annum and growing at 25% per annum.
- Some aspects of other markets (eg storage devices) - market worth $15 billion per annum and growing at 10% per annum.

3. They are operating in a market where IBM have set the de facto software standards (70% of market) and where existing user applications software represents an investment of some $300 and $400 billion in 1980.

4. Amdahl are aiming at technological leadership over their competitors (particularly IBM) and aim to achieve this by:

   - Using the most advanced technology
   - Maximising performance
   - High systems reliability
   - Upgrade flexibility

   By these means they intend to promote product comparisons (with IBM) and acceptance in the market.

5. Their R&D spend has increased significantly over the last decade and is still increasing:

   R&D spend

   $ 50 m in 1971 - 1975

   $150 m in 1976 - 1980

   $400 m in 1981 - 1985

6. Amdahl also claim that the second-hand value of their machines is typically 3 to 4 times the comparative value of similar IBM machines.

   The following comparison of IBM and Amdahl machines was given:

	Single processors			Dual processors	
	IBM 3033	Amdahl 470V/8	Amdahl 5860	IBM 3081	Amdahl 5880
Overall performance (cf IBM 3033)	1.0	1.3	2.6	2.0	4.5
Circuit switching speed (pico seconds)	1000	700	300-400	1000-1500	300-500
Number of circuits	400K	200K	300K	725K	600K
Physical Characteristics:					
- Cooling	Water	Air	Air	Water	Air
- Floor space (cf 3033)	1.0	0.3	0.2	0.8	0.4

In terms of reliability current Amdahl system availability exceeds 99% for the installed base. This is due to the technology, architecture, reliability of manufacture, diagnostics/serviceability of the equipment, and the large field service organisation.

Survey results showing greater user satisfaction with Amdahl equipment than with IBM equipment were also shown.

7. Software compatibility with IBM will be maintained.

8. Amdahl will expand from their traditional CPU base to include products such as front end processors, network support and, possibly, other devices such as storage products.

9. Pricing will be aggressive but will conform to an overall pattern. Prices will be flexible to customers' needs while holding a 20% - 30% price performance advantage over IBM. Conservative accounting practices are followed.

10. At present the company has a high shareholders equity with little debt, although debt is likely to increase to support the 580 product development. The attitude of the investor community remains positive.

11. A significant (but controlled) lease base will be maintained in future.

12. At present Amdahl is a one-product-line company and they are looking for greater financial stability in future. Within their existing product line the following opportunities were identified:

    - Potential upgrade of existing user base to more powerful machines
    - Build up the existing lease base
    - Build up maintenance/service business (currently $80 m pa)
    - Build up communications and software business (currently $30 m pa)

    In addition to these opportunities there are a number of factors which tend to work in the company's favour, namely:

    - Amdahl's improving image as a viable supplier
    - New competitor entry into the market is now more difficult than it was a decade ago due to the trend towards unbundled software (ie cheaper CPU prices) and the fact that a number of competitors are already in the market.

- Amdahl is a difficult take-over target due to two companies (Fujitsu and Heiser) owning almost half of the equity.
- The technology sharing/component supplier relationship of Fujitsu is considered to be an asset.
- Good quality people.

III. SOFTWARE STRATEGY

(Presented by Mike Berry, Director of corporate systems).

1. Amdahl may develop operating systems, data base management systems, networks, and development tools. However, this would be done selectively and they will not be developing any application packages.

2. The dominant factors affecting software developments were given as:

   - A shift in the revenue mix from hardware to software(IBM make 12% - 15% of their revenues from software and related products and this may well double over the next three years). By 1985 Amdahl and others will be providing operating systems software.
   - What can and will IBM do? Overall IBM are expected to protect their software investment and to force the pace of users upgrading software on IBM machines. The change from 3033 to H Series is expected to be 'painless' and evolutionary due to the need to protect users investment in applications software. The shift of revenue earning from hardware to software is expected to continue but IBM is not expected to become 'very difficult'.
   - What do users want to happen? Amdahl liaise with major users in the planning of future software products.
   - What is happening in the non-IBM world? Amdahl look at outside software developments to see whether software can be transferred to an IBM environment (one possible example quoted was that of Tandem type multiprocessing).

3. The Amdahl software strategy was defined under two main headings, namely:

   Defence (ie follow IBM and respond)

   - Compatible software
   - Mindful of huge user software applications investment
   - Promote Amdahl as a viable second source for software
   - Independence (ie not always follow IBM - eg VM/PE).

Forward strategy

Use software to 'pull together' the overall strategy of high performance processors, software products, communications, peripherals and storage.

There is expected to be a significant shift in Amdahl towards the development of software products.

4. The following key user criteria for software products was identified:

- IBM compatability	- this is the mainstream of the strategy, and should be relatively straight-forward to achieve
- Availability	- loosely coupled software (free standing processors 'hooked' together by software to look like a single system to the user) - simplified operating systems - 'appropriate' operating systems
- Location independence	- Access and control will be distributed - Data bases (distributed?) - problems of keeping in step - Access must be maintained continuously - Increasing communications expense versus reducing processor costs.

(But some systems management software is often missing in distributed processing systems, ie need some SNA type facilities).

- Programmer productivity	- Simpler operating systems contribute to productivity - Better design/programming tools - Maintenance tools (typically 70% of programming time is amending existing programs).

5. A software development philosophy was outlined, consisting of:

- Small teams (maximum 7)
- Simplified systems
- No restriction on innovation

6. Change in the area of software by suppliers will have to be evolutionary because of:

   - the massive user investment in applications software
   - user reluctance to 'pioneer'
   - user confidence in the suppliers' direction must be maintained.

IV. TECHNOLOGY 470 AND 580

(Presented by Dr John Foggiato, Processor technology manager).

1. Dr Foggiato described the rapid decline in cost/performance figures for chip technology over the last decade. He also described the comparative technologies used in the Amdahl 470 and the Amdahl 580 paying particular attention to the air cooling systems on the chips (cf IBM complex water cooling system).

2. In terms of relative performance the various Amdahl machines were analysed as follows:

V/7C	1.0
V/7B	1.4
V/7A	1.8
V/7	2.1
V/8	2.55
5860	5.1
5880	8.9

   (as a rough guide the V/8 is approx. 6.5 mips).

3. Amdahl design the chips and manufacturing processes for their products and then subcontract chip manufacture.

V. COMPANY REVIEW

(Presented by William F O'Connell, Jr - Senior vice president, international operations).

By the end of 1981, Amdahl will have more than 600 machines installed worldwide. More than 200 of these will be outside of

the United States, and over 100 will be in Europe. Outside of the United States, Amdahl employ about 750 people (most nationals).

Amdahl believe that IBM's announcements of the 3081 and of MVS/SP3 removed any fears that the 'H' series (and future IBM announcements) would not be compatible with existing IBM offerings. Mr O'Connell pointed out that Amdahl's 5860 was more than two times as powerful as the basic 3081 processor.

More than 50 units of the 580 will be shipped in 1982, with first-deliveries scheduled for Europe in mid 1982. Initial timing results for the 580 had been very encouraging.

Amdahl's aim is to produce the fastest general purpose computer in the world. The limiting factor is not the speed of the processor, but the speed of the cache memory, and Amdahl have the fastest cache memory. The company has a heavy emphasis on hardware R&D, although it is now making an increasing investment in software. Particular examples quoted were:

- Amdahl's own version of MVS/SP3
- Amdahl's own version of VM, which allows more than one version to be used
- the Unix-based UTS system (see Section VII)
- the new timesharing operating system being generated for Amdahl by Tom Simpson. This will provide Amdahl and IBM users with an alternative to IBM's TSO.

Mr O'Connell emphasised that Amdahl is a service company, and this means that it must understand networking, and links to the CPU (hence, the 4705 product and associated NCP software).

Amdahl had noted a recent polarisation of the market where organisations either used all-IBM equipment or all-Amdahl equipment.

VI. LARGE SYSTEMS IN THE 1980s

(Presented by Jeff Booth - Manager, advanced technology planning).

Amdahl's emphasis is on providing high-performance mainframes, system software alternatives, communications and systems maintenance and support. This is achieved by families of upgradeable models that, compared to the equivalent IBM models, provide enhancements in performance and functions, whilst both remaining compatible with IBM equipment and maintaining high residual values.

Mr Booth reviewed the relative advantages of ECL technology, MOS technology and Josephson Junction technology. He showed that although Josephson Junction offered considerable advantages in rev speed, in chip-crossing delay time, in the power consumed and in chip density, they had severe problems because of the cryogenic temperatures required. These problems made Josephson Junction technology an extremely risky technology.

The evolution of 1K RAMs, 4K RAMs, 16K RAMs and 64K RAMs was reviewed. Amdahl have determined that the point has now been reached when 64K RAMs are cheaper than 16K RAMs. 256K RAMs are now in the laboratories, and if history repeats itself, they will become economic in about three years' time. Amdahl's research effort, however, is not directed at increasing the density of RAM chips, but into increasing the speed at which RAMs can be accessed.

The implication of the advances being made in RAM technology is that mainframes will have lots of cheap main memory available, perhaps up to 100K of main memory. This increased amount of main memory will be used to close the gap between the increase in the mips rating of CPUs and the increase in DASD access times (which has been about three times less than the increase in mips during the past 10 years).

Amdahl believes that bubble memories will be used for specialised storage requirements such as 'electronic drums', DASD caches, videodisc 'staging' storage and small secondary storage devices.

Improvements in the packaging of LSI components (for example, multi-chip packages) will lead to reduced signal times, and lower manufacturing costs. Assemblies of components will become physically smaller, air will be used for external cooling. Internal cooling will be achieved through a mixture of air, liquid helium and heat pipes. The use of fibre optics or coaxial cabling will also reduce the overall physical size of equipment.

Much of Amdahl's design effort is put into automating the design process itself. They now have an integrated design facility which enables the design to be entered, simulated and tested. The layout of the packaging is then automatically produced, together with the artwork to be used for the production of masks.

Jeff Booth said that the design aims for CPUs in the late 1980s are as follows:

- 30 mips uniprocessors
- internal data rates in excess of 200 MB/sec

- channel rates in excess of 20 MB/sec
- compatability with 370 and later IBM machines
- improved system availability
- improved cost/performance
- 24-bit or 31-bit addressing (31-bit addressing has been built into the 470)
- modular architecture
- virtual machine support
- multiple processor support
- separate processors for I/O functions
- high speed links between processors.

He also highlighted the differences between the way in which a system was used in 1975, and the way it is likely to be used in 1985.

	1975	1985
Operating systems	Available to all; installed by manufacturers	Licensed use
Support	On-site programming support from manufacturers provided at no additional cost	Customer carries out front-end support, with remote software support provided by manufacturers. On-site support charged for separately
Installation	Manufacturers installed equipment	Some hardware will be 'plugged in' by the customer
Software/ hardware interface	Well defined	Dynamic
System software	IBM's	Increased dependence on 'PCM' software

Jeff Booth sees distributed processing consisting of three elements:

- individualised processes in terminals
- unattended distributed processes
- very large computing complexes.

The central complexes will be used to manage databases.

In order to be in a position to provide complete networking services, Amdahl have recently acquired the Tran Corporation. Amdahl's networking strategy will be based on the following:

- digital communications
- protocol transparency
- support for X.25, OSI and SNA protocols
- Add-on components for protocol converters, message store-and-forward, voice, computing, facsimile etc.

In summary, Jeff Booth said that the industry trends during the 1980s would be as follows:

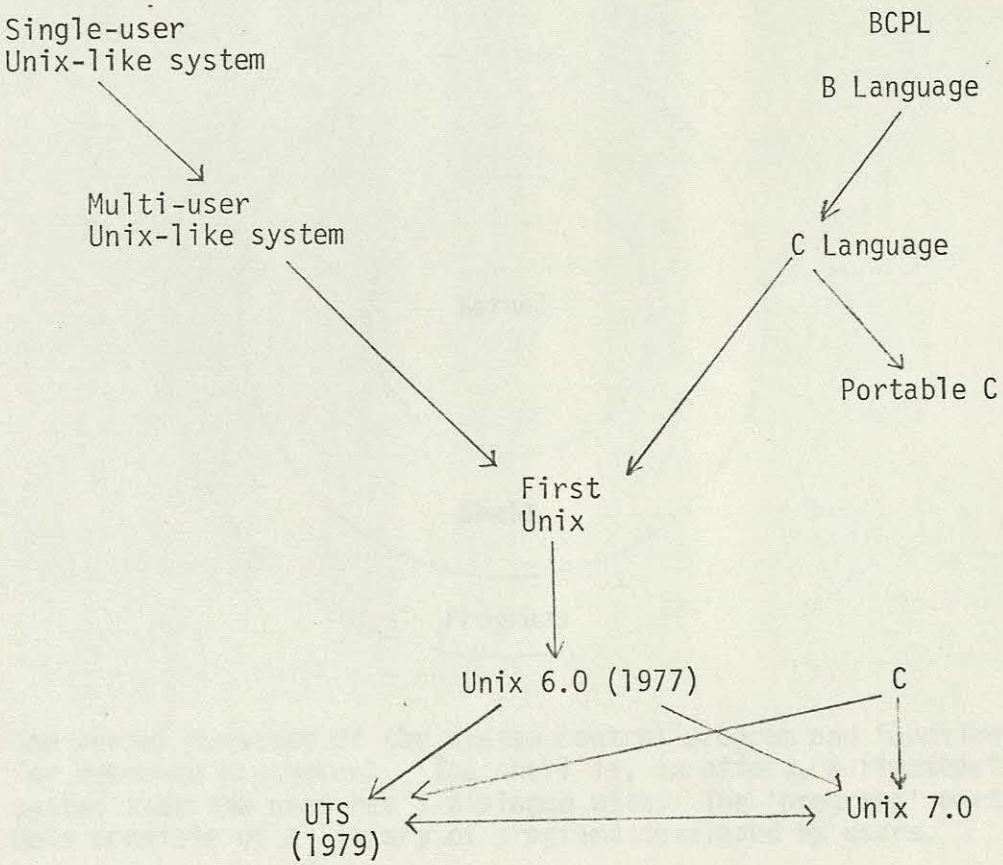
- an increasing market share for the 370 PCMs
- CPU performance would continue to increase at about 19% pa
- price/performance would continue to increase (it increased by 400% between 1975 and 1980)
- reliability would continue to increase
- operating systems will be charged for separately
- there will be periodic increases in program product licence fees
- PCMs will provide both hardware and software products
- the application backlog will increase
- there will be a greater use of application packages
- there will be an increasing use of remote hardware and software support facilities
- manufacturers will charge for on-site programmer support
- users will play a greater role in maintaining equipment
- digital communications will become widespread
- there will continue to be a lack of communications standards

- more data will be distributed for local use
- satellite data communications will become common
- there will be a multitude of vendors in the communications market offering a diverse set of products and series.

VII. UNIX AND UTS

(Presented by John Mangold - Manager, software marketing)

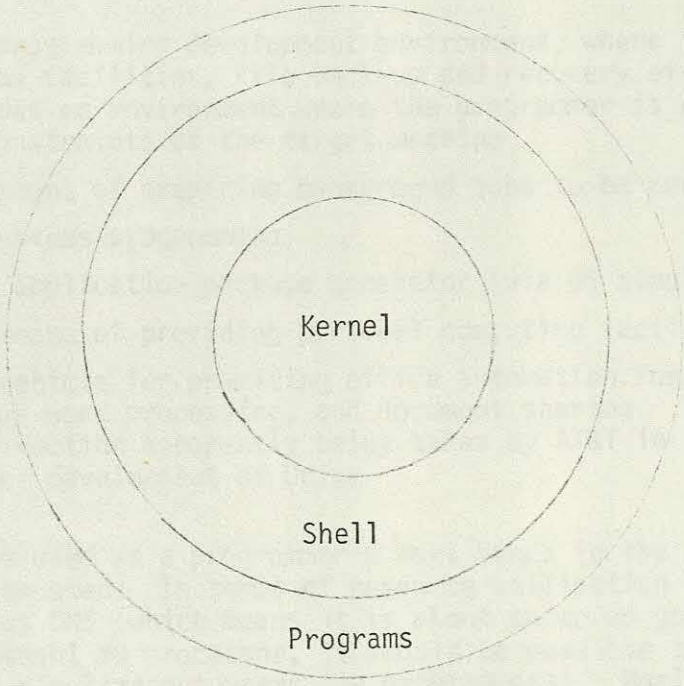
The first version of Unix was developed by Ken Thompson at Bell Laboratories in 1971. The subsequent development of Unix (and of the C language in which it is written) were represented diagrammatically as follows:



Unix provides:

- a structured programming interface
- a general facility for creating processes
- a hierarchical file and cataloging system
- a powerful command language.

It uses the pipe concept, where 'data' travels along a pipe. At junctions of the pipe, there are processes which act on the data. Conceptually, Unix consists of three parts: Kernel, Shell, and programs (see diagram below):



The kernel consists of the system control program and functions for resource management. The shell is, in effect, a timesharing system that the user has a dialogue with. The 'programs' part of Unix consists of a library of programs developed by users.

Files (which can be data, or source code, or object code), are structured in a traditional hierarchical tree manner. Each file has a security matrix, which is established and maintained by the file 'owner'. This matrix controls the access to the file by other Unix users.

The advantages of Unix are as follows:

- it provides program portability from one machine to another
- it enforces a standard programming style
- it facilitates multi-process sessions
- it helps in the management of large programming projects
- it provides a user-friendly system for programmers to use.

UTS is Amdahl's own implementation of Unix, designed to run on 370-type mainframes. (Unix from Bell Laboratories runs on PDP 11 equipment). UTS is available to Amdahl users, and will soon be available to non-Amdahl (ie IBM users). It can be used in the following ways:

- as a programming development environment, where it provides mailbox facilities, file back-up and recovery, etc. It provides an environment where the programmer is unaware of the constraints of the target machine
- as a means of preparing background jobs to be run
- for systems programming
- as an application package generator (via OS simulation)
- as a means of providing personal computing facilities
- as a vehicle for providing office automation functions, such as word processing, and document sharing. This is the direction apparently being taken by AT&T in their further development of Unix.

UTS can be used as a programmer's work bench in the same way that Unix can be used. In terms of resource utilisation it is about the same as CMS (which means it is about twice as good as TSO). With an Amdahl V8 processor, it should be possible to support about 300 simultaneous users (ie programmers). Worldwide, there are about 2000 users of Unix. UTS itself consists of about 250,000 lines of code.

Notes on visit to Rolm Corporation on 6 October 1981

I. THE ROLM CORPORATION

(Presented by Robert Maxfield - Founder, Executive vice president Rolm Corporation)

Rolm was founded in 1969, and its original business was in building ruggedised minicomputer systems for use in a military environment. In 1973, when it looked as if the military market might be limited, Rolm sought to diversify, and, at that time, the idea of putting a computer into a private branch exchange (PBX) seemed worth exploring. Rolm's first computerised private branch exchange (CBX) was shipped in April 1975, and sales revenue from telecommunications products was $243m in the year ended June 1981. (The military business has, however, also continued to grow. It currently stands at $50m p.a and is growing at 30% p.a.).

The original CBX was an exchange designed to handle between 100 and 800 extensions, but the range of CBX products has now been enhanced as follows:

1977	:	SCBX	(80 to 200 lines)
		DSCBX	(20 to 150 lines)
1979	:	VSCBX, VLCBX	larger versions, handling up to 4000 lines

Total corporate sales will be $295 p.a and are growing at 71% p.a. Net income is growing at 80% p.a.

Models in the range are fully compatible with each other (for example, 90% of the printed circuit boards are common to all models). This compatibility means that it is easy for companies either to install larger CBXs as their needs grow, or to install different sized CBXs at locations with different requirements. Rolm provides powerful networking software to interlink multisite CBXs. This software is being continually enhanced, and it currently includes about 200 features covering functions such as:

- Remote monitoring
- Telephone moves and changes
- Extended toll restrictions
- ACD traffic measurement
- Management reports
- Data communications (introduced recently)

The recently announced data communications features permit asynchronous terminals to interconnect via the CBX at up to 19.2 K bit/s.

Rolm now see the CBX providing a migration path to the office of the future, where the CBX would integrate the various types of electronic communications found in offices (public telephones, data networks, voice networks, computers, terminals, word processors and facsimile).

The advantage of this approach is that it provides built in redundancy and reliability together with integrated control and reporting facilities. It also provides the ability to put a terminal on everyon's desk.

By the mid to late 1980s, Rolm expect revenue from non-voice telecommunications products to be equal to that from voice products.

II. CURRENT TRENDS IN THE US MARKETPLACE

(Presented by Richard Moley - Vice president markets group)

The US interconnect marketplace can be represented as follows:

	1970	1980	1985
No. of PBXs	180,000	250,000	300,000
New shipments	16,000	27,500	37,500
Total market ($m)	$1,300	$2,500	$4,000
Interconnect share	4%	35%	50%
Interconnect market ($m)	Small	$900	$2,000

Richard Moley outlined the reasons for this spectacular growth in the interconnect market. The regulatary constraint was removed in 1968 (the Carter phone decision), and since 1975, the FCC (Federal Communications Commission) have actively supported the Caterphone decision. The FCC have now ruled that AT&T must establish an 'arms-length' deregulated subsidiary to provide terminal equipment (ie interconnect will now be the norm). This subsidiary is expected to be trading by the summer of 1982, and it will be created by transferring some 20,000 employees and $2 billion of assets. One unresolved issue is the extent to which Bell will be able to cross-subsidise the non-voice services provided by the new company.

Another factor in the growth of the interconnect market has been the growing awareness of large organisations of the size of their communications costs and the opportunities to reduce them. Long distance telephone rates in the US rose substantially in July this year, adding a total of $1.6 billion dollars to Bell's income. One company (GE) estimates that its long distance cost have risen by $75 million.

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The future trends that Rolm see are:

- Private networks will become more important (including microwave, CATV, and fibre optics networks)
- Local telecommunication costs will rise sharply
- Industry-specific equipment will become available
- Some traditional telecommunications suppliers will be replaced by new entrants from the data processing and office quipment suppliers
- IBM are expected at some stage to enter the US PBX market
- Office automation will be a vital ingredient

III. OFFICE AUTOMATION/INTEGRATED VOICE-DATA NETWORKS

(Presented by James Kasson - General Manager, vice president office systems division).

In the next ten years, office communication systems are going to be both pervasive and diverse. There will be an increasing number of systems functions, and the automated services will become indispensible. Thus absolute system reliability will become an essential feature. The diversity will come about from the different (and largely incompatible) communications facilities that will be used:

- Terminals
- Local-area networks of various types
- Public and private networks
- Specialised service, such as SBS, XTEN and SPCC
- Interfaces to computer equipment
- Teleconferencing
- Interfaces to word processors and database management systems.

There will therefore be a huge requirement to interconnect devices with different communication characteristics. Rolm's view is that this interconnection can best be done through a device such as the CBX - i.e to use the CBX as a means of integrating voice and data communications.

Some of the benefits of integrating voice and data communications with a CBX can be quantified in terms of the cash savings that can be achieved. For example, resources (such as printers ports, databases and modems) can be shared. Other benefits, which come from enhanced facilities provided by voice-data integration, are less easy to justify (for example desk-to-desk electronic mail, and voice annotation of documents).

There are three ways in which the various elements of office communications can be interconnected:

1. Computer/computer connections (The IBM-approved way!

The disadvantages of this approach are well known (it is not flexible, it is extremely inefficient in its use of resources - particularly if all the computers have to carry out protocol conversions; it is difficult to interconnect computers from different vendors.)

2. Baseband local-area networks

This approach is suitable for bursty unpredictable traffic loads, and it can be used for high-speed communications over short distances (for example, for linking computers to peripherals). However, the approach of using an Ethernet-type network as the backbone of office automation has several drawbacks:

- Reliability, redundancy and fragility issues (if the cable is accidentally bent, the communications can be corrupted)
- Lack of privacy (each terminal can talk to every other terminal)
- Lack of standards (The existing Ethernet standard defines only the first two protocol levels, and Intel, DEC and Xerox are taking different approaches for higher level protocols)
- Limited bandwidth
- Limited number of terminals (when the number of terminals increases, the bandwidth available decreases)
- High interface costs, even with LSI components
- High installation costs (Baseband networks are not suitable for voice traffic, which is not bursty, and is highly predictable. A local network therefore has to be installed in addition to the telephone wiring.).

Local networks use packet switching techniques which build an unpredictable delay into the delivery of the packets. This delay is not acceptable for voice communications.

3. Circuit switching PBXs (The Rolm approach

Rolm believe that this approach is the only way of achieving truly integrated office systems. The approach provides one switching matrix, one controller, and one set of wiring. It also provides ample bandwidth. (Twisted pairs can easily operate at 1.544m bit/s, for which there is a CCITT standard, and AT&T have a standard for 3m bit/s.)

A PBX used to integrate office communications should have the following features:

- Digital switching
- Controlled by software, so that functions can be changed as requirements change
- Upwards compatible with other PBXs in the range
- Complete redundancy
- Remote maintenance
- Comprehensive administration functions

Mr Kasson showed that it is sensible to base the integration of office communications on voice equipment. Even by making generous assumptions about the amount of communication traffic generated by word processors, database accesses, facsimile, etc, voice traffic is still likely to account for about 80% of the bandwidth requirement.

Voice-data integration does not necessarily imply the use of digital telephony (at the hand set). The analogue voice signals can be digitised by a codec in the PBX, and Rolm's view is that digital handsets are more expensive than the traditional analogue handsets, and they provide no increase in the quality.

Rolm see the role of their CBX as the integrator of office communications. Rolm will not necessarily provide a full range of office automation equipment, such as computers, electronic messaging systems, terminals, word processors, etc.

Questioned about the relative merits of broadband local-area networks, Mr Kasson agreed that some of the constraints of the Ethernet-type approach no longer apply. The interface costs are, however, still very high. Rolm see broadband networks as being suitable for specialised requirements (particularly video communications). Mr Kasson was, however, not certain that there was a demand for such services, particularly for switched services.

IV. ROLM IN THE INTERNATIONAL MARKET PLACE

(Presented by Laurent Mayer - Manager, market development international telecommunications division).

Mr Laurent reviewed Rolm's progress in (and plans for) providing equipment outside of the United States. Much of the ensuing discussion focused on Rolm's relationship with Plessey in the United Kingdom.

The Plessey PDX is designed and built by Plessey, but using technology licensed from Rolm. There is therefore no guarantee that the PDX will be compatible with the CBX. There is no joint development between Plessey and Rolm, although they do exchange ideas. Office automation equipment provided by Plessey for use with the PDX may not necessarily be compatible with the CBX (or vice-versa).

Apart from one special case, Plessey do not sell in the UK equipment built by Rolm. This special case applies to ACD (automatic call direction) equipment which is being purchased by several UK companies for a specialised task.

In Australia, Plessey have sold the Rolm CBX, even though their own PDX was available. The PDX was too expensive compared with the CBX.

Notes on visit to IBM, San Jose on 6th October 1981

(Presented by Larry Mark, Product Consultant, Executive Briefing Centre)

I. INTRODUCTION

The history of disc and non-impact technology development at San Jose was described. The existing IBM organisation, products and locations were then outlined as shown below:-

	DP Product Group	Hardware	Software	Location
(1)	General Technology Division (GTD)	Logic circuits memory circuits	-	East Fishkill Burlington Essonn Yasu
(2)	Systems Communication Division (SCD)	Terminals controllers Distributed (81XX)	VTAM,NCP, CICS, DPPX/DTMS	Raleigh Kingston Hursley La Gaude Fisisawa
(1)	Data Systems Division (DSD)	Large CPU's (30XX) memory channels	MVS/TSO VM/CMS RACF	Poughkeepsie
(2)	System Products Division (SPD)	Intermediate CPUs 43XX memory, channels	VS1 DOS/VSE DOS/DL1	Endicott Charlotte Boeblingen
(1)	General Products Division (GPD)	DASD Tape/Libraries Non-impact printers	IMS/DD Languages VSPC/VSAM/ DF HSM DCF/DLF	San Jose Tucson Santa Teresa

The recent re-organisation announcements are expected to combine those divisions marked 1 into one group (called the Information Systems and Technology Group) and those divisions marked 2 into a second group (called the Information Systems and communications group will also include the office products and systems division).

In the USA one IBM representative will cover the full range of IBM products.

II. STORAGE PRODUCTS AND DEVELOPMENTS

1. The customer requirements for storage products developments were outlined as:-

   - More data on line
   - Managed Data (Storage management system & better utilisation)
   - Optimised performance
   - Environmental (Reduced power consumption, reduced space needs)
   - Reduced price of storage

2. The ideal directions for future storage devices were given as:-

   - Single level storage (ie transparent CPU/storage interface - change CPU and only need to change microcode)
   - 'Infinite' capacity
   - Fast
   - Self-managed
   - Always available
   - Inexpensive
   - Low space requirement
   - Low power requirement
   - etc.

3. Bubble memory storage is not likely to be competitive with discs for at least a decade, although it is being used for specialist applications in defence, space, etc.

4. The next development step will be to automate manual procedures use storage devices more effectively and increase operational control.

5. The 'life cycle' of data was described as:-

   Create - Control - Relocate - Retire - Delete.

6. The total market for on-line storage devices is growing at a compound rate of 45% per annum.

7. The IBM 'total storage management concept' is aimed at providing a software controlled means of migrating data to the appropriate data storage media, depending primarily on the frequency of access. (For example, infrequently accessed data may be migrated to tape or mass storage, whereas archival material which becomes more frequently used might be migrated upwards onto disc). This concept also covers new higher performance back-up and recovery utility tools.

8. In practice the 'total storage management concept' will be met by:-

   - Storage products (main store, fixed head storage, disc, tape and mass storage)
   - Storage planning (what data goes where)
   - Storage programs (backup/recovery, etc)

9. HSM is the IBM concept for handling storage planning and storage programs.

III. TECHNOLOGY

1. The 3380 disc storage system was compared with the 3350 disc system. In essence, the 3380 was described as faster, physically smaller and requiring less power. The 3380 will be able to run alongside existing storage systems by using speed matching buffers.

2. The 3380 is a sealed unit which may not be adjusted on site - any problems will result in the unit being returned to IBM for repair.

3. The 3375 disc storage system was compared (favourably) with the 3340 disc system.

4. The 3880 Mass Storage device was also described and compared (favourably) with the 3850 mass storage device. The overall advantage of mass storage units is that they provide large on-line (but slow) storage facilities at a fraction of disc storage costs. The 3880 was expected to be shipped 'next month' in the USA.

5. Videodisc storage is not expected to become a significant storage media in the next decade. This is due to:-

   - Problems of impurities in the discs
   - Problems caused by repetitive reading with a laser effecting the surface.
   - The read-only nature of videodiscs necessitates a low cost before they become economic.

   By the time these problems are overcome the recording density of conventional discs will be equal to that of videodiscs.

6. Further technical details are contained in the IBM 'Disc Storage Technology' brochure.

Notes on Presentations made by
IBM on 7th October 1981

I. LARGE SYSTEMS

(Presented by Charlie Tuller, IBM Poughkeepsie)

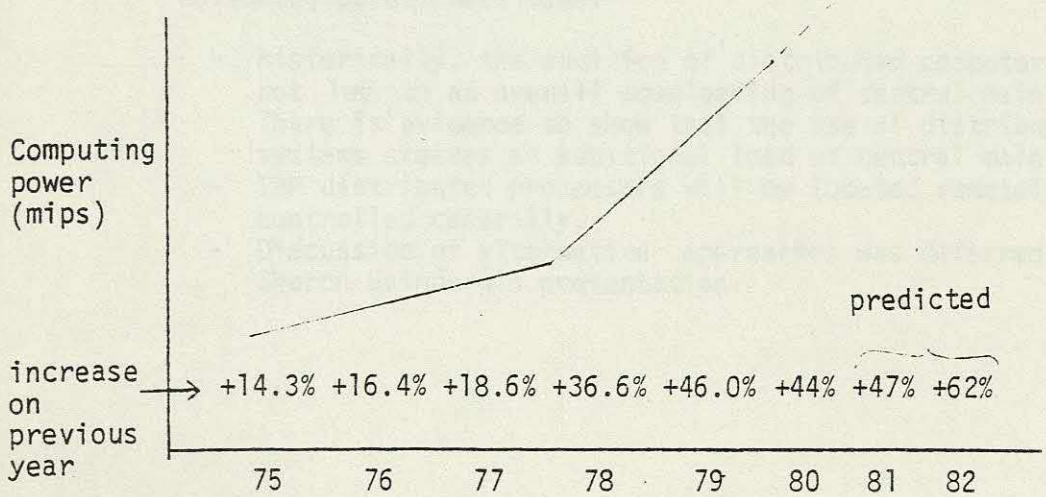
1. The trends in hardware cost distribution were shown as follows:-

	% of Hardware costs
IBM 3033	TP 37%, CPU 37%, I/O 26%
IBM 3081	TP 60%, CPU 24%, I/O 16%
later in 1980's	TP 69%, CPU 15%, I/O 16%

2. The increasing shift in computer systems expenses towards people costs was illustrated by the following comparisons:-

	1978	1979	1980
Applications Programming	31%	34%	40%
Operations, Systems programming	15%	14%	13%
Supplies	5%	5%	5%
Equipment (including software)	49%	46%	40%
overall % increase on previous year	-	+18.6%	+18.3%

3. The growth in installed IBM Computing power was shown as:-



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The significant rise in the growth rate in 1978 was due to the impact of increasing on-line usage within the prime 8-hour working day. This disrupted the previously established and more balanced machine utilisation and resulted in more computing power being purchased to meet the peak load demand.

4. This 'compression' effect resulted in much shorter capacity lives for installed computers before they had to be upgraded (typically 2½ years).

   Also, many DP managers were put under serious internal pressure because of increasing budgets and inaccurate forward plans.

5. The IBM strategy to overcome these problems is to make their medium/large machines easier to upgrade. In particular, new products will be introduced to:-

   - provide small turn key systems below the 4300 range (4311,4321?)
   - fill the gap between the 4300 series and the 3033 series
   - expand the 3081 series upwards by a power factor of 250% - 300%.

   One operating system will apply to all machines from the low level 4300s right up to the largest 3081 series machines. This will allow application programes to be retained as upgrades are made. The wider range of machines in each series is expected to extend the time period before a major upgrade to typically four years.

6. Architectural extensions to the 3081 series are planned but this will not violate the existing application structure. New functions in software (HSM, VTAM, CICS, IMS) will allow existing applications to be tolerated while exploiting features of the new architecture.

7. In a discussion of IBM's distributed processing philosophy the following points were made:-

   - historically, the addition of distributed computers has not led to an overall downloading of central mainframes. There is evidence to show that the use of distributed systems creates an additional load of central mainframes.
   - IBM distributed processors will be located remotely but controlled centrally.
   - Discussion of alternative approaches was deferred to Sharon Weinberg's presentation.

II. DATA SYSTEMS DIRECTIONS

(Presented by Sharon Weinberg)

IBM's data systems strategy encompasses the management of databases and the way in which terminals are used to access those databases. Much of the presentation was concerned with the way in which IBM's soon to be announced relational database product will meet what IBM believes are their customers' requirements for data systems. These requirements have been formulated as a result of a survey carried out amongst 100 large IBM users.

In particular, IBM's relational database product will complement (and not supersede) the existing IMS DL/1 offerings. IBM will is well aware that it must provide a development path that allows users to protect their investment in existing applications software. IBM's view is that IMS DL/1 applications will still be running at the end of the century.

IBM has itself been using System R (which is the prototype version of the relational product) for five years. Query-by-Example and SQL/DS are direct spin-offs from System R.

Many IBM users have substantial investment in applications based in IMS DL/1. These applications mostly deliver operational data to senior management. IBM see the relational product being used to deliver tactical information to middle managers and strategic information to top management.

IBM do not intend to provide a bridge between the relational product and Ansi/Sparc databases, because it does not believe that the Ansi/Sparc standard will be widely used. IBM's view is that the relational produce may in fact negate the need for the Ansi/Sparc standard.

Notes on Presentations made by Lexar on 8th October 1981

(Presented by Gil Pringle, Director of Product Marketing).

I. INTRODUCTION

Lexar, which orginated within the Citicorp organisation, has recently been taken over by the United Technologies group. This change has enabled Lexar to market its product, a voice and data switching PBX, which was launched in the USA two weeks ago. (Launch in Europe is being considered).

II. NEEDS AND LIKES (VOICE)

The following list of 'needs and likes' for voice communications were given:-

Needs
- Telephone in every office
- Flexible extension arrangements
- 'Least cost' routeing (administer trunks etc)
- Station message detail recording (accounting and control)

Likes
- Standard station wiring
- Digital technology and quality
- Enhanced features (e.g camp-on, hunt groups, etc)
- Non-blocking architecture

III. NEEDS AND LIKES (DATA)

A corresponding list of 'needs and likes' for data communications were also given:-

Needs
- Dedicated computer ports
- Modems for external connections
-

Likes
- Ability to switch data connections
- High throughput
- Call detail recording
- Pooled modems
- Redundancy protection (in case of breakdown)

IV. UNKNOWNS

In the marketplace a number of unknowns were identified as shown below:-

Customer unknowns
- Size of organisation
- Computer and terminal equipment
- Data applications
- Extension and trunk requirements
- Required features
- Floor plan and building space
- etc.

Industry unknown
- Transmission characteristics (CCIS, X25, etc)
- Data applications
- Manufacturer interfaces
- Standard protocols
- Typical bandwidth
- Non-wire facilities
- Private network support

In the context of these unknows, Lexar have designed their product to be flexible enough to cope with changes.

V. THE LEXAR LBX ARCHITECTURE

The LBX (voice & data switch) architecture contains:-

- Integrated voice and data
- Universal ports and wiring (two twisted pairs). The 72 Kbps/port bandwidth is divided to provide 56 Kbps for digitised voice information and 16 Kbps for data and control information (9,600 bps). This arrangement allows voice and data to be transmitted down one line (two twisted pairs) at the same time. However, if data transmission only is required on one line, up to 64 Kbps may be made available.
- A non-blocking matrix, using a time-division multiplex(TDM) switch, (e.g a 400 station switch can carry 400 simultaneous voice and data conversations).
- Modular architecture, consisting of processor module, tape module, port module and power module. This architecture allows a four hundred station switch to fit into a single cabinet. The system is expandable by additional cards and additional cabinets.
- Centralised computer control consisting of:-
  - Software configuration control
  - Networks facility control (automatic rate selection)
  - Centralised management reporting
  - Centralised diagnostics and maintenance
- Shared resources consisting of:-
  - Universal ports and wiring
  - Single equipment cabinet, small floor space, simple environment.)
  - Call detail recording, voice and data
  - Software diagnostics
  - Processor, memory and matrix redundancy
  - Battery backup
  - Administrative control
  - Traffic reporting and analysis
- Shared voice / data station features
- Transparent transmission, non-blocking at all baud rates, call and protocol insensitive, application independent. (Note: asynchronous protocols are handled at present but synchronous protocols are not yet provided for).

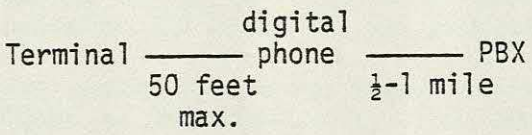
VI. ADVANTAGES OF TRANSPARENT TRANSMISSION

The advantages of transparent transmission to the user were given as:-

- not paying for unnecessary conversion capabilities
- not dependent on Lexar for applications development
- not limited to specific hardware manufacturers
- not constrained from using future technology and applications

VII. PHYSICAL LINKAGE

The Lexar concept allows terminals to be plugged (via jackplugs) into Lexar-provided digital telephones. The digital telephones are then connected to the voice/data PBX, allowing simultaneous voice and data switching.



Where data only transmission is required a modified digital telephone is used in place of the digital phone.

VIII. OTHER POINTS

1. Cost - Approximately $1,000 per line.
2. Local-area network interfaces are planned.
3. A telex interface is being studied.
4. Voice store-and-forward is being studied.
5. A typical lifetime for depreciation purposes was given as 5 to 7 years (due to replacement technology making it economical to change then).

Notes on the presentation by (and on behalf of) Delphi Communications Inc. on 8 October 1981

I. COMPANY BACKGROUND

(Presented by Larry Lolito - vice president, marketing)

Delphi was formed in 1972, and it is now part of the Exxon communication group. In 1978, the company built its first 'breadboard' voice store-and-forward system, and in 1976 the first Delta I system was installed in San Francisco. The Delta I has been used to provide a prototype telephone answering service. In 1980, the first production telephone (Delta) II was installed in Los Angeles, and in 1981, the voice message service (also based on the Delta II) was announced.

The Delta system is a large communications engine that is designed to integrate voice, text and image (facsimile) information. It provides store-and-forward facilities and can be used both in the private and public domain.

Delphi is marketing the Delta system to large companies (Fortune 500), Common carriers (ie PTTs) and organisations who will use the system to provide a service. Delphi itself operates a voicebank service using the Delta system in Los Angeles. Because the Delta system is in fact, a powerful computer system, it could also be marketed as such.

The Delta is not a small system. It can consist of up to 32 processors and have up to 4000 terminals attached. It is designed to provide a high level of availability - the aim is for not more than 15 minutes of downtime a year (including maintenance, reconfiguring, etc).

II. DELPHI'S VOICE BANK SERVICE

(Presented by Bob Manning)

Voicebank is essentially a tool for providing high-level store-and-forward telephone answering services for small businesses. (In the United States, there are 3.5 million companies with fewer than 20 employees, and these companies account for nearly 50% of the voice telecommunications market). For many years, the telephone answering service (TAS) industry has provided a basic service to such companies and these services have been provided by a multitude of small centres run very much as a cottage industry. The Delta switch has been designed to provide a shared-resource service that can provide a much more sophisticated service.

Delphi's first voicebank service was its experimental service in Brisbane, San Francisco. The experiment has been successful in proving (and subsequently modifying) the hardware and software and has shown how automated telephone answering services business should be handled. It has also enabled Delphi to develop new products based on the Brisbane experiences. The Brisbane system now services 2900 accounts, and handles 400,000 calls per month.

When a call is made to a subscriber's number, the call is automatically re-routed to the Delta system. When one of the many voicebanks operators answers the call, the CRT is front of her provides information about the called party (ie voicebank subscribers) and the salutation to be given. The Subscriber can leave instructions in the system, telling the operator how to respond to particular enquiries or callers. The operator stores the incoming information in the system, so that when the subscriber calls in later (perhaps to a different operator) he can have his messages (or a list of callers) read out to him.

A videotape showing the type of services provided (and the problems solved by) voicebank was then shown.

III. PACIFIC TELEPHONE COMPANY'S VIEW OF DELTA

(Presented by Bob Jordan)

On Bell's long distance network, 31% of all calls made are answered. If this could be reduced to 30% Bell's revenues would increase by $200m pa. Thus from a telephone company's point of view, sophisticated telephone answering services are very important.

Bob Jordan positioned automated telephone answering services (such as those provided by the Delta system) in relation to the automated 'office of the future'.

Voicebank is used by Pacific when an office's own switchboard operator is away from work. It takes about four minutes to establish the automated link to voicebank compared with the on-going problems of trying to hire and a temporary switchboard operator.

Half the calls to a telephone answering service are from subscribers enquiring about their messages. In many respects TAS is therefore an electronic mail system. Bob believes that the market for voice communications will explode in the near future and that voice message systems will be central to the automated office. The TAS

industry will evolve from being a cottage industry to one where large centralised resources will be shared by many subscribers. On average a subscriber pays $45 per month to use voicebank.

IV. DELPHI'S VOICE MESSAGE SERVICE

(Presented by Larry Lolito)

The elements of a voice message system were identified (answering, sending, and retrieving, together with help facilities), and Delphi's plans for using the Delta system to provide a voice message system were outlined. The touch-tone keys of a standard telephone handset will be used to input codes that will enable the subscriber to listen to messages, to save messages, to clear messages from the system, etc. Instructions for using the keys in this way are set out on the telephone handset (eg *1 to listen, *7 to clear, etc).

Delphi have demonstrated that the Delta system can also be used to store and forward image (facsimile) information.

Notes on presentation made by LBCI
on 9 October 1981

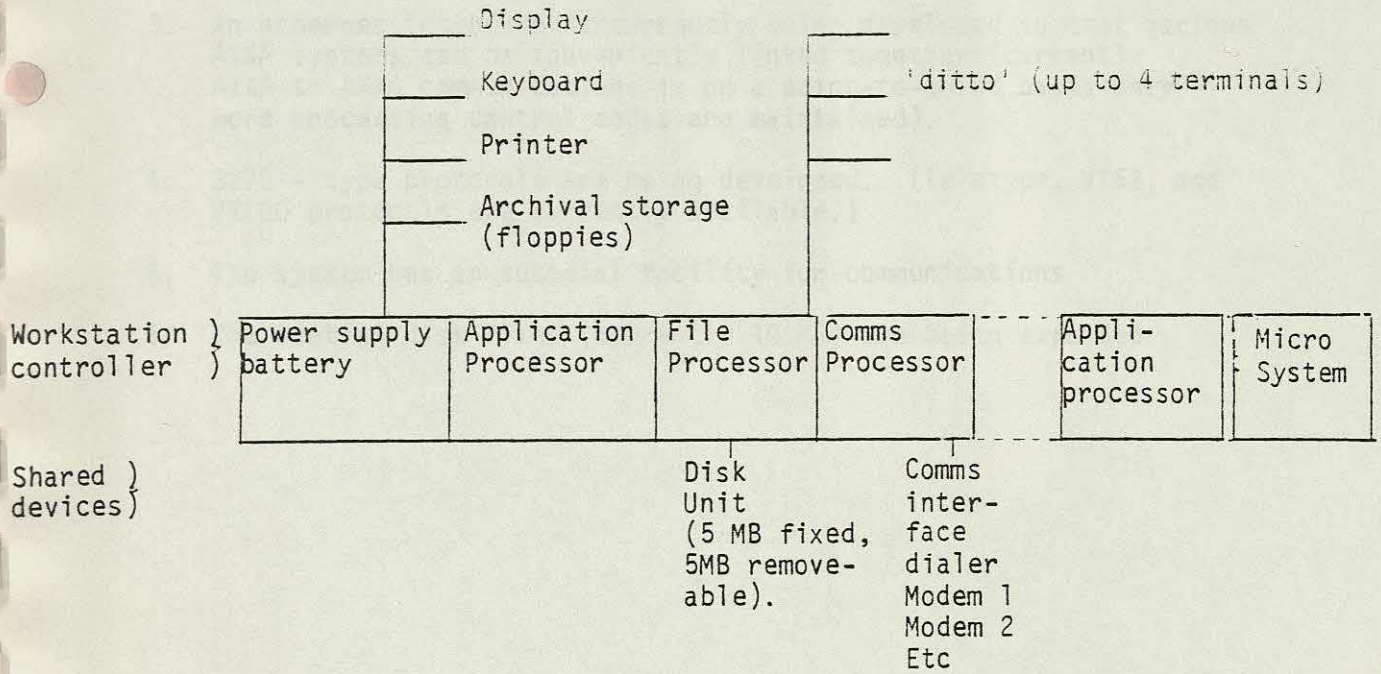
(Presentation by Al Hartung, General Manager)

I. INTRODUCTION

The AXXA manager/secretary terminal system was developed within the Citicorp organisation and has not so far been launched onto the market. However, take-over negotiations are currently under way and it is likely that the product will be launched in the USA within the next year. Over one hundred systems have been installed in Citicorp locations. Each system has 2 to 4 terminals and is designed to link a manager and his secretary together using electronic facilities for communications, storage and retrieval of information.

II. FACILITIES

The AXXA system consists of between two and four terminals/keyboards, 10 MB central disk storage, optional archival (floppy disk) storage, and daisy wheel printers. The architecture was schematically shown as:-



III. FEATURES

Current features of the AXXA system were given as:-

- electronic mail containing features for timestamp, sort, file, electronic wastebin, managers in-box, electronic out-box, etc.
- calendar (diary) facility
- links to host computers and outside services (currently only teletype protocols are available).

- remote access. A teletype terminal (ASCII) can link into AXXA from remote locations
- Word processing. The moveable vertical/horizontal screen allows documents to be created in either plane. Word processing is based on 20 functional keys (rather than menu type facilities) including modified key (next page, next document etc) and an 'oops' key
- Graphics capability. Histograms and graphs may be generated from raw data onto the high resolution screen
- Keyboard search and retrieval facilities
- Password security
- Storage of keystroke sequences
- a 'help' key

A number of these features were demonstrated to members.

IV. OTHER POINTS

1. Cost - a typical four terminal system currently costs about $56,000 but this is likely to be reduced when the product is launched and quantity manufacture begins.

2. No OCR links are yet available.

3. An ethernet interface is currently being developed so that various AXXA systems can be conveniently linked together (currently AXXA to AXXA communications is on a point-to-point basis only - word processing control codes are maintained).

4. 3270 - type protocols are being developed. (Teletype, VT52, and VT100 protocols are currently available.)

5. The system has an autodial facility for communications

6. The central disk files (currently 10 MB) are being expanded

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Notes on visit to Tandem Computer on
7 October 1981

(Presentation made by Charlie Ryle)

I. COMPANY BACKGROUND

Company founded	:	November
Product announced	:	December 1974
First shipment	:	May 1976
Revenue growth	:	$600,000 in 1976 to more than $280 million in 1981
Pre-tax profit	:	Currently running at about 21% or 22%
Revenue per employee	:	$106,000 pa

Tandem is an 'end-user oriented' company. It does not use intermediaries but sells direct to users. Breakdown of revenue in 1980:

Marketing	29%
General admin	5%
R&D	8%
Operating profit	21% (pre-tax)
Cost of revenues	37%

Because of the emphasis on marketing, about 80% of employees will be out in the field.

II. PRODUCT HISTORY

The Tandem NonStop computer system was first shipped in 1976, and since then it has been enhanced as follows:-

1978: Peripheral devices were available, as were Cobol and Fortran Compilers.

1979: The Expand networking capability was introduced (including X.25 interfaces), and the Enform query language was introduced.

1980: The Encompass database management system was introduced.

1981: The NonStop II computer was introduced.

Tandem design and manufacture all their own boards, CPUs and software. Peripherals are bought in.

There are now 407 customers with about 700 or 800 Non-Stop systems (between 30% and 35% are outside the United States). The major marketing effort is aimed at large companies and in the United States about 90% of the customers are Fortune 1000 companies. The systems are used in many different industry sectors, including banking, manufacturing, service bureaux, Frederal government, etc.

III. PRODUCT STRATEGY

The NonStop system is aimed at the on-line transaction processing marketplace, where a transaction is defined as an event that enters the system from outside the inter-connects with a database, causing a subsequent action (delete, add, etc.) Such systems need to be:-

- Available continously (for example, airline systems).
- Capable of graceful expansion, either into a larger single system, or into a network of processors.
- Able to provide data integrity (for example, banking systems).
- Provide programmer productivity (because of the shortage of skilled staff).
- Provide good operational performances (ie fast-response time).

IV. HARDWARE DESIGN

All hardware components are at least duplicated (processors, buses, controllers, discs, power supplies and files). The NonStop system is therefore single-fault tolerant, and all components can be replaced while the system is running. Additional processors can be added to a system, and each processor adds 85% of the power of the original two processors. The power of the NonStop system ranges from the equivalent of a 370/148 to a 3033 AP. The corresponding price range is from $350,000 to $4 million. Only 18 different printed circuit cards are used through the whole range. The mean time between complete failures of the system is calculated to be 108 years.

V. GUARDIAN OPERATING SYSTEM

The Guardian operating system allows processes in one processor to communicate with processes in another processor. The operating system co-exists in all processors.

The Guardian/Expand facility allows a network of systems to be interconnected by communication links. Processors can then communicate with other processors in remote systems. Tandem has its own in-company network of systems spanning several European and United States sites.

There is no network manager as such. Each system talks to its immediate neighbours about what it knows. If one system goes down, the total system will automatically reconfigure itself.

VI. ENCOMPASS

Encompass is a distributed data management system built on the relational database model. This permits data to be distributed across several physical locations. Encompass consists of four elements:-

- Terminal and tranaction control
- Data and messaging definition
- Transaction and auditing backout
- Report writing and query

VII. SOFTWARE DEVELOPMENTS

There are 150 programmers who use TAL (Tandem Application Language) to develop software. TAL (which is similar to Algal and PL10) is available to users, but in the main users prefer Cobol. All code generated for the NonStop system is re-entrant.

VIII. INTERNATIONAL OPERATIONS

Tandem has 15 offices in Europe, as well as offices in the Far East, Middle East and Australia.