MARCOM INCORPORATED

MARCOM INCORPORATED ▫ 30 EAST 42ND STREET, NEW YORK 17, NEW YORK ▫ OXFORD 7-7185

July 20, 1965

Mr. Prescott Behn
Digital Equipment Corporation
146 Main Street
Maynard, Massachusetts

Dear Mr. Behn:

Enclosed you will find two copies of our proposal for "A Study of Marketing Opportunities for the PDP-6." The study outlines the specific objectives that will be satisfied as well as our approach to the development of answers to your various problems.

We have quoted a fixed price for the total study including all expenses.

I am listing the names of three of our clients in order to facilitate your review of our qualifications. They are:

1) Mr. Richard Barnes
General Electric
570 Lexington Avenue
New York, N. Y.
Plaza 1-1311

2) Mr. Paul Gillease
E. I. duPont de Nemours
Wilmington 98, Delaware
(302) PR 4-5954

3) Mr. Marshall Brittain
Westinghouse Electric
Building 601
R&D Center
Pittsburgh 35, Penna.
(412) 242-1500

If you require any additional names or information, please feel free to contact me.

Thank you very much for this opportunity to submit our proposal and for the courtesies that you and your associates extended to me during my recent visit.

Sincerely,

Martin L. Ellis

Martin L. Ellis
President

MLE/pk
Enclosures

A STUDY OF MARKET OPPORTUNITIES

FOR THE PDP-6

PREPARED FOR

DIGITAL EQUIPMENT CORPORATION

Submitted by:

Marcom Incorporated
July 20, 1965

I INTRODUCTION

The Digital Equipment Corporation is engaged in a major company program to sell large scale, modular scientific computer systems. The company is currently selling the PDP-6 for time sharing, on-line and standard scientific computations applications. Selling efforts have been particularly successful in one specialized application market - film reading. DEC would like to duplicate this success in other application areas.

The company recognizes the need for a systematic investigation of the whole scientific computation area in order to determine those specialized applications and computation functions that would be most competitively - and profitability - served by the characteristics of the PDP-6. DEC has requested Marcom, Incorporated to submit a proposal to conduct a study program to accomplish these objectives. The specific results of this program will be a practical, profit-priented PDP-6 marketing program for the Digital Equipment Corporation.

The characteristics of the PDP-6 system lend themselves to the requirements of the most up-to-date scientific computational requirements. The system is particularly capable of accomplishing time sharing of scientific computational problems, as well as general business data processing. In effect, this means that the system is in a position to be utilized in a variety of scientific and business-type applications. But it is also more probable that the PDP-6 system is better suited for some applications than others and perhaps uniquely suited for a few applications with, hopefully, many unit systems required. The identification of these latter application areas is the ultimate objective of this study program.

The data processing requirements within scientific and technological disciplines has obviously increased almost immeasurably during the last decade. However, the quality and quantity (i.e., capacity requirements) of data processing capability has varied considerably among these disciplines and technologies. The requirements of and stimulus from applied nuclear physics, for example, influenced a whole generation of data processing equipment. Large scale, high computational speed, central processors have been developed specifically for applications in this area: Iterative partial differential equations, Monte Carlo techniques and random number generators. The development of more widely accessible program languages and economics effected through the further development of computer technology has increased the points of computer time requests at any single scientific data processing facility. However, the availability of computer time for any single user at a facility is highly dependent on the techniques and practices developed within the individual scientific or technical discipline for the use of electronic computers. The number of individual users, the size of any one user's problem, the type of computational requirement all affect the establishment of computer organization to satisfy all users of a facility.

The economic availability of time sharing capability in modular scientific computer systems is a practical answer to the computer needs of many such users. The degree of acceptance of this approach is only partially determined by the processing needs of the user and the system's capacity limitations. Among factors influencing users are economically competitive systems alternatives, biases among application areas and within them, degrees of sophistication among users in each application area, and the competitive strengths and weaknesses of individual EDP equipment suppliers.

Within the last several years, many highly researched scientific fields that have hithertofore not availed themselves of computer capability have begun to do so. The economic availability of computer time and, most important, the transference of personnel and techniques from one discipline to another have influenced this trend. This is particularly the case in the social sciences and for the bio-medical areas. Higher education is another example of this.

These areas are all characterized by many potential users and many potential applications. In bio-medical research, many experimental areas are capable of computational fulfillment by both independent data processors and time shared systems, depending on location and transmission facility within a group of users. Within one large medical research unit, it is entirely possible to have many presently computerized or potential areas of data processing: assistance in electrocardiological analyses, electroencephlogram analyses, in retinal studies, and other physiological research. Clinical usage of on-line computers is also a distinct possibility, albeit not at present an economic one. Several possible time-sharable clinical functions are (1) on-line data monitoring and procedural assistance in the operating room; (2) monitoring of intensive ward patients (post-operative care); and (3) processing medical data for diagnostic purposes to name just a few.

The extension of quantitative methods of analyses in the social sciences have made further demands upon computer facilities within institutions of higher learning. In colleges and universities it can be said that the data processing market has grown both vertically and horizontally. Vertically, in that mathematically-oriented physical sciences that make heavy use of computers are doing so at earlier levels of instruction, and horizontally, in that other

departments within the university that have never before used computers are beginning to do so. Witness the extension of an on-line GE 225 system to twenty five input/output terminal units dispersed throughout Dartmouth College. A more complex version of the same approach is Project MAC at MIT; or an industrial version of this at the Bell Telephone Laboratories.

In several technological areas there has been a tendency, perhaps due mainly to insularity, to build special purpose devices for the accomplishment of specific tasks. Control instrumentation has until recently been an example of this. The recent availability - within the last three or four years - of inexpensive digital computing elements has promulgated the computerization of hundreds of special purpose devices which in many cases operate in the same facility. An example of this may be found in industrial test laboratories where gas-chromatographs may operate side by side with spectrophotometers or scintillation counters; each instrument independently contained though assisted by limited computational capability.

The development of individual task computations along these lines is, of course, no accidental matter. Economic availability of computer elements coupled with demands for increased analytical results from tests stimulated their incorporation in instruments. Traditional methods of operation among users of this equipment reinforced a "unitized" approach. Thus, technical considerations in themselves cannot give a total indication of user requirements or equipment acceptance.

Several major advances in the state of computer sciences have rendered the use of large scientific systems in a "time-sharing" mode both feasible and

economic. The cumulative effect of this progress has resulted in significant reductions of price/performance ratios. Now, additional application or problem areas that previously could not be solved for either technical or economical reasons can be accomplished. However, the manner in which a system is used is materially affected.

From the user's point of view, time-sharing is desirable. In effect, a number of remote users with differing problems are able to take advantage of the power of the central computer facility. This allows them to utilize all of the expensive specialized units at the central site, as well as all its programming aids and software packages. This service is provided to the remote user on what appears to him to be on a "real time" basis. In this manner, regardless of a user's time requirement he is able - on a demand basis - to utilize the system.

There has been several major technical developments which affect the application of systems in a time sharing mode. These systems are by their nature real time oriented requiring memory-protect. The integrity of competiting programs are now guaranteed while these are internally stored. In addition, these systems normally have sophisticated instruction repertoires with a number of instruction for advanced data handling. This allows for the efficient performance of the editing function required in most data processing, as well as performing the computing required in other problems.

Another advance used in this mode is the ability to address large main memories and to function in a variety of interrupt states. The decline in circuit and memory costs over the past few years has enabled system designers to incorporate these features. These features improve the systems thruput and extend application to larger problems.

Improved I/O control, and the availability of a hierarchy of memories, also, have extended the application of time sharing systems. Through the use of these storage devices, programs, data, and compliers are easily accessible to the system. The speed of compiling, is improved. Recent developments in terminal devices are aiding in the application of these systems. Devices differing in price, flexibility, and function are now available. Display units are beginning to be used in both business, and scientific applications. The mumultative effect of these developments has been to materially improve the user-machine communication; and to thereby improve the thruput of systems.

Recent improvements in the capability, as well as the efficiency of compilers, executive routines, and programming aids has materially contributed to making time-sharing a feasible and economic method of computer application. In this mode, it is necessary while relocating programs and data to be constantly optimizing the use of the system while servicing a variety of remote communications units.

Technological factors in themselves cannot give a total indication of user requirements. The technical availability of a system or a component need not be economically feasible in some situations, nor what is more important, commercially acceptable. Users as well as computer manufacturers are often poor judges of their market's requirements, judging from past experience. This is also evident by the kind of assignments Marcom is given by manufacturers, particularly efforts to assist them in gaining information of the systems needs and formats of their equipment users.

We have found that major industry market segments must be carefully analyzed in order to determine, on a practical application level, their systems requirements. Each major market segment, for example the bio-medical market, is, in reality a series of sub-markets. Each sub-market must be analyzed in order to determine difference in systems requirements and rate of commercial development.

The basic benefits of the proposed study will be a realistic assessment of the direction of product needs and market opportunities for the PDP-6, in the highly complex, interrelated, and fast moving scientific field. The background given above points out only several of the major factors that may influence the opportunities for DEC. A large number of other factors must also be considered and related in this study. This points to the difficulty of investigating many largely unexplored application areas.

In the remainder of this proposal, we show how Marcom Inc. will approach the study of the objectives, the proposed methods of the study, the time and cost; and the qualifications of both our organization and its individuals for this work.

II SCOPE OF THE STUDY

The basic objective of the proposed study is to determine the specific market and applications areas that offer opportunities for the sale of the PDP-6. We can group several broad areas of investigation and their specifically related sub-objectives so that each group can be accomplished in a related fashion. These objectives are in effect the questions proposed by DEC in its work statement.

1. Determine the markets and applications for the PDP-6.

   1.1 Isolate and assess specific applications and functional markets for the PDP-6.

   1.2 Estimate the size of each market segment.

   1.3 Determine the rate of growth of each segment.

2. Examine the marketing factors affecting the sales potential of the PDP-6 in selected markets.

   2.1 Identify the applications requirements for computer users which favor time sharing systems; and the acceptability of this systems approach.

   2.2 Review the reputation of DEC and of the PDP-6 system among users and potential users.

   2.3 Determine the applications and software support requirements (including literature) for successful market penetration.

   2.4 Determine the suitability of the PDP-6 at its present price and with a price increase of 25% but with standard leasing terms.

2.5 Analyze the buying practices in the selected markets including discounts, buying terms, purchasing influences and methods of buying.

3. Analyze the role of the competitors that are important in each market segment:

360/40, 50
SDS ?
CDC 3200, 3400

3.1 Identify the strategy of each competitor.

3.2 Evaluate the marketing strategy of competitors.

3.3 Evaluate competitive equipment and pricing.

4. Review the technical requirements that the PDP-6 must satisfy to compete successfully in the selected markets.

4.1 Describe the general specification for the hardware and software required to compete effectively.

4.2 Assess the timing for introduction of a PDP-6A at a price reduced by one third but with existing performance speeds and fewer features.

4.3 Determine the importance of the 36-bit wordlength in the selected application areas.

5. Determine the importance of leasing of computers in the selected markets.

5.1 Assess normal lease life in these markets.

5.2 Describe manufacturer's experience with computer returns and examine the potential for resale of computers in the selected markets.

5.3 Appraise the importance of leasing to making sales in the scientific market.

6. Recommendations will be developed for the following:

6.1 The specific market and application areas that provide the most profitable opportunities for the PDP-6 during the next three years.

6.2 The marketing strategy that DEC will have to follow to achieve maximum penetration (and to improve its competitive reputation and position) in the selected areas.

6.3 The equipment, software and support programs that are necessary for DEC to compete effectively in the selected markets.

6.4 The timing of an introduction for a lower cost PDP-6A, and the features that such a system will require for effective market penetration.

6.5 The need for a lease-sale program and, if required, the best sources and terms for money to support a lease-sale program.

III DISCUSSION OF THE OBJECTIVES

The broad areas of investigation outlined above provide both the objectives for the study and the specific project results that Marcom Inc. will provide. Each broad area will be discussed in its approximate order of accomplishment. The following is a statement of the task sub-objective of the study.

1. Determine the Markets and Applications

Within the broad market areas (industrial, government, military and non-military and education) all major scientific applications areas will be identified. Within these identified application areas, the characteristic functional tasks performed will be collected. The task "mix" will be determined. The potential applicability of time sharing systems for each application area will be assessed (sub-objective 1.1).

It is important to recognize the interdependance of the marketing and competitive factors in the selection of applications areas for the PDP-6. These influences, discussed below, will be analyzed prior to the final selection of appropriate applications areas.

Based on the potential applicability of PDP-6 to the user's task "mix", those areas most suitable for market penetration will be identified. An individual marketing estimate will be developed for the selected applications as far as this is practicable (sub-objective 1.2).

How many "selected markets"

The factors that will influence the rate of growth of applications over the next several years will be isolated. Such factors may involve changes in the number of potential users in a facility, the increase or decrease in computational and data storage requirements, the changes in the kinds of applications and the attitudes of potential users. The significant factors will be identified and integrated into a generalized pattern of sales influences in each market segment to a rate of growth for each application market (sub-objective 1.3).

2. Examine the Marketing Factors Affecting the Sales Potential of the PDP-6 in Selected Markets

The marketing factors that will affect acceptance of the PDP-6 will be derived from an analysis of the field interviews. User applications that favor time sharing as well as user attitudes toward time sharing will be determined (sub-objective 2.1). These general attitudes will be related to attitudes expressed toward the reputation of DEC and the PDP-6 and the degree of familiarity with the system will examined. This information directly impacts the selling effort and will provide useful information for planning the advertising and sales promotion campaigns for the PDP-6. It will also develop by-product information for training of field sales personnel. These data will be obtained during the field interviews. It will be summarized into a representative review of DEC's reputation and the PDP's reputation among users, non-users and those who have chosen some alternative system (sub-objective 2.2).

The software support, application packages and literature required to support selling effort in the selected markets will involve determining the minimum degree of support required to compete, and the additional capabilities needed to provide marketing advantages (sub-objective 2.3). Since the growth of time sharing systems sales is related to software availability, this aspect of study assumes considerable importance.

The importance of price elasticity on the sales of computers in the various sub-markets will be examined. Determination of the importance of the price involves correlating factors such as the funding source, previous expenditures for accomplishing the data processing function, operating program needs and traditional practices of the facility. Representative facilities will be studied in order to develop general conclusions concerning price and specific suitability of the present price of the PDP-6.

The general conclusions about price elasticity will aid in determining possible acceptance of a 25% price increase for the PDP-6 with standard leasing terms (sub-objective 2.4).

The buying practices in each market segment will be examined during the field interviews and from data in Marcom's files. Discount practices and buying terms vary in each market sector. Through education these practices can have a significant impact on the profitability of a sale. The role of each of these factors may influence the final selection of markets. Conclusions concerning these factors, as well as the purchasing influences and usual methods of buying, will be examined (sub-objective 2.5).

3. Analyze the Role of the Competitors that are Important in Each Market Segment

The role of competitors, such as G.E., IBM, Burroughs, CDC, and SDS as well as other appropriate systems manufacturers, will be identified through interviews with data users and potential users. Data will be collected on how the competitors have approached the markets; what they are offering; how they are providing educational support; their discount practices and their software services. The identification of sales strategy (sub-objective 3.1) will then enable Marcom to evaluate the effectiveness of current marketing activities (sub-objective 3.2). The interviews will also provide the price information to determine DEC's relative position (sub-objective 3.3) in the competitive heirarchy.

4. Review the Technical Requirements That the PDP-6 Must Satisfy to Compete Successfully in the Selected Markets.

Upon completion of the above task objectives Marcom will be in a position to describe the general specifications for both hardware and software (sub-objective 4.1). The development of specifications involves the synthesis of data concerning user needs and competitor systems offerings. During this phase the importance of the 36 bit wordlength (sub-objective 4.3) will also be examined. The viability of offering a PDP-6A (sub-objective 4.2) will be determined simultaneously with the above. The timing of such an offering is dependent on the isolation of markets that will not buy at higher prices, the rate of growth of such markets, and on the planned actions of competitors. Marcom will utilize the data generated previously and its experience in arriving at this judgement.

5. Determine the Importance of Computer Leasing in the Selected Markets

The select sample computer users will be examined to develop data on leasing practices. This data as well as historical experience in other phases of the computer market will be analyzed to determine the normal lease life (sub-objective 5.1). This survey data and interviews with companies in the used computer business will be used to determine the potential for resale of returned computers (sub-objective 5.2). The data developed in the analysis buying practices (sub-objective 2.5) will be reviewed to determine the importance of leasing as a sales tool (sub-objective 5.3).

The above is an outline of some of the work tasks that Marcom will pursue during this study. It also provides an indication of the scope of the study and the interrelationship of the various objectives. The results of the study will be the program recommendations that Marcom will develop as a result of the study efforts and from the development of the answers to DEC questions.

IV METHOD OF STUDY

The proposed study will be conducted by a team of consultants knowledgeable and experienced in computer systems technology, market/product planning, computer financial analysis, and peripheral equipment research. The work will fall into four phases:

1) Project Structure Design and Market Intelligence Review
2) Field Research
3) Evaluation and Analysis
4) Presentation and Report Preparation

These are described below:

1) Project Structure Design and Market Intelligence Review

A detailed task schedule will be formulated in order to target accomplishment of the stated sub-objectives. Initial meetings will help to collect the required data on DEC capabilities and the PDP-6's product capabilities and limitations.

An intensive search will be conducted in published literature, manufacturers publications and Marcom files on relevant data on scientific computer markets and applications. This will identify the current technical availability and usage of computer systems and will indicate many of the people and places to visit in the next phase of the study.

2) Field Research

A structured field survey will be conducted among key users, industrial companies, university, military and government facilities in designated application areas. The field interviews will be aimed at the systems planner and principal scientific users in the operating facilities. Competitors tactics and sales features will be assessed from interviews with users of their equipment. Emphasis will be placed on determining current performance needs, traditional operating practices in each facility and planned for changes in performance requirements during the next three years. The attitude toward a time shared system will be developed in each type of facility as well as lines of development that various application requirements might be expected to follow. We anticipate conducting about forty personal and twenty telephone interviews.

3) Evaluation and Analysis

The very substantial amount of data gathered during the first two phases will be subjected to intensive review, evaluation and analysis by the study team. This complex task will require separating significant scientific application areas from those judged to be of limited consequence from a marketing standpoint. Hardware and software requirements in each of the sub-markets will be determined for the three year period under study. The success of this phase of the work is the key to success of the project and to the development of the answers to DEC's questions.

4) Presentation and Report Preparation

The results of the study will be incorporated in a comprehensive report of findings. A full-scale oral presentation will also be made. Periodic reports to DEC will inform company personnel of project progress.

V TIME AND COST

This project can be completed in about three months from date of authorization. The fee for professional services will be $24,000 including all out-of-pocket expenses.

VI QUALIFICATIONS OF MARCOM INCORPORATED

Marcom Incorporated is unusually well qualified to undertake the proposed study. Our professional staff is very familiar with the requirements of data processing and instrumentation users through the recent studies of these market areas. We have also worked recently with a number of the major manufacturers of information processing systems on short and long range product and marketing assignments.

Marcom Incorporated is a management consulting firm specializing in providing technical services to users and producers of advanced information systems and electronic equipment. We also have a strong operations research capability, with emphasis on the use of mathematical techniques for strategic and economic planning. An associated firm, Pennsylvania Research Associates, works with Marcom on studies involving basic scientific and electronic systems and equipment research. This firm is staffed with faculty and staff of the Moore School of Electrical Engineering at the University of Pennsylvania. PRA has had significant experience in the radar, simulator and military information systems research and development fields.

Our professional staff represents an average of five to fifteen years of experience in advanced technological industries. A very wide range of consulting assignments has taken these consultants into every kind of military, industrial and management problem.

Marcom's philosophy of operation is predicated on providing in-depth consulting services to the applied science field. Assignments have ranged

from the development and preparation of a complete electronic computer product specification to development of a complete company long range plan. Direct technical service assignments have also included support in computer selection, information systems design, programming and technical support.

A partial list of projects recently performed by Marcom Incorporated includes:

1. The development of a comprehensive market plan and detailed program for a major data processing supplier. This project involved the study and analysis of the market for low priced computer configurations in several sectors of the United States economy.

2. Development of a comprehensive system for storing and retrieving information for a national professional organization in the data processing and business equipment field.

3. Study and comprehensive market analysis of a specific computer system for a particular manufacturer in the field. This project involved a critical examination of the organization, logical design, circuitry, reliability, and supporting software and utility programs for this particular EDP system. A detailed assessment of the market potential for this system in various market segments of the United States economy was made.

4. Extensive studies have also been conducted in the field of process control, information storage and retrieval, and improvement of user systems organization and operations.

Some of the clients that have been served recently include:

American Machine and Foundry
American Telephone and Telegraph, Inc.
Department of Defense
E.I. duPont de Nemours Company
Ford Motor Company
General Electric Company
International Business Machines Corporation
International Telephone and Telegraph, Inc.
Interstate Commerce Commission
Logistics Management Institute
National Cash Register Corporation
Packard Bell, Inc.
Raytheon Computer
Sperry Rand Corporation

RESUMES OF

THE MARCOM PROJECT TEAM

Martin L. Ellis

Mr. Ellis, President of Marcom Incorporated, has been managing projects in business planning and product and market planning for many electronics and data processing equipment manufacturers in both the commercial and military marketing areas.

Mr. Ellis has been responsible for the development of market and product plans for major suppliers of military and electronic systems and devices including Radio Corporation, Ford Motor Company, General Electric, Westinghouse, and Packard Bell. He has been responsible for the development of the strategic concepts relating to design and marketing of data processing and communications equipment for companies such as Raytheon, North American Aviation, Marquardt, National Cash Register, and duPont.

Mr. Ellis has directed several projects which involved examination of technical and personnel capabilities and the correlation of the capabilities to specific technical requirements of a company's existing business or to new product markets they might enter. These studies were inputs for the development of long-range business plans. These assignments have included analysis of technical areas such as simulator-trainers, intelligence systems, computer systems, and products communications devices, and ordnance fuzes and safety and arming mechanisms.

Mr. Ellis holds a B.A. degree in Industrial Management from New York University and an M.A. degree in Political Science from the University of Colorado. He has completed all of the requirements for Ph.D. except the dissertation at American University. He was a research fellow and instructor in political science and public administration at the American University while completing his doctoral work and has lectured at the Graduate School of Business, Columbia University, and New York University.

Mr. Ellis is Adjunct Lecturer of Marketing at The Graduate School of Business, C.W. Post College, Long Island University where he teaches the Product and Market Planning Course.

Michael J. Geran

Since joining Marcom, Mr. Geran has been involved in a number of market studies, including the impact of a major new system on the market opportunities for computer manufacturer.

From 1958 to 1965, Mr. Geran has been involved with the planning and evaluation of existing and proposed computer systems and products. His assignment has included pricing and financial analysis, market research and planning, product planning, and sales.

Mr. Geran was responsible for pricing and financial evaluation of a number of computer units, including a major small scale system.

He has been involved in a number of market and planning studies, including an analysis of the municipal market for a medium scale computer system in 1960.

Mr. Geran was a Manager of Market Analysis for the Univac Division of Sperry Rand; his responsibilities included the determination of market potential by area, industry and computer class. He organized and instituted a market information gathering system for the Division.

Mr. Geran has been a product planner for General Electric. He conducted a number of studies in the application of computer systems for business and operations control.

Mr. Geran received a B.S. from Fordham in 1956; and an M.A. in economics from the University of Nebraska in 1957.

Harold E. Klein

Harold E. Klein, Senior Consultant with Marcom Incorporated, has conducted studies in market planning for advanced technological products and analysis of R&D management. Some of his recent assignments include analysis of the ten year requirements for electronic data processing systems and product configurations including an analysis of small establishment distributions, growth patterns, and entry; he has conducted studies in scientifics in factory and process computer and direct digital automation including possible application areas.

He has participated in or directed market planning studies in all phases of data processing activities for National Cash Register Company, Univac, Raytheon Computer, General Electric and Westinghouse.

Mr. Klein designed an R&D cost effectiveness evaluation system for use among defense contractors. He conducted intensive investigations into R&D project evaluation, both in professional assignments and in graduate study.

Mr. Klein holds the degree of Bachelor of Chemical Engineering from The City College. He received a degree of Master of Business Administration from The Amos Tuck School of Business Administration, Dartmouth College. He is presently in the Doctoral Program of the Columbia University School of Business; his areas of concentration are business planning and management control systems SECRET Clearance currently in force.

Melvin J. Klugman

Since joining Marcom, Inc., Mr. Klugman has participated in several client studies involving the identification of market opportunities for new products developed from the application of state-of-the-art technologies. These studies included an analysis of user requirements and the dynamics underlying the image as they relate to market structure and sales potential.

Prior to joining Marcom, Mr. Klugman was associated with Robert Manley Associates, Inc., and John Diebold Associates, Inc., both management consulting firms where he participated in marketing consulting assignments for advanced technical equipment. These projects involved the identification of application areas, definition of user requirements, sales projections of market acceptance and the development of product and market recommendations. Typical project assignments concerned computer systems and peripheral equipment, such as printers, data display, and mass random access memory systems, data communications equipment and facsimile transmission devices. He has participated in studies for companies such as, Radio Corporation of America, National Cash Register, Xerox and DuPont.

He was also employed by the Kearfott Division, General Precision, Inc. as a design engineer and defense marketing specialist.

Mr. Klugman received the degree of Bachelor of Electrical Engineering from The City College of New York and the degree of Master of Business Administration from the same school. He is a member of the American Marketing Association.

G B

dec INTEROFFICE MEMORANDUM

DATE August 10, 1964

SUBJECT ITT (Autodin)Discount Decision

TO Harlan Anderson
Kenneth Olsen
Gordon Bell

FROM Dave Packer

The final decision regarding discounts for the ITT (Autodin) proposal was made August 6, 1964 at a meeting attended by:

Harlan Anderson, Gordon Bell, Jim McKalip, Dick Best and Dave Packer.

This memo summarizes the decision process.

Background

DEC's initial proposal to ITT for the Autodin bid quoted a price of about $1,600,000 per duplex PDP-6 system. This price involved maximum discounts of 32-34% on processors and memories and discounts of 10 to 34% on other equipment.

Recently, ITT informed us that they believed their bid on the Autodin contract was higher than that of RCA for all sizes of systems and IBM for the smaller systems. ITT felt that to stand a good chance of being low bidder, their price should be reduced about $200,000 per duplex system. They requested that we evaluate whether our prices could be reduced, so that they could reduce their bid price.

Decision

Our decision was to reduce the price of a duplex system by about $58,600. The reduction was achieved by raising discounts on processors and memories to 35-40%. The result of the $58,600 reduction to a duplex system price of $1,600,000 is approximately 3.7%.

Procedure

The first step was to estimate manufacturing costs for each major system component. The Appendix gives the detailed estimates used for processors, memories, drums, and tapes.

The second step is depicted by Exhibit 1 below, which shows manufacturing cost, list price, price with the discounts previously offered (highest discount used), and cost of sales percentage for each component. It then gives the number of components per duplex system and the extended system price.

EXHIBIT 1

INITIAL DISCOUNT OFFER

(thousands of dollars)

Component	Mfg. Cost	List Price	Discounted Price	Cost of Sales %	Components/ System	System Price
Processor	38.3	161.1	106.4	36.0%	2	212.8
Memory	28.2	129.1	85.3	33.0%	5	426.5
Drum	36.5	81.0	71.7	51.0%	3	215.1
Tape	11.5	30.4	23.1	50.0%	13	300.3
Fast Memory	12.0	30.0	19.8	60.5%	2	39.6
					Total	1,194.3

Examination of Exhibit 1 data showed that only processors and memories had sufficiently low cost of sales percentages; i.e., high markups, to be considered for price reductions. On the other items, with markups already less than 2, it was decided to hold to previously quoted prices and discounts.

The next step was to try to cut $100,000 from each duplex system price by:

Reducing processor price $20,000 ($40,000/system)
and Reducing memory price $12,000 ($60,000/system).

Exhibit 2 shows the outcome of these reductions and calculates the discount percentage necessary to achieve the $100,000 cut.

EXHIBIT 2

$100,000 REDUCTION

(thousands of dollars)

Component	Mfg. Cost	List Price	New Discounted Price	Cost of Sales %	Discounted %
Processor	38.3	161.1	86.4	44.4%	46.5%
Memory	28.2	129.1	73.3	38.5%	43.2%

This alternative was rejected because it led to unacceptably high discount and cost of goods sold percentages.

The third step was to try a 40% discount, thought to be the maximum we should offer, on processors and memories. Exhibit 3 shows the effects of this decision.

EXHIBIT 3

40% DISCOUNT

(thousands of dollars)

Component	Mfg. Cost	List Price	New Discounted Price	Cost of Sales %	Components/ System	System Price
Processor	38.3	161.1	96.6	39.6%	2	193.2
Memory	28.2	129.1	77.5	36.4%	5	387.5

Exhibit 4 gives the total system price reduction achieved with the 40% discounts above. The reduction is $58,600.

EXHIBIT 4

SYSTEM PRICE REDUCTION

(thousands of dollars)

Original System Prices:	Processor	212.8	
	Memory	426.5	
	Total		639.3
40% Discount System Prices:	Processor	193.2	
	Memory	387.5	
	Total		580.7
Price Reduction			58.6

It was agreed to offer the 40% discount level on processors and memories.

Exhibit 5 shows the cost of goods sold percentage and markup for the entire system with the 40% discount on processors and memories.

EXHIBIT 5

40% DISCOUNT ON PROCESSORS AND MEMORIES

(thousands of dollars)

Component	Mfg. Cost	Components/ System	Mfg. Cost/ System	System Price
Processor	38.3	2	96.6	193.2
Memory	28.2	5	141.0	387.5
Drum	36.5	3	109.5	215.1
Tape	11.5	13	149.5	300.3
Fast Memory	12.0	2	12.0	39.6
		Totals	508.6	1,135.7

$$\text{Cost of Goods Sold \%} = \frac{508.6}{1,135.7} \times 100 = 44.7\%$$

$$\text{Markup} = 1/44.7 = 2.24$$

It is believed that the 2.24 markup is adequate considering the size of the order. We should note the markup for the entire ITT order should be higher than 2.24 because each duplex system requires about $400,000 of modules not included in the above analysis.

D. Packer

DWP:ncs

APPENDIX

MANUFACTURING COST ESTIMATES

Arithmetic Processor

Total 36.8 (See Jack Smith's memo dated 5 August, 64).

Memory (Revised 8/6/64 by J. McKalip)

Stack	13.2
Mod.	8.2
Mem Sel.	.155
Mem Cont. & Pwr.	3.3
Power	.8
2 Cabinets	.5
10 Wired Panel	1.5
Checkout	.5
Cable	.240
Total	28.2K

Drum/Drum Sw

Physical Drum	30.0
Electronics (4 mounting panels)	3.6
8 Cables	.480
1 Cabinet	.500
Hardware	.400
Power	.500
Checkout	1.000
Total	36.5

Tape

Transport	8.312
Labor	.645
Catalog Items	2.284
Miscellaneous	.175
Total	11.462

Gordon Bell

INTEROFFICE MEMORANDUM

COMPANY CONFIDENTIAL

DATE August 18, 1964

SUBJECT Product Line Information

TO Product Line Coordinators

FROM Dave Packer

Attached are two documents that give financial information on your product line. They are:

1. The Fiscal 1965 forecast, showing planned sales, expenditures by type, and profits.

2. A detailed list of engineering projects supported by your product line. This list first gives projects whose costs will be wholly charged to the line, then gives projects partially supported by the line. Both total forecast expenditures and the product line portion of expenditures are shown for each partially supported project. Actual costs of these projects will be charged to your product line in the same ratio as the forecasts.

$$\text{(Your charges = Actual Costs} \times \frac{\text{Product Line Portion of Forecast}}{\text{Total Forecast}}\text{)}$$

Review these documents carefully. If there are items that you don't understand or that appear improper, look into them. You should be familiar with the activities that the dollar figures represent.

D. Packer

DWP:ncs
Attach (2)

PDP-6 (includes A)

PRODUCT LINE FORECAST

FISCAL 1965

(July 1964 – June 1965)

(Thousands of Dollars)

			Amount	% of Sales
1.	Sales		$4,047.4	100
2.	Cost of Sales (Mfg., Checkout, Installation)		2,069.7	50
3.	Marketing Expenses:			
	Selling	$345.0		
	Sales Support	16.5		
	Space Advertising	12.0		
	Publicity	7.0		
	Mail	12.0		
	Shows	3.0		
	Literature, G.A., Other	15.0		
	Total		410.5	10
4.	Engineering Expenses:			
	Development & Production Engineering	661.5		
	Manuals and Graphic Arts	85.0		
	Total		746.5	18
5.	Other Expenses		56.8	
6.	Contribution to Administrative Expenses & Profit (1 less 2–5)		763.9	19
7.	Allocation of Administrative Expense		261.7	
8.	Profit before Taxes (6 less 7)		$502.2	12

PDP-6 (Includes A)

ENGINEERING PROJECTS*

FISCAL 1965

(July 1964 – June 1965)

(Thousands of Dollars)

1. Wholly Supported by Product Line:

Project #	Project Name	Responsible	Forecast Expenditure
1294	Peripheral Equipment Tester and Processor	E. Harwood	$ 6.0
1249	2 μsec. Memory Develop & Proto Type 161	J. McKalip	29.3
1311	TWX Interface, Development and Prototype	A. Kotok	1.0
1269	Word Address Memory Develop Linear Select	D. Wardimon	19.0
1230	760 Paper Tape Reader & Control Devel & Prototype PDP-6	R. Savell	.5
1231	761 Paper Tape Punch and Control Dev. & Prototype PDP-6	R. Savell	.5
1228	Printer Keyboard and Control Type 626 Dev. & Prototype	R. Savell	.5
1232	461 Card Reader & Control, Develop Proto PDP-6	R. Savell	2.0
1245	460 Card Punch.		25.0
1247	Flip Flop Memory Type 162 Develop & Proto	R. Savell	2.0
1261	Data Control 136 Develop & Prototype PDP-6	R. Savell	.5
1271	Type 551 Microtape Control PDP-6 Dev. & Proto.	R. Savell	2.5
1251	Type 237 Drum & Control Develop & Proto PDP-6	R. Tringale	45.0
1283	630-4 Data Comm. System for PDP-6-1	D. Smith	2.0
1262	Tape Control 516 PDP-6 Develop & Prototype	S. Lambert	11.0
1300	PDP-6 IO Device Tester Dev. & Prototype	E. Harwood	2.0
1266	PDP-6 Maintenance & Diagnostic Programming	L. Hantman	18.0
1229	646 Line Printer & Cont 300 lpm Dev. & Prototype PDP-6	L. White	.5
1239	680 Line Printer and Control 1000 lpm PDP-6	L. White	.5
1178	PDP-6 Development	G. Bell	58.0
1205	PDP-6 Prototype	G. Bell	58.0
1256	PDP-6 Programming	G. Bell	184.0
None	PDP-6A	G. Bell	150.0
Total			$617.8

1246

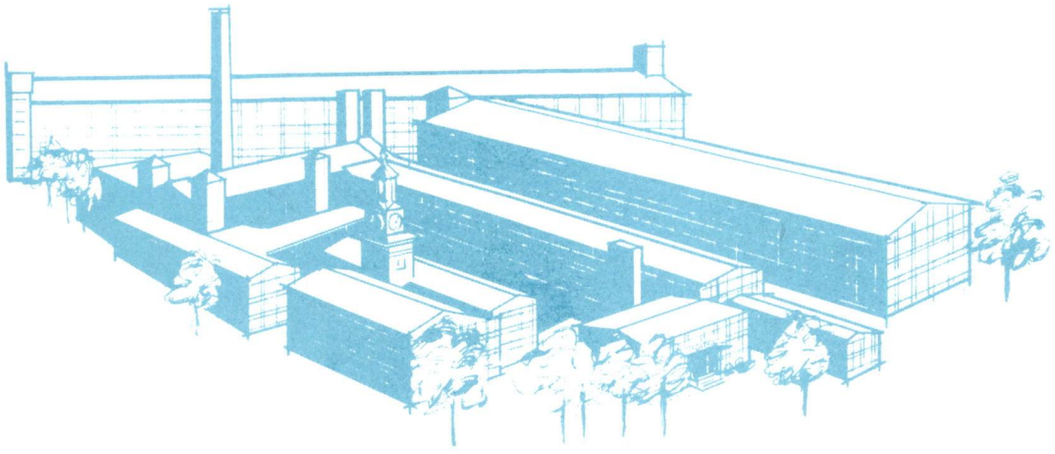
* Does not include publications work.

PDP-6 (Includes A)

II. Partially Supported by Product Line:

Project #	Project Name	Responsible	Total Forecast	Product Line Portion
1016	Core Memory Development	J.McKalip	$ 6.0	$ 2.4
1244	A-D Converter Test Equipment and Testing	B. Stephenson	1.2	.2
1301	New A-D Develop	B. Stephenson	15.5	3.1
1233	3 Phase Paper Tape Reader Develop & Proto	T. Stockebrand	4.0	2.0
1136	Relay Microtape Unit Development	D. Vonada	18.5	6.5
1237	Solid State Microtape Develop & Prototype	D. Vonada	7.0	2.5
1313	Tape Transport Simulator Development	S. Lambert	21.0	5.3
1196	M-3000 Tape Transport Prototype Type 570	R. Boisvert	5.0	3.0
1199	Type 580 Transport Development and Prototype	R. Boisvert	33.0	8.3
1259	Mag Tape Test Equipment	R. Boisvert	6.0	1.5
1182	Electrostatic Display Development	W. Long	1.0	.5
1209	Display Development, General	W. Long	1.5	.8
1236	340 Display Development and Prototype	W. Long	10.0	5.0
1180	Display 30 Camera Equipment	D. Chin	.5	.3
1211	Light Pen Development	W. Long	1.0	.3
1023	Mounting Panels	L. Prentice	10.1	1.7
Totals			$141.3	$43.4
Grand Totals			$141.3	$661.2

G Bell



PROGRESS REPORT
FOR THE MONTH OF
APRIL 1964

DIGITAL EQUIPMENT CORPORATION • MAYNARD, MASSACHUSETTS

DIGITAL EQUIPMENT CORPORATION
FINANCIAL STATEMENT

Highlights

Financial Comments

The month was better than anticipated due to higher volume and substantially lower operating expenses.

Presentation

Product Line statements have been restated to reflect peripheral equipment activity & related computer lines. This has enabled us to produce a computer line margin for the first time.

Warranty reserves have also been restated as a part of cost of goods sold (refer to footnote on Summary profit and loss statement).

Cash

Again our anticipated borrowing was deferred due to advance payments by the Atomic Energy Commission.

We do not anticipate any borrowing during June.

Detail cash flow comments are made on Page 7.

INDEX

DIGITAL EQUIPMENT CORPORATION

Profit and Loss Summary - April 24, 1964

		Current Month		Year to Date Operations					
		$	%	7/1/63 to 4/24/64 $	%	7/1/62 to 4/30/63 $	%	1963 over (+) or under (-) 1962 $	%
Sales and Rentals:									
Product:									
Sales		1,122,077.95	97.7	7,740,254.36	97.5	8,238,489.37	99.1	- 498,235.01	- 6.0
Rentals		20,509.57	1.8	180,180.21	2.3	69,217.26	.8	+ 110,962.95	+160.3
Field Service		5,790.72	.5	21,598.14	.2	5,957.34	.1	+ 15,640.80	+262.5
Net Sales and Rentals		1,148,378.24	100.0	7,942,032.71	100.0	8,313,663.97	100.0	- 371,631.26	- 4.5
Cost of Sales & Rentals:									
Product:									
Sales	(1)	476,075.38	41.5 (1)	3,214,294.27	40.5 (1)	3,516,338.25	42.3	- 302,043.98	- 8.6
Rentals		5,887.86	.5	79,538.35	1.0	30,817.14	.4	+ 48,721.21	+158.1
Totals		481,963.24	42.0	3,293,832.62	41.5	3,547,155.39	42.7	- 253,322.77	- 7.1
Field Service		25,245.41	2.2	194,213.38	2.4	107,389.88	1.3	+ 86,823.50	+ 80.8
Total Cost of Sales & Rentals	(2)	507,208.65	44.2	3,488,046.00	43.9	3,654,545.27	44.0	- 166,499.27	- 4.6
Gross Profit		641,169.59	55.8	4,453,986.71	56.1	4,659,118.70	56.0	- 205,131.99	- 4.4
Operating Expenses:									
Selling		106,303.37	9.3	895,765.96	11.3	594,972.17	7.2	+ 300,793.79	+ 50.6
Technical Publications		71,735.84	6.2	494,826.07	6.2	232,757.85	2.8	+ 262,068.22	+112.6
Administrative		64,421.72	5.6	603,123.31	7.6	664,421.86	8.0	- 61,298.55	- 9.2
Co. Sponsored Engineering		148,602.74	12.9	1,446,038.59	18.2	943,157.29	11.4	+ 502,881.30	+ 53.3
Total Operating Expenses		391,063.67	34.0	3,439,753.93	43.3	2,435,309.17	29.4	+1,004,444.76	+ 41.2
Operating Profit or (Loss)		250,105.92	21.8	1,014,232.78	12.8	2,223,809.53	26.6	-1,209,576.75	- 54.4
Other Income Less: Other Charges		8,398.68	.7	57,093.22	.7	(42,357.30)		+ 99,450.52	+234.7
Profit or (Loss) Before Taxes		258,504.60	22.5	1,071,326.00	13.5	2,181,452.23	26.1	-1,110,126.23	- 50.9
Less: Provision for Federal Taxes		123,500.00	10.7	518,997.00	6.5	1,057,100.00	12.8	- 538,103.00	- 50.9
Less: Provision for State Taxes		16,300.00	1.5	68,365.00	.9	142,700.00	1.7	- 74,335.00	- 50.9
Total		139,800.00	12.2	587,362.00	7.4	1,199,800.00	14.5	- 612,438.00	- 50.9
Net Profit or(Loss)		$ 118,704.60	10.3	$ 483,964.00	6.1	$ 981,652.23	11.6	$- 497,688.23	- 50.9

Comments

(1) Warranty reserves have been restated in Cost of Goods Sold - Sales in the following amounts:

April 1964	12,179.00
Year to date 1964	63,053.50
Year to date 1963	76,733.00

(2) Includes installation costs of $18,335.00

DIGITAL EQUIPMENT CORPORATION

Profit and Loss Statement - Month Ending April 24, 1964

	Sales	Cost of Goods Sold	Gross Profit	Gross Profit %	Selling	Administration	Co. Sponsored Engineering	Total Operating Expense	Operating Profit or (Loss)
Computers:									
PDP-1	$ 584,300.00	$ 259,366.45	$ 324,933.55	55.6	$ 23,440.64	$ 32,726.24	$ 7,426.86	$ 63,593.74	$ 261,339.81
PDP-4	89,256.00	36,150.31	53,105.69	59.5	30,552.29	4,999.13	3,317.67	38,869.09	14,236.60
PDP-5	212,439.00	107,816.49	104,622.51	49.2	50,559.14	11,905.13	6,269.34	68,733.61	35,888.90
PDP-6					10,996.94		72,001.73	82,998.67	(82,998.67)
PDP-7					5,722.23		10,650.90	16,373.13	(16,373.13)
PDP-8					3,653.09		2,120.43	5,773.52	(5,773.52)
Sub Total	885,995.00	403,333.25	482,661.75	54.2	124,924.33	49,630.50	101,786.93	276,341.76	206,319.99
New Computer Development					3,371.82		1,487.46	4,859.28	(4,859.28)
Rentals	20,509.57	5,887.86	14,621.71	71.2	4,016.33	1,133.82		5,150.15	9,471.56
Field Service	5,790.72	23,723.49	(17,932.77)			309.22		309.22	(18,241.99)
Total Computers	912,295.29	432,944.60	479,350.69	52.5	132,312.48	51,073.54	103,274.39	286,660.41	192,690.28
Systems:									
Tester & Exercisers, etc.	7,098.63	4,886.63	2,212.00	31.2	8,446.74	463.84	2,663.75	11,574.33	(9,362.33)
Field Service		1,521.92	(1,521.92)						(1,521.92)
Total Systems	7,098.63	6,408.55	690.08	9.7	8,446.74	463.84	2,663.75	11,574.33	(10,884.25)
Total Systems & Computers	$ 919,393.92	$ 439,353.15	$ 480,040.77	52.2	$ 140,759.22	$ 51,537.38	$ 105,938.14	$ 298,234.74	$ 181,806.03

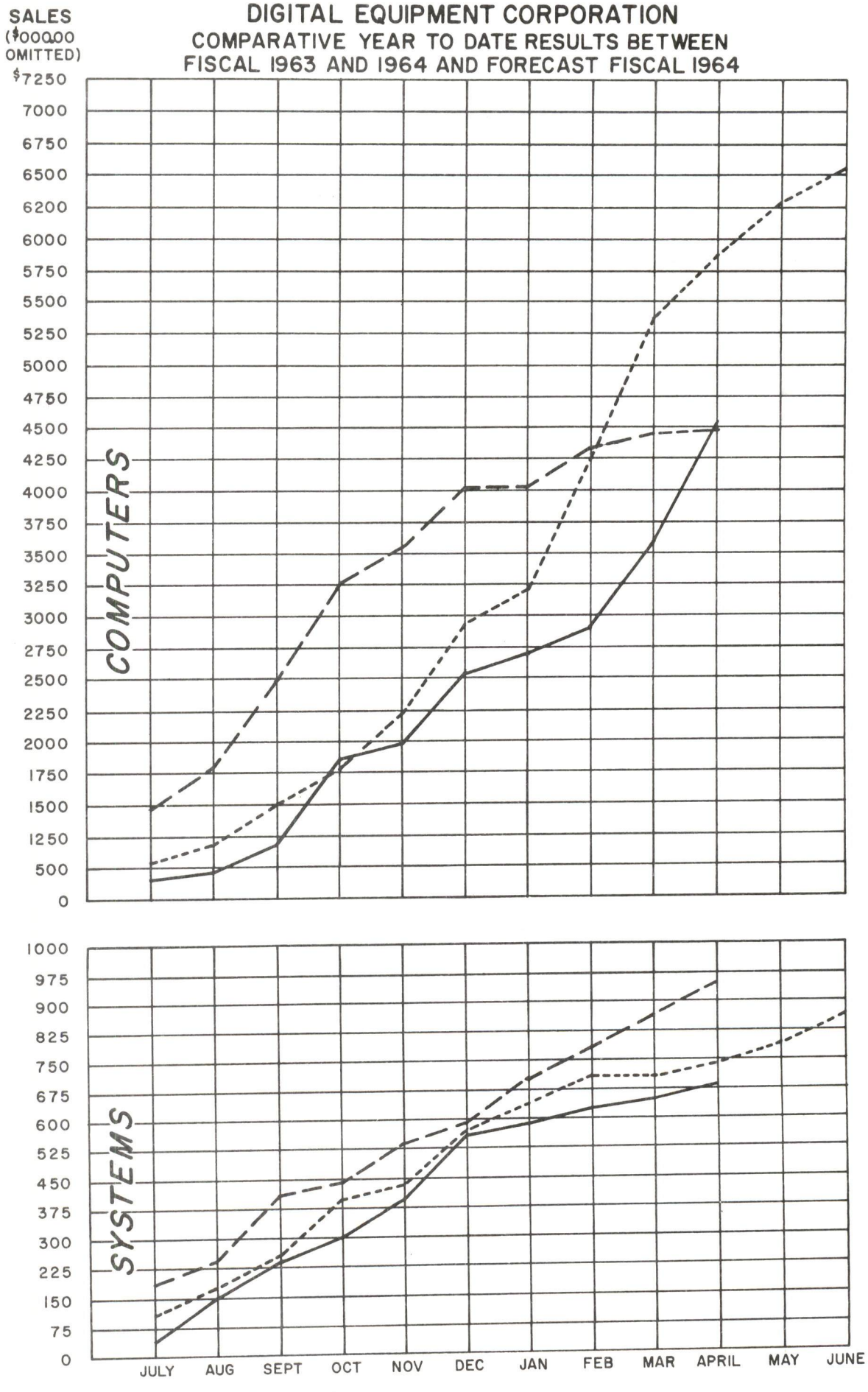
DIGITAL EQUIPMENT CORPORATION

Profit and Loss Statement - July 1, 1963 through April 24, 1964

	Sales	Cost of Goods Sold	Gross Profit	Gross Profit %	Selling	Administration	Co. Sponsored Engineering	Total Operating Expense	Operating Profit & (Loss)
Computers:									
PDP-1	$ 3,340,234.26	$ 1,522,003.07	$ 1,818,231.19	54.3			$ 403,219.61		
PDP-4	658,152.04	283,606.93	374,545.11	56.9			116,964.02		
PDP-5	348,080.03	178,741.73	169,338.30	48.6			58,537.78		
PDP-6							490,212.86		
PDP-7							21,624.14		
PDP-8							6,366.03		
Sub Total	4,346,466.33	1,984,351.73	2,362,114.60	54.3			1,096,924.44		
New Computer Development							9,493.93		
Rentals	180,180.21	79,538.35	100,641.86	55.9			562.39		
Field Service	21,598.14	185,931.53	(164,333.39)						
Total Computers	4,548,244.68	2,249,821.61	2,298,423.07	50.5			1,106,980.76		
Systems:									
Tester & Exercisers, etc.	602,412.03	352,325.11	250,086.92	41.5			58,793.58		
PDP-5	79,437.00	42,923.18	36,513.82	45.9			27,507.20		
Field Service		8,281.85	(8,281.85)						
Total Systems	681,849.03	403,530.14	278,318.89	40.8			86,300.78		
Total Systems & Computers -	$ 5,230,093.71	$ 2,653,351.75	$ 2,576,741.96	49.3	$ 1,210,399.53	$ 388,544.10	$ 1,193,281.54	$ 2,792,225.17	$ (215,483.21)

DIGITAL EQUIPMENT CORPORATION

COMPARATIVE YEAR TO DATE RESULTS BETWEEN FISCAL 1963 AND 1964 AND FORECAST FISCAL 1964



DIGITAL EQUIPMENT CORPORATION

Profit and Loss Statement - Month Ended April 24, 1964

	Sales	Cost of Goods Sold	Gross Profit	Gross Profit %	Selling	Administrative	Co. Sponsored Engineering	Total Operating Expenses	Operating Profit or (Loss)
Modules:									
Laboratory:									
10 Megacycle	$ 327.00	$ 82.39	$ 244.61	74.8	$ 1,457.56	$ 12.88	$ -0-	$ 1,470.44	$ (1,225.83)
5 Megacycle	1,227.82	287.18	940.64	76.6	2,192.64	64.42	-0-	2,257.06	(1,316.42)
500 Kilocycle	4,347.24	1,238.51	3,108.73	71.5	1,679.87	257.69	-0-	1,937.56	1,171.17
Education & Classroom					1,882.21		59.55	1,941.76	(1,941.76)
Total Laboratory	5,902.06	1,608.08	4,293.98	72.7	7,212.28	334.99	59.55	7,606.82	(3,312.84
Systems:									
V.H.F.					1,279.57		79.05	1,358.62	(1,358.62)
10 Megacycle	1,373.53	327.09	1,046.44	76.1	9,956.33	77.31	7,719.05	17,752.69	(16,706.25)
5 Megacycle	38,988.68	10,378.18	28,610.50	73.3	4,846.13	2,190.33	7,540.88	14,577.34	14,033.16
500 Kilocycle	137,336.82	39,079.40	98,257.42	71.5	6,444.38	7,717.72	15,420.05	29,582.15	68,675.27
Miscellaneous							210.36	210.36	(210.36)
Total Systems	177,699.03	49,784.67	127,914.36	71.9	22,526.41	9,985.36	30,969.39	63,481.16	64,433.20
Small Modules					3,250.86		6,860.22	10,111.08	(10,111.08)
Miscellaneous:									
Accessories	30,627.23	12,726.79	17,900.44	58.4	3,827.53	1,713.62	3,151.91	8,693.06	9,207.38
High Current Pulse	14,756.00	3,735.96	11,020.04	74.6	462.91	850.37	1,623.53	2,936.81	8,083.23
Total Miscellaneous	45,383.23	16,462.75	28,920.48	63.7	4,290.44	2,563.99	4,775.44	11,629.87	17,290.61
Total Modules -	$ 228,984.32	$ 67,855.50	$ 161,128.82	70.3	$ 37,279.99	$12,884.34	$ 42,664.60	$ 92,828.93	$ 68,299.89

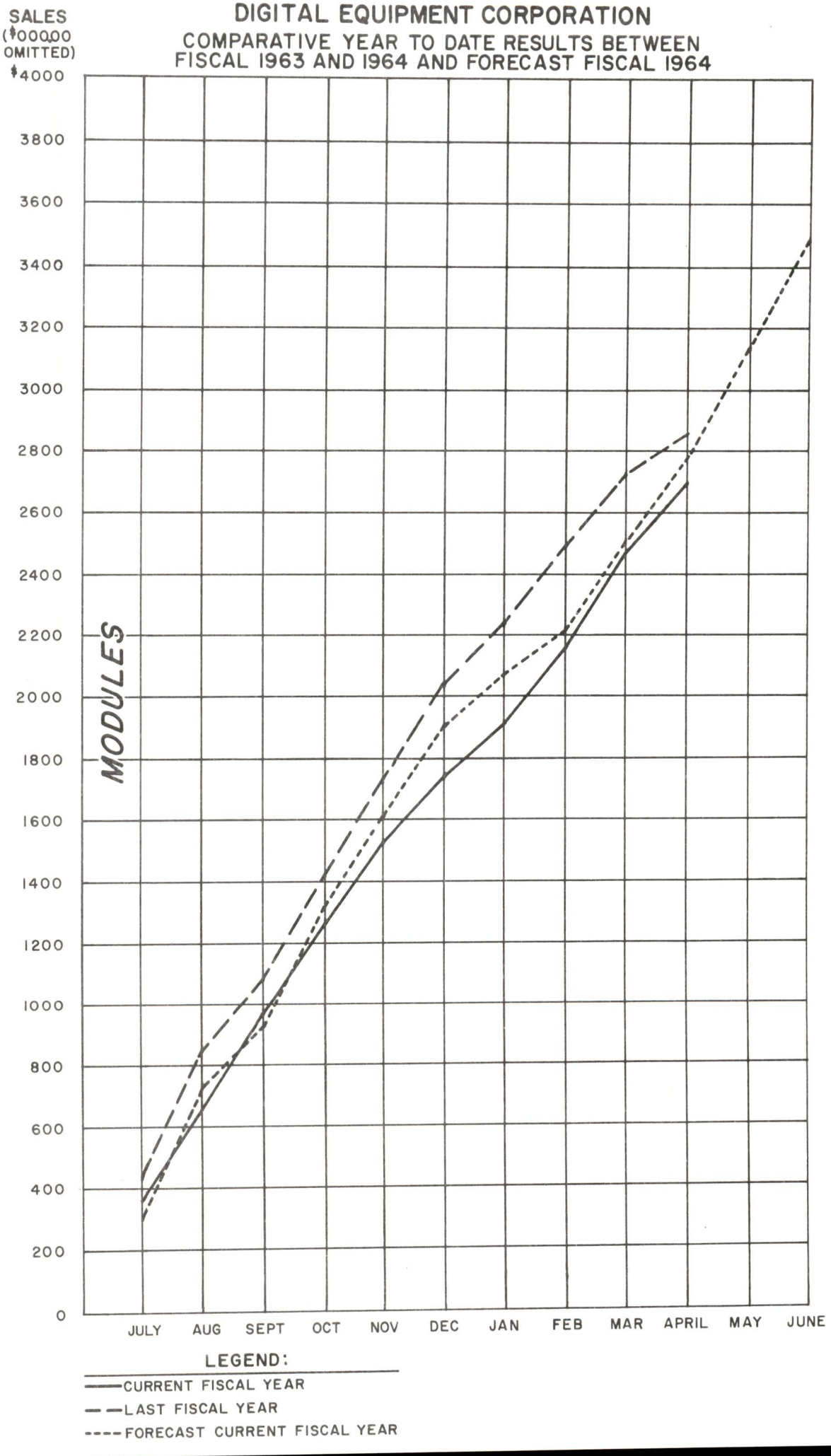
DIGITAL EQUIPMENT CORPORATION

Profit and Loss Statement - July 1, 1963 through April 24, 1964

	Sales	Cost of Goods Sold	Gross Profit	Gross Profit %	Selling	Administration	Co. Sponsored Engineering	Total Operating Expense	Operating Profit or (Loss)
Modules:									
Laboratory:	$ 22,956.75	$ 4,002.65	$ 18,954.10	82.5	$	$	$ 1,473.77	$	$
10 Megacycle	32,994.22	6,905.20	26,089.02	79.0			3,399.06		
5 Megacycle	55,203.58	16,469.73	35,733.85	64.7			2,262.00		
500 Kilocycle							1,766.48		
Education & Classroom	111,154.55	30,377.58	80,776.97	72.6			8,901.31		
Total Laboratory									
Systems:							15,131.69		
V.H.F.	101,158.95	19,910.40	81,248.55	80.3			33,266.70		
10 Megacycle	548,535.51	133,364.50	415,171.01	75.6			41,076.72		
5 Megacycle	1,476,937.03	464,466.60	1,012,470.43	68.5			61,583.61		
500 Kilocycle	36,800.63	10,494.52	26,306.11	71.5			32,708.82		
Miscellaneous	2,163,432.12	628,236.02	1,535,196.10	70.9			183,767.54		
Total Systems									
Small Modules							6,860.22		
Miscellaneous:	365,094.13	156,847.65	208,246.48	57.0			22,138.08		
Accessories	72,258.20	19,233.00	53,025.20	73.3			31,089.90		
High Current Pulse	437,352.33	176,080.65	261,271.68	59.7			53,227.98		
Total Miscellaneous									
Total Modules	$ 2,711,939.00	$ 834,694.25	$ 1,877,244.75	69.2	$ 180,192.50	$ 214,579.21	$ 252,757.05	$ 647,528.76	$ 1,229,715.

DIGITAL EQUIPMENT CORPORATION

COMPARATIVE YEAR TO DATE RESULTS BETWEEN FISCAL 1963 AND 1964 AND FORECAST FISCAL 1964



DIGITAL EQUIPMENT CORPORATION

Profit and Loss Statement - Month Ending April 30, 1963

	Sales	Cost of Goods Sold	Gross Profit	Gross Profit %	Selling	Technical Publications	Administration	Co. Sponsored Engineering	Total Operating Expense	Operating Profit or Loss
Computers:										
PDP-1	$ 30,000.00	$	$		$	$	$	$21,666.33	$	$
PDP-4								12,181.05		
PDP-6		35,768.80	47,870.20	56.3				5,700.98		
Magnetic Tape								38,055.33		
CRT	41,250.00							6,763.71		
Other In-Out Equipment	13,736.00							7,506.91		
Rentals	13,174.22	5,927.02	7,247.20	55.0						
New Computer Development								2,204.01		
Field Service	3,160.06	9,259.98	(6,099.92)							
Sub Total	101,320.28									
Less: Reserve for warranties	1,347.00									
Total Computers	99,973.28	50,955.80	49,017.48	49.0%				94,078.32		
Modules:										
Laboratory:										
10 Megacycle	6,461.33	1,077.24	5,384.09	83.3				837.16		
5 Megacycle	4,792.33	1,024.74	3,767.59	78.6				989.12		
500 Kilocycle	6,517.81	2,102.07	4,415.74	67.7				396.56		
Education & Classroom								533.36		
Total Laboratory	17,771.47	4,204.05	13,567.42	76.3%				2,756.20		
Systems:										
V.H.F.								1,548.62		
10 Megacycle	2,196.20	466.59	1,729.61	78.7				922.29		
5 Megacycle	23,191.63	4,583.09	18,608.54	80.2				5,462.31		
500 Kilocycle	60,313.48	14,189.88	46,123.60	76.5				4,877.60		
Miscellaneous	3,108.85	590.49	2,518.36	81.0				3,513.12		
Total Systems	88,810.16	19,830.05	68,980.11	77.6%				16,323.94		
Total Modules	106,581.63	24,034.10	82,547.53	77.4%				19,080.14		
Systems:										
Tester Exercisers	116,507.00	71,984.62	44,522.38	38.2				9,330.08		
PDP-5								1,250.63		
Field Service		992.31	(992.31)							
Rentals										
Total Systems	116,507.00	72,976.93	43,530.07	37.4%				10,580.71		
Miscellaneous:										
Accessories	37,284.27	9,131.64	28,152.63	75.5				3,325.41		
High Current Pulse Equipment	4,841.10	1,205.46	3,635.64	75.0				5,997.80		
Total Miscellaneous	42,125.37	10,337.10	31,788.27	75.4%				9,323.21		
TOTAL	$365,187.28	$158,303.93	$206,883.35	56.7%		$159,537.85		$133,062.38	$292,600.23	($85,716.88

DIGITAL EQUIPMENT CORPORATION

Profit and Loss Summary for the period 7/1/62 through 4/30/63

	Sales	Cost of Goods Sold	Gross Profit	Gross Profit %	Selling	Technical Publications	Administration	Co. Sponsored Engineering	Total Operating Expense	Operating Profit or Loss
Computers:										
PDP-1	$1,592,650.00							192,246.51		
PDP-4	162,876.00							129,321.39		
PDP-6								9,863.92		
Magnetic Tape	944,450.00	1,906,009.37	2,435,894.21	55.1				179,225.03		
CRT	132,567.00							57,661.45		
Other In-Out Equipment	1,586,093.58							75,792.56		
Rentals	69,217.26	30,817.14	38,400.12	55.4						
New Computer Development								32,005.00		
Field Service	6,641.94	99,563.51	(92,921.57)							
Sub Total	4,494,495.78									
Less: Reserve for warranties	76,733.00									
Total Computers	4,417,762.78	2,036,390.02	2,381,372.76	53.9%				676,115.81		
Modules:										
Laboratory:										
10 Megacycle	39,661.41	9,794.56	29,866.85	75.3				2,044.51		
5 Megacycle	67,773.44	17,982.01	49,791.43	73.4				2,496.25		
500 Kilocycle	36,800.46	16,588.45	20,212.01	54.9				1,942.89		
Education & Classroom	32,523.70	14,858.04	17,665.66	54.3				3,476.49		
Total Laboratory	176,759.01	59,223.06	117,535.95	66.5%				9,960.14		
Systems:										
V.H.F.								18,711.08		
10 Megacycle	63,793.36	15,075.71	48,717.65	76.3				14,764.09		
5 Megacycle	841,334.94	230,455.59	610,879.35	72.6				29,346.38		
500 Kilocycle	1,178,751.99	396,790.66	781,961.33	66.3				38,438.19		
Miscellaneous	29,286.14	9,372.56	19,913.58	67.9				21,864.21		
Total Systems	2,113,166.43	651,694.52	1,461,471.91	69.1%				123,123.95		
Total Modules	2,289,925.44	710,917.58	1,579,007.86	68.9%				133,084.09		
Systems:										
Tester Exercisers etc.	956,872.10	610,374.48	346,497.62	36.2				64,620.93		
PDP-5								1,250.63		
Field Service		7,826.37	(7,826.37)							
Rentals										
Total Systems	956,872.10	618,200.85	338,671.25	35.4%				65,871.56		
Miscellaneous:										
Accessories	426,221.48	158,416.19	267,805.29	62.8				38,315.52		
High Current Pulse Equipment	146,149.17	53,887.63	92,261.54	63.1				29,770.31		
Total Miscellaneous	572,370.65	212,303.82	360,066.83	62.9%				68,085.83		
TOTAL	$8,236,930.97	$3,577,812.27	$4,659,118.70	56.6%		$1,492,151.88		$943,157.29	$2,435,309.17	$2,223,809.53

DIGITAL EQUIPMENT CORPORATION

Balance Sheet

April 24, 1964

ASSETS:	4/24/64	3/27/64	6/30/63
Current:			
Cash	$ 107,940.04	$ 196,585.95	$ 315,593.00
Investments	-0-	-0-	299,171.18
Accounts Receivable	1,172,864.36	651,020.19	1,356,083.03
Cash Surrender Value of Life Ins.	4,812.70	4,812.70	4,812.70
Inventories:			
Raw Materials	478,587.89	455,501.03	462,061.40
W.I.P. - Manufacturing	1,298,230.20	1,124,598.98	580,792.29
W.I.P. - Systems	392,198.04	490,376.42	587,987.63
Finished Goods - Maynard	367,013.25	342,795.58	242,424.46
Finished Goods - Branches	22,596.22	22,954.73	15,624.46
Sub total Inventory	2,558,625.60	2,436,226.74	1,888,890.24
Consignments	251,573.37	335,329.99	347,435.45
Total Inventory	2,810,198.97	2,771,556.73	2,236,325.69
Insurance & Other Prepayments	36,000.73	35,569.30	43,802.07
Total Current Assets -	4,131,816.80	3,659,544.87	4,255,787.67
Non-Current Assets:			
Investments in Subsidiaries	27,735.00	27,735.00	6,000.00
Fixed Assets:			
*Leased Equipment	217,424.38	217,424.38	216,054.28
Less: Reserve for Depreciation	114,994.73	109,106.87	81,410.36
Total Leased Equipment -	102,429.65	108,317.51	134,643.92
Plant Equipment at Cost:			
Machinery	328,367.28	322,548.34	267,028.35
Manufacturing	58,197.58	58,197.58	35,225.30
Furniture & Equipment	441,294.42	438,866.57	254,944.87
Motor Vehicles	2,379.24	2,379.24	2,379.24
Sub Total	830,238.52	821,991.73	559,577.76
Less: Allowance for Depreciation	311,066.17	293,112.36	163,382.34
Total Plant Equipment	519,172.35	528,879.37	396,195.42
Leasehold Improvements at Amort. Cost	74,039.31	72,888.34	49,211.38
TOTAL ASSETS -	$4,855,193.11	$4,397,365.09	$4,841,838.39

*Includes Mass. General Loan

Digital Equipment Corporation

Balance Sheet Continued:

	4/24/64	3/27/64	6/30/63
LIABILITIES & CAPITAL:			
Current:			
Accounts Payable	$ 410,316.06	$ 293,318.69	$ 445,071.96
Notes Payable	16,250.00	16,250.00	16,250.00
Employees Withholding	94,174.38	51,323.92	57,694.18
Accrued Expenses:			
Salaries & Wages	122,869.36	118,339.83	115,804.28
Insurance	11,743.92	18,501.92	6,472.32
Taxes	82,756.95	47,167.07	38,524.43
Interest	3,565.01	1,711.88	699.33
Accrued for Patent Royalties	71,127.04	69,283.84	69,468.16
Reserve for Warranties	46,680.00	41,179.56	33,000.00
Reserve for Taxes	491,124.53	354,407.12	1,019,176.65
Deferred Income	-0-	-0-	3,555.22
Total Current Liabilities -	1,350,607.25	1,011,483.83	1,805,716.53
Long-term Debt:			
Notes Payable	354,375.00	354,375.00	370,625.00
Capital:			
Reserve for Contingencies			
Common Stock	50,900.00	50,900.00	50,650.00
Capital in Excess of Par Value	81,427.50	81,427.50	80,927.50
Retained Earnings	3,017,883.36	2,899,178.76	2,533,919.36
TOTAL LIABILITIES & CAPITAL	$4,855,193.11	$4,397,365.09	$4,841,838.39

DIGITAL EQUIPMENT CORPORATION

Balance Sheet

Actual vs. Forecast

April 24, 1964

	Actual $	Forecast $	Actual over (+) or under (-) Forecast $
ASSETS			
Current:			
Cash	107,940.	249,311.	- 141,371.
Investments	-0-	-0-	
Receivables	1,172,864.	1,254,123.	- 81,259.
Inventory	2,810,199.	2,536,902.	+ 273,297.
Prepayments & Other	40,814.	40,500.	+ 314.
Total Current Assets	4,131,817.	4,080,836.	+ 50,981.
Investments in Subsidiaries:	27,735.	56,000.	- 28,265.
Fixed Assets:			
Leased Equipment	102,430.	101,859.	+ 571.
Plant Equipment	519,172.	538,280.	- 19,108.
Leasehold Improvements at Amort. Cost	74,039.	120,478.	- 46,439.
Total Assets	$4,855,193.	$4,897,453.	-$ 42,260.
LIABILITIES			
Current:			
Accounts Payable	$ 410,316.	$ 327,999.	+$ 82,317.
Notes Payable	16,250.	16,250.	-0-
Employee Withholdings	94,174.	50,000.	+ 44,174.
Accrued Expenses	338,742.	299,000.	+ 39,742.
Accrued Taxes	491,125.	592,447.	- 101,322.
Total Current Liabilities	1,350,607.	1,285,696.	+ 64,911.
Long-Term Debt:			
Notes Payable	354,375.	354,375.	-0-
CAPITAL			
Common Stock	50,900.	50,900.	-0-
Capital in Excess of Par Value	81,427.	81,427.	-0-
Retained Earnings	3,017,884.	3,125,055.	- 107,171.
Total Liabilities and Capital	$4,855,193.	$4,897,453.	-$ 42,260.

DIGITAL EQUIPMENT CORPORATION

Cash Flow

Actual vs. Forecast

Month Ending April 24, 1964

	Actual	Forecast	Actual over (+) or under (-) Forecast
Beginning Balance	$ 196,585.	$ 230,593.	$- 34,008.
Receipts:			
Customers	650,119.	460,000.	+190,119.(1)
Loans	-0-	200,000.	-200,000.
Other	6,778.	-0-	+ 6,778.
Total Receipts	656,897.	660,000.	- 3,103.
Disbursements:			
Payroll	240,518.	241,500.	- 982.
Operating Supplies	76,802.	75,000	+ 1,802.
Utilities	26,344.	24,000.	+ 2,344.
Travel	17,062.	16,500.	+ 562.
Other Overhead Items	77,210.	54,600.	+ 22,610.(2)
Prepayments and Deposits	4,070.	2,000.	+ 2,070.
Capital Equipment	12,222.	10,000.	+ 2,222.
Leasehold Improvements	5,134.	15,000.	- 9,866.
Income Taxes	-0-	-0-	-0-
Outside Contracting	64,978.	80,000.	- 15,022.
Investments	-0-	-0-	-0-
AR&D Repayments	-0-	-0-	-0-
Module Inventory Purchase	116,514.	130,000.	- 13,486.
Peripheral Items & Major Components	65,992.	87,400.	- 21,408.
Space Advertising	9,952.	8,500.	+ 1,452.
*Foreign Sales Disbursement	8,131.	16,500.	- 8,369.
Land and Buildings	-0-	7,000.	- 7,000.
Development Purchase	20,613.	20,000.	+ 613.
Bank Loan Repayment	-0-	-0-	-0-
Total Disbursements	745,542.	788,000.	- 42,458.
Closing Cash Balance	$ 107,940.	$ 102,593.	$+ 5,347.

(1) Payments before terms were due by AEC

(2) Freight, Aid, and small tools purchase in excess of forecast.

* Foreign Operations - Capitalization 3,000.
Advances 5,131.
8,131.

DIGITAL EQUIPMENT CORPORATION

Statement of Administrative, Sales and Technical Publication Expenses

For the Month Ended - April 24, 1964

	Actual Total	SALES			TECHNICAL PUBLICATIONS			ADMINISTRATIVE		
		Actual	Rev. 1/1/64 Forecast	Actual over (+) or under (-) Forecast	Actual	Rev. 1/1/64 Forecast	Actual over (+) or under (-) Forecast	Actual	Rev. 1/1/64 Forecast	Actual over (+) or under (-) Forecast
Salaries & Wages	$ 89,472.	$ 43,080.	$ 43,755.	$- 675.	$ 17,198.	$ 18,078.	$- 880.	$ 29,194.	$ 32,996.	$- 3,802.
Fringe Benefits	8,763.	3,919.	4,350.	- 431.	2,486.	1,688.	+ 798.	2,358.	2,690.	- 332.
Payroll Taxes	8,851.	4,399.	4,188.	+ 211.	1,753.	1,400.	+ 353.	2,699.	2,101.	+ 598.
Overtime Premium	1,163.	765.	580.	+ 185.	315.	500.	- 185.	83.	90.	- 7.
Operating Supplies	34,761.	2,882.	3,685.	- 803.	26,402.	36,000.	- 9,598.	5,477.	3,455.	+ 2,022.
Sales Promotion	28,569.	14,553.	10,000.	+ 4,553.	14,016.	12,000.	+ 2,016.			
Rent	9,935.	3,592.	3,642.	- 50.	1,493.	1,338.	+ 155.	4,850.	4,552.	+ 298.
Depreciation & Amortization	6,722.	2,739.	1,707.	+ 1,032.	1,342.	852.	+ 490.	2,641.	1,750.	+ 891.
Repairs & Maintenance	1,013.	242.	110.	+ 132.	446.	50.	+ 396.	325.	20.	+ 305.
Utilities	7,637.	4,362.	5,550.	- 1,188.	590.	578.	+ 12.	2,685.	2,499.	+ 186.
Insurance	4,432.	830.	722.	+ 108.	135.	87.	+ 48.	3,467.	319.	+ 3,148.
Professional Service	9,845.	5,269.	438.	+ 4,831.	2,306.	168.	+ 2,138.	2,270.	3,352.	- 1,082.
Legal & Auditing	1,000.							1,000.	200.	+ 800.
Travel	16,562.	13,743.	9,615.	+ 4,128.	451.	400.	+ 51.	2,368.	4,125.	- 1,757.
Freight	4,042.	2,501.	500.	+ 2,001.				1,541.	2,000.	- 459.
Other Taxes	1.							1.	20.	- 19.
Contributions	893.							893.	4,000.	- 3,107.
Other	8,800.	3,427.	1,053.	+ 2,374.	2,803.	695.	+ 2,108.	2,570.	1,117.	+ 1,453.
TOTAL -	$ 242,461.	$ 106,303.	$ 89,895.	$+ 16,408.	$ 71,736.	$ 73,834.	$- 2,098.	$ 64,422.	$ 65,286.	$- 864.

For the Ten Months Ended - April 24, 1964

Salaries & Wages	$ 847,171.	$ 385,716.	$ 458,231.	$- 72,515.	$ 161,250.	$ 196,740.	$- 35,490.	$ 300,205.	$ 353,432.	$- 53,227.
Fringe Benefits	82,206.	38,994.	39,282.	- 288.	17,875.	20,495.	- 2,620.	25,337.	26,471.	- 1,134.
Payroll Taxes	49,230.	22,557.	28,397.	- 5,840.	9,766.	10,410.	- 644.	16,907.	17,167.	- 260.
Overtime Premium	9,881.	6,508.	7,339.	- 831.	2,664.	3,253.	- 589.	709.	1,988.	- 1,279.
Operating Supplies	240,499.	43,097.	38,915.	+ 4,182.	164,216.	182,500.	- 18,284.	33,186.	34,880.	- 1,694.
Sales Promotion	164,345.	101,019.	100,280.	+ 739.	63,295.	49,050.	+ 14,245.	31.		+ 31.
Rent	98,820.	35,718.	34,563.	+ 1,155.	14,363.	15,687.	- 1,324.	48,739.	44,396.	+ 4,343.
Depreciation & Amortization	70,395.	42,257.	16,103.	+ 26,154.	9,435.	6,949.	+ 2,486.	18,703.	13,468.	+ 5,235.
Repairs & Maintenance	12,066.	3,995.	1,215.	+ 2,780.	2,436.	725.	+ 1,711.	5,635.	829.	+ 4,806.
Utilities	78,492.	47,817.	44,631.	+ 3,186.	5,739.	5,259.	+ 480.	24,936.	23,686.	+ 1,250.
Insurance	14,338.	7,517.	7,972.	- 455.	890.	735.	+ 155.	5,931.	3,008.	+ 2,923.
Professional Service	93,876.	25,891.	3,453.	+ 22,438.	18,161.	4,167.	+ 13,994.	49,824.	17,279.	+ 32,545.
Legal & Auditing	5,423.	676.		+ 676.				4,747.	7,700.	- 2,953.
Travel	110,148.	94,275.	79,360.	+ 14,915.	1,667.	4,300.	- 2,633.	14,206.	18,560.	- 4,354.
Freight	42,721.	22,918.	16,700.	+ 6,218.				19,803.	14,600.	+ 5,203.
Other Taxes	668.	257.		+ 257.				411.	410.	+ 1.
Contributions	9,450.	25.		+ 25.				9,425.	19,000.	- 9,575.
Other	64,187.	16,529.	10,727.	+ 5,802.	23,070.	7,975.	+ 15,095.	24,588.	16,444.	+ 8,144.
TOTAL -	$1,993,916.	$ 895,766.	$ 887,168.	$+ 8,598.	$ 494,827.	$ 508,245.	$- 13,418.	$ 603,323.	$ 613,318.	$- 9,995.

DIGITAL EQUIPMENT CORPORATION

Cost Center Report Control

Month Ended - April 24, 1964

General Ledger Control

$539,337.00

Description of Cost Center	Cost Center Manager	Actual	Forecast	Actual over (+) or under (-) Forecast
Sub System Assembly	J. Smith	$ 37,274.	$ 29,235.	$+ 8,039.
Silk Screening	M. Sandler	4,491.	2,720.	+ 1,771.
Sheet Metal	L. Prentice	16,365.	15,980.	+ 385.
Field Sales - California	S. Olsen	16,443.	14,519.	+ 1,924.
Field Sales - New Jersey	S. Olsen	3,016.	2,018.	+ 998.
Field Sales-Washington D.C.	S. Olsen	2,852.	2,689.	+ 163.
Field Sales - Pittsburg	S. Olsen	2,319.	2,118.	+ 201.
Field Sales - Illinois	S. Olsen	2,245.	1,997.	+ 248.
Home Office Sales	S. Olsen	38,983.	32,689.	+ 6,294.
Test Equipment	R. Hughes	7,615.	5,639.	+ 1,976.
Technical Publications	J. Atwood	71,729.	78,834.	- 7,105.
Module Assembly	M. Sandler	42,086.	43,585.	- 1,499.
Machine Shop	L. Prentice	13,010.	12,581.	+ 429.
Maintenance	J. Culkins	9,610.	8,114.	+ 1,496.
Model Shop	G. Gerelds	6,538.	6,547.	- 9.
Drafting	R. Melanson	21,535.	24,196.	- 2,661.
Systems Engineering	P. Greene	12,365.	13,579.	- 1,214.
Computer Engineering	A. Hall	44,470.	43,864.	+ 606.
Final Test	M. Sandler	8,891.	9,210.	- 319.
Production Control	M. Sandler	17,496.	13,156.	+ 4,340.
General Administrative	R. Mills	46,554.	49,846.	- 3,292.
Programming	H. Morse	15,943.	16,908.	- 965.
Purchasing	H. Crouse	13,865.	11,210.	+ 2,655.
Personnel	R. Lassen	5,068.	4,230.	+ 838.
Quality Control	R. Hughes	13,117.	16,710.	- 3,593.
Computer Checkout	E. Harwood	12,771.	9,603.	+ 3,168.
Computer Sales	N. Mazzarese	17,847.	17,215.	+ 632.
Customer Relations	R. Beckman	30,804.	25,211.	+ 5,593.
International Marketing	J. Fadiman	4,035.	3,383.	+ 652.
TOTAL -		$539,337.	$517,586.	$+ 21,751.

DIGITAL EQUIPMENT CORPORATION - FOREIGN OPERATIONS

Consolidated Profit and Loss from Incorporation Date

	Germany 5/8/63 -4/30/64	Australia 1/22/64 -4/30/64	Canada 5/1/63 -4/30/64	Consolidated Profit or Loss	%
Sales, net of returns & allowances	$ 135.38	$	$526,018.04	$526,153.42	
Commissions Income	29,864.48			29,864.48	
	29,999.86		526,018.04	556,017.90	100.0
Cost of Sales	100.62		420,455.01	420,555.63	75.6
Gross Profit	29,899.24		105,563.03	135,462.27	24.4
Operating Expenses:					
Payroll	16,813.82	2,781.14	23,263.39	42,858.35	7.7
Supplies	1,607.17		1,618.68	3,225.85	.6
Electricity	120.75		167.75	288.50	
Advertising	330.26	267.50	1,203.17	1,800.93	.3
Maintenance	239.50		474.28	713.78	.1
Sales Promotion	4,743.91	1,383.75	2,649.35	8,777.01	1.6
Travel	2,738.00	2,568.22	5,510.45	10,816.67	1.9
Professional Services	1,543.52	343.97	1,259.70	3,147.19	.6
Telephone & Telegraph	3,609.41	139.30	1,976.91	5,725.62	1.0
Postage	660.15	16.01	425.30	1,101.46	.2
Rent	2,373.75	726.45	1,660.50	4,760.70	.9
Depreciation & Amort.	2,890.22	7.79	645.49	3,543.50	.6
Taxes	664.90		1,602.85	2,267.75	.5
All Other	3,301.06	332.31	1,842.26	5,475.63	1.0
Total Expenses	41,636.42	8,566.44	44,300.08	94,502.94	17.0
Net Profit or (Loss) before taxes	($ 11,737.18)	($ 8,566.44)	$ 61,262.95	$ 40,959.33	7.4
Provision for Taxes			22,527.45	22,527.45	4.1
Net Profit or (Loss)	($ 11,737.18)	($ 8,566.44)	$ 38,735.50	$ 18,431.88	3.3

DIGITAL EQUIPMENT AUSTRALIA PTY LTD.

FINANCIAL STATEMENT

INDEX

DIGITAL EQUIPMENT AUSTRALIA PTY LTD.

Balance Sheet
as of April 30, 1964

ASSETS

Current Assets:	
Cash at Bank	$1,647.24
Cash on Hand	67.50
Prepaid Rent	
Deposit Electricity	33.75
Total Current Assets -	$1,748.49
Fixed Assets:	
Office Furniture	114.75
Office Equipment	877.50
Total	992.25
Less: Allowance for Depreciation	7.79
Total Fixed Assets -	984.46
Total Assets -	$2,732.95

LIABILITIES

Current Liabilities:	
Accrued Expenses	$1,549.40
Due DEC	9,745.49
Total	11,294.89
Capital:	
Capital Stock	
Ordinary Shares of £1 each	4.50
Accumulated Loss	(8,566.44)
Total Liabilities and Capital -	$2,732.95

DIGITAL EQUIPMENT AUSTRALIA PTY LTD.

Statement of Earnings

	One Month Ended 4/30/64	Fiscal Period 1/22/64 - 4/30/64
Expenses:		
Salaries & Wages	$1,115.70	$2,781.14
Accountancy	62.16	276.47
Audit Fee	22.50	67.50
Books	159.25	169.52
Postage	-0-.	16.01
Telephone & Telegraph	11.25	139.30
Travelling	1,912.18	2,568.22
Miscellaneous Expenses	4.34	133.53
Rent	441.26	726.45
Freight	5.63	5.63
Rent of Equipment	23.63	23.63
Depreciation	7.79	7.79
Advertising	267.50	267.50
Sales Promotion	1,383.75	1,383.75
Net Profit or (Loss) for period	($5,416.94)	($8,566.44)

DIGITAL EQUIPMENT OF CANADA, LTD.
FINANCIAL STATEMENTS

INDEX

DIGITAL EQUIPMENT OF CANADA, LTD.

Balance Sheet as of April 30, 1964

	(U.S.) Amount
Assets	
Current Assets	
Cash	$ 72,800.73
Accounts Receivable	13,153.56
Inventories - Modules & Computers	31,311.47
Prepayments & Deposits	2,959.85
Total Current Assets	120,225.61
Fixed Assets	
Manufacturing Equipment	422.39
Office Furniture & Fixtures	1,586.38
Office Equipment	1,994.25
Total Cost	4,003.02
Less: Allowance for Depreciation	504.18
Net Book Value	3,498.84
Leasehold Improvements at Amortized Cost	288.37
Total Fixed Assets - Book Value	3,787.21
Other Assets	
Deposit for Sales Tax Exemption Certificate	1,750.70
TOTAL ASSETS -	$125,763.52
Liabilities	
Current Liabilities	
Accounts Payable - Trade	$ 549.39
Accounts Payable - Parent	63,029.26
Reserve for Taxes	22,526.87
Total Current Liabilities	86,105.52
Net Worth	
Capital Stock	
Authorized, Issued and Fully Paid	922.50
Net Profit for the Period	38,735.50
Total Net Worth	39,658.00
TOTAL LIABILITIES & NET WORTH -	$125,763.52

DIGITAL EQUIPMENT OF CANADA, LTD.

Profit and Loss

	U.S.			
	Twelve Months 5/1/63 - 4/30/64	%	Ten Months 7/1/63 - 4/30/64	%
Sales	$526,018.04	100.0	$515,444.70	100.0
Cost of Sales	420,455.01	79.9	411,205.80	79.8
Gross Profit	105,563.03	20.1	104,238.90	20.2
Operating Expenses:				
Salaries	23,263.39	4.4	21,110.89	4.1
Travelling	5,510.45	1.0	4,954.61	1.0
Rent	1,660.50	.3	1,383.75	.3
Sales Promotion	2,649.35	.5	2,649.35	.5
Telephone and Telegraph	1,976.91	.4	1,756.49	.3
Advertising	1,203.17	.2	859.15	.2
Stationery & Supplies	1,618.68	.3	1,264.42	.2
Professional Services	1,259.70	.2	890.70	.2
All Other	5,157.93	1.0	4,792.29	.9
Total Expenses	44,300.08	8.4	39,661.65	7.7
Profit before Taxes	61,262.95	11.7	64,577.25	12.5
Less: Provision for Taxes	22,527.45	4.3	22,527.45	4.3
Net Profit	$ 38,735.50	7.4	$ 42,049.80	8.2

DIGITAL EQUIPMENT OF CANADA, LTD.

Parent Investment

April 1963 through April 1964:

Cash Advanced Excluding original capitalization of $1,000	$ 12,499.62
Billings for Shipments to Customers	445,442.42
Billings for Equipment etc. sent to DECAN	3,650.71
	$461,592.75
Less: Cash Payments to DEC	398,563.49
	$ 63,029.26
Plus: Miscellaneous Adjustments	-0-
DEC Cash Investment as of 4/30/64	$ 63,029.26

DIGITAL EQUIPMENT GmbH

FINANCIAL STATEMENTS

INDEX

DIGITAL EQUIPMENT GmbH

Balance Sheet
as of April 30, 1964

Assets

Cash	$ 12.
Due from DEC (Net)	564.
Other Current Assets	3,474.
Total Current Assets	4,050.
Fixed Assets (Net)	3,812.
Leasehold Improvements (Net)	1,704.
Total Assets -	$9,566.

Liabilities

Trade Payables	$ 240.
Accrued Liabilities	1,063.
Total Liabilities	$1,303.

Net Worth

Paid In Capital	20,000.
Deficit	(11,737.)
Net Worth	$8,263.
Total Liabilities and Net Worth -	$9,566.

DIGITAL EQUIPMENT GmbH

Statement of Profit and Loss

	One Month Ended 4/30/64	Fiscal Period 5/8/63 thru 4/30/64
Sales	$ -0-	$ 135.
Cost of Sales	-0-	100.
Gross Margin on Sales	-0-	35.
Commissions Income	6,031.	29,864.
Gross Margin	6,031.	29,899.
Less: Operating Expenses:		
Salaries	1,763.	16,814.
Promotion, Travel and Adv.	717.	7,812.
Telephone & Telegraph	242.	3,609.
Depreciation & Amortization	309.	2,890.
Rent	325.	2,374.
Legal and Auditing	210.	1,544.
Operating Supplies	60.	1,607.
Capital Transfer Tax	-0-	500.
All Other Expenses	367.	4,486.
Total Expenses	3,993.	41,636.
Net Profit or (Loss)	$ 2,038.	($11,737.)

DIGITAL EQUIPMENT GmbH

Cash Flow, Parent and Subsidiary
Twelve Months Ended April 30, 1964

Cash Advanced Excluding Invested Capital of $20,000.	$31,102.*	
Fixed Assets Acquired from Parent at Cost	2,536.	
Services Rendered by Parent at Cost	1,125.	
Total Payment by Parent		$34,763.
Less:		
Commissions Earned by DEGmbH	29,895.	
Expenses Incurred on behalf of Parent	462.	
Total Credit		30,357.
Net Due Parent		$ 4,406.*

*$5,000 advance not shown on DEGmbH books as in transit on April 30, 1964.

Net Cash Flow:

Invested Capital	$20,000.
Total per above	31,102.
Grand Total	$51,102.

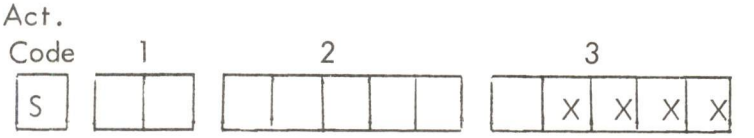

digital
EQUIPMENT
CORPORATION
MAYNARD, MASSACHUSETTS

June 17, 1964

Product Line Codes

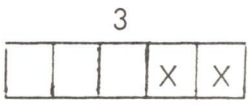
Effective June 29, 1964

All sales work will be charged to product lines by means of the codes specified below. On job tickets, sales charges are made by placing an "S" in the activity code column and a 4 digit product line code number in field 3, as indicated below. Fields 1 and 2 are left blank.

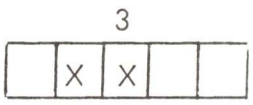


The 4 digit product line code contains two parts:

The right 2 digits give hardware product line



The left 2 digits give application type



Hardware Product Line Codes: (Right 2 digits)

Code	Product Line
00	Not chargeable to a product line
01	PDP-1
04	PDP-4
05	PDP-5
06	PDP-6
07	PDP-7
08	PDP-8
55	Lab Modules
65	System Modules
81	Small Modules
90	Memory Test Equipment

Application Product Line Codes: (Left 2 digits)

Code	Application
00	No defined application
10	Physics
20	Medical
30	Process Control
40	Communications

DWP:ncs

dec INTEROFFICE MEMORANDUM

Gordon Bell

Charge Numbering System

Effective June 29, 1964

On June 29, 1964, a new charge numbering procedure will go into effect throughout the company. This memo describes the new system. The system will be used for charging labor, materials, and other expenditures. It provides a consistent format that will facilitate computer processing of company data and production of reports. It is the first step toward an automatic data processing application that will make company information more readily accessible for control and planning purposes.

I. Overview of the System

Numbers used for charging contain two types of information. The first type identifies the source of the charge. The second specifies the use of the charge. The source is identified by badge and cost center numbers and employee names. The use of the charge is specified by either:

a. Job Numbers, for charges to particular jobs (such as development and manufacturing projects.

b. Product line codes, for charges that can be identified only with product lines (such as sales work).

c. Cost center numbers, for overhead work done for a cost center (such as printing forms and building partitions).

II. Charge Number Specifications

The charge procedure is best described in the context of the new labor job tickets, which will be distributed before June 26. A sample job ticket appears below.

DATE / /

DAILY JOB TICKET

BADGE NO.	HOME CC	CHARGE TO CC *	NAME	ACT CODE	1	2	3	Operation Code	TIME
			ACTIVITY CODE USE						
			M - USE FIELDS 1, 2, 3,						
			D - USE FIELDS 3,						
			C - USE FIELDS 3,						
			S - USE FIELDS 3						
			G - USE FIELDS 1, 3						
			F - USE FIELDS 1, 2, 3,						
			P-use fields 3						

* CONSULT SUPERVISOR FOR USE OF THIS FIELD

The left four columns of the job ticket identify the source of charges. They contain:

a. Badge Number -- prepunched (4 digits)

b. Home Cost Center Number -- prepunched (2 digits)

c. "Charge to" Cost Center -- (2 digits) This column is used only when a man is performing work that is not the normal function in his home cost center. It gives the number of the cost center for whom he is actually working. A field service man working in computer checkout would, for example, give the checkout cost center number (33). Similarly, module assembly girls stuffing envelopes for technical publications would give the technical publications cost center number. The use of "charge to" cost center numbers will enable tabulation of the amount of labor actually used by each cost center.

d. Employee's name -- prepunched.

The five columns labeled "Act.Code," "1," "2," "3," and "Operation Code" specify the use of the charge. They contain a) an activity code, b) a cost accumulation number, and c) an operation number. Each of these items is described below:

a. Activity Code (one alphabetic character). Six basic company activities have been defined. Each is identified by a different alphabetic character. Definitions and code letters appear below:

Activity Code	Description
D	Development work. Includes all work that is development expense. Similar in concept to current "EN1000" series.
P	Production Engineering. Includes engineering work done to provide facilities necessary for manufacture of a product or to make modifications necessitated by factors outside the company's control.

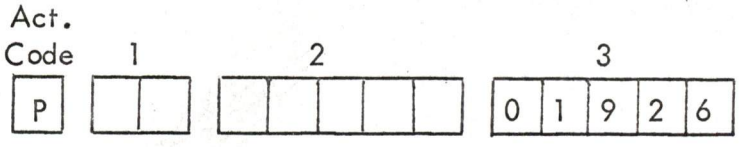
Activity Code	Description
C	Customer work. Includes all work charged to a particular customer order, except for manufacturing charges. Customer liaison, installation, etc. will fall under this code. Similar in concept to the current "EN2000" series.
M	Manufacturing work. Includes all manufacturing charges.
S	Sales work. Includes all sales activity, independent of origin. Thus, engineers working on proposals, salesmen selling, and customer relations men giving sales support will use this code.
F	Field service. Includes all charges incurred maintaining equipment after customer acceptance. Both warranty and non-warranty maintenance charges will be collected under this code.
G	General. This code identifies charges for overhead work done for a cost center and not chargeable to jobs or product lines. Thus, technical publications work for the personnel department would qualify for a "G" code.

b. Cost Accumulation Number (12 digits). This number goes in the fields labeled "1," "2," and "3" on the card. A different type of number is used for each activity code, as described below:

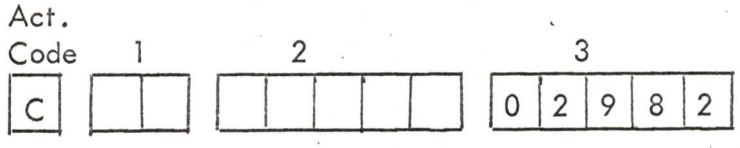
i. Development work: Identified by a D activity code. The specific project is identified by a five digit number in field 3. Numbers will be serially assigned as new development projects are accepted. A charge to project 01926 would look like:

Act. Code	1		2					3				
D								0	1	9	2	6

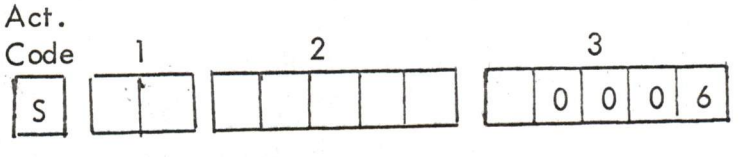
ii. Production Engineering: Identified by a P activity code. The specific project is identified by a five digit number in field 3. The five digit number is the same as that used for development of the item. Engineering work to solve production problems on the product developed under D 01926 would be charged to:



iii. Customer work: Identified by a C activity code. The specific project is identified by a five digit number in field 5. Numbers would be serially assigned as orders arrive. A charge to project 02982 would look like:



iv. Sales work: Identified by an S activity code. The specific product line is identified by a 4 digit number in field 3. The right two digits in field 3 are for the hardware product line (PDP-1, PDP-4, PDP-6, system modules, etc.). The left two digits denote particular application types (physics, medical, etc.) on which the company desires cost accumulation. Sales time spent on PDP-6 with no particular application type would be charged to:



v. Field service work: Identified by an F activity code. Maintenance work on units in the field will be identified by:

a. 2 digits identifying machine type (in field 1)

b. 3 digits identifying specific installation (in field 2)

c. 3 digits identifying type of equipment serviced (in field 3)

Work on PDP-5 installation number 103, servicing equipment designated 041 would be charged to:

Act. Code	1	2	3
F	05	103	041

Some maintenance activity, such as training for new machine servicing, might be charged only to a product line. Such charges will be made through a 4 digit product line code in field 3. The product line code is the same as used for sales charges. PDP-6 maintenance classes would be charged to:

Act. Code	1	2	3
F			0006

vi. Manufacturing: Identified by an M activity code. Modules and manufactured parts work is charged to a twelve digit number where:

a. 2 digits specify the type of unit -- module, transformer, etc. (in field 1)

b. 5 digits specify the particular module type; or, where applicable, the module in which the manufactured part is used (in field 2)

c. 5 digits specify the manufacturing lot number, serially assigned (in field 3)

Thus, 1201 module assembly (04), lot number 4130 would be charged to:

Act. Code	1	2	3
M	0 4	0 1 2 0 1	0 4 1 3 0

Computers and peripheral equipment work is charged to a twelve digit number using:

a. 2 digits to identify as a computer system, computer component, or a peripheral item (in field 1)

b. 5 digits for the model number (in field 2)

c. 5 digits for the serial number of the item (in field 3)

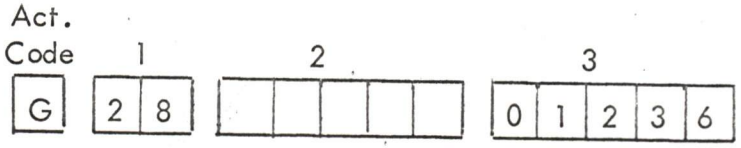
Thus, work on a PDP-5 system (20) with serial number 65 would be charged to:

Act. Code	1	2	3
M	2 0	0 0 0 0 5	0 0 0 6 5

vii. General work: Identified by a G activity code. A two digit number in field 1 gives the cost center for whom the work is being done. Thus, technical publications design and printing of forms for personnel (cost center 79), would be charged to:

Act. Code	1	2	3
G	7 9		

If an internal work order for general work exists, its number would appear in field 3. Thus, electrical work with work order number 1236 for the sales department (cost center 28) would be charged to:



c. Operation numbers: The five digit field at the right of the card allows for operation numbers or other codes that vary from department to department and are used for intradepartmental control purposes.

Material requisitions, purchase orders, and vouchers will include the same basic number as labor job tickets, so that these items can be charged properly. All requisitions, purchase orders, and vouchers should include:

a. The badge number of the person requesting the item.
b. The number of the cost center where items are used.
c. The one character activity code, as described for job tickets.
d. The cost accumulation number, in the same format as on job tickets.
e. An operation number, where required by a cost center.

III. Start-up Procedures

Each department manager should lay out complete specifications for numbers used in his area and take responsibility for introducing his people to the new system.

Should questions arise, call Dave Packer (X305) or Win Hindle (X338).

DWP:ncs
June 16, 1964

Gordon Bell

Proposed Class Codes

June 10, 1964
Dave Packer
Gordon Bell

COMPUTERS

01	PDP-1
04	PDP-4
05	PDP-5
06	PDP-6
07	PDP-7
08	PDP-8
30	Magnetic Tape (general)
31	CRT Displays (general)
32	Other In-Out Equipment (general)
35	LINC
36	A-D-A Equipment (general)
37	Drum (general)
38	Memory (general)

MODULES

55	Lab Modules (general)
65	Systems Modules (general)
56	Power Supplies
57	Mounting Panels, Accessories
81	Small Modules
90	Memory Test Equipment

Proposed Class Codes

June 10, 1964
Dave Packer
Gordon Bell

COMPUTERS

01	PDP-1
04	PDP-4
05	PDP-5
06	PDP-6
07	PDP-7
08	PDP-8
30	Magnetic Tape (general)
31	CRT Displays (general)
32	Other In-Out Equipment (general)
35	LINC
36	A-D-A Equipment (general)
37	Drum (general)
38	Memory (general)

MODULES

55	Lab Modules (general)
65	Systems Modules (general)
56	Power Supplies
57	Mounting Panels, Accessories
81	Small Modules
90	Memory Test Equipment

TITLE: DEC FINANCIAL FORECAST FISCAL '65

INDEX

COMPANY CONFIDENTIAL

SUMMARY ITEMS

Sales: $14,887,200

Profit before Taxes: $3,356,400 or 22.5% of sales

Profit after Taxes: $1,577,800 or 10.6% of sales

Financing

Probable outside financing of 400K around September or October of 1964, with repayment before December.

Investments

If module and computer manufacturing schedules remain at the same level, we will reach an investment situation in the last half of fiscal 1965 with ending investments of $1,600,000.

COMPANY CONFIDENTIAL

FORECAST ASSUMPTIONS

1. Total Sales in Fiscal '65 will be $14,887,200.

2. Cost of Sales will not change from current experience. Historical costs are the basis.

3. Total module production will be 91,900 units of which 26,500 will be small modules. Computer production will be 2 - 1's, 4 - 4's, 95 - 5's, 11 - 6's, 12 - 7's, 10 - 8's.

4. Sales Value of small modules will average $30 with a cost of $10.

5. There will be no personnel increases in manufacturing and engineering other than replacement and summer help.

6. Company Sponsored Engineering will not exceed $1,700,000.

7. There will be two leases, Value 490K in Fiscal '65.

8. Leasehold improvements will not exceed $100,000.

9. Capital Equipment purchases will approximate $380,000 for Fiscal '65.

10. Small modules will only be used in the PDP-7 line, 5A line

COMPANY CONFIDENTIAL

DIGITAL EQUIPMENT CORPORATION

Production Schedule

Fiscal '65

	Modules	Systems	Computers
July	7,100	2	9
August	8,200	2	10
September	8,100	2	11
October	7,900	2	12
November	7,900	2	12
December	7,800	2	11
January	7,000	2	12
February	7,000	2	11
March	7,600	2	12
April	7,600	2	12
May	7,900	2	11
June	7,800	2	11
TOTAL	91,900	24	134

00.00 omitted

DIGITAL EQUIPMENT CORPORATION
Profit and Loss Schedule
Fiscal '65

COMPANY CONFIDENTIAL

		July	August	September	October	November	December	January	February	March	April	May	June	Total	
Sales:	Modules	$ 369,0	$ 374,0	$ 366,0	$ 350,0	$ 350,0	$ 350,0	$ 300,0	$ 300,0	$ 350,0	$ 350,0	$ 370,0	$ 370,0	$4,199,0	
	Systems	83,4	83,4	83,4	83,4	83,4	83,4	83,4	83,4	83,4	83,4	83,4	83,4	1,000,8	
	Computers	448,0	452,0	767,0	707,0	852,0	867,0	717,0	777,0	967,0	1,222,0	767,0	767,0	9,310,0	
	Rentals	20,0	20,0	20,0	20,0	20,0	24,2	22,2	22,2	22,2	22,2	22,2	22,2	257,4	
	Field Service	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	120,0	
Total Sales		930,4	939,4	1,246,4	1,170,4	1,315,4	1,334,6	1,132,6	1,192,6	1,432,6	1,687,6	1,252,6	1,252,6	14,887,2	100%
Cost of Sales:	Modules	130,0	130,9	128,1	122,5	122,5	122,5	90,0	90,0	105,0	105,0	111,0	111,0	1,368,5	
	Systems	50,0	50,0	50,0	50,0	50,0	50,0	50,0	50,0	50,0	50,0	50,0	50,0	600,0	
	Computers	228,5	230,5	391,2	360,6	434,5	442,2	365,7	396,3	493,2	623,2	391,2	391,2	4,748,3	
	Rentals	4,8	4,5	4,5	4,5	4,5	4,5	8,6	7,8	7,8	7,8	7,8	7,8	74,9	
	Field Service	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0	36,0	
Total Cost of Sales		416,3	418,9	576,8	540,6	614,5	622,2	517,3	547,1	659,0	789,0	563,0	563,0	6,827,7	45.8
Gross Profit		514,1	520,5	669,6	629,8	700,9	712,4	615,3	645,5	773,6	898,6	689,6	689,6	8,059,5	54.2
Operating Expenses:															
	Selling	106,9	111,1	125,4	117,5	117,9	146,3	129,5	131,1	147,0	133,4	134,0	147,7	1,547,8	10.4
	Technical Publications	50,0	50,0	56,0	50,0	50,0	56,0	50,0	50,0	56,0	50,0	50,0	56,0	624,0	4.2
	Administration	68,9	60,3	70,1	63,8	59,6	68,8	70,1	66,3	71,6	69,9	65,5	162,4	897,3	6.0
	Co. Sponsored	130,7	130,7	163,6	130,7	130,7	163,6	130,7	130,7	163,6	130,7	130,7	163,6	1,700,0	11.5
Total Operating Expense		356,5	352,1	415,1	362,0	358,2	434,7	380,3	378,1	438,2	384,0	380,2	529,7	4,769,1	32.1
Operating Profit or Loss		157,6	168,4	254,5	267,8	342,7	277,7	235,0	267,4	335,4	514,6	309,4	159,9	3,290,4	22.0
	Other Income	5,5	5,5	5,5	5,5	5,5	5,5	5,5	5,5	5,5	5,5	5,5	5,5	66,0	
Profit or (Loss) before Taxes		163,1	173,9	260,0	273,3	348,2	283,2	240,5	272,9	340,9	520,1	314,9	165,4	3,356,4	22.5
	Taxes	86,4	92,1	137,8	144,8	184,5	150,0	127,5	144,6	180,7	275,7	166,9	87,6	1,778,6	11.9
Profit after Taxes		76,7	81,8	122,2	128,5	163,7	133,2	113,0	128,3	160,2	244,4	148,0	77,8	1,577,8	10.6

00.00 omitted

DIGITAL EQUIPMENT CORPORATION
Domestic, Canada and Europe Profit and Loss
Fiscal '65

COMPANY CONFIDENTIAL

		July	August	September	October	November	December	January	February	March	April	May	June	Total	
Sales:	Domestic	$ 878,4	$ 916,4	$1,179,4	$1,020,4	$ 883,4	$1,271,6	$1,095,6	$1,105,6	$1,388,6	$1,672,6	$1,205,6	$ 945,6	$13,563,2	
	Canada	40,0	5,0	15,0	85,0	70,0	36,0	25,0	60,0	15,0	15,0	40,0	57,0	463,0	
	Europe and Other	12,0	18,0	52,0	65,0	362,0	27,0	12,0	27,0	29,0		7,0	250,0	861,0	
Total Sales		930,4	939,4	1,246,4	1,170,4	1,315,4	1,334,6	1,132,6	1,192,6	1,432,6	1,687,6	1,252,6	1,252,6	14,887,2	100%
Cost of Sales:	Domestic	392,2	405,1	536,8	450,0	332,7	582,3	503,2	498,1	634,7	783,3	538,1	360,9	6,017,4	44.3
	Canada	19,5	1,9	5,7	51,9	46,2	22,1	9,5	31,2	5,7	5,7	22,2	37,1	258,7	55.8
	Europe and Other	4,6	11,9	34,3	38,7	235,6	17,8	4,6	17,8	18,6		2,7	165,0	551,6	64.0
Total Cost of Sales		416,3	418,9	576,8	540,6	614,5	622,2	517,3	547,1	659,0	789,0	563,0	563,0	6,827,7	45.8
Gross Profit:	Domestic	486,2	511,3	642,6	570,4	550,7	689,3	592,4	607,5	753,9	889,3	667,5	584,7	7,545,8	55.7
	Canada	20,5	3,1	9,3	33,1	23,8	13,9	15,5	28,8	9,3	9,3	17,8	19,9	204,3	44.2
	Europe and Other	7,4	6,1	17,7	26,3	126,4	9,2	7,4	9,2	10,4		4,3	85,0	309,4	36.0
Total Gross Profit		514,1	520,5	669,6	629,8	700,9	712,4	615,3	645,5	773,6	898,6	689,6	689,6	8,059,5	54.2

00.00 omitted

DIGITAL EQUIPMENT CORPORATION
Computer and Peripheral Equipment Forecast
Billing Date
Fiscal '65

COMPANY CONFIDENTIAL

	July	August	September	October	November	December	January	February	March	April	May	June	Total
PDP-1													
Value	$120,0			$120,0									$ 240,0
Units	1			1									2
PDP-4													
Value	85,0	185,0			80,0								350,0
Units	1	2			1								4
PDP-5													
Value	168,0	192,0	192,0	192,0	192,0	192,0	192,0	192,0	192,0	192,0	192,0	192,0	2,280,0
Units	7	8	8	8	8	8	8	8	8	8	8	8	95
PDP-6													
Value			350,0	170,0	350,0	450,0	200,0	360,0	450,0	810,0	350,0	350,0	3,840,0
Units			1	1	1	1	1	1	1	2	1	1	11
PDP-7													
Value			100,0	100,0	100,0	100,0	200,0	100,0	200,0	100,0	100,0	100,0	1,200,0
Units			1	1	1	1	2	1	2	1	1	1	12
PDP-8													
Value			50,0	50,0	50,0	50,0	50,0	50,0	50,0	50,0	50,0	50,0	500,0
Units			1	1	1	1	1	1	1	1	1	1	10
Peripheral Equipment													
Value	75,0	75,0	75,0	75,0	75,0	75,0	75,0	75,0	75,0	75,0	75,0	75,0	900,0
Total Units	9	10	11	12	12	11	12	11	12	12	11	11	134

00.00 omitted

DIGITAL EQUIPMENT CORPORATION
Balance Sheet
Fiscal '65

COMPANY CONFIDENTIAL

	July	August	September	October	November	December	January	February	March	April	May	June	net Change
Assets													
Current:													
Cash	$ 378,1	$ 194,8	$ 30,3	$ 83,7	$ 144,3	$ 36,8	$ 207,3	$ 274,6	$ 119,9	$ 287,1	$ 295,3	$ 220,4	$ 157,7-
Investments							300,0	400,0	400,0	800,0	1,300,0	1,600,0	1,600,0+
Receivables	1,230,4	1,274,4	1,582,4	1,600,4	1,727,4	1,786,4	1,590,4	1,606,4	1,863,4	2,175,4	1,995,4	1,758,4	528,0+
Inventory	2,849,5	2,878,6	2,979,2	3,102,4	3,110,8	3,125,3	2,760,5	2,815,7	2,772,5	2,552,4	2,520,4	2,505,9	143,6-
Prepayment & Other	38,0	38,0	38,0	38,0	38,0	38,0	38,0	38,0	38,0	38,0	38,0	38,0	-0-
Total Current Assets	4,296,0	4,385,8	4,629,9	4,824,5	5,020,5	4,986,5	4,896,2	5,134,7	5,193,8	5,852,9	6,149,1	6,122,7	1,826,7+
Investment in Subsidiaries	37,7	37,7	37,7	37,7	37,7	37,7	37,7	37,7	37,7	37,7	37,7	37,7	-0-
Fixed Assets:													
Leased Equipment	85,2	80,7	76,2	71,7	67,2	62,9	544,3	536,5	528,7	520,9	513,1	505,3	420,0+
Plant Equipment	564,2	584,6	705,2	714,5	722,6	729,6	711,2	692,4	673,3	653,9	629,5	605,1	40,9+
Leaseholds at Amort. Cost	112,7	113,2	113,5	113,5	113,4	113,0	112,3	111,4	110,2	108,8	106,7	99,8	12,9-
Total Assets	5,095,8	5,202,0	5,562,5	5,761,9	5,961,4	5,929,7	6,301,7	6,512,7	6,543,7	7,174,2	7,436,1	7,370,6	2,274,8+
Liabilities & Capital													
Current:													
Accounts Payable	292,5	264,8	250,3	271,4	392,1	412,2	535,6	513,7	381,8	487,2	524,2	580,3	287,8+
Notes Payable	16,3	16,3	416,3	216,3	116,3	16,3	16,3	16,3	16,3	16,3	16,3	16,3	-0-
Employee Withholding	100,0	50,0	95,0	120,0	50,0	95,0	130,0	80,0	155,0	280,0	180,0	200,0	-0-
Accrued Expenses	330,0	340,0	360,0	440,0	350,0	370,0	350,0	360,0	480,0	360,0	370,0	490,0	160,0+
Accrued Taxes	602,7	694,8	482,6	627,4	811,9	661,9	789,4	934,0	741,7	1,017,4	1,184,3	844,9	242,2+
Total Current Liabilities	1,341,5	1,365,9	1,604,2	1,675,1	1,720,3	1,555,4	1,821,3	1,904,0	1,774,8	2,160,9	2,274,8	2,131,5	790,0+
Long Term Debt:													
Notes Payable	354,4	354,4	354,4	354,4	345,0	345,0	338,1	338,1	338,1	338,1	338,1	338,1	16,3-
Capital:													
Common Stock	50,9	50,9	50,9	50,9	50,9	50,9	50,9	50,9	50,9	50,9	50,9	50,9	-0-
Capital in excess of Par	81,4	81,4	81,4	81,4	81,4	81,4	81,4	81,4	81,4	81,4	81,4	81,4	-0-
Retained Earnings	3,267,6	3,349,4	3,471,6	3,600,1	3,763,8	3,897,0	4,010,0	4,138,3	4,298,5	4,542,9	4,690,9	4,768,7	1,501,1+
Total Capital	3,399,9	3,481,7	3,603,9	3,732,4	3,896,1	4,029,3	4,142,3	4,270,6	4,430,8	4,675,2	4,823,2	4,901,0	1,501,1+
Total Liabilities & Capital	$5,095,8	$5,202,0	$5,562,5	$5,761,9	$5,961,4	$5,929,7	$6,301,7	$6,512,7	$6,543,7	$7,174,2	$7,436,1	$7,370,6	$2,274,8+

00.00 omitted

DIGITAL EQUIPMENT CORPORATION
Cash Flow
Fiscal '65

COMPANY CONFIDENTIAL

	July	August	September	October	November	December	January	February	March	April	May	June	Total
Beginning Balance	$ 300,0	$ 378,1	$ 194,8	$ 30,3	$ 83,7	$ 144,3	$ 36,8	$ 207,3	$ 274,6	$ 119,9	$ 287,1	$ 295,3	$
Receipts:													
Customer	950,0	895,4	938,4	1,152,4	1,188,4	1,275,6	1,328,6	1,176,6	1,175,6	1,375,6	1,432,6	1,489,6	14,378,8
Investments													400,0
Loans			400,0										
Other Receipts	5,0	5,0	7,0	5,0	5,0	7,0	5,0	5,0	7,0	5,0	5,0	7,0	68,0
Total Receipts	955,0	900,4	1,345,4	1,157,4	1,193,4	1,282,6	1,333,6	1,181,6	1,182,6	1,380,6	1,437,6	1,496,6	14,846,8
Total Available	1,255,0	1,278,5	1,540,2	1,187,7	1,277,1	1,426,9	1,370,4	1,388,9	1,457,2	1,500,5	1,724,7	1,791,9	
Disbursements:													
Payroll and Payroll Taxes	261,0	391,3	346,0	245,8	383,0	341,6	246,5	401,1	351,6	245,6	400,0	285,6	3,899,1
Operating Supplies	60,0	50,0	60,0	50,0	50,0	60,0	55,0	55,0	65,0	55,0	55,0	65,0	680,0
Utilities	24,0	24,0	24,0	25,0	25,0	25,0	26,0	26,0	26,0	27,0	27,0	27,0	306,0
Travel	20,0	20,0	25,0	20,0	20,0	25,0	22,0	22,0	27,0	22,0	22,0	27,0	272,0
Other Operating Expenses	85,0	85,0	95,0	85,0	85,0	95,0	85,0	85,0	95,0	85,0	85,0	95,0	1,060,0
Capital Equipment	40,0	40,0	145,0	35,0	35,0	35,0	10,0	10,0	10,0	10,0	5,0	5,0	380,0
Leasehold Improvements	15,0	10,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	75,0
Federal & State Income Taxes			350,0			300,0			373,0			427,0	1,450,0
Outside Contracting	80,0	80,0	80,0	80,0	80,0	80,0	80,0	60,0	60,0	60,0	40,0	40,0	820,0
Investments							300,0	100,0		400,0	500,0	300,0	1,600,0
AR&D Principal & Int. Repayment			4,5		9,4	5,9	7,6		4,5			4,5	36,4
Loan Repayments				200,0	100,0	100,0							400,0
Inventory Purchases	273,4	368,4	360,4	343,2	325,4	302,6	311,0	300,2	305,2	288,8	275,4	275,4	3,729,4
Space Advertising	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	180,0
Foreign Capital Req.	3,5												3,5
Land & Building								35,0					35,0
Total Disbursements	876,9	1,083,7	1,509,9	1,104,0	1,132,8	1,390,1	1,163,1	1,114,3	1,337,3	1,213,4	1,429,4	1,571,5	14,926,4
Ending Cash Balance	$ 378,1	$ 194,8	$ 30,3	$ 83,7	$ 144,3	$ 36,8	$ 207,3	$ 274,6	$ 119,9	$ 287,1	$ 295,3	$ 220,4	

G. Bell

COMPANY CONFIDENTIAL

INTEROFFICE MEMORANDUM

DATE: 8/19/64

SUBJECT: Computer Sales Forecast

TO: Works Committee
E. Harwood
B. Lane
J. Fadiman
B. Beckman
T. Johnson

FROM: N. Mazzarese

PDP-1 Computer Orders

Customer	Quantity	Total Value	Probability	Remarks	Sales Engineer	When
Univ. of Washington	1	300K	25%	R*	J. Jones	4-6 mos.
ITT (ASX-11)	1	120K	25%	NR**	R. Lane	4-6 mos.
PDP-4 Computer Orders						
Fischer & Porter	1	125K	80%	NR	R. Lindsay	1-3 mos.
Foxboro	1	65K	50%	NR	A. Hall	1-3 mos.
RPI	1	70K	75%	R	J. Jones	1-3 mos.
CEA, Harvard	1	80K	50%	R	G. Rice	4-6 mos.
Univ. of Maryland	1	75K	25%	R	J. Jones	4-6 mos.

** NR -- Non-Renegotiable
* R -- Renegotiable

Customer	Quantity	Total Value	Probability	Remarks	Sales Engineer	When
PDP-5 Computer Orders						
Mare Island	1	27K	75%	R	K. Larsen	1-3 mos.
Univ. of Michigan (on rental)	1	26K	80%	NR	G. Rice	1-3 mos.
Argonne Nat'l Labs	1	45K	60%	R	J. Jones	1-3 mos.
Loyola	1	20K	50%	NR	T. Quinn	1-3 mos.
Hayward School	1	18K	75%	NR	R. Maxcy	1-3 mos.
Watertown Arsenal	1	50K	85%	R	J. Jones	1-3 mos.
NRTA	1	24K	70%	R	Showalter-Judd	1-3 mos.
Boston College	1	30K	75%	NR	R. Maxcy	1-3 mos.
AECL	2	50K	50%	NR	D. Doyle	1-3 mos.
St. John's Univ.	1	41K	65%		D. Denniston	1-3 mos.
Univ of Tokyo	1	50K	95%	NR	Rikei Trading Co.	1-3 mos.
Prince Henry Hospital Sydney, Australia	1	30K	60%	NR	R. Smart	1-3 mos.
Princeton	1	80K	90%	R	J. Jorgenson	1-3 mos.
Applied Dynamics	1	30K	75%	NR	R. Oakley	1-3 mos.
UCLA	1	55K	90%	NR	M. Ruderman	1-3 mos.
Dow Jones	2	80K	90%	NR	D. Denniston	1-3 mos.
Univ. of Pennsylvania	1	40K	50%	NR	M. Ruderman	4-6 mos.
T.R.W.	1	30K	25%	NR	R. Colman	4-6 mos.
Calcomp	1	30K	25%	NR	R. Colman	4-6 mos.
DuPont	1	30K	25%	NR	A. Titcomb	4-6 mos.

PDP-5 Computer Orders (con't.)

Customer	Quantity	Total Value	Probability	Remarks	Sales Engineers	When
Teleregister	1	30K	25%	NR	R. Lane G. Rice	4-6 mos.
Philco	1	100K	25%	NR	P. Green	4-6 mos.
American Type Founders	1	30K	25%	NR	D. Denniston	4-6 mos.
Airborne Inst. Lab	1	30K	25%	NR	D. Denniston	4-6 mos.
Milgo	1	27K	25%	R	J. Ridgeway	4-6 mos.
Engineering Systems	1	24K	25%	R	G. Rice	4-6 mos.
Data Rec. Inc.	1	27K	25%	R	Datronics	4-6 mos.
Colorado State	1	27K	25%	NR	R. Maxcy	4-6 mos.
Ketchum, Milo	1	27K	25%	NR	R. Maxcy	4-6 mos.
Dynatronics	1	33K	25%	NR	J. Ridgeway	4-6 mos.
ITT	1	50K	25%	NR	R. Lane	4-6 mos.

PDP-6 Computer Orders

Brookhaven Labs	1	325K	100%		R. Lane	1-3 mos.
Adams Associates	1	600K	100%		H. Anderson	1-3 mos.
Univ. of Pennsylvania	1	325K	75%		R. Lindsay	1-3 mos.
MIT, Lab for N. S.	1	240K	75%		R. Lane	1-3 mos.
Rand Corporation	1	780K	50%		R. Stiver	1-3 mos.
Edinborough	1	420K	50%		J. Long	4-6 mos.
Oregon	1	500K	50%		K. Larsen	4-6 mos.
Stanford, Berkeley	1	210K	75%		R. Lane	4-6 mos.
Univ. of Bonn	1	300K	50%	NR	G. Huewe	4-6 mos.
United Aircraft	1	500K	50%		G. Moore	4-6 mos.

PDP-6 Computer Orders (con't.)

Customer	Quantity	Total Value	Probability	Remarks	Sales Engineer	When
ITT	1	350K	25%		R. Lane	4-6 mos.
Axel-Springer	1	500K	25%		G. Huewe	4-6 mos.
Rensselaer	1	800K	25%		G. Rice	1-3 mos.
Lockheed, Sunnyvale	1	400K	25%		P. Harris	4-6 mos.
Univ. of Notre Dame	1	250K	25%		T. Quinn	4-6 mos.
Transdata	1	300K	25%	NR	K. Larsen	4-6 mos.
Lockheed, Georgia	1	350K	25%	NR	G. Moore	4-6 mos.
UCLA	1	300K	25%	NR	R. Colman	4-6 mos.
Univ. of Michigan	1	400K	25%	NR	R. Oakley	4-6 mos.
NASA Houston	1	700K	25%	R	G. Moore	4-6 mos.
Dominion Observatories	1	350K	25%	NR	G. Moore	4-6 mos.
National Research Council	1	350K	25%	NR	G. Moore	4-6 mos.
Hanford Laboratories	1	1.5M	25%	R	G. Moore	4-6 mos.
Oxford University	1	270K	25%	NR	J. Levy	4-6 mos.

PDP-7 Computer Orders

Lockheed, Marietta	1	200K	50%	R	G. Moore	1-3 mos.
Mass. Gen. Hospital	1	100K (rental)	90%	NR	G. Moore	1-3 mos.
G.E., Richland	1	60K	50%	R	O. Judd	4-6 mos.
Univ. of Texas	1	150K	75%	R	A. Titcomb J. Jones	4-6 mos.
Univ. of Aachen	1	72K	60%	NR	G. Huewe	4-6 mos.
Univ. of Delft	1	96K	90%	NR	G. Huewe	4-6 mos.
Humble Oil Co.	1	200K	50%	NR	D. Colton	4-6 mos.

PDP-7 Computer Orders (con't.)

Customer	Quantity	Total Value	Probability	Remarks	Sales Engineer	When
Cyclotron, Karlsruhe	1	80K	25%		G. Huewe	
Soesterberg, Holland	1	65K	25%		G. Huewe	
SLAC, Stanford	2	140K	25%		K. Larsen	
Fort Meade	1	200K	25%		R. Wilson	
LRL	1	72K	25%	R	K. Larsen	4-6 mos.
JPL	1	72K	25%	R	T. Johnson	4-6 mos.

LINC Computer Orders

Washington University	3	125K	90%	NR	M. Ruderman	1-3 mos.
Univ. of Pennsylvania Physiology	1	43K	85%	NR	M. Ruderman	4-6 mos.
Stanford University	1	43K	50%	NR	M. Ruderman	4-6 mos.
Yale University	1	43K	50%	NR	M. Ruderman	4-6 mos.
Nebraska University	1	43K	25%	NR	M. Ruderman	4-6 mos.

Computer Option Orders

Customer	Option	Value	Probability	Remarks	Sales Engineer	When
ITT	Extra Memory	240K	100%	NR	R. Lane	4-6 mos.
ITT	Extra Memory	113K	50%	NR	R. Lane	4-6 mos.
ITT	Miscellaneous	25K	90%	NR	R. Lane	4-6 mos.

Removed From Last Month's List

Customer	Item	Reason
Univ. of Delft	PDP-4	PDP-7
Mass. Gen. Hosp.	PDP-4	PDP-7
NASA Ames	PDP-5	order received
NASA Houston	PDP-5	order received
Univ. of Illinois	PDP-5	no decision to be made this year
UCLA	PDP-5	order received
BTL/NYC	PDP-5	order received
Fairfield Univ., Conn.	PDP-5	
Brookhaven Nat'l Labs	PDP-6	
LRL	PDP-6	order received
Project MAC, MIT	PDP-6	
MIT, Lab for Nuclear Science	PDP-6	
Adams Associates	PDP-6	
NYU	PDP-7	order received
BTL/MH, Rosenfeld, N. J.	PDP-7	order received
Univ. of Rochester	PDP-7	Probably not this year
Stanford	PDP-4	PDP-7
Westinghouse Bettis	PDP-4	order received
Lockheed Georgia	PDP-4	PDP-7
Aachen Univ.	PDP-6	
OAL (DSL)	Peripheral Equipment	
American Cyanamide	LINC	order received

Removed From Last Month's List (con't.)

Customer	from	Reason
Univ. of Pennsylvania	LINC	order received
Worcester Foundation for Experimental Biology	LINC	order received

1000 Series Numbers Specifically
Assignable to Product Lines

JUL 6 1964

PDP-1

1263	Maintenance and Diagnostic Programming	2,000
1189	Tape Control 510 Development	2,800
		4,800

PDP-4

1062	4 - Development	600
1264	4 - Maintenance and Diagnostic Programming	3,000
		3,600

PDP-5

1219	5 - Programming	15,000
1191	5 - Prototype Operation	1,500
1290	Type 157 Interface 57A Dev. for 5	2,000
1265	Maintenance & Diagnostic Programming	2,500
1177	5 - Development	16,500
1285	Type 552 Micro Tape Control Dev. for 5	6,500
		44,000

PDP-6

1294	Peripheral Equipment Tester & Programming	6,000
1249	2 Usec Memory Dev. Type 161	29,250
1311	TWX Interface Dev.	1,000
1269	Word Address Memory Dev. Linear Select	19,000
1230	760 Paper Tape Reader & Control Dev.	500
1231	761 Paper Tape Punch & Control Dev.	500
1228	Type 626 Printer Keyboard & Control	500
1232	461 Card Reader & Control	2,000
1245		25,000
1247	Flip-Flop Memory Type 162 Dev.	2,000
1261	Data Control 136 Dev.	500
1271	Type 551 Micro Tape Control D[illegible]	2,500
[illegible]	[illegible]	45,000
1233	630-4 Data Comm. System for 6	2,000
1262	Tape Control 516 Dev.	11,000
1300	I.O. Device Tester & Dev. for PDP-6	2,000
1266	Maintenance and Diagnostic	18,000
1229	646 Line Printer & Control	500
1239	680 Linc Printer and Control	500
1178	6 - Development	58,000
1205	6 - Prototype	58,000
1256	6 - Programming	184,000
		467,750

PDP-7

1282	Development and Prototype	52,500
1297	Memory Development	33,000
		85,500

PDP-5A

1315	Development	38,000
1316	Prototype	10,000
		48,000

Linc

1292	Linc	24,000

PDP-6A

None		150,000

Computer Aided Design

1267		117,000
1210	Drafting Automation	2,500
		119,500

Special Systems

1018	Memory Tester Development	45,000
1057	Core Tester Development	45,000
		90,000

COMPANY SPONSORED ENGINEERING FORECAST
(Including both Development & Production Engineering)
Fiscal '65

A. Suggested Target (Including Labor, Materials and Overhead) 1,700,000
Includes both development and production engineering

B. Suggested Procedure

1. Works Committee establish budget ceiling of 1.7 million dollars on July 7, 1964.
2. Engineering Department review each project in detail.
3. Following completion of step 2, Engineering Department disclose results of review to Works Committee and recommend termination of projects and personnel.
4. Works Committee accept, reject, or modify engineering department recommendations on Tuesday, July 28, 1964.
5. The decision by Works Committee on July 28 is the acceptable budget.

	PDP-1	PDP-4	PDP-5	PDP-6	PDP-7	PDP-5A	Linc	PDP-6A	Computer Aided Design	Special Systems	Modules	Total
1000 Series numbers specifically assignable to product lines	$ 4,800	$3,600	$44,000	$467,750	$ 85,500	$48,000	$24,000	$150,000	$149,500	$ 90,000	$536,100	$1,573,250
Miscellaneous Development			3,340	7,740	7,140	5,140	3,340					26,700
Micro and Magnetic Tape	2,550	2,550	17,550	26,925	17,550							90,500
Displays			250	6,750	6,750	250						14,000
Allocated Items	2,808	2,808	2,808	1,683	2,809	1,684				10,200	10,200	35,000
	$10,158	$8,958	$67,948	$510,848	$125,574	$72,624	$27,340	$150,000	$119,500	$100,200	$546,300	$1,739,450
Percent of Forecast to each line	.5%	.5%	3.9%	29.3%	7.2%	4.1%	1.5%	8.8%	6.8%	5.9%	31.3%	100.0%

COMPANY SPONSORED ENGINEERING FORECAST
Fiscal '65

JUL 6 1964

Present: H. E. Anderson
R. L. Best
J. Hastings
R. Dill
D. Packer

Objective: To assign an allocation basis to 1000 series company sponsored numbers which overlapped product lines.

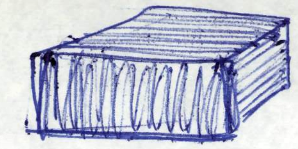
Process: Each engineering number was considered individually for the product lines which benefit or aid by the development to be incurred. Once the lines benefiting were determined, a percentage was assigned and applied to each product line.

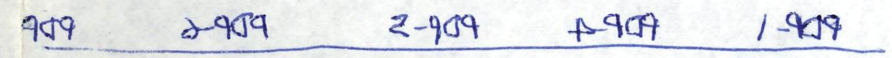
Note: The percentages used for each product line were approximations.

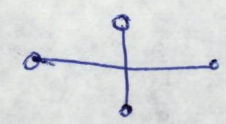
		PDP-1	PDP-4	PDP-5	PDP-6	PDP-7	PDP-5A	Linc	Computer Total	Modules	Special Systems	Grand Total
Miscellaneous Development												
Core Memory	1016	$	$	$	$ 2,400	$ 1,800	$ 1,800	$	$ 6,000	$	$	$
A-D Converter Test Equip.	1244			240	240	240	240	240	1,200			
New A - D	1301			3,100	3,100	3,100	3,100	3,100	15,500			
3 Phase Paper Tape Reader	1233				2,000	2,000			4,000			
				$ 3,340	$ 7,740	$ 7,140	$ 5,140	$ 3,340	$ 26,700			$ 26,700
Micro and Magnetic Tape												
Relay Micro Tape Dev.	1136	1,850	1,850	1,850	6,475	4,625	1,850		18,500			
Solid State Micro Tape Dev	1237	700	700	700	2,450	1,750	700		7,000			
Tape Trans. Simulator Dev	1313			5,250	5,250	5,250	5,250		21,000			
M-3000 Tape Trans Pro & Dev	1196				3,000	2,000			5,000			
Type 580 Trans Dev & Pro	1199			8,250	8,250	8,250	8,250		33,000			
Mag. Tape Test Equip.	1259			1,500	1,500	1,500	1,500		6,000			
		$ 2,550	$ 2,550	$ 17,550	$ 26,925	$ 23,375	$ 17,550		$ 90,500			$ 90,500
Displays												
Electrostatic Display Dev.	1182				500	500			1,000			
General Display Dev.	1209				750	750			1,500			
340 Display Dev.	1236				5,000	5,000			10,000			
Display 30 Camera Eq.	1180				250	250			500			
Light Pen Dev.	1211			250	250	250	250		1,000			
				$ 250	$ 6,750	$ 6,750	$ 250		$ 14,000			$ 14,000
Allocated Items												
Type 57A Mag Tape Cont. Dev.	1161	1,000	1,000	1,000		1,000			4,000			4,000
64 Line Printer & Cont.	1298	125	125	125		125			500			500
Mounting Panels	1023	1,683	1,683	1,683	1,683	1,684	1,684		10,100	10,200	10,200	30,500
		$ 2,808	$ 2,808	$ 2,808	$ 1,683	$ 2,809	$ 1,684	$	$ 14,600	$ 10,200	$ 10,200	$ 35,000

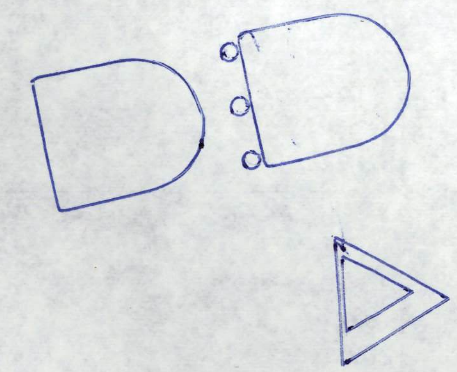
$ 166,200

Z → 45
1 → 5 BTL
1 → 6
4 → 1




PDP-1
PDP-4
PDP-5
PDP-6
PDP





To. G. Bell
H. Anderson

November 10, 1964

Subject. PDP6 Software Acceptance for Australian Machine

The following is a description of the software to be offered for acceptance testing for the University of Western Australia, plus a description of the testing procedure.

1. Fortran -- The Fortran compiler will be Fortran II and will occupy 9K words of storage. It will use a modified version of ATLATL in place of a processor executive routine. It will not include an assembler. The user will give the command to "GET FORTRAN", at which point the compiler will be loaded. The user then gives the command "GO". Using the modified ATLATL the compiler will operate upon the command string to determine its source and destination files, initialize devices, create named files, etc. At the end of compilation the compiled output (Macro 6 symbolic) will exist as a named file on DECtape, and a control will return to the monitor. The user will then give the command to "GET MACRO6". After Macro 6 has been loaded and the user has typed "GO", the user will enter the command string, naming the output file of the compiler as the source file for Macro 6, and the Macro 6 output (relocatable binary) as a named file on DECtape.

To run the program which he has just compiled, the user requests that his program be loaded; after loading the user's program, the loader will search the library tape to satisfy unresolved externals from the Fortran Operating System. The test for Fortran will consist of two programs being written by Bill Segal, one of which will contain at least one of all types of Fortran II statements, while the other will be a matrix inversion which will be used to compare the efficiency of the compiled code with the same application coded in Macro 6 by Harris Hyman. The following must take place before the test:

A. ATLATL must be included in the compiler, and the compiler be successfully incorporated into the monitor environment.

B. The Fortran library must be available in a form satisfactory to the loader.

C. Macro 6 must be operating successfully in the monitor environment.

D. The facility for handling subscripts must be included.

E. Bill Segal must have time to test the OP. system using compiler output.

2. MACRO 6 - The MACRO 6 test will consist of assembling a program containing at least one of each type of statement allowable in MACRO 6 language, and

demonstrating the successful assembly of this program by executing it.

3.The Editor-- This test will consist of using all facilities of the editor to edit a DECtape. The Editor will be 1K.

4.The Monitor- The test for the Monitor will consist of using multi-user stations to initiate and demonstrate the simultaneous action of two users editing tapes while a third program is assembling (or compiling, or being executed, or being debugged). A second test for the monitor will be two people editing while a third demonstrates ATLATL by going from paper tape to DECtape, or paper tape to printer, or DECtape to printer.

Since there is no doubt that there will be many bugs, this acceptance testing is not intended to be a hard and fast shakedown of the software; it is intended to demonstrate the availability of a system, our adherence to the specifications in the contract, and the usability of our software on the Australian Computer.

dec INTEROFFICE MEMORANDUM

DATE November 3, 1964

SUBJECT Summary of the PDP-6 Planning Meeting - October 15, 1964

TO Kenneth H. Olsen
Harlan Anderson
Nick Mazzarese
Gordon Bell
Bob Lane

FROM W. R. Hindle, Jr.

1. Total PDP-6 Business - PDP-6 should not be more than 30% of DEC's gross business. If it should exceed 30%, the Company would be too vulnerable to a competitive machine which could obsolete it. In the most recent forecast of fiscal 1965 sales, PDP-6 is 30% of gross volume and 18% of the profit after taxes.

2. Standard PDP-6 Product Line - Ken proposed that the PDP-6 product line be set, both hardware and software, and that we then sell that configuration with little emphasis on special configurations. We are almost to the point where we can specify the product line and we should document exactly what it is.

3. Computation Center Market - Andy believes the Computation Center market for PDP-6 is an excellent one for our equipment. He divided the market into two classes:

    1. Present IBM 1620 computation centers where users have a relatively low level of sophistication on the use of computers. The directors of these centers are quite susceptible to generalizations and need to be impressed by the solidity of the company from which they are buying.

    2. Current 7090/7094 Computation Centers. These computation centers are, in general, run by much more knowledgeable people. It will be harder to sell PDP-6 in this market.

4. Minimum Configuration - It was decided that the minimum configuration for PDP-6 would be 16K of memory and that we would not offer an 8K configuration. However, we will keep the 8K memory module option but only for 5 microsecond memories.

5. Tape Transport - It was agreed that we need to keep a high performance, IBM-compatible magnetic tape transport in our product line.

6. Double Precision Floating Point - It was decided that we would not offer double precision floating point on the PDP-6 but would consider it for the PDP-6A.

7. Disc File - No final decision was made to add a disc file to the product line, pending further discussion on the various PDP-6 configurations that would be offered.

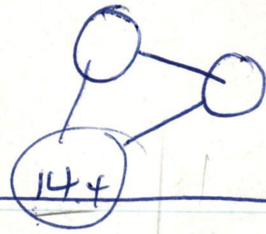
8. PDP-6 Configurations - The first level PDP-6 system (possible name - Genesis or Classic) will be a standard 16K memory with DECtape. The second level system will include a drum. The third level system, if offered, will include a Disc and Magnetic Tapes. In order to define these systems clearly, Gordon Bell will prepare a proposal for the various configurations, both hardware and software. This proposal will include the cost of developing new hardware and new software for each configuration. Final decision on what configurations to offer will await Gordon's memorandum.

Win Hindle

WRH:ech

	July '64 Forecast	July '64 Expend.	Aug '64 Forecast	Aug '64 Expend.	Sept '64 Forecast	Sept '64 Expend.	FY '65 1st Quar. Forecast	FY '65 First Quar. Expend.
A-D-A	3.5	1.6	3.5	4.1	3.5	2.9	10.5	8.6
Card Readers & Punches	3.0	.6	3.0	0	3.0	.6	9.0	1.2
Drums	1.2	4.5	1.2	2.7	1.2	3.6	3.6	10.8
Displays	4.0	.9	3.0	8.1	2.5	.7	9.5	9.7
I/O Misc.	1.5	3.3	1.0	1.1	1.0	1.2	3.5	5.6
Mag Tape, DECtape	15.5	17.9	13.5	24.1	12.5	19.8	41.5	61.8
Memories	13.5	20.0	16.0	22.8	13.5	14.5	43.0	57.3
FLIP CHIP modules	27.5	34.4	25.5	34.3	35.0	59.6	88.0	128.3
Standard modules	17.5	25.9	19.5	18.1	10.0	13.0	47.0	57.0
Paper Tape	3.5	.8	1.5	3.7	1.0	.1	6.0	4.6
PDP-1	.5	.1	.5	.6	.5	.1	1.5	.8
PDP-4	3.0	5.4	2.5	1.7	2.5	3.9	8.0	11.0
PDP-5 (incl 8)	3.0 4.0	7.8	2.5 4.0	9.4	2.0 4.0	3.9	7.5 12.0 (PDP-8)	21.1
PDP-6 (incl 6A)	15.0 12.5 (6A)	26.2	15.0 12.5 (6A)	13.2	10.5 12.5 (6A)	16.4	40.5 37.5 (PDP-6A)	55.8
PDP-7	5.5	9.9	5.5	13.5	5.5	15.3	16.5	38.7
LINC	4.0	9.4	3.5	3.4	3.0	8.9	10.5	21.7
Printers & Typewriters	2.0	1.0	0.	2.0	0.	1.0	2.0	4.0
Programming	30.0	24.6	30.0	27.5	28.5	25.4	88.5	77.5
Special Systems	7.5	2.8	7.5	6.8	7.5	7.0	22.5	16.6
Contingencies	20.0	0.	20.0	0.	20.0	0.	60.0	0.
	197.7	197.1	191.2	197.1	179.7	197.9	568.6	592.1

August,



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MAC	✓	8/31		.4
Brookhaven	Buffers	10/15		.4 ✓
W. Australia	?	10/21		.4 ✓
L. R. L.	1402, Burroughs DISC	11/16		.4 ✓
Adams	Rand, Drum Memory

1/15		.8 ✓
Rutgers	nothing	1/15		.2 ✓
Rand	consoles, DP discfile	2/1	3.4	.8 ✓
U. of Penn.		4/1	3.7	.3
LNS		3/1	4.1	.4
United Aircraft		4/1	4.6	.5

20

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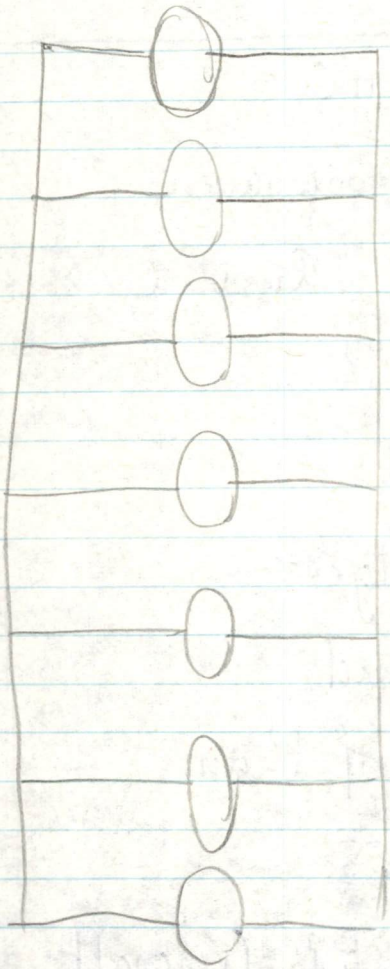


TECHNICAL PUBLICATIONS EXPENSES

BUDGET FOR FISCAL 1965

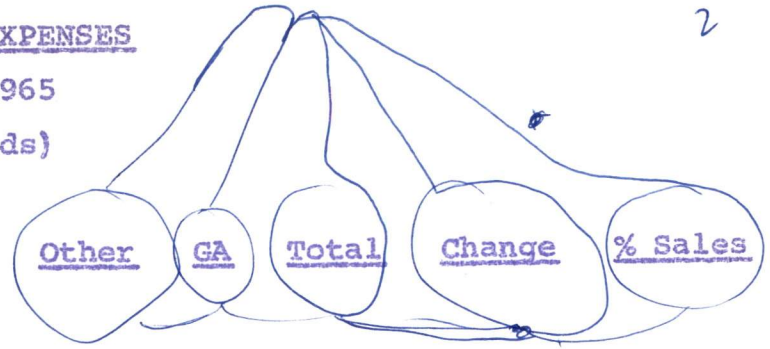
(Dollars in Thousands)

Activity	Space	Publ	Mail	Shows	Liter.	Other	GA	Total	Change	% Sales
ADMINISTRATION	15	20			20		20	75	(+25)	0.50
SALES										
Computers										
PDP-1		2	1				1	4		
PDP-4		2	2		2		1	7		
PDP-5	10	5	10	2	10	1	1	39		
PDP-6	35	7	12	3	15	2	3	77		
PDP-7	20	5	10	3	12	1	3	54		
LINC	2	2	5	1	5		1	16		
PDP-5X	20	5	10	2	12	1	3	53		
Total	87	28	50	11	56	5	13	250	(-13)	1.67
Modules										
Laboratory		1	1		5			7		
System		2	5	1	17		2	27		
Small	45	8	15	3	30	3	2	106		
Total	45	11	21	4	52	3	4	140	(+91)	0.93
Systems	4	2	5	2	5	1	1	20	(-5)	0.13
Sales Subtotal	136	41	76	17	113	9	18	410	(+73)	2.73

TECHNICAL PUBLICATIONS EXPENSES

BUDGET FOR FISCAL 1965

(Dollars in Thousands)



Activity	Space	Publ	Mail	Shows	Liter.	Other	GA	Total	Change	% Sales
ENGINEERING										
Computers										
PDP-1							1	1		
PDP-4					4		1	5		
PDP-5					15		3	18		
PDP-6					55		5	60		
PDP-7					17		5	22		
LINC							3	3		
PDP-5X					10		4	14		
Total					101		22	123	(+4)	0.82
Modules										
Laboratory							1	1		
System					4		3	7		
Small					6		6	12		
Total					10		10	20	(+8)	0.13
Systems					5		2	7	(+1)	0.05
Engineering Subtotal					116		34	150	(+13)	1.00

$\frac{10^{e}}{2}$

$\frac{2000}{10000}$

TECHNICAL PUBLICATIONS EXPENSES

BUDGET FOR FISCAL 1965

(Dollars in Thousands)

Activity	Space	Publ	Mail	Shows	Liter.	Other	GA	Total	Change	% Sales
MANUFACTURING										
Computers										
PDP-1							1	1		
PDP-4					4		1	5		
PDP-5					10		2	12		
PDP-6					25		3	28		
PDP-7					10		3	13		
LINC							1	1		
PDP-5X					10		3	13		
Total					59		14	73	(+11)	0.49
Modules										
Laboratory							2	2		
System							10	10		
Small							15	15		
Total							27	27	(+1)	0.18
Systems					10		5	15	(+2)	0.10
Manufacturing Subtotal					69		46	115	(+14)	0.77
TOTAL BUDGET	151	61	76	17	318	9	118	750	(+125)	5.00

TECHNICAL PUBLICATIONS EXPENSES

BUDGET FOR FISCAL 1965

(Dollars in Thousands)

Product Line	Space	Publ	Mail	Shows	Liter.	Other	Graphic Arts	Total	Change	% Sales
COMPUTERS										
PDP-1		2	1				3	6		
PDP-4		2	2		10		3	17		
PDP-5	10	5	10	2	35	1	6	69		
PDP-6	35	7	12	3	95	2	11	165		
PDP-7	20	5	10	3	39	1	11	89		
LINC	2	2	5	1	5		5	20		
PDP-5X	20	5	10	2	32	1	10	80		
Total	87	28	50	11	216	5	49	446	(+2)	2.97
MODULES										
Laboratory		1	1		5		3	10		
System		2	5	1	21		15	44		
Small	45	8	15	3	36	3	23	133		
Total	45	11	21	4	62	3	41	187	(+100)	1.25
SYSTEMS	4	2	5	2	20	1	8	42	(-2)	0.28
Subtotal	136	41	76	17	298	9	98	675	(+100)	4.50
OTHER (Administration)	15	20			20		20	75	(+ 25)	0.50
TOTAL	151	61	76	17	318	9	118	750	(+125)	5.00

Digital

TECHNICAL PUBLICATIONS EXPENSES

Adjusted By Application

July 1963 - March 1964

PRODUCT LINE

Computers & Options	71%
Modules & Accessories	14%
Systems	7%
(Administration	8%)

FUNCTION

Public Relations	5%
Sales Promotion	51%
Technical Information	27%
Graphic Arts	17%

ACTIVITY

Space Advertising	16%
Publicity	6%
Direct Mail	9%
Trade Shows	4%
Literature	45%
Other Creative	3%
Graphic Arts	17%

TECHNICAL PUBLICATIONS EXPENSES

Adjusted By Product Line

July 1963 - March 1964

	Dollars	%	Dollars	%	Dollars	%
COMPUTERS & OPTIONS						
Computers						
PDP-1	23,352	5.7				
PDP-4	20,339	4.9				
PDP-5	102,764	24.9				
PDP-6	74,828	18.1				
Total			221,283	53.6		
Options						
Mag Tape	15,185	3.7				
Displays	36,595	8.9				
Other I/O	17,703	4.3				
Total			69,483	16.9		
Combined Total					290,766	70.5
MODULES						
Lab Modules						
100 Series	1,586	0.4				
3000 Series	2,257	0.5				
5000 Series	654	0.2				
Total			4,497	1.1		
System Modules						
1000 Series	5,604	1.3				
4000 Series	15,106	3.7				
6000 Series	19,273	4.7				
8000 Series	711	0.2				
Total			40,694	9.9		
Accessories*			14,450	3.5		
Combined Total					59,641	14.5
SYSTEMS					27,114	6.6
ADMINISTRATION					34,750	8.4
TOTAL					412,271	100.0

*Including High Current Pulse Equipment

Summary

TECHNICAL PUBLICATIONS EXPENSES

BUDGET FOR FISCAL 1965

(Dollars In Thousands)

PRODUCT LINE	Space	Publ	Mail	Shows	Liter.	Other	GA	Total	Change	% Sales
Computers										
PDP-1										
PDP-4		1	2		10		2	15		
PDP-5	5	2	4	1	22		6	40		
PDP-6	10	4	8	2	52		9	85		
PDP-7	20	5	10	3	35		7	80		
PDP-8	5	2	5	1	18		4	35		
PDP-5X	15	4	7	2	28		9	65		
PDP-6X	5	3	10	2	27		8	55		
Total	60	21	46	11	192		45	375	(-69)	2.88
Modules										
Laboratory			1		4		5	10		
System		1	3	1	17		13	35		
Small	30	5	10	3	28	2	22	100		
Special	30	5	10	3	32	2	23	105		
Accessories		2	2		8		8	20		
Total	60	13	26	7	89	4	71	270	(+183)	2.08
Systems		2	5	2	15		6	30	(-14)	0.23
Total	120	36	77	20	296	4	122	675	(+100)	5.19

1600 lad

releases/press kit

$2.5/prospect + setup

releases

TECHNICAL PUBLICATIONS EXPENSES

ESTIMATED FISCAL 1964

(Dollars In Thousands)

Classification	Space Advert.	Publicity	Direct Mail	Shows	Litera-ture	Other Promotion	Graphic Arts	Total	% Sales
ACTIVITY									
A Administration	13	6			12		19	50	0.46
Sales									
Computers	38	19	31	12	144	6	13	263	
B Modules	6	6	12	6	19			49	
Systems		6	6	6	7			25	
Total	44	31	49	24	170	6	13	337	3.12
Engineering									
Computers					100		19	119	
C Modules					6		6	12	
Systems					6			6	
Total					112		25	137	1.27
Manufacturing									
Computers					31		31	62	
D Modules					6		20	26	
Systems					7		6	13	
Total					44		57	101	0.93
Total	57	37	49	24	338	6	114	625	5.78
PRODUCT LINE									
Computers	38	19	31	12	275	6	63	444	4.11
E Modules	6	6	12	6	31		26	87	.80
Systems		6	6	6	20		6	44	.41
Total	44	31	49	24	326	6	95	575	5.32

TECHNICAL PUBLICATIONS EXPENSES

BUDGET FOR FISCAL 1965

(Dollars in Thousands)

ACTIVITY	Space	Publicity	Mail	Shows	Liter.	Other	GA	Total	Change	% Sales
Administration	15	20			20		20	75	(+25)	0.58
Sales										
Computers										
PDP-1										
PDP-4		1	2		2			5		
PDP-5	5	2	4	1	7		1	20		
PDP-6	10	4	8	2	14		2	40		
PDP-7	20	5	10	3	10		2	50		
PDP-8	5	2	5	1	6		1	20		
PDP-5X	15	4	7	2	10		2	40		
PDP-6X	5	3	10	2	8		2	30		
Total	60	21	46	11	57		10	205	(-58)	
Modules										
Laboratory			1		4			5		
System		1	3	1	14		1	20		
Small	30	5	10	3	22	2	3	75		
Special	30	5	10	3	22	2	3	75		
Accessories		2	2		5		1	10		
Total	60	13	26	7	67	4	8	185	(+136)	
Systems		2	5	2	10		1	20	(-5)	
Total	120	36	77	20	134	4	19	410	(+73)	3.15

TECHNICAL PUBLICATIONS EXPENSES

BUDGET FOR FISCAL 1965

(Dollars In Thousands)

	Space	Publ	Mail	Shows	Liter.	Other	GA	Total	Change	% Sales
Engineering										
Computers										
PDP-1										
PDP-4					4		1	5		
PDP-5					7		3	10		
PDP-6					26		4	30		
PDP-7					17		3	20		
PDP-8					8		2	10		
PDP-5X					10		5	15		
PDP-6X					17		3	20		
Total					89		21	110	(-9)	
Modules										
Laboratory										
System					3		2	5		
Small					6		4	10		
Special					10		5	15		
Accessories					3		2	5		
Total					22		13	35	(+23)	
Systems					3		2	5	(-1)	
Total					114		36	150	(+13)	1.15

TECHNICAL PUBLICATIONS EXPENSES

BUDGET FOR FISCAL 1965

(Dollars In Thousands)

Graphic ~~Graf~~ic Arts

	Space	Publ	Mail	Shows	Liter.	Other	GA	Total	Change	% Sales
Manufacturing										
Computers										
PDP-1										
PDP-4					4		1	5		
PDP-5					8		2	10		
PDP-6					12		3	15		
PDP-7					8		2	10		
PDP-8					4		1	5		
PDP-5X					8		2	10		
PDP-6X					2		3	5		
Total					46		14	60	(-2)	
Modules										
Laboratory							5	5		
System							10	10		
Small							15	15		
Special							15	15		
Accessories							5	5		
Total							50	50	(+24)	
Systems					2		3	5	(-8)	
Total					48		67	115	(+14)	0.88
Total	120	36	77	20	296	4	122	675	(+50)	5.76

G. Bell

File Copy

Interoffice Memorandum

To: Works Committee
Computer Guidance Committee
A. Kotok
R. Savell
D. Packer
A. Hall
E. Harwood

Date: April 22, 1964

From: Gordon Bell

Subject: PDP-6 Projections of Costs, Proposal For Change In Sales, Production Levels

Summary

We are presently planning to produce PDP-6 Systems at too low a rate to be successful. The low rate also increases the likelihood that in the recovery period, technical obsolescence will enter the picture.

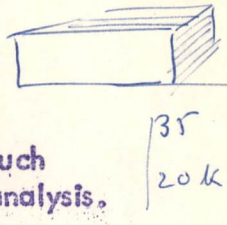
Enclosed are the following tabular and graphical data for the PDP-6 project:

1. Monthly development costs broken down into I/O, Memory and Drum, Processors and Programming. (graph and table)
2. Total Development costs. (graph)
3. Monthly total (fixed) expenditures, and per unit cost of goods sold. (table)
4. Other (fixed) operating expenses. (graph)
5. Manpower vs. machine production rate. (graph)
6. Summary of quarterly expenditures and receipts (projected) - P & L. (graph and table)

The above graphs and charts are presented mainly as backup for the summary P & L graphs and tables (6 above).

The project operation observations are:

1. We should attempt to reach a very early break-even point and minimize our risk of machine obsolescence.



2. Early cost projections were inadequate and did not point out need for such a vigorous sales effort. At the time there was no attempt at dynamic analysis.

3. Some phases of the development have been lagging the processor and I/O equipment. The above items continue to accrue charges that could be written off in the production, rather than the development phase. We cannot produce systems until all items are developed.

4. Of crucial importance are the outstanding development items, namely:

   a. Programming (off by a factor of 2 in price and timing).

   b. Drum development (will hold up sales to approximately 0.3 of our customers, plus programming development).

   c. Memory development (on schedule).

5. Any accelerated development will not increase the fixed costs, but will minimize total development cost by getting job done sooner and other parts will not have to to "wait" on others for system production.

The next few months are important and I propose:

1. The sales effort necessary to realize 1.5 machines/month in January, 1965 should be applied.

2. Start right now assembling and testing already operating components for systems, they are:

   a. Fast Memory

   b. Tape Reader, Tape Punch, Teleprinter

   c. Microtape and Data Control

   d. Line Printer (order and test)
   e. Card Reader

3. Programming scheduling and planning necessary to realize schedule at nearer budgetted figures should be employed.

4. Purchase drum now for development and delivery as soon as possible, but necessary for programming development. First production should be geared to January 1, 1965 at latest.

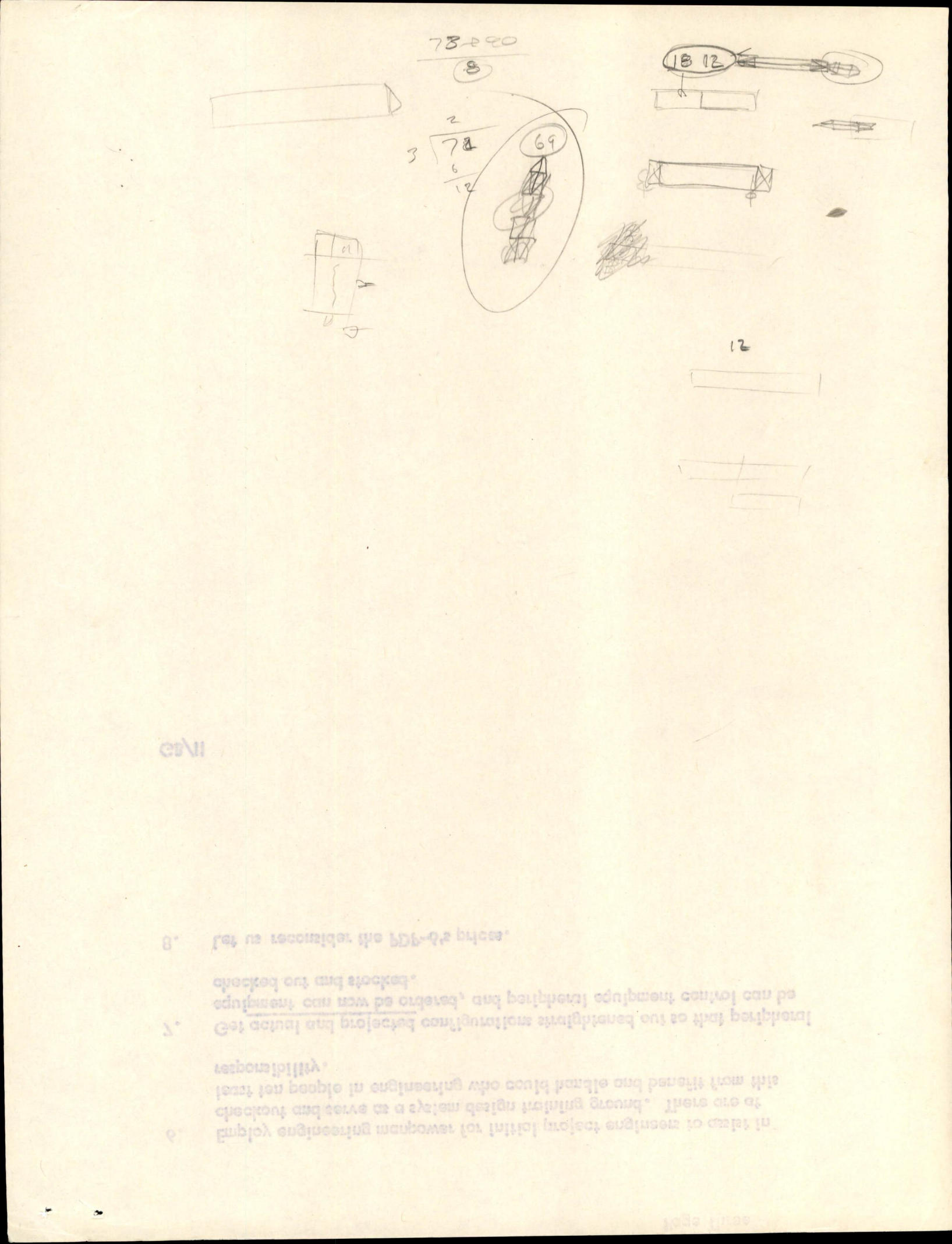
5. Order card punches for development and for first customer (Perth).

6. Employ engineering manpower for initial project engineers to assist in checkout and serve as a system design training ground. There are at least ten people in engineering who could handle and benefit from this responsibility.

7. Get actual and projected configurations straightened out so that peripheral equipment can now be ordered, and peripheral equipment control can be checked out and stocked.

8. Let us reconsider the PDP-6's prices.

GB/ll



INTEROFFICE MEMORANDUM

DATE November 12, 1965

SUBJECT PDP-6 Commitments

TO Ken Olsen
Harry Mann

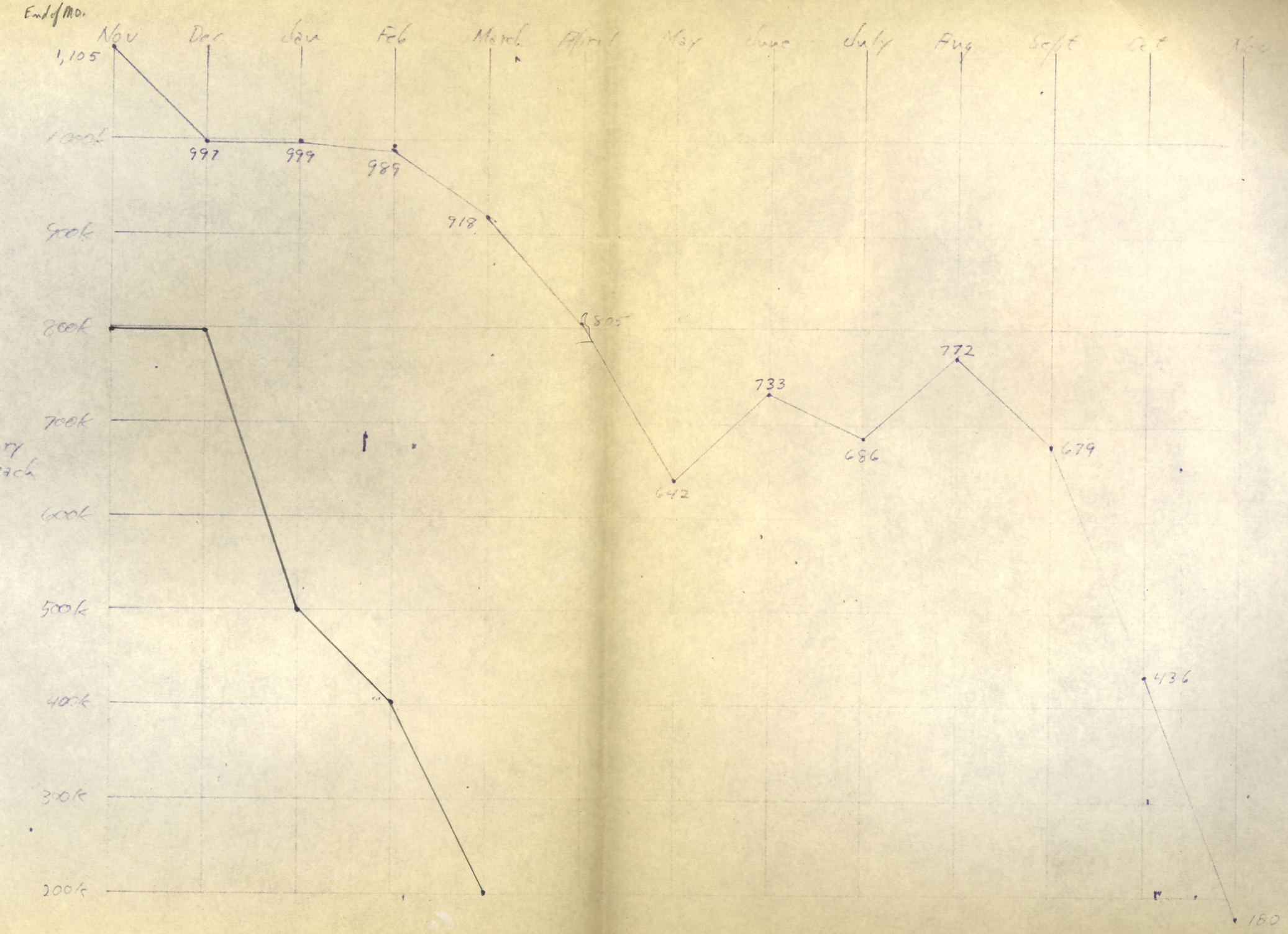
FROM Win Hindle

PDP-6 Customers	Proposed Action
1. United Aircraft 2. Colgate 3. Rochester 4. Stanford 5. MIT - LNS Feb. 15	Group I. P. O. Received
6. Yale - 7. Oxford 8. Imperial	Group II. P. O. Imminent
9. ~~Weizmann~~ 10. LRL #2 11. New Mexico 12. BBN 13. U. of Penn	Group III. Follow up and accept P.O. if it is placed. Withdrawal would have very negative effect on an important customer or important market.
14. Berkeley #2 15. Witwatersrand 16. Martin - Denver 17. Cerci - Orly 18. CERCI - Own 19. ARL- 20. Vandenberg AFB	Group IV. Withdraw proposal nicely. Some loss of good will inevitable.

We have six machines in progress. I propose we ~~start one more now to~~ keep one machine including the Engineering machine. ahead of the actual orders. This will be an engineering and checkout machine and will be the next to last machine shipped. The programming machine will be shipped last. As new orders are received, ~~on numbers 9 - 13,~~ we will start a new central processor until we reach the engineering machine as the next to last shipment. Deliveries will be 6 months from date of P.O. but no closer than 1 month apart.

Under this plan we have a potential of starting ~~8~~ 6 more processors in addition to the ~~7~~ 8 now in-house (including the Engineering and Programming machines.) However, I believe the likelihood is that only ~~5~~ 6 of the ~~7~~ 8 potential orders will be placed. To take a conservative look at the inventory effects of this plan, the attached chart on PDP-6 inventory assumes that we build 5 6 more processors and ship the last one (Oxford) in November, 1966.

I believe this plan will hurt us least in our customer's eyes. In several withdrawal situations, we may be able to keep the proposal alive enough to propose a FC-6 when and if it is available. Another significant advantage to the plan is that it provides a bridge between current PDP-6 production and potential FC-6 production.



Estimated PDP-6 inventory at end of each month.

FC-6 not included

P/B
11/12/69

dec INTEROFFICE MEMORANDUM

DATE December 31, 1965

SUBJECT Computer System Testing

TO G. Bell
W. Hindle
R. Savell
A. Kotok
E. Harwood
R. Beckman

FROM A. Hall

Following a discussion with Gordon Bell concerning computer system testing I wrote the attached notes to clarify my own ideas on the relationship of testing to other functions of design and production. Because testing has frequently been regarded almost as an end in itself I felt that a re-establishment of its raison d'etre would help to define its proper application.

On the chance that it might be of some general interest I have passed it along to a few people beside Gordon.

SYSTEM SPECIFICATION TESTS, & INSPECTION

GIVEN: That the sole purpose of a test is to ensure that a specification has been met.

SPECIFICATIONS:

A computer system has its origin in someone's idea of a new way to meet the computing requirements of some market. The idea, as it starts out, is diffuse and can be defined only in the most general terms.

The first structuring of this idea occurs when it becomes limited by financial and personnel resources, by the product continuity requirements of marketing and by the state of the art required for its physical implementation. The basic system specification starts its formation at this stage.

Final system specification occurs during design and should be virtually complete at the end of prototype system checkout. These detailed specifications are, for the most part, a documentation of the performance limitations discovered during the testing period. It is obvious that the system should deliberately be pushed to its performance and environmental limits during the initial testing period and that the specifications should be adjusted before documentation to allow acceptance of production units which exhibit reasonabledeviation from nominal performance levels.

Aside from basic design for producibility and manufacturing speed, no factor has a greater influence on production and maintenance costs than the reasonableness of system specifications. The time and skill levels required to produce an acceptable system rise sharply when acceptance requirements exceed the reasonable level.

Because of the extremely complex relationship between system performance, environmental conditions and component production tolerances, the establishment of reasonable system specifications is a job requiring great competence, judgment and experience. Decisions and compromises made at this point govern:

1. Published system capabilities (& thus, sales).
2. Performance levels (& thus, cost) of components
3. Skill level (& thus, salary) of checkout personnel
4. % of product yield (& thus, overhead expense)
5. Checkout time (& thus, inventory costs)
6. Maintenance costs (warranty reserve or cost of goods sold)

TESTS AND INSPECTION

Assuming that the specifications established have allowed a reasonable compromise between stated system capability and the expense necessary to achieve it, the primary reasons for test and inspection are to ensure first, that manufactured systems meet or exceed the performance criteria established by the specifications, and second, that the specifications remain compatible with the factors on which they were based.

The criteria for the form and extent of testing are:

a. Complexity of tests to be that which minimizes the sum of warranty-period maintenance expense plus testing expense.

b. The extent of testing must remain compatible with the current quality of manufactured products. Statistical and qualitative analysis should reveal when it is possible to liberalize testing procedures. Enforced repetition of obviously superfluous testing is not only expensive but decreases the confidence in the necessity of other tests as well.

c. Testing must remain compatible with system specifications as they change. (This is a subtle and complex job requiring great skill.)

d. The order in which tests are performed and the format of the papers on which the results are noted should be as logical and simple as human thought can make them. The user of the testing system, not the originator, must use it over and over again. The results will be as good and as easily verified as the method established to find them.

Because of the circumstances of DEC's production facility (module shortages, personnel absence, system and option assignment changes and modifications) there must be a qualified person available to rule on the omission, repetition or change of order of tests when nominal procedures cannot be followed. These decisions are by no means obvious and because of the time and expense they may involve, should be made by a responsible and knowledgeable person available on a top priority basis to Checkout.

Because the specifications (and the tests which verify them) are an inseparable part of the system design information they must appear in the system documentation; most probably on the Master Drawing List. The same ECO procedures apply to these documents as apply to other design information.

Design engineering with the advice of Field Service, Marketing, and Checkout is responsible for the establishment of system and component configurations and performance specifications and for the tests which verify the specifications.

Checkout is responsible for verifying that systems meet performance and configuration specifications and for providing the necessary information to Production and Engineering to ensure that products, specifications and tests remain compatible.

A. Hall/bwf

H.E.G.

dec INTEROFFICE MEMORANDUM

DATE 14 September 1965

SUBJECT Large Computer Production Department Organization
A. Time Allotment Chart B. Organization Chart

TO Large Computer Production Dept.

FROM Bob Beckman

I. Introduction

The Department's tasks lend themselves to be divided into groups and sections as follows:

Group	Section
1. Production	1. Systems Test
	2. Peripheral Equipment Test
	3. Production Control
2. Production Engineering	1. Equipment Engineering
	2. Test Procedures
	3. Producible Equipment
3. Administration	

Enclosure A summarizes the personnel in the department and the percentage of their time to be spent in specific sectional duties.

Each section has a head whose responsibility is to summarize progress, both at section meetings and with formal reports. The Department head is currently considered the Group Leader for all Groups.

II. Section Description

The section personnel report to the Section Head. Enclosure A indicates the percentage of time spent working on the Section duties.

A. Systems Test Section

Personnel

1.	Sullivan	80% (Head)
2.	Dreslinski	100%
3.	Floyd	70%
4.	Fortin	10%

5.	Freer	100%
6.	Fries	100%
7.	Simeone	100%
8.	Streeter	80%
9.	Weston	20%

Objectives

Produce large computer systems at a rate of 12/year. Plan for production rates to increase during next 6 months period. Establish a "time of testing" which can be used for all standard systems.

B. Peripheral Equipment Test Section

Personnel

1.	Fortin	70% (Head)
2.	Floyd	30%
3.	French	20%
4.	Mikulski	5%
5.	Streeter	20%
6.	Weston	20%
7.	White	5%

Objectives

Testing of all peripheral equipment to be used in systems using an "on-line" method. Evaluating techniques used in off-line testing methods. Establishing test criteria with engineering.

C. Production Control

Personnel

1.	Solito	50% (Head)
2.	Fortin	10%
3.	Mikulski	5%
4.	Weston	60%

Objectives

Establish methods and procedures for manufacturing large computer systems. "Smoothing" the current operation of production. Establishing stockroom control.

D. Equipment Engineering Section

Personnel

1.	White	90% (Head)
2.	Sullivan	15%

Objectives

Establish modifications to current systems to meet design goals.

E. Test Procedures Section

Personnel

1.	Mikulski	70% (Head)
2.	French	80%
3.	Fortin	5%
4.	Solito	5%
5.	White	5%

Objectives

Establish test procedures and equipment to produce large computer systems. High production rates at low cost are goals.

F. Producible Equipment Section

Personnel

1.	Mikulski	5% (Head)
2.	Sullivan	5%

Objectives

Furnish input to advance design systems to allow integration into production line.

G. Administrative Group

Personnel

1.	Beckman	100% (Leader)
2.	Fortin	5%
3.	Mikulski	15%
4.	Solito	45%

H. Summary - The Sectional tasks and heads are defined above. It is the responsibility of the heads of sections to assure the tasks are scheduled and completed. Rather than having single tasks for specific people -- a large number work on more than one task. These people are responsible for scheduling their own time proportions. The leaders responsibility is to know what his people are doing, when they will or will not be available, and to keep the section working smoothly toward its objectives.

Meetings

A. Departmental meetings with individual Section Heads will occur at following intervals:

Systems Test	1 week
Peripheral Test	2 weeks
Production Control	4 weeks
Equipment Engineering	2 weeks
Test Procedures	4 weeks
Administration	1 week

Personnel from other Sections attending meetings must be determined from the agenda.

Note: For the time being, all meetings will be combined in the weekly Friday morning meeting.

Sectional Meetings are scheduled by the section leader at his own convenience. They should not interfere with Departmental activities.

III. Summary Reports

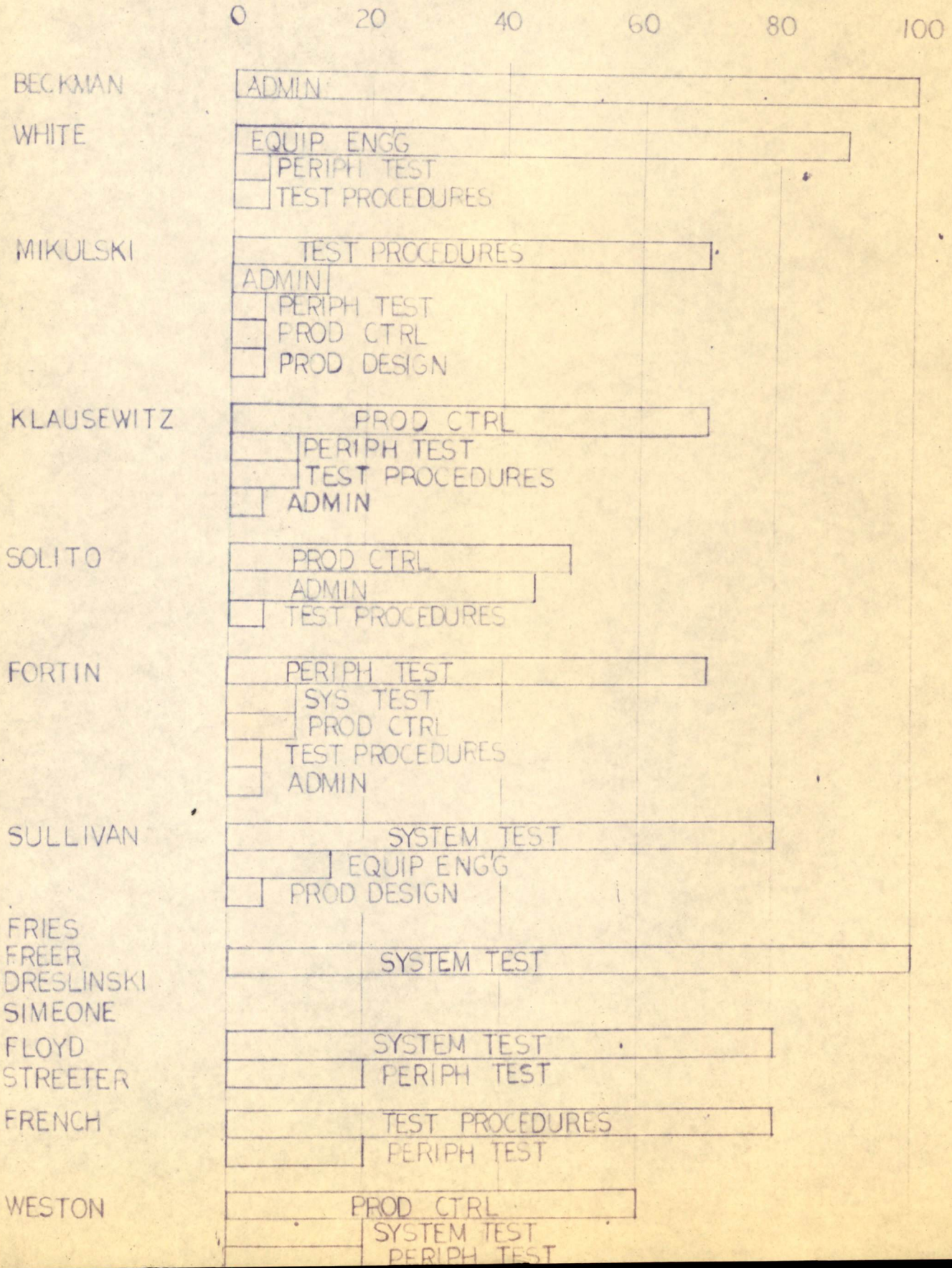
One of the responsibilities of the Section head is to summarize his efforts and project his plans. This will be done through a formal report, written to the department head every 2 months. These reports should be generated the first of the even numbered months. All work done during the previous 2 months should be summarized and projected effort for the next 2 months period should be forecasted.

IV. Summary

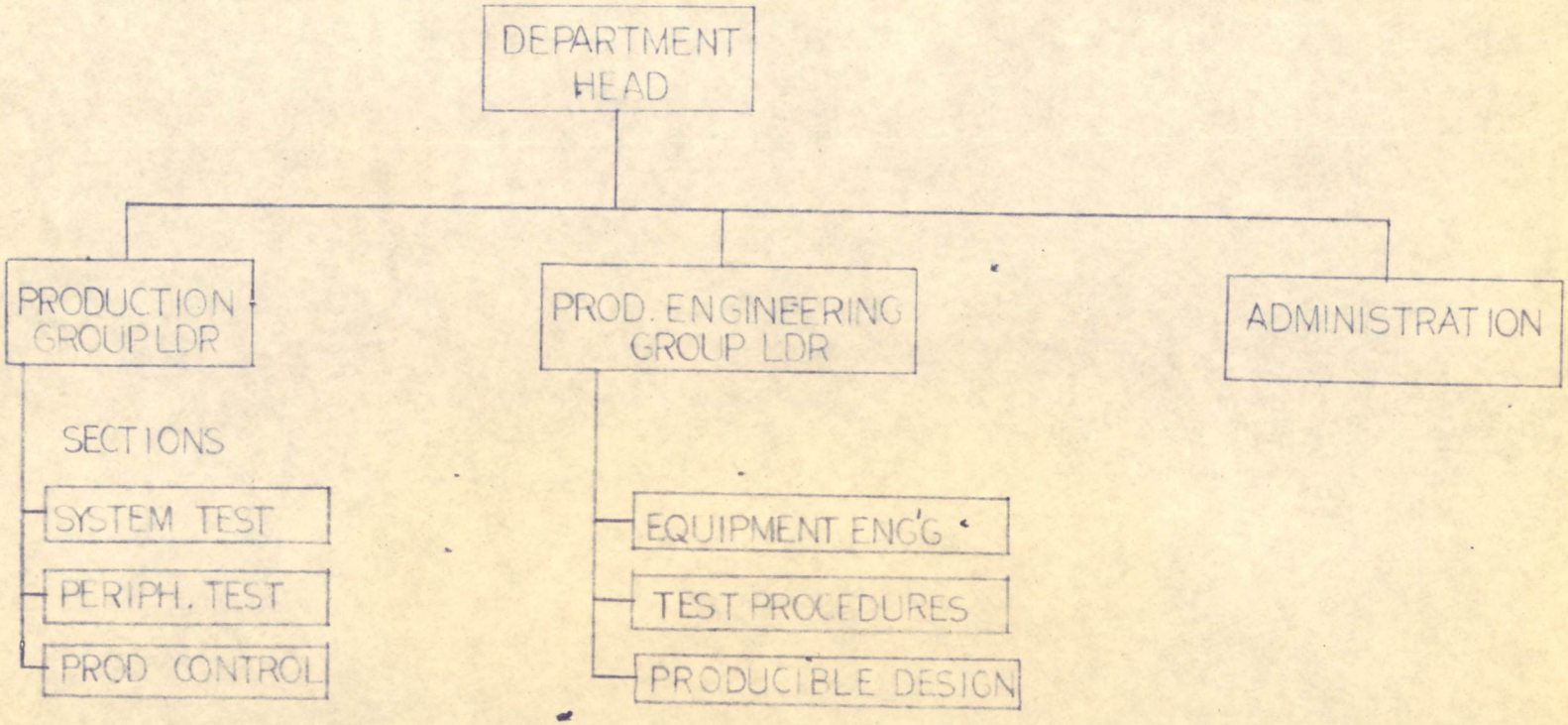
1. The department, as a whole, using this method of dividing and specifying responsibility should gradually become more efficient.
2. All documentation is available at the completion of a task.
3. The system is flexible enough to allow rescheduling of tasks or personnel and is laid out to allow expansion easily.

LARGE COMPUTER PRODUCTION

TIME ALLOTMENT — OCT-DEC 65



LARGE COMPUTER PRODUCTION



E. Simeone
IV-1-65

SUMMARY OF INVENTORIES

($000 omitted)

SMALL COMPUTERS

	July 2	August 28	October 2 (September)	October 30
Loans and Consignments	$ 424	$ 170	$ 117	$ 138
Jobs in Assembly and Checkout	640	1,097	1,182	1,133
Parts in Stock for Systems	210	146	67	65
Raw Materials for Systems	135	125	191	151
	$1,409	$ 1,538	$ 1,557	$ 1,487
Finished Modules	$ 98	$ 73	$ 160	$ 268
Modules in Process	232	260	415	356
Parts in Stock for Modules	72	27	29	35
Raw Materials for Modules	348	269	412	415
	$ 750	$ 629	$ 1,016	$ 1,074
Total Inventories	$2,159	$ 2,167	$ 2,573	$ 2,561
Rate of Turnover				3.2

SUMMARY OF INVENTORIES

($000 omitted)

LARGE COMPUTERS

	July 2	August 28	October 2 (September)	October 30
Loans and Consignments	$ 78	$ 24	$ 26	$ 31
Jobs in Assembly and Checkout	681	1,117	1,291	1,215
Parts in Stock for Systems	210	146	67	65
Raw Materials for Systems	135	125	191	150
	$1,104	$1,412	$1,575	$1,461
Finished Modules	$ 44	$ 50	$ 67	$ 106
Modules in Process	49	89	58	57
Parts in Stock for Modules	15	9	4	6
Raw Materials for Modules	73	92	58	66
	$ 181	$ 240	$ 187	$ 235
Total Inventories	$ 1,285	$ 1,652	$ 1,762	$ 1,696
Rate of Turnover				1.5

SUMMARY OF INVENTORIES

($000 omitted)

MEMORY TESTERS

	July 2	August 28	October 2 (September)	October 30
Loans and Consignments	$ 21	$ 23	$	$
Jobs in Assembly and Checkout	41	53	108	99
Parts in Stock for Systems				
Raw Materials for Systems				
	$ 62	$ 76	$ 108	$ 99
Finished Modules	$ 25	$ 31	$ 45	$ 59
Modules in Process	11	22	17	16
Parts in Stock for Modules	3	2	1	2
Raw Materials for Modules	16	23	16	19
	$ 55	$ 78	$ 79	$ 96
Total Inventories	$ 117	$ 154	$ 187	$ 195
Rate of Turnover				3.6

SUMMARY OF INVENTORIES

($000 omitted)

MODULES

	July 2	August 28	October 2 (September)	October 30
Loans and Consignments				
Jobs in Assembly and Checkout				
Parts in Stock for Systems		N. A.		
Raw Materials for Systems				
Finished Modules	$ 148	$ 230	$ 259	$ 279
Modules in Process	249	371	340	380
Parts in Stock for Modules	77	38	24	37
Raw Materials for Modules	373	385	338	444
	$ 847	$1,024	$ 961	$ 1,140
Total Inventories	$ 847	$1,024	$ 961	$ 1,140
Rate of Turnover				1.7

dec INTEROFFICE MEMORANDUM

DATE December 8, 1965

SUBJECT PDP-6 Starts

TO Bob Beckman
Jack Smith

FROM Win Hindle

cc: Harry Mann
Ken Olsen
Pres Behn
Bob Lane

Harry Mann and Ken Olsen have approved restarting 166-18 and 166-19. The first processor will cover the Yale University order. The second processor will cover the expected order from LRL. Since the LRL order has not yet been received, we want a check point in the production process so that we can stop it again if the order does not materialize. Would you alert me when 166-19 is returned from the subcontractor before starting internal work and we will then decide whether to continue work. It is imperative that we expedite these two processors because both are counted on as May deliveries.

ecc

dec INTEROFFICE MEMORANDUM

DATE November 12, 1965

SUBJECT

TO
Win Hindle

FROM
Pres Behn

Here is a review of the contracts related to our undelivered sales.

1. United Aircraft - This was handled with a purchase order on the back of which is a very simple set of boiler plate. I see nothing there to take exception to. Only requirement for United Aircraft is that the machine we deliver must be up to Change Notice #3 speeds. Invoice on shipment. No insurance.

2. Brookhaven National Lab. This is a $155,840 contract for two 163 memories and two DECtapes and one Type 136 Data Control. The only thing I found on their boiler plate was that DEC is liable in the event of a "seller's breach" for excess costs. Essentially this means that if we drive them to another supplier and they have to pay more, we must make up the difference.

3. Rochester - Requires change notice #3 speeds. Invoicing will take place on acceptance and is payable in 30 days. Taxes are included in the price. Sale is F.O.B. Maynard, customer pays transportation. Rochester could have cancelled this order up to November 1, 1965. Installation is specified for about January 1st. DEC has committed itself to one month of resident applications programmer time and three months of "on call" applications programmer availability including free travel. DEC is not liable for any damages.

4. Colgate Research & Development - This is a 36 month lease during which time DEC bears all risk of loss due to damage, etc. Maintenance is included in the rental price. DEC is not liable for any damages. The customer must buy the machine in a year or pay a $10K penalty and continue his lease. On purchase, the customer is allowed a 75% credit for the monies paid for rentals. If the customer goes out of business, DEC will re-purchase at 40% of the sale price. In the event of catastrophe, the lease can be terminated by customer paying 5% of the unused first twelve month period. In the event of financial difficulty, the customer can terminate his lease after twelve months on 30 days notice but a third party named in the

contract must agree that trouble exists. Customer can cancel this order any time before delivery if ARPA doesn't provide money. DEC is lending (with no termination date on the loan) one each of the following: 136 Data Control, 551 DECtape Control, and 555 Dual DECtape Unit - in exchange for 15 hours per month of computer time. Thirty days notice is required for special acceptance tests. Transportation, drayage, and rigging will be paid by the customer. Transportation insurance will not be paid by the customer. The contract is not assignable. For tax purposes, DEC is to treat this as a purchase, thus allowing Colgate to take advantage of investment credits.

5. Stanford University - This is currently under negotiation.

6. Oxford & Imperial - Likewise, currently under negotiation but has been reviewed by Dick Testa. Basic features are that the transportation and insurance questions are resolved by an $8,000 overpayment by the customer, and that delivery is for approximately a year hence, and that prices are quoted in English pounds with a clause that allows escalation of the price in pounds if the valuation of an English pound at the time of sale drops below $2.79. DEC will not be liable for any damages in connection with this sale. Transport by air is expensive. If we want ocean transport, we should allow lots of lead time.

7. MIT-LNS - Will be reviewed by R. Lane. I've seen no contractural details that shake me except the return of the PDP-1.

dec INTEROFFICE MEMORANDUM

Yes

DATE November 2, 1965

SUBJECT PDP-6 Interim Sales Strategy

TO

FROM Pres Behn

This memorandum is for the purpose of re-confirming and re-stating PDP-6 Sales plans for use during the interim period until the "go" decision is made on the FC-6.

1. Leads from Non-DEC Customers

   Leads of this type should be ignored where possible. If the customer is insistent, take as little time with him as possible. Refer the lead to Maynard.

2. Leads From Established DEC Customers

   Field salesmen should make an initial visit to these customers, write up the situation and send it back to Maynard for any decision. The customer should be told during this initial visit that Maynard handles all PDP-6 sales so he will be hearing from us.

3. Add-ons to Existing PDP-6 Customers

   These customers have a right to buy and we should sell them, using the minimum possible sales effort.

4. Leads which have gone so far that the Customer has a Dependence on DEC

   A decision will be made by Ken Olsen on each of these, based on whether or not DEC has a "moral obligation" to the customer. Subsequent selling, if any, should be done with the minimum possible effort.

5. Leads Referred to Maynard

Telephone the customer and then confirm by letter. Our basic message is that our production schedule is heavily committed, that we cannot discuss a sale to them at this time. We are currently working on FC-6 and when its specs become clear, we will get in touch with them. This should be in six to ten months.

If an element of moral obligation creeps in to one of these leads (such as might, for example, from a long standing PDP-7 or 8 customer), offer to put him on the waiting list for cancellations.

6. Rules for Selling Interim PDP-6's

Except for those commitments already made, we should allow no trade-ins, no rentals, no special engineering or software, and not use letters of intent. Delivery dates should be quoted in approximate terms until a purchase order is in hand at which point a firm date can be issued. All discounts must be approved by the PDP-6 Marketing Department before being allowed, so salesmen should not even discuss this issue.

	Customer	Good Customer	Physics Bio/based Univ. Research	Profit	Moral Commitment	LOI F.P.O.	Future Value to DEC	Stnd. Equip.	Inverse Risk Factor	GEO.	Total	RATING
1	Univ. of Penn. 3	1	1	1	.5	0	1	1	.75	1	7.25	11
2	Weitzmann Inst. 3	0	1	.8	.5	1	.75	1	.8	0	5.85 ←	15
3	Oxford 2	1	1	.8	.75	1	1	1	.8	.5	7.85	4
4	Imperial 2	.75	1	.8	.75	1	1	1	.8	.5	7.60	9
5	Stanford 2	1	1	.75	1	1	1	.5	.6	1	7.85	4
6	Wiltwatersrand NO	0	.75	.95	.85	1	.3	.75	.25	0	4.95	
7	New Mexico 2	0	1	.8	1	1	.75	1	.95	.75	7.15	12
8	Yale 1	1	1	.8	1	1	1	1	1	1	8.8	1
9	BBN. 3	1	1	.85	.51	0	1	.75	.50	1	6.6	13
10	CERCI NO CERCI NO	0	0	1	.25	0	0	.5	.25	.25	2.25	17
11	LRL #2 2	1	1	.76	1	0	1	1	1	1	7.76	7
12	BERKLEY #2 NO	1	1	.8	0	0	1	.75	.9	1	6.45	14
13	MARTIN-DENVER NO	0	0	1	0	0	.5	.8	.5	.75	3.55	16
14	COLGATE 1	1	0	.9	1	1	1	1	.5	1	7.4	10
15	ROCH 2	1	1	.8	1	1	1	.8	.9	1	8.5	3
16	UA/C 1	1	0	1	1	1	1	1	.8	1	7.8	6
17	LNS 1	1	1	.76	1	1	1	1	1	1	8.76	2
18												
19												

Analysis of PDP-6 Orders by Profitability

1. Gross Profits summarized:

100	UAC	49%	80 OXF	67%	BBN	53%
95	ROC	54	80 IMP	67	BR2	NA
100	COL	58	75 WEI	56	LR2	56
100	MIT	39	80 NEW	61	MAR	52
95	YAL	48	40 PEN	55	CER	NA
90	STA	42	WIT	60	ORL	60

2. If our average gross profit on these sales is 50%, we must cover our costs of marketing, programming, engineering, administration, and make a profit from the remaining 50%. Leaving profit aside, our costs budgeted for FY 1966 looked like this:

Marketing & Selling	$464 K
Hardware Eng.	384
Software	220
Central Eng.	114
Strates	23
Manuals	35
Overhead variance	157
Admin.	933
	$2330 K
Rounded:	2400

3. This means that to break even, we must sell twice $2400 K at an average gross profit of 50%. The $4800 K thus implied means that we must sell 12 machines to break even, since our average discounted sale has been running $400 K. If our production rate were 18 machines, we would realize $67 K per machine or 16.8% on sales. This chart shows a broader picture:

Machines Sold/yr.	K$ Pre-tax Profit/sale	Pre-tax Profit % on Sales
10	(40)	10% loss
12	0	0 break even
14	28	7% profit
16	50	12.5 profit
18	67	16.8 profit
20	80	20 profit

Assumes: no change in expenses over this range.

4. Conclusion: At our present 12/yr. rate, we're losing on sales showing less than 50% gross profit and earning on those showing more.

No

PDP-6 Division Proposed Marketing Plan November 3, 1965

Goals - Long Term

Med. scale computers for applications in which we can gain a firm market share.

Short Term

Construct an operation by which computers are sold, made and serviced in such a way as to give DEC a good reputation and increase our repeat business by creating satisfied customers.

Markets - Physics
Biomedical
Computer use research
On-line, with TS (?) simulation & control

Marketing Plan - Continue selling PDP-6 until it dies, then switch sales to FC-6. FC-6 should be a duplicate of PDP-6 or better for less money. Continue low markup, low service selling.

Focus all marketing effort on the above markets. Sell the first three from Maynard. Develop applications specialists. Field men should keep eyes open for solid leads in fourth category and in miscellaneous category.

Make sales as clean as possible. Sell only those with a gross margin of 55% or better except by Works Committee approval. Avoid all loans, trade-ins, LOI's, rentals, except by Works Committee approval.

Production Plan - Control on basis of production cost of each item, and adherance to schedules. Manufacture only to firm purchase orders.

Proceed to tighten up methods and staffing ASAP, then allow growth to accommodate new sales.

Engineering Plan - Concentrate on FC-6 being a replacement for PDP-6.

Finish 165, Drum, 545, ASAP.
Set up a special-engineering group on a profit-center basis, to accommodate our customers.

Programming Plan - Continue with present plan.

Administration Plan - Control staffing and expense of Division by limiting to an overall 45% of Net Income during previous 6 months. Adjust quarterly.

Adams file

8/6/65

TO: All DEC Sales Office Branch Managers

The PDP-6 at Keydata (Adams Associates) has at their request been pulled out.

The basic reason for this situation is that we were unable to get the Adams machine up and running steadily in a short enough time. The machine was four months overdue. For a company such as Keydata, which depends on the earnings from its machine, this is a severe problem and they were not able to tolerate it.

As you know, an overdue period such as the above, while deplorable, is not exactly unusual in our industry. The reasons for our slowness in bringing the machine to a state of readiness are these:

1) This is the most extensive system we have ever sold and its very size created some problems, which took a while to solve.

2) At Adams' request, certain special items were supplied and these put considerable strain on our capabilities to meet the dates earlier agreed on.

You will almost certainly be asked about this incident by customers and potential customers so here's how to handle it:

1) Be very careful to say nothing negative about Adams Associates or Keydata.

2) Mention the above points frankly and without elaboration.

3) Point out that this is the first (and we trust the last) time this has ever happened to the PDP-6.

4) Mention other systems we have in and running, i.e.:

Project MAC
U. of Western Australia
Brookhaven Nat'l. Laboratory
Rutgers University

Lawrence Radiation Laboratory
RAND Corp
University of Bonn
Aachen Physics Institute

Some of the lessons we have learned from this episode are already being translated into action.

1) All modifications made on the Adams machine will be retro-fitted onto all other machines in the field as soon as possible. There will, of course, be no charge to any customer. These modifications will also be added to all present and future machines in production.

2) In-house acceptance test procedures are being considerably toughened.

3) An advertising campaign will be launched in September with the specific intent of mentioning our important customers with highly reliable systems.

In closing, let me say that we expect lots of good to come out of all this - we have learned some lessons very well.

Prescott Behn
Marketing Manager
Large Computer Division

PB/b

PDP-6 INSTALLATIONS AND APPROXIMATE DATE OF INSTALLATIONS

		INSTALLED	TO BE INSTALLED
#1	DEC, Prototype - Later Scrapped		
#2	MIT-MAC	October 1964	
#3	Brookhaven Nat'l Labs.	March 1965	
#4	Univ. of W. Australia	February 1965	
#5	LRL #1	December 1964	
#6	Adams - Returned to DEC, redesignated 14		
#7	DEC, Programming		
#8	Rutgers	April 1965	
#9	Rand	July 1965	
#10	Univ. of Bonn	June 1965	
#11	Univ. of Berkeley	October 1965	
#12	Aachen	June 1965	
#13	Colgate R & D	December 1965 (RENTAL)	
#14	United Aircraft	December 1965	
#15	Stanford		May 1966
#16	MIT-LNS	March 1966	
#17	Rochester	April 1966	
#18	LRL #2		June 1966
#19	Yale		June 1966
#20	Pennsylvania		August 1966
#21	Oxford		October 1966
#22	Imperial		November 1966

Total Sold	19
Rental	1
DEC	1
Prototype	1

R. Lane
5-26-66

Competitive Equipment to PDP-6

IBM
- 7079
- 7044
- 7040
- 360-30, 40, 50, 67
- 360-44

CDC
- 3100
- 3200
- 3400
- 3300
- 3600
- 6400

UNIVAC
- 491
- 492
- 1107

SDS
- SIGMA-7
- SDS 940
- SDS 9300

GE
- 625
- 645
- 235

ENGLISH ELECTRIC
- KDF-6, 7, 8, 9

ICT
- 1900 Series

R. Lane
5-26-66

INTEROFFICE MEMORANDUM

DATE March 16, 1966

SUBJECT Outstanding Status and Projects: Manufacturing Representatives and Distributors

TO Ken Olsen
Nick Mazzarese
John Jones
Mike Ford
Stan Olsen
Win Hindle ✓
Mort Ruderman
Pat Greene
Dick Testa

FROM Ted Johnson

I have been lagging in the action-taking required for our rep and distributor program. To keep you informed of our current situation and my plans, here is a list of our present and projected relationships and changes planned.

We have discussed future expansions individually. The needs of the various product lines differ quite radically. But I think we can work out fairly clear guidlines and develop our capability for drawing sensibly and efficiently on a range of available channels of sales, service and market development and distribution. Knowing where we stand in the other product lines will be useful to each product manager.

I am going to try to arrange appointments at IEEE with as many of these people as are available. So far, I have scheduled a meeting with Landseas Corporation. I would like to discuss any questions you have before IEEE so that we have a common understanding of our commitments, representatives and policies.

U.S.

1. ALLIED RADIO

A. No official signed agreement, allowing a non-exclusive arrangement for modules.

B. Some activity, mostly Mid West and North West, but requires active mail support and salesman's cooperation from us.

C. Advantage simply in promotion and service to customer on small module orders.

2. CARROLL COLLIER, Sacramento

A. Standard modules and small computers agreement.

B. Area basically Sacramento and McClellan AFB.

C. Completely under Ken Larsen's control.

D. Non-exclusive (allows Allied to compete).

E. On continuing basis, subject to 30 day notice.

F. Not clear yet what we gain, but not draining our time and providing quite knowledgeable liaison.

3. DATRONICS - Texas

A. Modules only.

B. Stocking (distributor) small quantities currently being considered.

C. Doing a fair job, cooperative.

D. Might extend area to Mississippi.

E. Under Don Henderson, support will be forthcoming from Laveris, who will concentrate on small computers.

F. New agreement pending.

4. SHOWALTER-JUDD

A. Modules and possibly memory testers.

B. Currently being reviewed, now that we have an office (Dick Wilkinson).

C. Under Ken Larsen.

5. SY STERLING - Manufacturing Rep/Dealer - MidWest

A. Currently considering supporting as a non-authorized dealer (quantity discount) for modules and Lab Kits.

B. Owner (Sterling) owns big part of Ann Arbor Computer.

C. Have respect for their operation, old H-P rep., businesslike, high technical capability.

D. Decide at IEEE Show.

6. Other Possibilities

A. Distributor/Representative in Southeast.

B. Laboratory distributors for Lab Kits to educational markets.

C. Modules distributor/dealers.

FOREIGN

1. RIKEI - Japan

   A. Sold memory testers and some small computers.

   B. In response to request, supplied excellent market survey/forecast. (attached)

   C. No serious mention of modules, I intend to probe possibility of distributor agreement with them or others immediately.

   D. No active agreement, they are requesting a new one.

   E. Require more active liaison and support program. (see final conclusions)

   F. Suggest we review seriously, possibly get another rep for modules to test their activity. We need to have a trading company in any case.

   G. Japan is big but increasingly competitive market for computers. Unless we put in Japanese-American, recommend we continue on same restricted basis.

2. ENGLAND (SASCO)

   A. Mail-order Allied-type distributor.

   B. Propose concluding agreement now for modules.

   C. Mailing list 25,000.

   D. Salesmen, limited, non-technical.

   E. Service strictly their only asset.

   F. Only concern is that largely owned by Phillips.

   G. Non-exclusive arrangement.

3. GERMANY (Consideration)

   A. Have possible distributors for modules, mainly Amphenol-Borg. Being reviewed, along with Benelux, Switzerland, Italy, France.

4. LANDSEAS (Israel)

   A. Informal agreement, they've been working for us for many months.

   B. Excellent reputation in Israel, have New York Office.

   C. Proposed modules distributor arrangement.

   D. Suggest New York meeting (IEEE).

   E. Need to define their areas immediately.

F. Intend no field support, all service through New York.

G. Good field service capability, if used right.

H. (Have current request from Dr. Harel, senior computer engineer, to represent us in Israel, direct input to K.H. Olsen requiring discussion as soon as possible.)

5. S.S. KOPPE (Latin and South America)

A. Represent us on PDP-8 Typesetting systems.

B. Purchasing Agent for publishers in that area.

C. Requires 60 days notice for termination.

6. TELARE (Scandinavia)

A. Rep for all DEC standard products in Sweden, Norway, Denmark and Finland.

B. Agreement in Sweden until June 1967.

C. Field Service and other countries subject to 60 days notice.

D. Not, in our opinion, doing a good job, but has new management. (ARENCO)

E. Recommend termination in areas outside Sweden. Have candidates for other three countries now.

F. Now being handled through U.K. office, which will need more administrative help.

G. We move in Field Service and hardware sales engineer as soon as possible to support AGA and Telare and other Scandinavian reps.

H. Contact to see if representative will be at IEEE.

7. UNIVERSITY OF MEXICO (S. Beltran)

A. Negotiating arrangement for representing us on sale of Lab Kits.

B. Commission in free modules to the University.

8. HODGES - South Africa

A. This arrangement kept active because of PDP-6 lead at Witwatersrand.

B. Must clear up arrangement as soon as possible.

C. Authorized by Gerry Moore to represent us on computers and modules.

D. Requires prompt attention and clarification. Will consult with you immediately for your opinions. I'm afraid this one is least under control at this point, but no written agreement except telex. University of Witwatersrand deserves special letter.

Other Current Inquiries, etc.

1. PLURIMAC (Brazil)

   A. American engineer who has company and wants to rep us on computers in Brazil.

   B. Require more information on them.

   C. Suggest modules distributor and see how it works. (if they look good)

2. ARNOLD RATNER ASSOCIATES, INC.

   A. South, New Jersey, Philadelphia, Maryland, North Virginia.

   B. Rep.

   C. Suggest no interest (bad lines) for any product.

3. TAGE OLSEN (Copenhagen)

   A. Tektronix rep.

   B. Suggest modules distributor arrangement.

   C. Possible finder's fee on computers.

4. JAPAN

   A. Connecticut Yankee Research Corporation requesting opportunity to help us in Japan. (Information only)

   B. Munzig International - Successful Japanese rep firm, managed by an American here. I will meet him again to discuss possibilities (modules particularly).

5. RAMCO

   A. New Mexico, Arizona, Utah, Colorado, South Nevada, W. Texas.

   B. Suggest we explore additional help in New Mexico and Colorado.

   C. Giving to Skip for comment.

   D. Currently planning to put Denver office under either Los Angeles or San Francisco office.

6. MARIOS DALLEGIO (Beckman)

   A. Inquired for PDP-6, sending letter immediately Greek AEC.

   B. No agreement.

   c. Letter Januray 11, 1966 from Gerry Moore inferred commission on small

computers. Will consult with you immediately and write a nice letter to clear up our situation.

D. If look good (so far they do), propose modules distributor.

Final Conclusions

1. Small Computers have clearly spelled out a no-expansion policy on sales to other countries. We have remote installation policy which should be considered. Suggest we work out long-term plan before we make other commitments. Basic criteria now: direct sales, no expansion without clear plan for going direct.

   Future: Look at ease of service on machines to determine feasibility of remote sales.

2. Recommend clarification of memory tester sales program, and costs.

3. Propose reasonable modules and/or Lab Kit distributor/dealer arrangements, with no area support except answers from Maynard. Will develop good future framework gradually and commit representatives to performance.

4. Look at parallel advantage of reps to get fast market penetration.

5. Get distributor/rep support man to work for me to make the small program and Allied successful. (See attached recommendations on Allied)

TJ/mr

Attachments

ALLIED

1. Get Allied management to send letter to each Allied office spelling out our working relationship.

   A. Service not sales (delivery)

   B. Keeping our sales offices informed.

   C. Not giving customers impression they are reps, can look to us for applications support or point of order.

   D. Their success demands cooperation on both sides.

2. Mail out instructions and simple guides to promoting our products, especially Lab. Kits.

3. Push advantages of Lab Kits.

4. Help our salesmen to understand relationship (most are still confused).

5. Hopefully get chance to mail to them (salesmen) directly, encouraging them about the advantages of working with us.

INTEROFFICE MEMORANDUM

DATE May 11, 1966

SUBJECT Customer Certification of DEC Tapes.

TO Larry Portner

FROM R. L. Lane RLL

The DEC policy is not to sell un-certified DEC Tapes. I feel this is a good policy since our stocks of DEC Tape have no quality control checks made.

This policy should no way restrict us from supplying the PDP-6 certification program to customers. Many of these customers have tapes go "sour" and want to re-certify them. Others have stocks of DEC Tapes from previous machines PDP-4, 1, 5, 8, 7 and want to use these tapes on their PDP-6.

Please distribute the DEC Tape Certification Program freely to all PDP-6 users.

This memo infers nothing about the DEC policy to sell or not to sell uncertified DEC Tape.

CC: Geoff Finch
Gerry Moore
Win Hindle ✓
Ken Larsen
Ron Smart
Robin Frith
Dick Musson
Roger Handy
Sales Newsletter

dec INTEROFFICE MEMORANDUM

DATE February 9, 1966

SUBJECT PDP-6 Price List

TO Dick Musson
Ken Larsen
John Leng
Geoff Finch
Gerry Moore
Ron Smart
John Jorgensen
Ted Johnson
Roger Handy

FROM R. L. Lane

This price list is furnished for your information since there are PDP-6 Customers in your territory. We are not currently quoting or accepting PDP-6 orders. Discounts are not permitted for add-on options and deliveries must be specified from Maynard. There are 11 systems installed and MIT-LNS will be delivered on February 28, 1966.

We have firm orders from:

Stanford	- April
Rochester	- March
Yale	- May
LRL #2	- May
Oxford	- September
Imperial	- October

We have a strong commitment to NIH and the University of Pennsylvania for a system at the Johnson Foundation. We do not have a firm P.O. from them as yet.

The MIT-PEPR system specifications have been sent out to bidders and the conference is February 15, 1966. All the major manufacturers have been invited. We have now quoted 4 - YALE type PEPR Controllers with orders for 2 (Yale & Princeton). BONN and Oxford are presently deciding which way to go. (Yale's Controller is scheduled for delivery on 2-20-66 but it looks a little late.) As you can see, the MIT consortium has lost a few members.

The Type 164 Memory is about 3 weeks from going onto a PDP-6. We expect first deliveries to be late April and early May to United Aircraft.

The Type 545 Tape Unit has not been checked out. We have been promised our first unit this week. We plan to install 2 on the System Programmers "007" system.

FORTRAN IV is not complete but the object code looks very good as the compiler is working. The loader and operating system is being finished and field deliveries are scheduled for about Mid March (with fingers crossed). It's about 10K in length. FORCE is about 2.5K and the loader 2K.

The RAND drum system will be shipped about Mid April and our confidence factor is about .95 at this time. It has been running on the computer.

The parity option is working at RAND and they have Memory speed up (.95 to 1.00 access) with the percolate modification. (This mod still is not correct and more changes will be made.)

Price List

PROGRAMMED DATA PROCESSOR-6

January 1, 1966

Type 166	Arithmetic Processor Paper Tape Reader 16,384 Word Core Memory I/O Console Teleprinter Floating Point Hardware 7 Channel Priority Interrupt System 36 Bit Word Length 16 Accumulators 15 Index Registers Buffered I/O System and Control	$300,000.
Type 164	Core Memory, (16,384 Words, 1.8 μsec cycle)	85,000.
Type 162	Fast Memory (16 Words, 400 nsec access)	30,000.
Type 187	Add'l Processor-Memory Interfaces	2,700.
Type 551	DEC Tape Control	14,000.
Type 555	Dual DEC Tape Unit	7,400.
Type 136	Data Control	10,000.
Type 516-520	Tape Control for DEC Type 50 Tape Unit	18,000.
Type 516-521	Tape Control for DEC Type 545,570 T. U.	18,000.
Type 516-522	Tape Control for IBM 729	24,000.
Type 545	Tape Unit, 45'/sec, 556 or 800 bpi	12,000.
Type 50	Tape Unit, 75'/sec, 200,556 bpi	18,000.
Type 570	Tape Unit, 112'/sec, 200,556, or 800 bpi	30,400.
Type 760	Paper Tape Reader (400 cps)	9,000.
Type 761	Paper Tape Punch (63.3 cps)	5,500.
Type 461A	Card Reader (200 cpm)	16,500.
Type 461B	Card Reader (800 cpm)	27,200.
Type 646	Line Printer	
	300 lpm, 120 col.	30,000.
	300 lpm, 132 col.	31,750.
	600 lpm, 120 col.	37,500.
	600 lpm, 132 col.	39,150.
	1000 lpm, 120 col.	47,500.
	1000 lpm, 132 col.	50,500.

Type 346	CRT Display w/light pen	$ 33,225.
Type 346	CRT Display w/light pen & Character Generator	40,000.
Type 630A	Data Communication System	
	1 Line	9,869.
	2 Lines	10,488.
	3 Lines	11,107.
	4 Lines	11,726.
	5 Lines	12,345.
	6 Lines	12,964.
	7 Lines	13,583.
	8 Lines	14,202.
	16 Lines	21,642.
	24 Lines	29,082.
	32 Lines	36,522.
Type 635A	Line Power Supply	500.
Type 635B	Patch Panel	600.
Type 635C	KSR33	900.
Type 635D	KSR35	2,500.
Type 635E	ASR33	1,200.
Type 635F	ASR35	4,000.

dec INTEROFFICE MEMORANDUM

DATE December 6, 1965

SUBJECT

TO Jack Shields FROM Win Hindle

CC: Bob Lassen
Harry Mann

In order to meet committments to our customers, it is necessary for us to hire an additional number of PDP-6 Field Service people.

I realize that this may be done at a time when we are in excess of our budget, however, these committments must be met and the additional people hired.

We require six additional people to cover committments at:

1. University of California, Berkeley
2. Applied Logic Corporation
3. University of Rochester
4. Stanford
5. United Aircraft
6. MIT LNS

In order to allow for proper training and help solve a critical manpower proplem which exists now, these people should join the company no later than the middle of January, 1966.

W. R. Hindle Jr.
Win Hindle

dec INTEROFFICE MEMORANDUM

DATE DECEMBER 3, 1965

SUBJECT USE OF THE PDP-6 FOR INTERNAL DATA PROCESSING

TO WIN HINDLE
DAVE PACKER

FROM LARRY PORTNER

This memo discusses the pros and cons of doing our internal data processing on the programming department's PDP-6 or its successor. The following assumptions have been made:

1. This computer and associated peripheral gear must remain at Maynard to allow us to provide continuing service for the software that already exists, as well as that which we are currently implementing.

2. The PDP-6, if properly maintained, is at least as reliable as any competitive equipment we might consider leasing.

3. Basing our internal data processing operations on a competitor's computer would serve only to put off our own inevitable and potentially profitable venture into this area of computer applications.

There are many good arguments for using the PDP-6 for internal data processing; admittedly some are emotional, but some translate directly into dollars and cents:

1. Our demands upon the computer will have tapered off by the fall of 1966 to the point where a good deal of the system's capacity will be idle. This is considering demands for software development and maintenance and does not include the weight of other in-house users who are slowly gravitating toward this system. I also am assuming that no major software projects will appear on the horizon. Since the system must remain here anyway, all applications we place upon our PDP-6 will be using free computer time. Our time-sharing software using the type 270 Disc will allow us to make the machine available to in-house users while the normal software development is going on.

2. The ability for many people to make simultaneous inquiries or file updates from many remote stations is a built-in feature of our PDP-6 system.

3. The 270 Disc, although comparatively slow, has a very large capacity (5-3/4 million 36-bit words), several times the requirement that Dave Packer has predicted for two years hence.

4. I personally believe that it is very much to the advantage of any manufacturer to use his own equipment, even if it cannot be absolutely justified economically; first, for the sake of appearance, second, to demonstrate the suitability of the system for the application, third, to demonstrate confidence in reliability and, finally, to experience the user's eye view of his own equipment.

5. Training in the development and use of commercial software would be a valuable experience for us. While it is true that we are not currently selling to a commercial market, there are certainly those potential customers who would be favorably influenced by the availability of commercial software, perhaps to the point where it could swing a marginal sale or open doors where computers without this type of software are not even considered.

6. The availability of an easy-to-learn, easy-to-use language like COBOL coupled with a totally accessible system like our time-shared PDP-6 could of itself generate numerous efforts internally to utilize this powerful a tool.

7. The number and diversity of I/O devices that can be attached to the PDP-6 present all sorts of possibilities for expanding our data processing and accounting practices, such as remote terminal input and output, graphical data display, etc.

On the other side, there are several negative arguments to be considered:

1. DEC historically has given lowest priority to maintenance of in-house equipment. While the up time experience on PDP-6 No. 7 has been outstanding for the past several months, the lack of adequate preventive maintenance is bound to show up as some period of down time. It is reasonable to expect that any time our service facilities become strained, our in-house equipment will suffer first.

2. Renting a system from some manufacturer who is seriously in the commercial market would provide a much larger selection of software, both from the manufacturer and from users' groups.

3. Much of the peripheral gear on PDP-6 No. 7 is unproven; the card reader has had very limited use; the type 570 magnetic tapes have been available for about six months, but for a variety of reasons are still not on-line and working; the disc file has received limited use, but appears to be reliable. In addition, the printer is 300 lines per minute, rather slow for any volume of printed reports.

There are two items of software which must be provided for the PDP-6 before we can consider doing any data processing; these are a suitable language and a sort-merge program. The sort-merge program would be a generalized package in that it should sort variable length records with variable length keys, occurring anywhere within the data block (i.e. not necessarily the first word or words). This program must be device-independent, that is, it should sort records from mag tape, DECtape, Disc, etc.

The second and major item of software required is a data processing language. I strongly recommend a compact Colbol compiler; first, because the language is well defined and second because Cobol is the standard commercial language and would certainly enhance the attractiveness of the PDP-6 to many potential customers. Cobol has the additional virtures of being "self-documenting" and relatively easy for an inexperienced programmer (or for that matter anyone) to use.

The sort/merge program has been worked on informally by a member of the programming group. It would probably require three man-months to complete at a cost of approximately $7000. Alternatively, a less general sort package could be written in Cobol in less time, say six weeks, for half the cost.

There are several alternatives open for obtaining the compact Cobol compiler. We have solicited proposals from several software venders for this compiler. The price seems to be around $70,000 for compiler, object system and full user and maintenance documentation. Adding the full time service of one DEC programmer brings the price to $95,000. The delivery date would be about one year from contract. Alternatively, we could implement the compiler and object system in-house, using the compiler that Peter Watt is writing for the University of Western Australia as the skeleton, with Peter himself doing the major portion of the work here at Maynard with another full-time programmer working with Peter, plus half-time of a third programmer. Assuming that Peter would be able to come to Maynard in March with a working basic compiler, we should have an operating compact Cobol system by October, at a cost of approximately $43,000 beyond that which Peter will already have expended in Australia, plus approximately $4000 for professional documentation.

I am not suggesting that this proposal serve as the basis for a decision on the question of using the PDP-6 for internal data processing. My time and cost estimates are based on some experience plus large amounts of intuition. In addition, Peter Watt is doing the initial design work under a severe time bind, so there is no guarantee that his compiler would be a satisfactory starting point for the standard compact Cobol compiler. I think that a decision should be made to spend several weeks doing a preliminary design and specification for the compiler with the purpose of developing accurate time and cost estimates.

The question could be asked, "Why not just use Peter's compiler for our internal processing?", and my answer would be that spending a good deal of time and money in developing systems that would work only on a PDP-6 would be a mistake when by using a standard language, you can (at least theoretically) shift to any computer that possesses a COBOL compiler, if it becomes desirable or necessary.

LJP/vc

dec INTEROFFICE MEMORANDUM

COMPANY CONFIDENTIAL

DATE November 15, 1965

SUBJECT In House Business Data Processing Equipment

TO Works Committee

FROM David Packer

We have been attempting to use PDP-4 hardware in implementing our first major internal data processing application, an accounting and financial reporting system. The poor reliability of the equipment during a three month period of trial operation has led us to discontinue processing until more reliable equipment could be obtained.

Future data processing plans include design and implementation of a materials control system, to keep stock and order records, perform many functions now done manually, and provide better control of the business. A system like this would require random access storage and systems programs not now available on the PDP-4/7.

The in-house PDP-6, although satisfying hardware needs for data processing, does not have a language or utility programs suitable for business applications. Development of an acceptable language would require a considerable investment of time and money. Reliability of this system, too, is uncertain.

Commercial equipment, such as IBM or Honeywell, designed specifically for business applications has many advantages. The hardware appears to be reliable, as it is in extensive use. Software includes languages, applications, and utility routines that reduce programming and implementation costs. Systems design assistance is available from manufacturers. Backup systems are commercially available.

Incremental costs of the alternative approaches to in-house business data processing, through Fiscal 1968, are estimated to be:

PDP-4/7 System	
Hardware	$113
Programming	48
	$161
PDP-6 System	
Programming	$ 83
(Assumes no charge for use of existing equipment)	
Commercial System	$ 80

The cost factors, plus reliability and other considerations, lead to the following recommendations:

1. That we use commercial data processing equipment for in-house business applications.

2. That we evaluate commercial equipment and decide upon a system by March, 1966.

3. That PDP-4 business programming be curtailed until an equipment decision is made. Systems planning should, however, continue utilizing punched card or manual methods for short term implementation.

D. W. Packer

DWP:ncs

Andy –

Is it important for me to meet your

IBM visitor at 11?

INTEROFFICE MEMORANDUM

DATE November 16, 1965

SUBJECT RETROFIT OF THE PDP-6 SYSTEM AT LAWRENCE RADIATION LABORATORY

TO H. ANDERSON FROM A. ROBERTS

1. MODIFICATIONS

The following modifications were installed:
144, 146, 148, 149, 150, 151, 159, 160, 161, 162, 169, 170, 173, 174, 176, 177, 182, 183, 185, 186, 187, 189, 191, 193, 194, 196, 200, 206, 207, 208, 209.

The following were not installed:
148, 149, 155, 158, 167, 171, 190, 199 because they did not apply.

2. COMMENTS ON MODIFICATIONS

Mod. #191 Deleted an important wire and did not replace it 1K14E to 1D17N (CHT 8)

Mod. #194 Poorly organized unnecessarily time consuming

Mod. #206 UML did not show jumpers for the 1316 in 1E21
UML showed incorrect jumpers for the 6102 in 1E02
Modification required 2 1000 modules, only one was sent.
No adjustment procedure for the 505 low voltage protect.

Mod. #207 Error in Section 11 2J23T should have been 2J24T. This is on the add sheet (memory inhibit gating).

Mod. #189 100 ohm series resistor superfluous due to package modification.

Mod. #150 No power cords sent.
No. blank panels sent.

Mod. #144 Needed 2 6124s. None sent.

Mod. #159 Required 6000 ohm resistors. None sent. Not enough switch plates or stand-offs or decals sent.

Mod. #209 Required 350 ohm 25 watt resistors. None were sent

3. PROBLEMS IN MODIFICATIONS

Mod. #160 Part 3 failed when two IOTs were attempted, one following the other. Found that the second IOT began while the first was in progress. Changed the delay for IOT T4 to 1.85 microseconds.

4. DESIGN CHANGES

A. The following modules have 100 ohm series resistors in the base circuit: all 6106, 6122, 6123, 6124, 6105, 6102, 6603, 1607.

This change required in excess of 1300 100 ohm resistors

5. OTHER PROBLEMS

A. The new 6205 and 6615 boards had a large number of cold solder joints where the plugs connect to the board and one was logically defective

B. After getting the system back in shape PT3 was failing with unknown bits on the IO Buss. The failure was traced to LRL peripheral equipment shorting out the IO Buss Cable.

C. LRL's IO Cables were removed from the system and some time was again lost in the ensuing confusion due to the 136 and 516 IO Cable Connectors being wired incorrectly, or differently from the 166.

D. Then a problem showed up with the Papertape Reader dropping bits. This was traced to a cold solder joint in an IO Cable. At this point, it was decided to pull the complete IO Buss and check all cables. This showed many bad joints where the plugs were soldered to the boards.

E. Came instruction failure, traced to bad AR (6205).

F. IOT failure, bad IOT 60 flip flop (6227).

G. SCT maintenance switch had a wiring error which disabled the function of the switch entirely.

H. Unknown interrupt in Part 3, bad decoder (4151) CPA.

I. IOT failure, bad 1316.
Delay IOT 3 restart at ET5.

J. At this point all diagnostics ran except Protect and Relocate PT 1 & 2 and BLT when relocating into upper core. Requested new 6131 DC Adders from Maynard. This cured the problem in Part Two of Protect and Relocate, Part One will run without Fast Memory. We then started margins in an effort to locate the failures, since neither Protect and Relocate or BLT lend

J. (Contd.) themselves to efficient trouble shooting. Found that Part Five would fail when Panel 1B +10V lines were varied except when Fast Memory was off-line. By this time it was evident that the troubles we had would probably run us well over the LRL imposed time limit so we requested help from Maynard and Bob Clements and Bob Savell came out to help.

K. We then started a three shift, around the clock operation and began cleaning up the low margins.

L. 162 Fast Memory.
A number of the (1250) Flip Flop Boards had poor margins and not having spares necessitated the changing of components on the boards we replaced:

16 - 2894-1 transistors
12 - 664 diodes
8 - 662 diodes

Also found one no solder joint (DE12EK).

M. 163-3
No -15V marginal check Panels 1D and 1E. 6684 Margin Switch wired incorrectly. 6684 Board short between Pins A and B, Delay (1310) 1E15 had internal reflections changed jumper from W to V.

N. 163-5
No Marginal Check 1D,E 6684 Margin Switch wired incorrectly. Bad 6227, 1D2, bad 6122 1D10 replaced 4 2894 Transistors.

O. In BLT test we got multiple selects. Moved delay in 1L16 to 100 ns.

P. RLAB 21 output was sloppy, added 56 Pf at 2L7S (6684).

Q. 162 dropping bits in right half word on first reference. Swapped 1665's and problem disappeared.

R. Ex inhibit relocate not getting up fast enough. AT, one to MC request gate allowing request to two memories.

S. Poor margins in 1B were caused by MB 18 glitching. Added diode to 1E17K.

T. Poor margins in 1D and E were caused by a 6122 with Floating Base (CFAC AR SH RT) grounded 1E12U.

U. Error in Floating Point found by systems program (PT5 OK) caused by spurious NRT3 moved NRT2 Delay to 200 NS.

V. Repeat Key Execute not working. Missing wire (1M10W) to (1N20V).

W. MEM Continue Switch defective. Does not work in full up position.

X. TTY Receiver Card came loose in the socket a few times. Also 2 transistors and one diode were changed.

Y. 6684 Margin Switch in the 516 and 136 wired incorrectly.

Z. Pin SK of 2DE5 had a loose ground wire. It was shorting to SJ.

I. BLT trouble moved Delay (1316) to 150 NS between BLT-4 and BLT-5 (1L11).

II. LDB instruction picking up Bit 20, Bad 6205.

III. The 1998 Boards in memory were modified and diodes added to Pin W.

IV. Panel 2J is not included in marginal checking of Part 5.

V. The 1665 and 1664 in both memories were modified. The PDP-6 was run as P0, P1, P2, P3, all O.K.

VI. BLT will not run relocating into the 2nd core without the change which causes the timing chain to start on active rather than request.

AR:nd

dec INTEROFFICE MEMORANDUM

DATE November 12, 1965

SUBJECT University of Western Australia

TO File

FROM Harlan Anderson

The following information was obtained by interviewing Robin Frith after he returned to Maynard following eight months of residence in Perth, Western Australia. The PDP-6 computer was shipped from Maynard in February and the hardware portion of the acceptance test was completed within two weeks of its arrival at Perth. The software portion of the acceptance test was completed by May 17 approximately two months after the hardware. The overall attitude of the University towards the PDP-6 appears to be very good. They recognized that they were taking somewhat of a technical gamble on the new time sharing concept but feel it has worked out quite satisfactory and Robin feels that if they had to do it again they would indeed follow the same course of action.

Hardware Troubles

The following specific hardware problems seem to be the key ones that come to Robin's mind:

1. DECtape Start/Stop Time. The DECtape drives that were sent to Australia was the first ones that ever used 50 cycle motors and they were not balanced properly on one of the drives and thus created bad Start/Stop times. This was corrected during early operation of the system by replacing one or more of the motors.

2. Robin discovered several instances of pulse splitting where two places were driven from a common source without the hundred ohm isolating resistors that we now use. He apparently discovered this before there was any formal engineering change created for this problem.

3. Several transistors burned out in the 630 Data Communications System in the 4707 and 4706 modules. He feels this may have been caused by an accident in the process of hooking up the telephone lines.

4. The 800 card per minute card reader had a cold solder joint on a light bulb that was used in reading cards. This was in the non-DEC part of the equipment and it showed up as a heat sensitive problem and apparently took some time to isolate. This was corrected and Robin now estimates that the card reader has been used for upwards of three million cards satisfactorily.

5. I/O Bus Cable Open Circuit. The symptom that led to the solution of this problem was that the DECtape directories were occasionally wiped out. The final problem turned out to be on the connector module where the Methode connector is used, the wires poking through the printed circuit board had been clipped off, after soldering, so close to the board as to remove the solder that was intended to make the connection. It was not clear why this clipping had been done but it conceivably was to prevent the wire sticking through the board from shorting out from an adjacent connector module. Robin removed all bus cables and soldered them again and the problem indeed went away.

6. Robin reported that several modules which had incorrect internal jumpers were found during checkout in Maynard. One trouble was traced to incorrect jumpers in Perth. He couldn't understand how the machine could run at all with this mistake. He did not remove all modules which use internal jumpers as requested because of the length of time required to do it. (Estimated to be one week of evenings.)

7. DEC tapes have been known to drag and stop on occasion due to some friction. This seems to appear at times of hot dry weather. No solution to this is known at the moment and a similar phenomenon is appearing on the DEC programmers machine.

Software

Robin feels that their greatest disappointment would probably be in the software backup that they received. They were perhaps sensitive on this subject because of the delay in the availability of the software by two months. After Don Witcraft's departure from Perth, it was apparently about two months before he knew the software systems tape was made available to them. No one knows quite why this long delay. Robin feels we were not set up in Maynard to do enough user oriented testing of our software. In particular, they apparently sent in by telex some problem with writing binary tapes and the new system tape that they were sent some time later which was suppose to have fixed the problem still had the problem in it.

In general, their usage of the software is largely Fortran from punched cards. The biggest user outside of the computation center is the crystallographers who use an average of about three hours per day. There are a total of about three of them. They make very little use of the Editor program or the DDT program. They claim the reason they do not use much DDT is because its usefulness with Fortran Source Programs is limited.

An interesting side light that Robin mentioned was the unavailability of program listings for software from manufacturers such as IBM and CDC. Apparently, they take a position in Australia that this is proprietary information and, in general, do not make it available to customers. This, apparently, is very annoying to many customers and the fact that we did make it available was a positive point at the University. This information along with some initial help from Don Witcraft enabled University personnel to add to our Monitor program subroutines to accommodate a mass spectrometer that they had connected. This mass spectrometer then acted like one of the users in a time sharing sense. They used the time sharing Monitor mode of operation approximately four hours of every day.

They were quite concerned to find that we had a desk calculator program in preparation since they were also preparing one. This is a sticky problem, because if one mentions that such a thing is being prepared and it never gets finished "ill will" will exist if the customer was counting on its availability.

Special Equipment

While Robin was there, he designed for them a special interface out of our modules to allow the interconnection to the mass spectrometer and one other device. They then purchased the modules and assembled the device and was quite satisfied with its operation. The size of this device required about $2,200 worth of DEC modules.

Reliability and Service

The servicing procedure that Robin followed was to do one-half hour of preventive maintenance each day between 8:30 and 9:00 a.m. During this time, he would run our main DEC programs and take margins by group. Anything that did not look satisfactory at that point, he would attempt to fix it and, if necessary, keep the machine under his control beyond 9 o'clock. When he was done, he would load the Monitor program into the computer so they were ready to commence operations.

Their record keeping techniques for reliability purposes were not entirely clear or precise. However, Robin feels that Dennis would estimate the percent of assigned time that was useable at about 98%. For example, during the month of September, Robin indicated there were 4.5 hours of downtime. They use the machine approximately 15 hours a day at the present time. The machine has been in use a total of 5,000 hours at present.

Future

The University is now making plans for a future expansion of a PDP-6. They have done this by presenting a proposal to the University's Commission

(source of funding). They anticipate adding a 270 disc unit, another core memory and more teletypewriters.

Summary

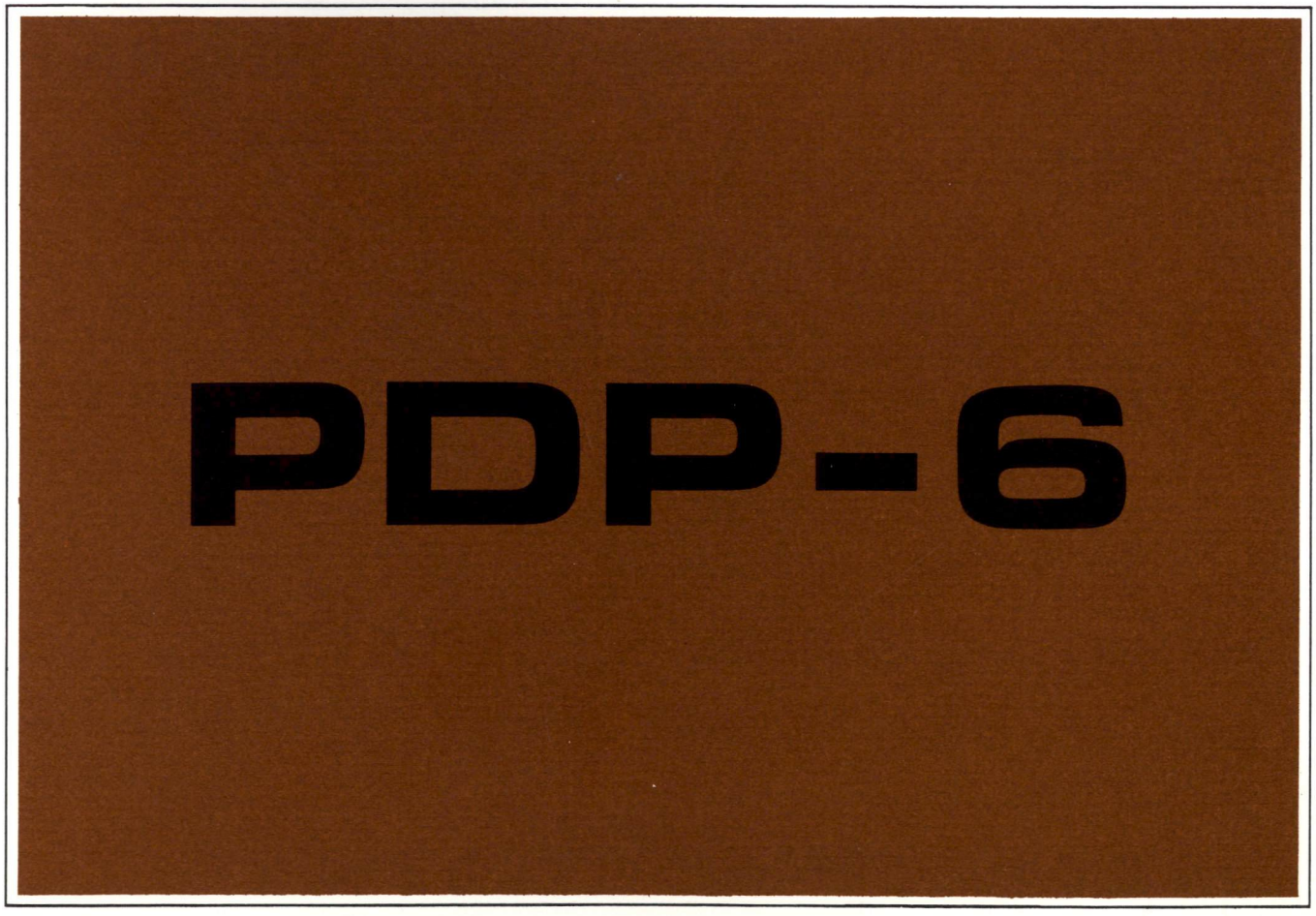
Overall, I think they are quite happy from what Robin says but I think there are some specific details that we could have improved on back here in the way of communications.

H. Anderson

HEA:ncs
cc: W. Hindle

PROGRAMMED DATA PROCESSOR-6 PRICE LIST

MAY 1, 1965



DIGITAL EQUIPMENT CORPORATION • MAYNARD, MASSACHUSETTS

PDP-6 PRICING BY TYPE NUMBER 1 August 1965

TYPE	DESCRIPTION	Discountable	LIST Purchase Price
50	Magnetic Tape Transport	No	18,000
136	Data Control	Yes	10,000
161 B	Core Memory - 5ys-8K	Yes	49,000
161 C	Core Memory - 5ys-16K	Yes	85,000
162	Fast Memory .4ys-16 words	Yes	30,000
163 C	Core Memory 1.75ys - 16 K	Yes	126,000
165 A	Multiple Computer Interchange	Yes	18,500
165 B	"	Yes	4,000
165 C	"	Yes	5,400
165 D	"	Yes	2,000
165 E	"	Yes	1,700
165 F	"	Yes	200
166	Arithmetic Processor	Yes	151,000
187	Memory Interface	Yes	2,700
270	Disc File	No	140,000
346	Display Unit	Yes	40,000
461 A	Card Reader 200 cpm	No	16,500
461 B	Card Reader 800 cpm	No	27,200
516-520	Magnetic Tape Control (50)	Yes	18,000
516-521	" (570)	Yes	18,000
516-522A	" (729)	Yes	24,000
551	DECtape Control	Yes	14,000
555	Dual DECtape Transport	Yes	7,400
563 A	Calcomp Plotter/I/O Bus	No	20,000
563 B	/630	No	16,000
564 A	Calcomp Plotter/ I/O Bus	No	22,100
564 B	" / 630	No	18,100
565 A	/ I/O Bus	No	15,500
565 B	" / 630	No	11,500
566 A	" / I/O	No	15,900
566 B	" / 630	No	11,900
630	Data Communication System (8 lines)	Yes	14,202
635 A	Line Power Supply	Yes	500
635 B	Patch Panel	Yes	600
635 C	33 KSR Teletype	No	900
635 D	35 KSR "	No	2,500

635 E	33 ASR Teletype	No	1,200
635 F	35 ASR "	No	4,000
646 A	Line Printer 300 lpm/120 col.	No	30,000
646 B	" " 600 lpm/120 col.	No	37,500
646 C	" " 1000 lpm/120 col.	No	47,500
646 D	" " 300 lpm/132 col.	No	31,750
646 E	" " 600 lpm/132 col.	No	39,150
646 F	" " 1000 lpm/132 col.	No	50,500
760	Paper Tape Punch	Yes	9,000
761	Paper Tape Reader	Yes	5,500

F-62 PDP-6 Price List Change Notice # 1

1) DELETE type 460 card punch

2) DELETE type 167-236 drum processor
This will no longer be offered

3) DELETE type 237 Magnetic Drum unit. This will no longer be offered

4) ADD under Peripheral Equipments type 165 multiple computer interchange (reference 165 bulletin)

165 A	PDP-6 Memory Interface	18,500
165 B	Long Line Option	4,000
165 C	Long Line Option	5,400
165 D	PDP-7-8 Interface	2,000
165 E	PDP-6 Interrupt	1,700
165 F	PDP-7-8 Interrupt	200

	Central Processor Options	
Parity	Type 188 Memory Parity Option.	$2,000
	Readers and Punches	
Reader	Type 750C High Speed Perforated Tape Reader and Control (Type Change).	$3,500*
Punch	Type 75E High Speed Perforated Tape Punch and Control (Type Change).	$4,000*
Cards	Type CR01C Low Speed Card Reader. Reads standard punched cards at rates up to 100 cards per minute.	$4,100*
	CRT Displays	
Symbol Generator	Type 33 Symbol Generator. Plots symbols on a 5x7 dot matrix in one of four sizes on the 30N Display.	$4,900
	Analog-Digital Equipment	
Converter	Type 138E General Purpose Analog-to-Digital Converter. Converts analog voltage to a binary value selectable in length of 6 to 12 bits. Maximum conversion time for 12 bits = 35 μsec.	$2,500*
Multiplexer	Type 139E General Purpose Multiplexer Control. Permits up to 64 channels of analog information to be applied singly to the input of an analog-to-digital converter. Channels can be selected in sequence or by individual address. Price for individual switches must be added. (Resolution limited to 11 bits over 10 volt range.)	
	Multiplexer with room for up to 24 channels	$2,000*
	Multiplexer with room for up to 64 channels	$2,300*
Switches	Type 100 Series Multiplexer Switches. Used to activate Type 139E Multiplexer. Four types are in the series for different performance requirements. See DEC Flip Chip Catalog No. C-105 for specifications. Per pair	$86 to $178
	Magnetic Tape	
Transport	Type 545 Magnetic Tape Transport. Reads and writes IBM compatible tape at 45 ips; with recording densities of 200,556 or 800 bpi. Requires Type 57A-521 Control.	$12,000
Transport	Type 570 Magnetic Tape Transport. Reads and writes IBM compatible tape at 75 or 112.5 ips; with densities of 200,556 or 800 bpi. Requires Type 57A-521 Control.	$30,400
Control	Type 57A Automatic Magnetic Tape Control. Controls up to 8 magnetic tape transports automatically. Provides for buffered information transfers through computers' Data Break facility.	
	57A-520 Control/Interface for use with Type 50 Transport.	$16,200
	57A-521 Control/Interface for use with Type 570 or 545 Transports.	$18,900
	57A-522 Control/Interface for use with IBM Series 729 Mod. II,IV,V and VI Transports	$21,600

Data Communication Equipment

Teleprinters	Spare Send/Receive Sets:	
	Model 33 RO	$ 825
	Model 33 KSR	$ 900
	Model 33 ASR	$ 1,200
	Model 35 KSR	$ 2,500
	Model 35 ASR	$ 4,000

Equipment Bays

Cabinets	Type CAB-8A, free standing base cabinet with winged table.	$ 1,100
	Type CAB-8B, free standing base cabinet with rectangular table.	$ 1,000
	Type CAB-1, expander cabinet, full-length French doors, no end panels.	$ 500
	Type CAB-3, expander cabinet, for use with "operator-accessible" options such as DECtape, etc., no end panels.	$ 600

Spare Parts List

Spares	One module of type in PDP-8 computer including Type 182 EAE Option. Budgetary estimate only	$ 1,900

*Requires additional equipment bay.

Price List

PROGRAMMED DATA PROCESSOR-1

June 1, 1964

STANDARD PDP-1 COMPUTER

Central Processor
Alphanumeric On-Line Typewriter
400 cps Perforated Tape Reader
63 cps Perforated Tape Punch
Automatic Multiply and Divide
One Channel Sequence Break

With 4,096-word Core Memory	$100,000
With 8,192-word Core Memory	$120,000
With 16,384-word Core Memory	$140,000
With 24,576-word Core Memory	$180,000
With 32,768-word Core Memory	$200,000

Central Processor Options

HIGH SPEED CHANNEL CONTROL
TYPE 19

Permits block data transfer at rates up to 200,000 18-bit words per second. $ 9,000

HIGH SPEED DATA CONTROL
TYPE 131

Transfers data in blocks between PDP-1 and external devices. $ 10,500

MULTIPLE CHANNEL SEQUENCE BREAK SYSTEM
TYPE 120

Provides 16 automatic, independent, priority sequenced interrupt channels. $ 15,300

Input-Output Options

PARALLEL MAGNETIC DRUM SYSTEM
TYPE 23B

A parallel transfer system containing 32 fields of 19 tracks 4,096 bits per track for a total storage capacity of 131,072 words. Transfers of from 1 to 4,096 can be carried out at a rate of one word in 8.4 microseconds. $ 73,400

SERIAL MAGNETIC DRUM SYSTEM
TYPE 24

Serial transfer system which stores and transfers 19-bit words in blocks of 256 words at a rate of approximately 61 microseconds per word.

Type 24E	32,768 words	$ 36,200
Type 24F	65,536 words	$ 38,680
Type 24G	131,072 words	$ 43,400

PRECISION CRT DISPLAY
TYPE 30

Plots data point by point at a 50 microsecond rate on a 16-inch cathode ray tube. Separately variable 10-bit X and Y coordinates. $ 14,300

ULTRA PRECISION CRT DISPLAY
TYPE 31

Plots data point by point on a 5-inch cathode ray tube with high degree of resolution, accuracy and stability. Suitable for precision photographic recording of display data or scanning of photographic negatives. Includes mounting bezel for camera or photomultiplier. $ 41,200

PRECISION INCREMENTAL CRT DISPLAY
TYPE 340

Plots points, lines, vectors, and characters on a 9 3/8 inch square raster of 1,024 points along each axis. 1 1/2 microseconds is required per point in vector, increment, and character modes. Random point plotting rate of 35 microseconds. Special channel required. $ 28,600*

OSCILLOSCOPE DISPLAY
TYPE 34

Plots data point by point on an X-Y plotting scope such as the Tektronix Model RM 503. Ten bits per axis.

Control only	$ 3,060
With oscilloscope	$ 3,900

SYMBOL GENERATOR
TYPE 33

Plots symbols on a 35-dot (5-7) matrix in one of four sizes on the Type 30A or 30D Display. Average plotting time: 140 microseconds. $ 4,900

HIGH SPEED LIGHT PEN
TYPE 370

Uses fiber optic light pipe and photomultiplier system for fast detection of information displayed on Type 340 Displays. $ 1,625

CARD PUNCH CONTROL
TYPE 40

Controls on-line buffered operation of standard card punch equipment. Maximum speed is 100 cards per minute. Buffer holds one 80-bit row. Any or all positions may be punched, in IBM or any format. $ 15,000

CARD READER AND CONTROL
TYPE 421A

Reads standard punched cards at rates of up to 200 cards per minute. Cards are read optically, column by column, in binary or alphanumeric modes. $ 14,900

CARD READER AND CONTROL
TYPE 421B

Reads standard punched cards at rates of up to 800 cards per minute. $ 26,000

*Does not include character mode, or special channel

PROGRAMMED MAGNETIC TAPE CONTROL
TYPE 51

Transfers information one character at a time, choice of format. All transfer operations are performed by stored routine. $ 7,500

MAGNETIC TAPE TRANSPORT
TYPE 50

Reads and writes IBM formats at transfer rate of 15,000 cps. $ 18,000

AUTOMATIC MAGNETIC TAPE CONTROL
TYPE 510

Transfers data blocks between the computer and high-density tape transports in systems containing the Type 131 High Speed Data Control and Type 19 High Speed Channel Control. Up to 8 transports, IBM 729 or Digital Type 570, can be operated by the Type 510. $ 21,200

MAGNETIC TAPE TRANSPORT
TYPE 570

Reads and writes IBM data formats with a recording density of 200 or 556 (7-bit) characters per inch. Tape speed is 75 or 112.5 inches per second with transfer rates from 15 to 62.5 KC. $ 30,400

DUAL MICRO TAPE SYSTEM

Provides a fixed address magnetic tape facility for high speed loading, readout and program updating.

Type 555 Dual Transport (includes two independent tape drives)	$ 7,400
Type 550 Control Unit (controls up to eight Type 555 Tape Transports)	$ 9,400

Printers

AUTOMATIC LINE PRINTER AND CONTROL
TYPE 64

Prints 300 lines per minute, 120 columns per line, any one of 64 characters per column. $ 28,900

PRINTER-KEYBOARD AND CONTROL
TYPE 65

10 cps Input/Output Teleprinter. Provides for simplified expansion of additional teleprinters. $ 5,000

Analog-to-Digital Equipment

GENERAL PURPOSE ANALOG-TO-DIGITAL CONVERTER
TYPE 138

Transforms an analog voltage to a binary number selectable from 6 to 11 bits. $ 5,000

GENERAL PURPOSE MULTIPLEXER AND CONTROL
TYPE 139

Permits up to 64 channels of analog information to be applied singly to the input of the Type 138. Channels can be selected in sequence or by individual address. Requires Type 1578 Multiplexer Switches. $ 3,600

MULTIPLEXER SWITCHES
TYPE 15780

Module containing four independent floating switches. $ 333

HIGH SPEED ANALOG-TO-DIGITAL CONVERTER
TYPE 142

Transforms an analog voltage to a signed, 10-bit binary number in 5 microseconds. Conversion accuracy is ± 0.15% ± 1/2 least significant bit. $ 16,400

In-Out Connections and Controls

18-BIT OUTPUT RELAY BUFFER
TYPE 140

Eighteen (SPDT) Relays actuated by computer command. Includes 18-bit buffer. $ 1,950

18-BIT REAL TIME CLOCK
TYPE 152

Counts according to frequency of a crystal-controlled oscillator. Counter contents can be cleared or read into the processor at any time. Counter overflow causes a sequence break. $ 4,200

ADDITIONAL ON-LINE TYPEWRITER $ 7,700

Incremental Plotters and Controls

GRAPH PLOTTER AND CONTROL

For Cal-Comp Model 560. 12-inch; 12,000 steps per minute. $ 7,300

GRAPH PLOTTER AND CONTROL

For Cal-Comp Model 565. 12-inch; 18,000 steps per minute. $ 8,900

GRAPH PLOTTER AND CONTROL

For Cal-Comp Model 563. 29-inch; 12,000 steps per minute. $ 13,400

Additional Off Line Equipment

SPARE TYPEWRITER $ 2,800

SPARE TAPE READER $ 3,300

SPARE TAPE PUNCH $ 1,050

OFF-LINE PERFORATED TAPE PREPARATION UNIT
Model FIO-DEC $ 5,000

Prices quoted are effective June 1, 1964, FOB Maynard, Massachusetts, and apply in the continental United States only. Federal, state or local taxes are not included. Option prices are for factory installation; field installation prices will be quoted on request. Quantity prices quoted on request. All prices are subject to change without notice.

DIGITAL EQUIPMENT CORPORATION · MAYNARD, MASSACHUSETTS

10-6/64

3586

Printed in U.S.A.

PRICE LIST

PROGRAMMED DATA PROCESSOR-6

May 1, 1965

PROCESSORS

ARITHMETIC PROCESSOR
TYPE 166

36-Bit Word Length
16 Accumulators
15 Index Registers
Floating Point Arithmetic
Console Teleprinter and Control
Paper Tape Reader and Control
7-Channel Priority Interrupt System
Buffered I/O System and Control — $151,000

RANDOM ACCESS MEMORY

Type No.	Description	Size	Cycle Time	Price
162	Flip-Flop	16	400 nsec	$ 30,000
161B	Core	8,192	5 μsec	49,000
161C	Core	16,384	5 μsec	85,000
163C	Core	16,384	1.8 μsec	126,000

MEMORY INTERFACE
TYPE 187

Core memories are supplied with an interface to one Type 166 Arithmetic Processor. Drum processors or additional Arithmetic Processors require an additional Type 187 Interface for each core memory module connected to them. — $ 2,700

DISC AND DRUM MEMORIES

DRUM PROCESSOR
TYPE 167-236

Controls transfer of data between core memory and up to four drum units. Requires one memory bus Interface Type 187 for each PDP-6 memory module with which it communicates. — $ 35,000

MAGNETIC DRUM UNIT
TYPE 237

Each drum stores 1,048,576 36-bit words. The drum rotates at 1680 rpm (35.7 msec per revolution) and provides a 36-bit word transfer every 4.2 μsec. Requires Type 167-236 Drum Processor. $ 75,000

DISC FILE
TYPE 270

Each disc file stores a total of 5.76 million 36-bit words. Transfer rates are 51.8 μsec/word outer zone, 88.8 μsec/word inner zone. Average access time is 190 msec. Requires Data Control Type 136. Each control can service up to four disc files.

Disc File System	$140,000
Additional Files (maximum of 3) each	$ 90,000

DATA CONTROL
TYPE 136

Assembles and disassembles 36-bit data words. May be used with up to four tape controls and two special purpose data handling devices. $ 10,000

MAGNETIC TAPE EQUIPMENT

MAGNETIC TAPE CONTROL
TYPE 516-521

Controls up to eight Type 570 Magnetic Tape Transports. Permits reading, writing, forward or backward spacing, and rewind. Requires Type 136 Data Control. $ 18,000

MAGNETIC TAPE TRANSPORT
TYPE 570

Reads and writes IBM-compatible tape at a recording density of 200, 556, and 800 bpi. Tape speed is 75 or 112.5 ips with transfer rates from 15 to 90 kc. Reverse reading at all densities; less than one transient read error per 10^7 characters. Requires Type 516-521 Magnetic Tape Control. $ 30,400

MAGNETIC TAPE CONTROL
TYPE 516-520

Controls up to eight DEC Type 50 Magnetic Tape Transports operating at 200 and 556 bpi. Requires Type 136 Data Control. $ 18,000

MAGNETIC TAPE TRANSPORT
TYPE 50

Reads and writes IBM-compatible magnetic tape at transfer rates of 15 and 41 kc. Tape speed is 75 ips; densities, 200 and 556 bpi. Requires Type 516-520 Magnetic Tape Control. $ 18,000

MAGNETIC TAPE CONTROL
TYPE 516-522A

Permits control of up to eight IBM-729 VI tape transports operating at 200, 556, and 800 bpi. Requires Type 136 Data Control. $ 24,000

DUAL DECTAPE SYSTEM

CONTROL UNIT
TYPE 551

Controls up to four Type 555 Tape Transports. Requires Type 136 Data Control. $ 14,000

DUAL TRANSPORT
TYPE 555

Consists of two independent tape drives. A fixed address magnetic tape facility for high speed loading, readout, and program updating. Density is 375 ±60 bpi; tape speed is 80 ips with 15 kc transfer rate. Reads and writes in both directions; redundant tracks provide less than one transient error per 10^{10} characters. Requires Type 551 Control Unit. $ 7,400

PERIPHERAL EQUIPMENT

PAPER TAPE I/O

HIGH SPEED PAPER TAPE READER AND CONTROL* TYPE 760

Reads 5, 7, or 8-hole perforated paper tape photoelectrically at 400 characters per second. $ 9,000

*Furnished as standard equipment with 166 Arithmetic Processor.

HIGH SPEED PAPER TAPE PUNCH AND CONTROL TYPE 761

Punches 8-hole paper tape at 63.3 characters per second. $ 5,500

PUNCH CARD I/O

CARD READER AND CONTROL TYPE 461

Provides on-line reading of 80-column punched cards at 200 or 800 cards per minute in either alphanumeric or binary codes.

200 cards per minute	$ 16,500
800 cards per minute	$ 27,200

CARD PUNCH AND CONTROL
TYPE 460

Permits on-line punching of 80-column cards at 100 or 300 cards per minute.

100 cards per minute	$ 29,000
300 cards per minute	$ 42,000

HIGH SPEED
LINE PRINTER AND CONTROL
TYPE 646

Prints ASCII character set, 10 characters per inch horizontally, 6 lines per inch vertically.

120 columns per line, 64 characters per column.

300 lines per minute	$ 30,000
600 lines per minute	$ 37,500
1000 lines per minute	$ 47,500

132 columns per line, 64 characters per column.

300 lines per minute	$ 31,750
600 lines per minute	$ 39,150
1000 lines per minute	$ 50,500

CALCOMP PLOTTERS

Calcomp plotters can be interfaced to the PDP-6 System either of two ways, directly via the I/O Bus or as terminals via the Type 630 Data Communication System.

CALCOMP MODEL

	563	564	565	566
Width	29-1/2"	29-1/2"	11"	11"
Step/min	12,000	18,000	18,000	18,000
Step size	.01"	.005"	.01"	.005"
Price via I/O Bus	$20,000	$22,100	$15,500	$15,900
Price via 630 DCS	$16,000	$18,100	$11,500	$11,900

CRT DISPLAY SYSTEMS
TYPE 346

Plots points, lines, and vectors, on a 9-3/8 inch square raster 1024 points along each axis.

1-1/2 μsec is required per point in vector and increment modes; random point plotting rate of 35 μsec per point. Includes fiber optic light pipe and photo-multiplier system for fast detection of displayed information. $ 33,225

Incremental Display with Character Generator

64 characters	$ 40,000
128 characters	$ 43,900

DATA COMMUNICATION SYSTEM
TYPE 630

Provides interface to local or remote I/O Teletypes for message switching and time sharing applications. Half Duplex Operation, 8 Level Code.

Number of Station Interfaces	Price
1	$ 9,869
2	10,488
3	11,107
4	11,726
5	12,345
6	12,964
7	13,583
8	14,202
16	21,642
24	29,082
32	36,522
48	51,402
64	66,282

I/O TELETYPES AND RELATED OPTIONS

Teletypewriters operate at 10 characters per second rate with standard ASCII character set. One 635A Line Power Supply is required per 32 half-duplex terminals.

Type 635A Line Power Supply	$ 500
Type 635B Patch Panel	$ 600
Type 635C Model 33 KSR Teletype Station	$ 900
Type 635D Model 35 KSR Teletype Station	$ 2,500
Type 635E Model 33 ASR Teletype Station	$ 1,200
Type 635F Model 35 ASR Teletype Station	$ 4,000

Prices quoted are effective May 1, 1965, FOB Maynard, Mass., and apply in continental United States only. Federal, state or local taxes are not included. Option prices are for factory installation; field installation prices will be quoted on request. All prices are subject to change without notice.

DIGITAL SALES AND SERVICE

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Elsewhere: AC617-897-8821
TWX: 710-347-0212 Cable: Digital Mayn. Telex: 092-027

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LOS ANGELES OFFICE:
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Telephone: AC213-670-0690 TWX: 910-328-6121

SAN FRANCISCO OFFICE:
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Telephone: AC415-326-5640 TWX: 910-373-1266

IN CANADA:
Digital Equipment of Canada, Ltd.,
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Telephone: AC613-237-0772 TWX: 610-561-1650

IN EUROPE:
Digital Equipment GmbH, Theresienstrasse 29
Munich 2/West Germany
Telephone: 29 94 07, 29 25 66 Telex: 841-5-24226

Digital Equipment Corporation (UK) Ltd.
11 Castle Street
Reading, Berkshire, England
Telephone: Reading 57231 Telex: 851-84327

IN AUSTRALIA:
Digital Equipment Australia Pty. Ltd.,
89 Berry Street
North Sydney, New South Wales, Australia
Telephone: 92-0919 Telex: 790AA-20740
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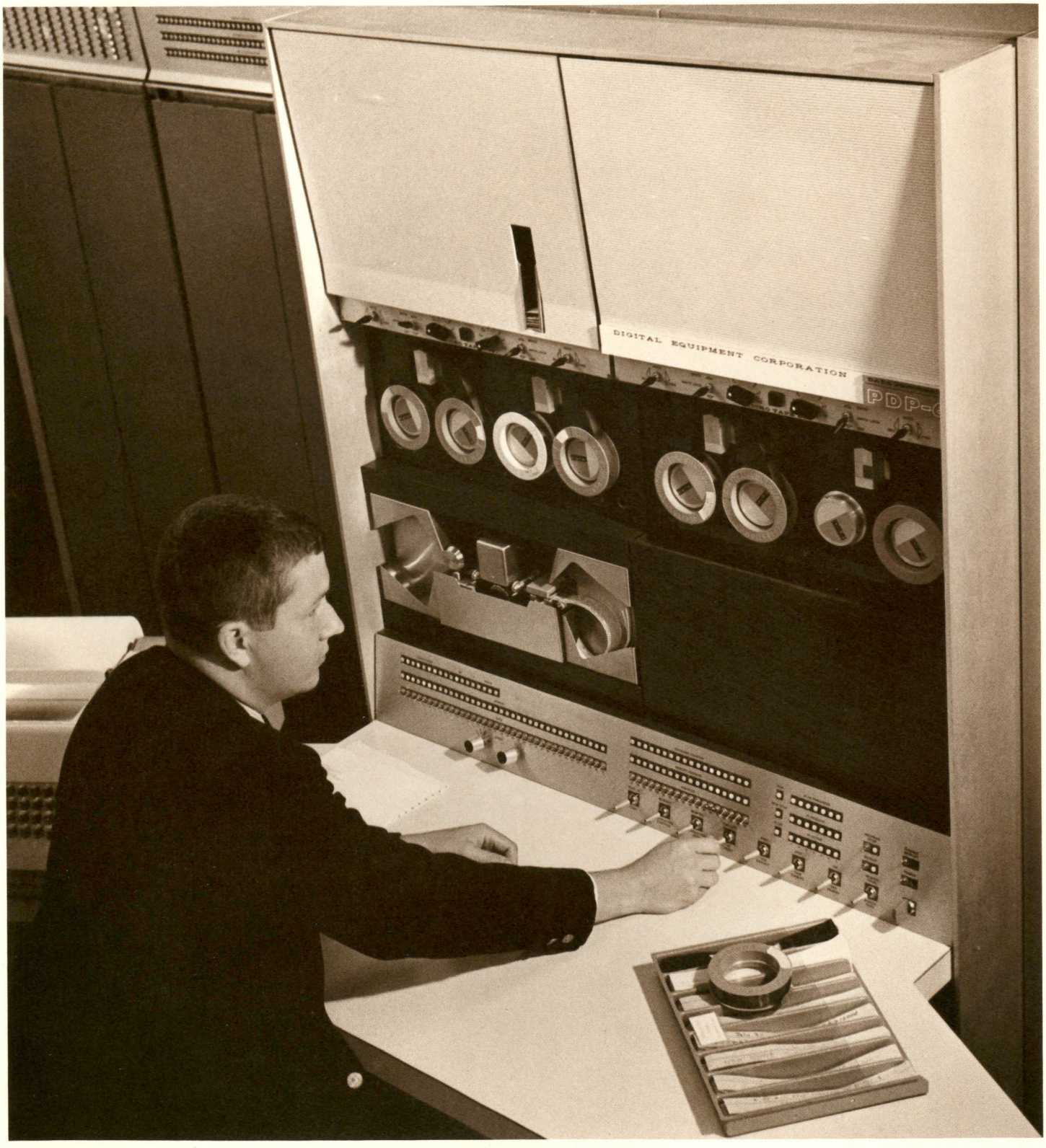
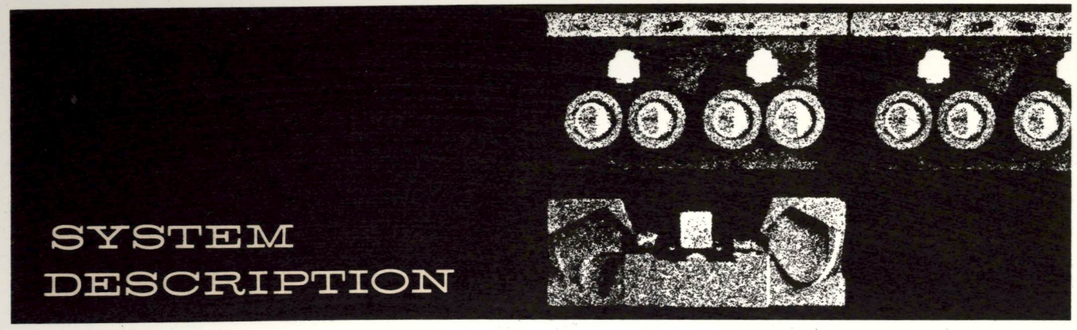
PROGRAMMED DATA PROCESSOR



DIGITAL EQUIPMENT CORPORATION • MAYNARD, MASSACHUSETTS

PROGRAMMED DATA PROCESSOR-6

36-bit word length ■ 15 index registers and/or accumulators
FORTRAN II — MACRO-6 assembler — utility programming library
Integrated hardware and software for time sharing ■ Microtape
Asynchronous operation, modular construction ■ Memory overlap
Core memories up to 262,144 words, 2 μsec, directly addressable
Fast memory 16 words, 0.4 microsecond ■ 128 input-output devices
363 instructions ■ fast floating point — multiply 14 μsec average
Program assignable operation codes ■ Byte manipulation, half word
Block transmission ■ Seven channel priority interrupt system
Programmed input-output transfers require no data channels
Multiple processors ■ Remote input-output ■ Mass memory



SYSTEM DESCRIPTION

Programmed Data Processor-6 (PDP-6) is a general-purpose digital computing system designed for scientific data processing. The flexibility of this system permits the user to specify the data handling capacity and the exact configuration needed to meet his requirements. The system can be expanded with presently available equipment or, at a later date, with equipment yet to be developed. Faster memories, for example, can be added as they become available.

PDP-6 design eliminates the need for off-line conversion equipment. Conversion of programs from cards or paper tape to magnetic tape can be done concurrent with normal program running. Users at peripheral Teleprinters can simultaneously prepare and debug their programs on line.

The PDP-6 system consists of processors, memories, and input/output devices. Since each is autonomous (no device is dependent upon another for its timing), a system configuration can include memory modules of different speeds, processors of different types sharing the same memory modules, and standard or unique input/output devices.

For maximum flexibility of system configurations, the PDP-6 system is built around two busses: processor-memory bus and processor-input/output bus. The memory bus permits each processor to directly address 262,144 words of core memory, automatically permits overlapping, and simplifies multiprocessor operation. An input/output bus of processor can service up to 128 devices.

The Operating System consists of a supervisory control program, system programs, and system subroutines. Included are a Symbolic Assembler and Macro Processor, a FORTRAN II Compiler, and debugging aids. A library of general utility programs is also provided.

Neither the processors nor any of the standard peripheral equipment require an air-conditioned environment or floor reinforcement. Ordinary 115-volt power is sufficient for all equipment.

PROCESSORS

A PDP-6 system can include any number of processors of the same or different types. The Type 166 is a 36-bit arithmetic processor with many powerful features, including 16 accumulators, 15 index registers, built-in floating point arithmetic, and byte operations capability. Memory protection and relocation registers are included for time-sharing operations.

The Type 167 I-O Processor gives direct memory access to high speed devices, such as drums, discs, and displays. It takes over local control of data transfers after receiving system commands and initial conditions from the arithmetic processor. Thereafter the two processors operate asynchronously, so that I-O transfers are carried out in parallel with arithmetic processing.

Up to three controls, such as the Type 236 Drum Control, can be connected to the Type 167 I-O Processor.

INPUT/OUTPUT

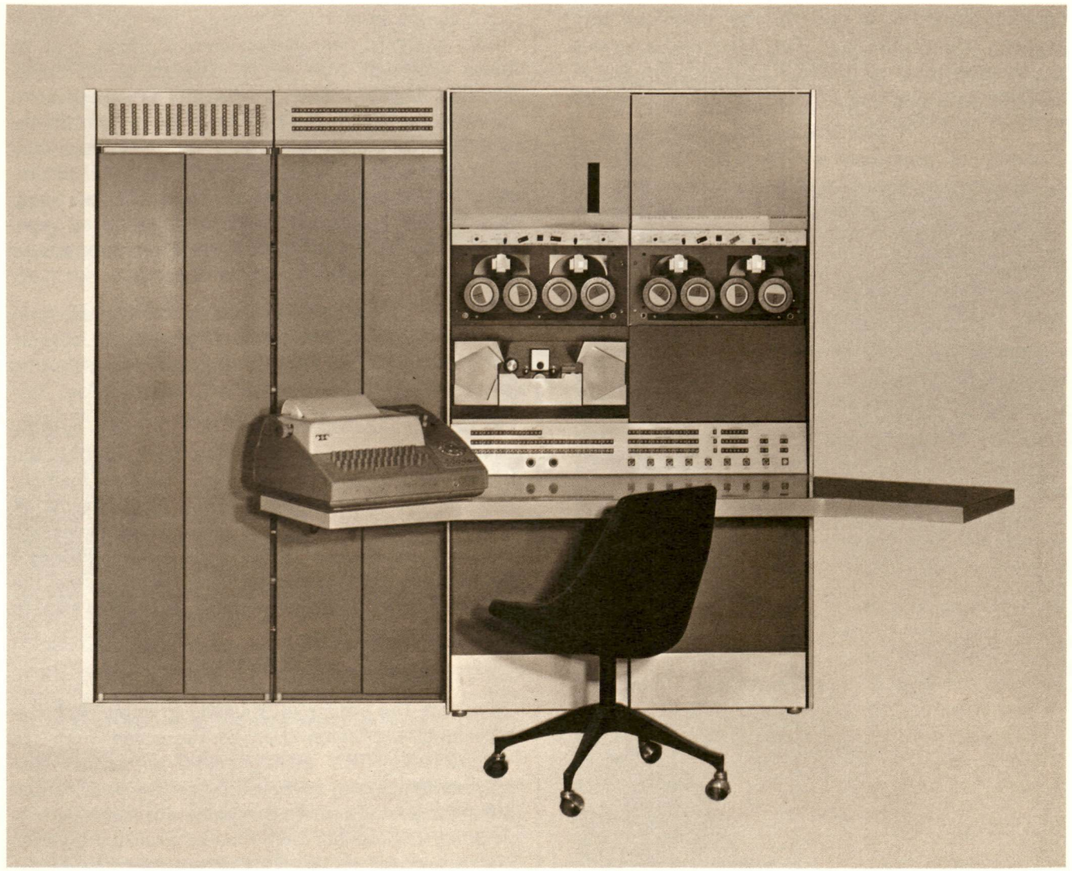
The input/output bus consists of device selection, data, control, and status sense lines. A seven-channel program-assignable priority interrupt system signals the processor when input/output devices require service. Word count and memory address registers are located in the processor and are available to all devices. This reduces the cost of various input/output controls, and permits data block transfers between tapes, card readers, printers, displays, and other devices.

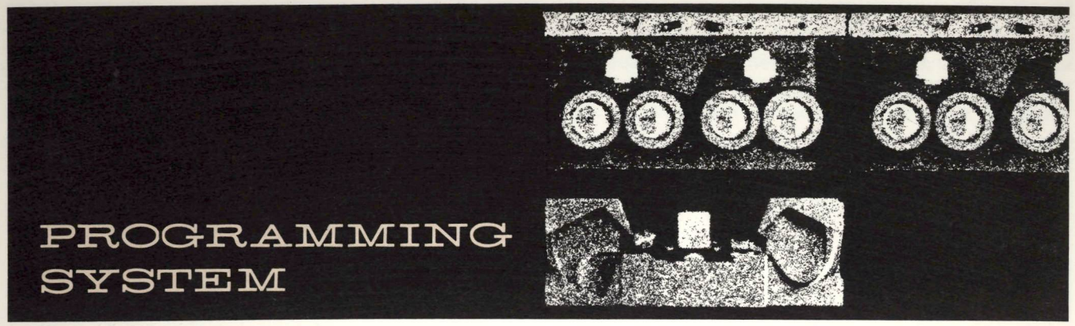
MEMORY

The PDP-6 core memory subsystem permits modular expansion using blocks of different sizes and speeds. The Types 163B and 163C core memory modules contain 8,192 and 16,384 words, respectively. Each has a word length of 36 bits, a cycle time of 2 microseconds, and an access time of 0.8 microseconds. The Type 162 Fast Memory Module contains 16 words with a 0.4-microsecond cycle. Slower core memories, such as the 5-microsecond Type 161, can be used where economy is an overriding criterion.

The memory-processor bus permits memory cycle overlap, gives all processors direct access to memory, and permits easy expansion and modification of the memory subsystem. In addition, the bus allows the processors to remain connected to memory only as long as needed to transfer information: That is, a processor can put a word on the bus and resume operations as soon as the memory acknowledges, without waiting for the memory to store the word. Similarly, when reading a word out of memory, the processor takes the information and operates on it immediately, without waiting for the memory to finish the rewrite portion of its cycle.

Maximum system efficiency is achieved when sequential memory references address alternate memory modules. The addressed module places data on the bus as soon as it is available in the memory buffer and disconnects itself from the bus while rewriting, freeing the processor to store the result or seek the next instruction in a second memory module before the first one has completed rewriting. Utilizing such overlapping memory references, PDP-6 users can effectively cut in half the time required for average random accesses. Multiple connections between the bus and each memory module permit module sharing on a priority basis for multiprocessor operations.





PROGRAMMING SYSTEM

The programming system for PDP-6 consists of a supervisory control program, system programs, and library routines. The entire system is designed to run on any PDP-6 system with at least 16,384 words of core memory, a console Teleprinter, and a Microtape system. However, the programming system is modular. Parts of it can run on machines with smaller memory capacity. For example, programs can be assembled with MACRO-6 using the above-mentioned input-output equipment and only 8,192 words of core memory.

A variety of programs are provided through the Digital program library, and a continuous in-house program design effort regularly improves and expands the library.

THE SUPERVISORY CONTROL PROGRAM

This is the name given to a collection of programs remaining permanently in memory to provide overall coordination and control of the total operating system. The segments of the program are:

Command Control Program, which handles all commands addressed to the system from the User-Consoles. These commands would include requests to log in or out, a request to use the edit program, requests to have a program placed on the run queue, requests to load a program, etc.

Program Scheduler, which is called at regular intervals to decide which program in memory is to be run. A running program is temporarily terminated each time its allotted time has run out, or when it requires input-output operations with a device that is busy. A program may be terminated temporarily by user intervention to the scheduler, or it may suspend its own operation. Temporary termination does not remove the program from memory. A program may be dumped on backing storage and permanently discontinued by calling the scheduler and allocator.

Facilities Allocator, which is called any time an I/O device or memory space is required. It may be called from a User-Console or by a running program. Under this program one User-Console is designated the operator console. As such it has special facilities available which are not available to other consoles, such as line printer assignments. Storage is permanently assigned for all resident programs, that is, those programs that are in memory at all times. Finally, "logical" tape assignments are made. Two Micro Tape units are designated the system library and the system scratch tape. Two other tapes may be assigned as Peripheral Input Tape, used to prepare jobs to be stacked from cards or paper tape, and System Input Tape, used to input a full tape. (Each User-Console may require a Micro Tape unless programs requiring files are to be run.)

Command Decoder preprocesses commands from the User-Console. This program is used to convert parameters, etc., before the command is sent to the program for which the command is intended.

I/O Control is called whenever an I/O device is to be used. This program assigns equipment, controls the I/O devices, controls data transfers between memory and the I/O device, and controls the buffering of data for the device. (Users provide the necessary buffering for devices which require file buffering.) All program I/O instructions are trapped, and the actual control of the I/O operation then passes to the I/O Control Program.

SYSTEM PROGRAMS

These are the programs designed to implement system functions which may be requested from the User-Console. This is in contrast to system subroutines which may be called by system programs or other programs. System programs are normally provided by Digital, but they may be provided by each installation for its users. The programs contain a mode by which they may be terminated to return the communication link to the system. Some of the system programs are described below.

Editor Program, which provides a means for manipulating the text of a named file on a Micro Tape or in the user area of the drum (corresponding to Micro Tape). This file may be used for the creation of text or for later use as data or as a program to be translated by the FORTRAN compiler, etc. The commands provided for the editor allow text to be created, deleted, or moved about.

Peripheral Conversion Program, which handles all those jobs normally done by a separate peripheral processor. The priority interrupt system and multiple memory accumulators in the PDP-6 eliminate virtually all loss in running time. Such processing is done through the arithmetic processor.

Inter-Console Message Program, which switches message traffic between the various User-Consoles. This program provides a means by which the user may request manual operations by the operator and receive acknowledgment. Such an operation would be the mounting/dismounting of user tapes.

Linking Loader Program accepts programs in a form produced by the translators, and produces an area of core memory loaded with the program. Upon request, it may also produce a storage map of the loaded programs along with symbol tables. Several programs may be linked together in loading. The loader requests special library tapes to be loaded, and verifies that the program has been completely loaded.

Translator Dispatcher is called to load the FORTRAN, MACRO-6, or other translators. The translators are rather large programs that do not reside in memory, but are stored on the System Library tape until they are called into memory by the translator.

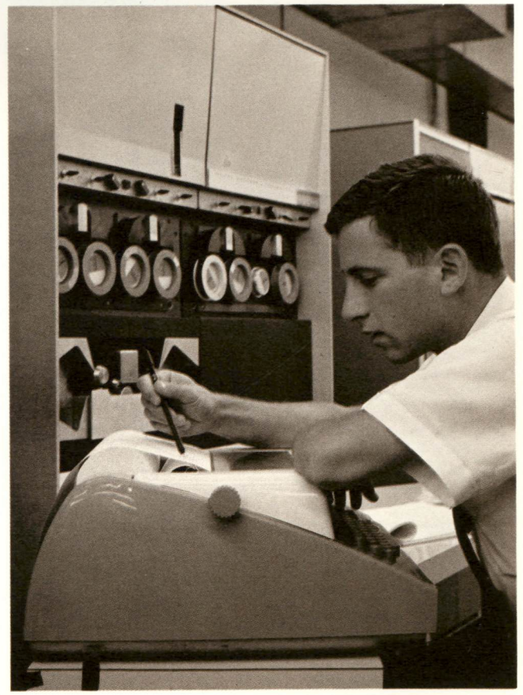
FORTRAN II Compiler accepts FORTRAN II input statements and produces relocatable binary output coding for later loading by the Linking Loader. Compiling is done in one pass. PDP-6 FORTRAN II is an extension of the conventional FORTRAN II language to give the user more facilities and to take advantage of PDP-6 hardware. The ASCII character set is used. Subscripts may consist of statements (fixed or floating). Any number of dimensions may be used to specify an array. Signed integers have 36-bit values, but when used as subscripts are truncated to 18 bits.

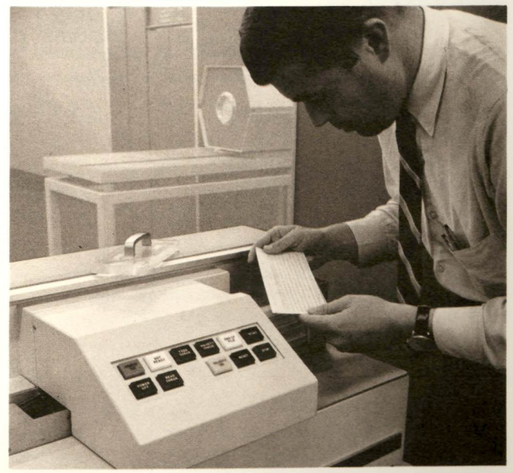
MACRO-6 Assembly Program translates MACRO-6 input language to a relocatable binary output for the Linking Loader. MACRO-6 is a two-pass assembly program and the language provides for instruction definitions and usage. Literal assignments are made by brackets []. Numbers may be expressed as binary, octal, decimal, and floating point. Text may be placed in a binary program by the occurrence of the "text" data generating statement, and "byte" will cause a string of bytes to be assigned and packed into a word. The "repeat" control statement causes the statements following the control to be repeated "n" times.

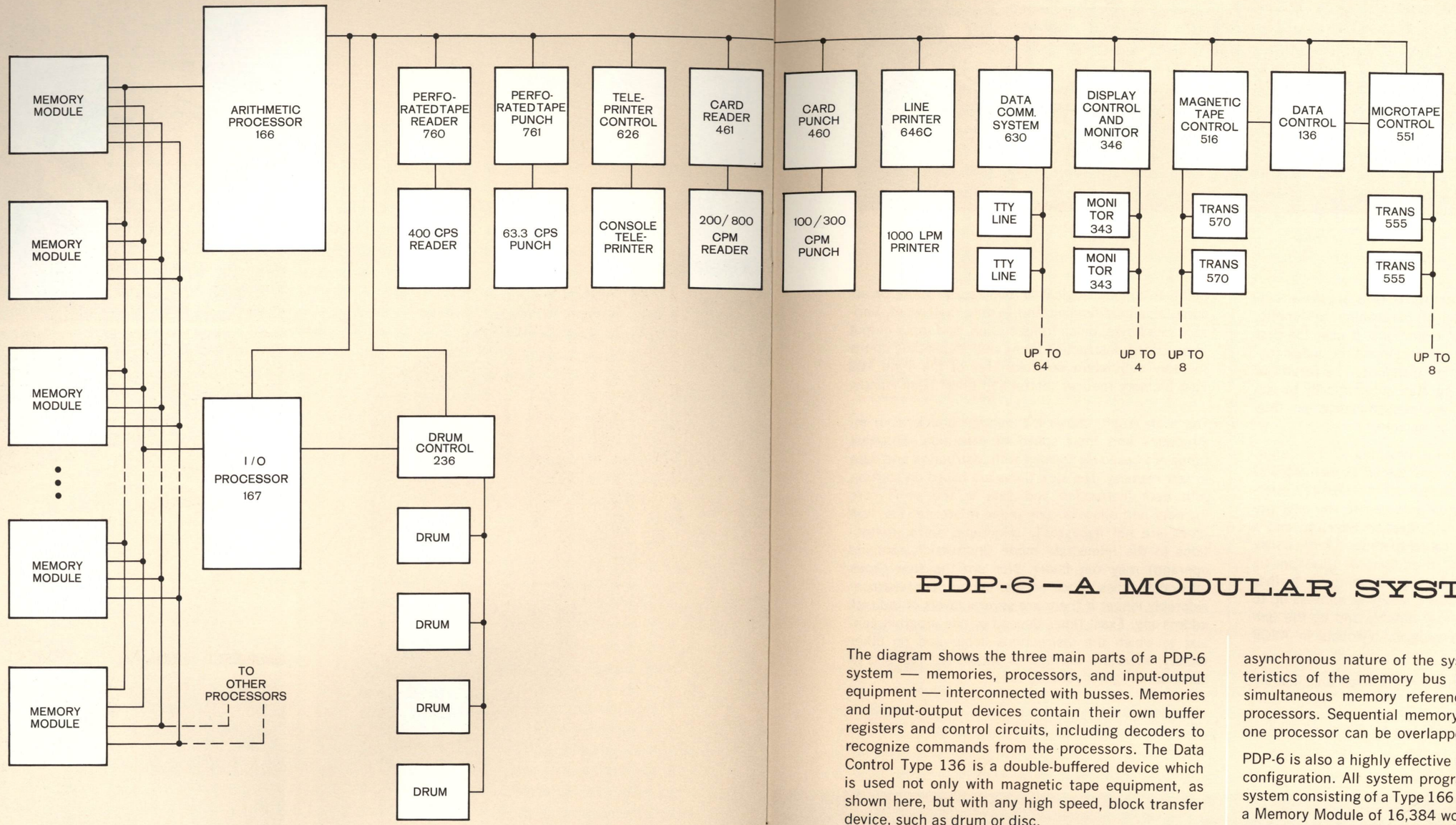
Debugging Program (DDT) is loaded with a program and allows all assembly language programs to be debugged. The program may be started or stopped, words in the program may be modified, and DDT may search the program looking for particular words. DDT may also be used in a "trace" or break point mode, and the program is run until a particular location (a break point) is encountered.

The System Subroutines include:

1. I/O Format Control which provides for the various format statements used in the FORTRAN II language. These subroutines are also available to other programs and may be called from the systems library tape.
2. Arithmetic Subroutines which include all the arithmetic subroutines required for FORTRAN II, such as, sine, cosine, $\log_e$, $\log_{10}$, exponent, tangent, arc-tangent, and square root.







PDP-6 – A MODULAR SYSTEM

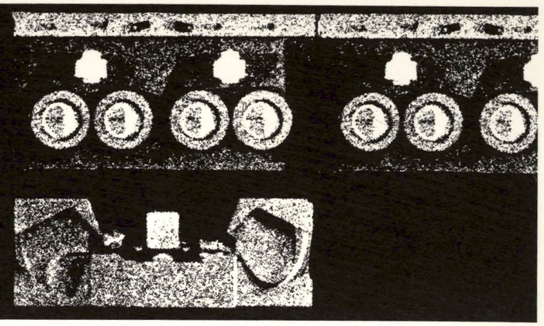
The diagram shows the three main parts of a PDP-6 system — memories, processors, and input-output equipment — interconnected with busses. Memories and input-output devices contain their own buffer registers and control circuits, including decoders to recognize commands from the processors. The Data Control Type 136 is a double-buffered device which is used not only with magnetic tape equipment, as shown here, but with any high speed, block transfer device, such as drum or disc.

The system shown in this diagram is a theoretical one of very high capacity, but it is entirely within the capability of PDP-6. Memory size, indicated by the modules on the left, can be as large as 262,144 words per processor, and up to four processors can address a given memory module. Very high speed devices, such as drum, tape, disc, and display, can have direct access to the memory system through the I-O Processor Type 167. The combination of the asynchronous nature of the system and the characteristics of the memory bus makes possible truly simultaneous memory references by two or more processors. Sequential memory references made by one processor can be overlapped.

PDP-6 is also a highly effective system in a minimum configuration. All system programs will operate in a system consisting of a Type 166 Arithmetic Processor, a Memory Module of 16,384 words, a Microtape system, and a Teleprinter. Later expansion of either the memory or input-output system can be made with no change whatever in the existing system. Memory modules can be of any speed: A low cost system might call initially for slower (5-microsecond) memories, later to be augmented by faster memories (down to 0.5-microsecond).

PDP-6 systems are thus completely adaptable to current and future requirements, both technical and budgetary.

TYPE 166 ARITHMETIC PROCESSOR



The Type 166 Arithmetic Processor is a general purpose processor capable of performing arithmetic, logical and input/output operations. It uses the first 16 locations in memory as accumulators, index registers, or ordinary memory locations. The results of each operation are transmitted automatically to one of these registers at the end of each instruction; thus the accumulator resides in memory.

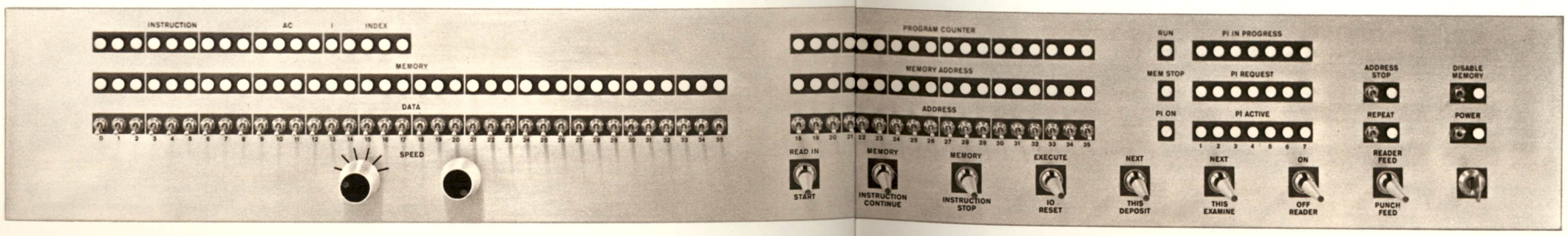
Executive mode hardware is provided for time sharing. Programs to be run are placed in memory and relocated by the Relocation Register. Memory references outside of the area assigned to the user are detected by the Memory Protection Register, and a supervisory program is called to check for the cause of the illegal reference. In addition to this specific hardware, PDP-6 time-sharing capability is further enhanced by the processor's ability to address up to 262,144 words of memory directly and by the uniform representation of program symbols in ASCII code.

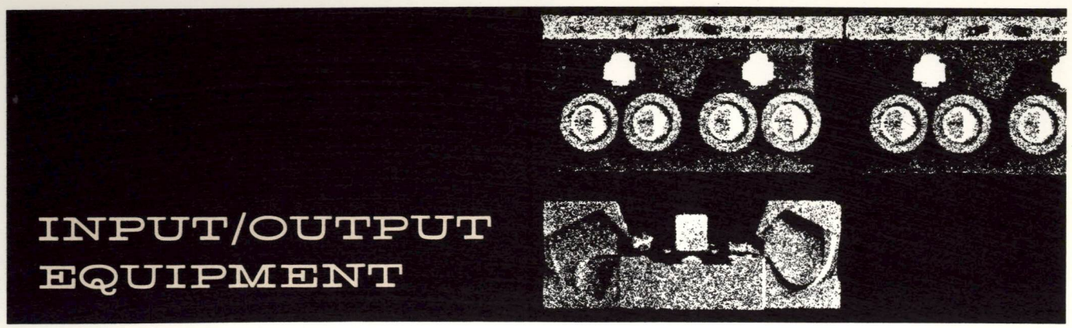
The 363 operation codes include fixed and floating point arithmetic, logical or Boolean, memory or accumulator modification and testing, half word, variable sized byte, block transmission, and input-output instructions. Instruction times vary, depending on the memory subsystem selected. Use of the Type 162 Fast Memory reduces instruction times significantly.

The table (right) shows the number and kind of instructions and their speed of execution. The fast times are based on starting with instruction and data in fast memory. The slow times are based on starting with both instruction and data in the same core memory and allow for one index reference. The fast times are not necessarily minimum, since instructions in the immediate mode (instruction contains operand) may run faster. Nor are the slow times maximum times, since an instruction may take considerably longer if there are several levels of indirect addressing. Exact times depend on the program context in which the instructions occur and on other factors; therefore the figures should not be used to calculate program running time.

INSTRUCTIONS

Instructions	No. of Instructions			Instruction Times	
	Operations	Modes	Total Instructions	Fast	Slow
Full word moves	4	4	16	1.9μsec	4.0μsec
Half word moves	16	4	64	1.9	4.0
Byte manipulation	5		5	5.7	8.0
Block transfer	1		1	1.5+0.8n	2.4+1.2n
Exchange	1		1	2.8	4.0
Fixed point add	1	4	4	2.7	4.3
Fixed point subtract	1	4	4	2.9	4.5
Fixed point multiply	2	4	8	14.5	16.1
Fixed point divide	2	4	8	23.4	25.0
Floating point add	2	4	8	5.8	8.0
Floating point subtract	2	4	8	6.0	8.2
Floating point multiply	2, 1	4	9	12.4	14.5
Floating point divide	2	4	8	18.4	20.5
Boolean	16	4	64	2.7	4.3
Shifting (18 bits)	6		6	4.7	5.9
Memory, AC modification and testing	6	8	48	2.6	3.9
Arithmetic compare	2	8	16	2.7	4.4
Logical compare	16	4	64	2.7	4.4
Jumping	8		8	1.8	3.0
I/O					
basic	4		4	3.0	6.2
augmented	4		4	3.8	7.0
Push down	4		4	3.1	6.4





INPUT/OUTPUT EQUIPMENT

Digital offers a large selection of optional equipment for full utilization of the extensive input/output capacity of the system.

MICRO TAPE TRANSPORT TYPE 555

A fixed address magnetic tape facility for high speed loading, readout, and on-line program debugging. Read, write, and search speed is 80 inches a second. Density is 375 bits an inch. Total storage is three million bits. Features phase recording, rather than amplitude recording; redundant, nonadjacent data tracks, and a pre-recorded timing and mark track.

MICRO TAPE CONTROL TYPE 551

Controls up to eight Type 555 Micro Tape Transports. Searches in either direction for specified block numbers, then reads or writes data. Uses the Type 136 Data Control to assemble data and buffer transfers to the processor.

DATA CONTROL TYPE 136

Provides for assembly of 6, 12, 18, or 36-bit characters; six input/output devices can be controlled.

TELEPRINTER AND CONTROL TYPE 626

Permits on-line programming and debugging. Provides hardcopy outputs. Is standard Teletype equipment, operating at ten characters a second.

TELEPRINTER INTERFACE TYPE 630

Automatically scans up to 64 teleprinter (TTY) lines. Signals a program interrupt when teleprinter needs service.

CARD PUNCH CONTROL TYPE 460

Permits on-line punching of cards in any format, including IBM, at 100 or 300 cards a minute.

CARD READER AND CONTROL TYPE 461

Provides on-line reading of standard punched cards at 200 or 800 cards a minute in alphanumeric or binary codes.

HIGH SPEED PERFORATED TAPE PUNCH AND CONTROL TYPE 761

Punches 8-hole tape at 63.3 characters a second.

HIGH SPEED PERFORATED TAPE READER AND CONTROL TYPE 760

Reads perforated paper tape photo-electrically at 400 characters a second.

MAGNETIC TAPE CONTROL TYPE 516

Automatically controls up to eight tape transports Type 570 or IBM 729 series. Permits reading, writing, forward/backward spacing, rewind and unload, and rewind. Uses a Type 136 Data Control to assemble data and buffer transfers to the processor. Longitudinal and lateral parity is checked.

MAGNETIC TAPE TRANSPORT TYPE 570

Tape motion is controlled by pneumatic capstans and brakes, eliminating conventional pinch rollers, clamps, and mechanical arms. Tape speed is either 75 or 112.5 inches per second. Track density, program-selectable, is 200, 556, and 800 bits per inch. Tape width is one-half inch, with six data tracks and one for parity. Format is compatible with IBM NRZI. Dual heads permit read-checking while writing.

I-O PROCESSOR TYPE 167

Establishes a data transmission path between main memory and block transfer devices, such as drums, magnetic tape, disc files, or CRT displays.

MAGNETIC DRUM AND CONTROL TYPE 236

Drum stores 1,048,576 36-bit words organized into 128 tracks, each with 8,192 words consisting of 64 128-word blocks. A word is transferred in 6.4 microseconds, and the drum revolution time is 52 milliseconds.

DISPLAY CONTROL AND MONITOR TYPE 346

Plots points, lines, vectors, and characters on a 9⅜-inch-square raster of 1,024 points along each axis. Time between points plotted is 1.5 microseconds in the vector, increment, and character modes. In random point plotting, a time of about 35 microseconds is required per point.

DISPLAY MONITOR TYPE 343

Provides additional cathode ray tube display for multiple consoles.

HIGH SPEED LIGHT PEN TYPE 370

Detects data displayed by the Types 346 and 343 and inputs identifying signal to the computer.

ANALOG-TO-DIGITAL CONVERTER TYPE 138

Transforms an analog voltage to a binary number, selectable from six to eleven bits. Conversion time varies, depending on the number of bits and the accuracy required. Twenty-one combinations of switching point accuracy and number of bits can be selected on the front panel.

MULTIPLEXED ANALOG-TO-DIGITAL CONVERTER TYPE 138/139

The Type 139 Multiplexer Control permits up to 64 channels of analog information to be applied singly to the input of the Type 138 Analog-to-Digital Converter. Channels can be selected in sequence or by individual addresses.

HIGH-SPEED ANALOG-TO-DIGITAL CONVERTER TYPE 142

Transforms an analog voltage to a signed, 10-bit binary number in 6 microseconds. Conversion accuracy is ±0.15% ±1/2 least significant bit.

ANALOG-DIGITAL-ANALOG CONVERTER SYSTEM TYPE ADA-1

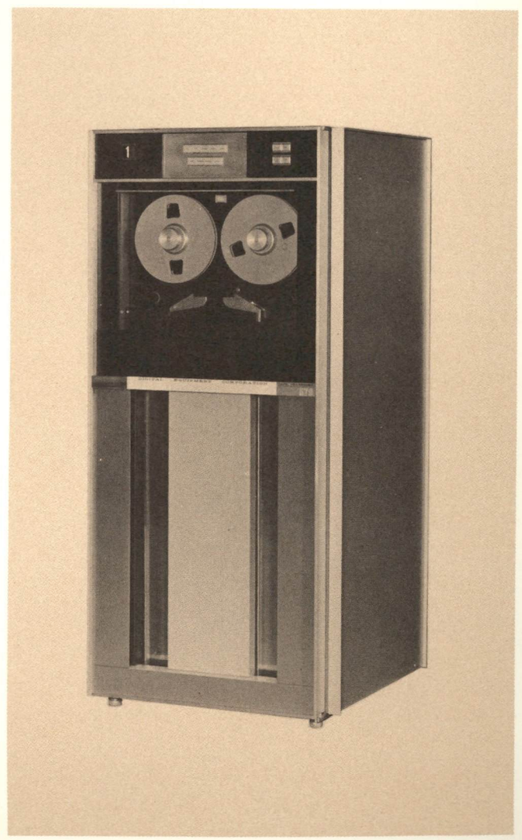
Performs fast, real-time data conversion between digital and analog computers. Maximum sample rate for D/A conversion is 200 kc; for A/D and interlaced conversions, 100 kc. Digital word length is 10 bits. Actual conversion times are 5 microseconds for A/D and 2 microseconds for D/A. Semiautomatic features enable the converter system to perform many of the functions that a computer normally performs for other converter interfaces.

AUTOMATIC LINE PRINTER AND CONTROL TYPE 646C

Prints 1000 lines a minute, 120 columns a line, any one of 64 characters a column.

AUTOMATIC LINE PRINTER AND CONTROL TYPE 646A

Prints 300 lines a minute, 120 columns a line, any one of 64 characters a column.



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