INTEROFFICE MEMORANDUM

DATE September 30, 1966

SUBJECT PDP-9 Review

TO K. Olsen
S. Olsen
N. Mazzarese
W. Hindle
T. Johnson
H. Mann
Engineering Review Committee

FROM Jack Shields

Much consideration and planning has gone into the PDP-9 project and the committee feels that this should be clearly stated in the introduction to this report.

The committee broke the project down into seven areas. This report will cover each one of these areas in the order taken.

OVERALL DESIGN CONCEPT, LOGIC ORGANIZATION, SPECIFICATIONS AND INTERFACING

The internal organization of the Central Processor is exceptionally well done. There is an economical use of hardware, and the use of the control memory is considered to be a significant advance.

The 1μsec cycle time is of concern to the committee. It is felt that this spec is very tight with the standard memory and there is a good probability that it will not be met with extra memory. We recommend an immediate change to 20 mil cores in anticipation of this problem.

Heat specs have not been defined and we expect a problem here. The IO bus length, cable type, and connector type have not been determined and must be resolved quickly.

The input gates on the B213 flip flop should be changed prior to the time that the output gate changes or there is a good possibility of timing problems. If there are long line outputs on the B213's, they will most likely require termination. The direct memory access option must be looked at. There are questions about the use of high impedence signals and floating lines.

It is difficult to follow the signal flow on a print to print basis, and it would be helpful to combine control memory and main memory timing flows on the same prints.

The committee questions the need for all the fuses. Protection can be provided for each line with fewer fuses; e.g., five at 10 amps each on the Power Supply, or one on each plenum, rather than all the three amp fuses that are presently used. They are an added expense and could be an unneeded source of trouble. We recommend more environmental testing than is presently called for; e.g., radiation, static electricity, etc.

SCHEDULE

The schedule appears realistic and so far has been met. A potential problem appears to be the late phase out of the PDP-7 and resultant shortage of checkout technicians. Current plans call for shipping two machines before the wired-in options have been checked out. This is quite likely to cause trouble with field retrofits and should be avoided if possible.

CIRCUITS

In general the whole machine must be looked at for loading violations, particularly the B213. The committee asks that the B131 adder module be given more testing; e.g., drift and temperature, but does not question the concept of the use of adder module.

MEMORY

The memory speed is the biggest question and since it is an overall system speed spec, it was mentioned previously. The use of diodes wired in the stack rather than external is questioned and the diode should be very carefully tested if this plan is pursued.

RELIABILITY, MAINTAINABILITY, DIAGNOSTICS

The MA's are not indicated at this time and the committee feels each memory address register should be indicated. Logic close to the floor will make it difficult to work on the machine and the question of the trade off of a one bay machine (for marketing reasons) against ease of checkout and service should be resolved in the future. The key maintenance loop, repeat/start

RELIABILITY, MAINTAINABILITY, DIAGNOSTICS (continued)

and the fact that examine and deposit will not effect other registers are valuable additions to the console. There is, however, a trade off with the console switch selection of registers and only use will tell. The diagnostic situation appears to be progressing well.

MECHANICAL

Cooling is still a serious question. Heat tests have not been completed and a baffle may be needed. The memory package is rather cumbersome. The mounting and weight of the control memory looks like a source of mechanical problems. It is recommended that this memory be braced and supported.

PRODUCTION ENGINEERING

A significant effort has been made in Production Engineering for the first time in the history of the company. The overall plan looks sound and well managed. Documentation and procedures are vital to the success of this operation and special attention must be given here. The testers themselves must go through margins and heat testing as their proper operation and reliability is of utmost importance.

The "known module" swapping technique creates the need for many loose modules which could pose a problem. It is recommended that pluggable sections of known working modules be used rather than just a basket of "known working" modules.

dec INTEROFFICE MEMORANDUM

DATE September 30, 1966

SUBJECT Low Cost Photo Resists

TO Ken Olsen

FROM Walter Bonin

You may find the information in this article is of interest. It discusses a photo resist made from photoengraving glue. I have summarized its advantages and its disadvantages below. Its unique advantage is its very low cost but as you will note it also has some marked disadvantages which we may or may not be able to circumvent.

ADVANTAGES

1. Water soluble; may be developed with a water spray.

2. Development time short 30 seconds or less.

3. May be mixed in various proportions for different properties.

4. Inexpensive ($3.50 per gal. less mixing expenses, compared with $50.00 (KMER), $60.00 (KPR) and $75.00 (AZ) in gal. amounts.

5. May be stored after coat for several days (away from light).

6. High adhesion to metal surfaces.

7. Easily stripped in alkali solution.

DISADVANTAGES

1. Short shelf life (two weeks).

2. Can not be spray coated due to difficulties of spraying water solutions.

3. Must be baked at 315°C (400°F to be acid resistant.

4. Because of temperature can not be used on

metal - epoxy laminates.

5. More alkali resistant (see "Advantage number 7").

One possible area of application may be on ceramic substrates coated with pyrolitic tungsten. There would be no temperature difficulties with a system of this sort. How practical ceramic substrates are as completed circuit boards is a question.

WB/mf

PHOTOENGRAVING GLUE:

A UNIQUE PHOTO RESIST BASE

By Robert E. Norland

Although chemical milling using acid resists applied photographically is considered a recent development, the basic idea is not new. Photoengravers have been using this process since 1890. But the technology has changed. Now metal parts are mass produced at speeds which would have seemed unbelievable only ten years ago. Chemical milling has taken the technique of the photoengraver and changed it into a high volume production process.

One product used by both the photoengraver and industry is photoengraving glue. The name has the connotation of an adhesive. Actually, it is the base of a photo resist that can be compounded by the user.

Photoengraving glue is a specially processed fish glue which can be made into a light sensitive coating solution by adding ammonium bichromate and water. The resultant coating has high adhesion to glass, metal, and some plastics. Upon exposure to the high intensity light of an arc lamp or pulsed xenon lamp, the coating becomes insoluble. Unexposed areas are still soluble in water at room temperature. Thus it is possible to print the reverse of a photographic line negative on any surface to which the coating will adhere.

INDUSTRIAL APPLICATIONS

This image has interesting properties. It can be dyed readily with water soluble dyes. Patterns can then be duplicated in any color, and this is done on instrument dials, piping layouts, and nameplates.

Silver salts can be absorbed into the image, and thus a black, opaque image can be obtained. This process is used to make fine reticle images, such as cross hairs on glass. Other metal salts can be absorbed also. If the image is on glass or ceramic, the organic glue can be fired off, leaving the metallic image on the surface.

The largest use of photoengraving glue is in chemical milling of metal sheet. After the printing and developing steps of the glue photoresist image, it is baked at a high temperature (600°). This step converts the image into an acid resistant coating, and the open areas can now be etched.

Nameplates, instrument panels, and wiring diagrams are examples where a design is recessed by etching and then either filled in with lacquer or chemically treated to give a color that contrasts with the raised metal surface. This design is practically indestructible, since the recessed image can always be read.

One of the most unique chemical milling operations is the continuous production of color television shadow masks. The heart of the color television picture tube is the shadow mask, a large, thin metal disc the size of the tube and containing 400,000 holes exactly positioned in an optically perfect pattern. The holes vary in diameter from 0.010 to 0.012 inches according to a precise mathematical formula. The shadow mask is the key that allows each of the three electron guns in the neck of the tube to see its respective phosphor dot on the face of the television tube.

This complicated metal part is mass produced by a photographic and chemical etching process, and photoengraving glue is used as the photo resist base.

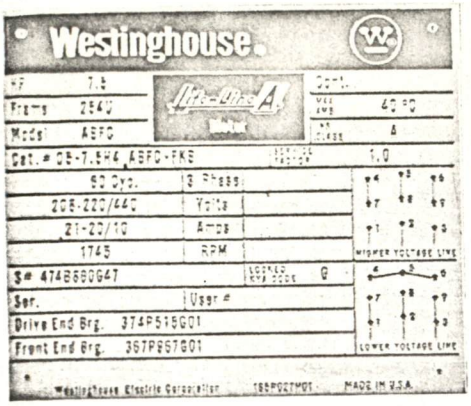
ECONOMICS

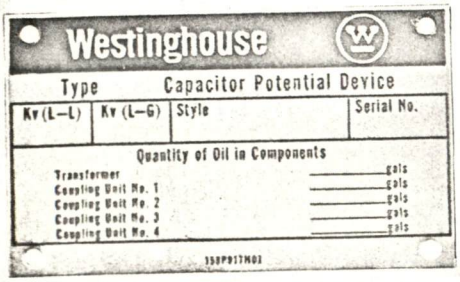
Photo resists made from photoengraving glue can be compounded by the user or purchased already mixed. Economic considerations determine which alternative should be used. Where large quantities are required, there is no question. Raw material costs for a typical formulation of 11 parts photoengraving glue, 1 part ammonium bichromate, and 26 parts water would be approximately $3.50 per gallon. To this must be added preparation costs, which are dependent upon quantities mixed. Equipment needed is fairly simple, — scales, mixing tank with paddle stirrer and a suitable filter.

Shadow mask of a color television tube made by chemical milling process using Norland Photoengraving Glue as a photo resist base. Standard 55 gallon drum gives comparison of mask size.

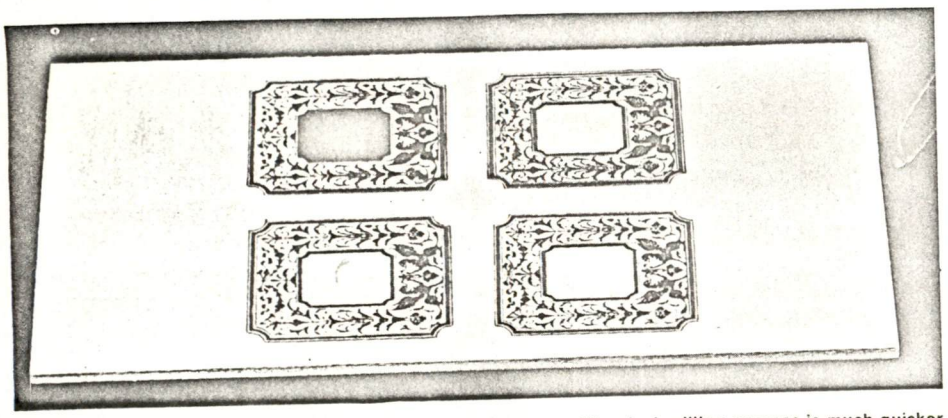
Already mixed photo resists would take into account the additional preparation and packaging costs, and for the company using ten gallons of photo resist per week, this is probably the cheaper way.

One factor to consider in mixing a bichromated glue photo resist is the shelf life. The solution has a shelf life of approximately two weeks, depending upon the temperature at which it is held. This is because the bichromate gradually reacts with





Nameplates made by photo resist process using photoengraving glue. The two Westinghouse nameplates are stainless steel, etched and filled with enamel. The Healy-Ruff Co. and Industrias Metalicas nameplates are aluminum, etched and filled. The Angarita nameplate is a dyed image.



Placques or instrument panels can be made by etch and fill process on heavy gauge aluminum. Chemical milling process is much quicker than pantograph method.

the photoengraving glue base and converts it into an insoluble coating. Already compounded glue photo resists are stabilized to extend the shelf life to six months or more.

PROCEDURE FOR USE

A brief description of the procedure for using photo resists made from photoengraving glue will be of interest to those unfamiliar with the product.

Application of the photo resist is normally done by dipping, flowing, or whirling. Dip coating can be done dry, but whirler coating and flow coating are always done with the metal initially wet with water. Since the cleaning process usually involves water solutions, this presents no problem. The wet surface is more receptive to the water-based resist, and the photo resist displaces the water as the metal is coated.

In dipping or flow coating, the coating thickness is wedge shaped, i.e. thinner on the top than on the bottom. The thickness of the coat is dependent upon the condition of the surface coated, and the solids and viscosity of the resist. If the surface is exceptionally smooth, solids must be increased to maintain a minimum thickness on the top. Usually the coating difference from top to bottom presents no difficulty.

Spraying is not recommended because of the problem of a suitable spray coat with a water solution.

After drying, preferably at a temperature below 150°F, the resist will maintain its light sensitivity for several days, if stored away from light. The bichromated gelatin does gradually become insoluble, thus, the coating should be exposed and developed within three or four days.

Exposure of the resist image is carried out in the usual manner with either an arc lamp or a xenon light source. The resist has a maximum absorption peak at 3600-3700 angstroms with a secondary absorption peak at 2700 angstroms. Since exposure is dependent upon resist formulation, resist thickness, light intensity, and distance of resist from light source, it is difficult to set any specific time. Normal exposure for a photoengraver can be in a range of 3 to 8 minutes. For high speed production in chemical milling, exposure times can be reduced to 30 seconds.

Development is by a water wash. Either a water spray or a wash under running water will develop out the unexposed resist easily. A temperature in the range of 65-75°F is preferred. Water development is fairly fast and should not require time in excess of 30 seconds.

After development the image is dried. If it is to be used as an acid resist, the part is baked. Although photoengraving glue has excellent adhesion to most metals, including stainless steel, the resist image must be baked at 600°F for a short period of time to make the image acid resistant. Laminants (especially printed circuit board) will not withstand this high-temperature bake. All the chemical milling now being done with photoengraving glue is on metal sheet.

The preferred etchant is iron chloride, and photoengraving glue resist will withstand iron chloride etching temperatures up to 140°F. All the metals mentioned can be etched with iron chloride. The image is acid resistant, but not alkali resistant.

The fact that the resist is attacked by alkali simplifies the problem of

dec INTEROFFICE MEMORANDUM

DATE September 29, 1966

SUBJECT Photo Resist

TO Ken Olsen

FROM Walter Bonin

Enclosed you will find a general photo resist summary which contains information regarding special resist properties and application methods. This information may be used as a general guide to this Company's photo resists efforts.

Enclosure

WB/mf

Technical Memo No. 8 September 29, 1966

GENERAL RESIST INFORMATION

TYPES

1. Kodak (Negative Acting)
   A. KMER
   B. KPR
   C. KTFR
   D. KOR
   E. KPL

2. Shipley (Positive Acting)
   A. AZ-340
   B. AZ-1350

3. Surface Preparation

4. Coating Methods
   A. Dipping
   B. Spraying
   C. Spinning
   D. Painting (or rolling)

5. Dry

6. Prebake

7. Exposure

8. Develop

9. Post Bake

10. Resist Removal

PHOTO RESIST SUMMARY

1. Kodak (Negative Acting)

These resists are polymerized by ultraviolet light. This alters their solubility in certain solvents which allows for the development (removal) of unexposed resist.

A. KMER
   a. Most chemically resistant
   b. Poorest resolution
   c. Thickest of the Kodak resists
   d. Depending on thinning, spin coating this resist yields thicknesses from .5 to 20 microns
   e. Most viscous of Kodak resists
   f. Designed for thick coatings by vertical flow system
   g. Fewer pin holes due to greater thickness
   h. Higher temperature resistance may be pre-baked up to 120°C; post baked to 140°C

B. KPR
   a. Highest resolution and thinnest coatings
   b. Thickness from .3 to 1 micron obtained by spin coatings
   c. Most susceptible to pin holes
   d. Considerably less viscous than KMER
   e. Less adherant than KMER
   f. May be prebaked up to 120°C; post baked to 200°C

C. KTFR
   a. Designed for semiconductor use
   b. Wide varity of thicknesses (≈ .3 to 6 microns)
   c. Greater resolution than KMER
   d. Less than KPR
   e. Same type as KMER, differs in resolution
   f. May be baked up to 80°C

D. KOR
   a. Three times the viscosity as KPR
   b. Same type as KPR
   c. Most heat sensitive
   d. Considerably shorter exposure time
   e. May be baked up to 80°C

E. KPL
   a. Identical to KPR except for solids content (4 times KPR)

b. Lower resolution than KPR
c. Fast evaporation system
d. Little success in semiconductor industry

2. Shipley Resist

Pretreatment involves polymerization of resists which is degraded and made soluble in certain solutions by ultraviolet exposure. These resists may be prebaked to 65°C.

A. AZ-340
   a. Thickest of Shipley Resists
   b. Poor resolution
   c. Better than AZ-1350 for irregular surfaces
   d. More resistant to etching and plating
   e. Is easier to apply than AZ-1350

B. AZ-1350
   a. Greatest resolution
   b. Most subject to dust effects
   c. Poorer resistance to etching and plating
   d. Intended for finer images
   e. May give better resolution than KPR due to negative coving.*

3. Surface Preparation

The adherance of resists to different materials is greatly dependant on the cleanliness of the surface prior to coating. For questionable surfaces a rigorous surface cleaning treatment is advised including the use of a vapor degreaser (if material compatible) followed by thorough rinsing. Moisture is severe and baking may be necessary before coating.

4. Coating Methods

A. Dip
   a. Used to coat both sides
   b. Used with low viscosity resists
   c. Yields thicker coats
   d. For straight and contoured surfaces

B. Spraying
   a. Best for contoured surfaces
   b. Used with any resist viscosity
   c. Use spray gun without air atomizer
   d. Work must be laid horizontal following application to allow coat to level
   e. Multiple spray coats may be used for thicker coats

* SEE Page 5

C. Spin
   a. Thinnest coats
   b. Used in semiconductor applications
   c. Questionable production rates for large pieces
   d. May be practical for rigid circular pieces only
   e. May be combined with other coat method

D. Roller
   a. High production rates
   b. Used on flat surfaces
   c. Uniform coat
   d. Thick coat
   e. Roller material must be compatible with resist*
   f. Coats both sides

5. Drying
If the resist is heated right after drying, a thin skin will form on the surface prohibiting the further evaporation of the solvent. It is therefore necessary to air dry the resist for from 10 to 60 minutes before prebaking. The thicker coats will require the longer drying times. Air drying is not recommended for Shipley resists.

6. Prebaking
The temperature of the prebake will be different from resist to resist. The main reason for baking is to remove all the solvent from the resist before being exposed and developed. Excessive temperatures may adversely effect the adhesion of the resist.

7. Exposure
The exposure times will vary for different resists and for different thicknesses being longer for thicker coatings. The length of the exposure time is also a function of the light source intensity.

8. Develop
Following exposure the depolymerized resist is removed by a suitable solvent. The most common removal method involves soaking the part in the solvent for one to two minutes followed by a spray developer and rinse. A vapor degreaser has been used to develop and post bake the resist at the same time but no report of the results was made.

*Rollers made by Thiokol Corporation, Trenton 7, New Jersey.

With satisfactory results this method lends itself very well to production quantities. For those resists which are more difficult to remove, ultrasonically agitating the solution may be desirable. Spray developing is encouraged because of its tendency to remove lodged particles in addition to the loose resist. Following development a rinse or spray in a developer type solution followed by a deionized water spray is recommended.

KPR may be developed with Trichlorethelene, Stoddard solvent, or KPR developer. These same solvents in addition to KMER developer may be used to develop KMER. AZ developer is used on the AZ resists.

Negative acting resists (Kodak) have a tendency to swell during development and generally fail to completely recover their original dimensions. This swelling reduces the resolution of Kodak resists. The AZ resists are not affected to such an extent by swelling and will give better resolution.

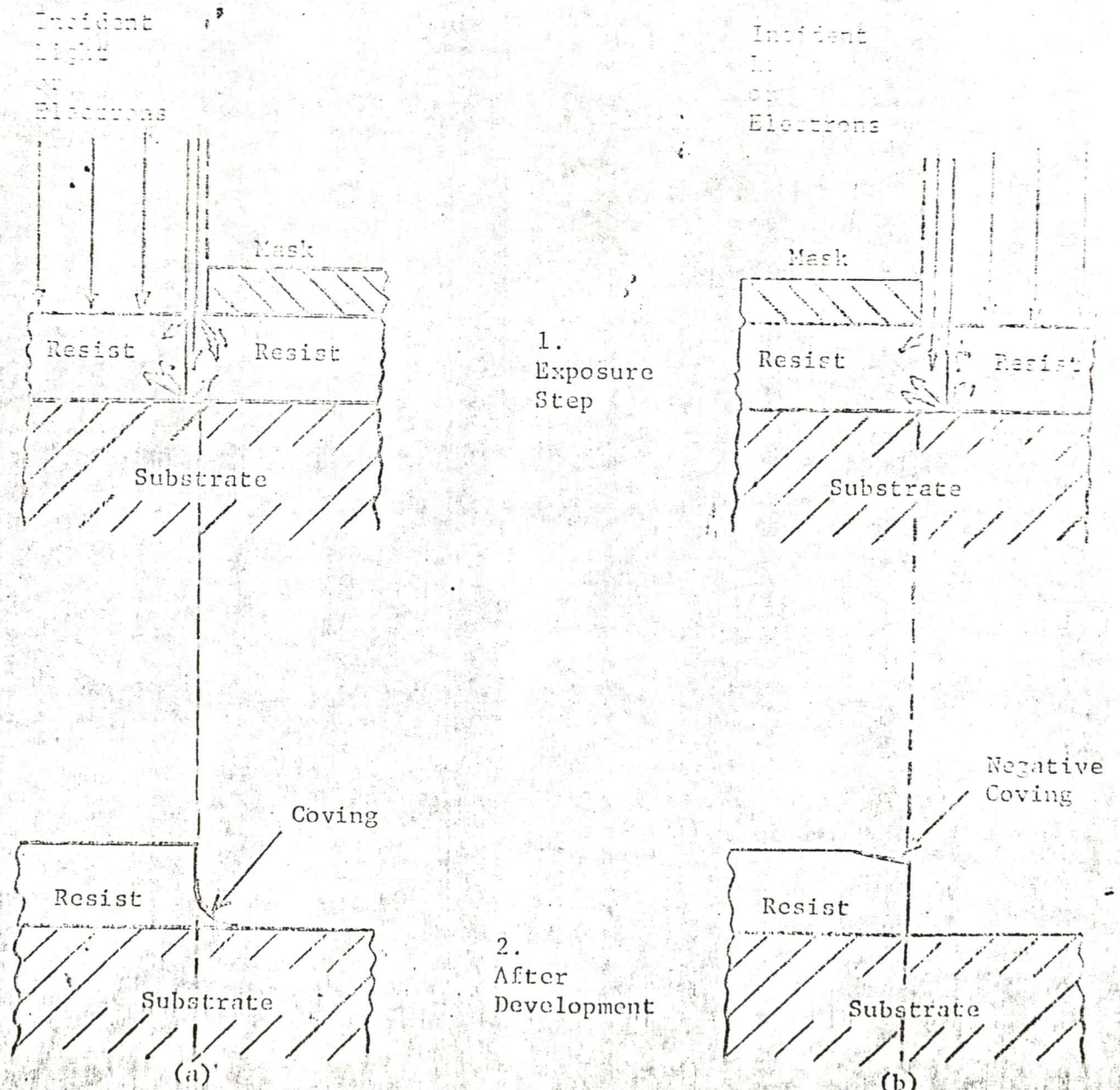
9. Post Bake

Post baking is recommended for the Kodak resists to remove all the developer that the resist may have absorbed. Failure to do this will reduce the resist's adherance. For KMER the resist may be baked for from 10 to 30 minutes at temperatures up to 140°C and similar times for KPR up to 260°C. The resists may be post baked up to 140°C for times from 10 to 30 minutes. The AZ resists may be baked as high as 200°C but this temperature, while considerably improving chemical resistance, makes the resist removal extremely difficult.

10. Resist Removal

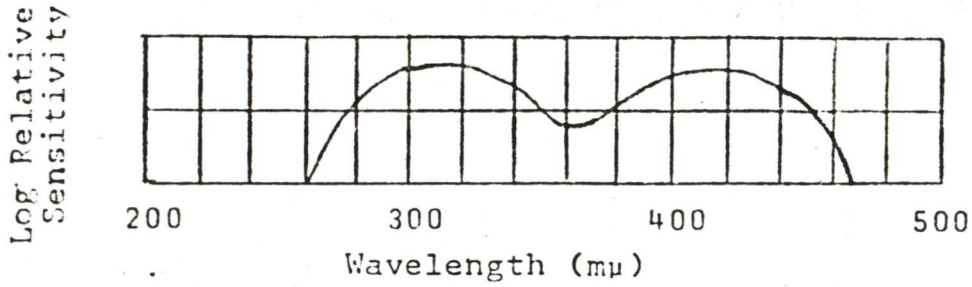
Following etching it is necessary to remove the resist completely leaving the surface of the piece in a very clean condition. AZ resists which have been post baked at temperatures less than 95°C may be removed in AZ remover by immersing in the solution at room temperature from one to five minutes. Coats baked at temperatures higher than 95°C may require that the temperature of the AZ remover by increased to 50°C to 65°C. Concentrated hot sulfuric acid will be required to remove resist baked at high temperatures. The Kodak resists may be removed using J100*, followed by immersion in a vapor degreaser to remove the excess J100.

* Indust-Ri-Chem Lab, Richardson, Texas

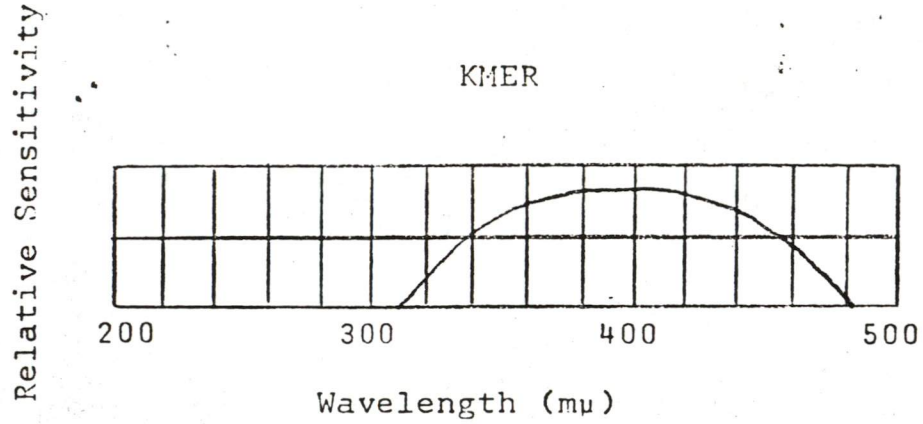


(a) Coving with negative-acting resists
(b) Coving with positive-acting resists

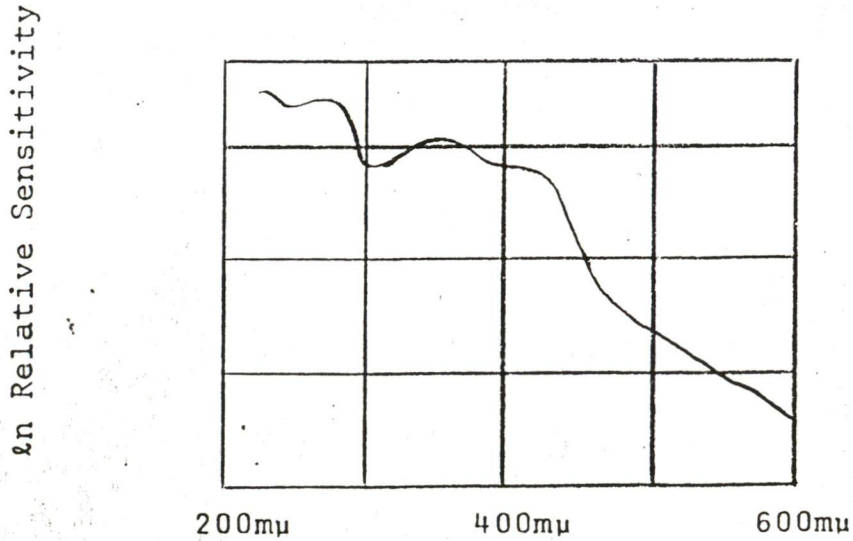
KPR


Log Relative Sensitivity
200
300
400
500
Wavelength (mμ)

KMER


Log Relative Sensitivity
200
300
400
500
Wavelength (mμ)

AZ


Log Relative Sensitivity
200mμ
400mμ
600mμ

II. Summary

In summary the information contained in this presentation is a general treatment which is a combination of individual experience, manufacturers information and miscellaneous technical documents. It is very difficult to state in absolute terms what resists and what process is ideal for a given application. I can only relate in general terms the comparisions between the various resists but this information must be supplemented by actual experience.

WB/mf

CONFIDENTIAL

dec INTEROFFICE MEMORANDUM

DATE September 29, 1966

SUBJECT PROGRESS REPORT - LEXINGTON LABORATORIES

TO Stan Olsen
Nick Mazzarese
Win Hindle
Dick Best
Loren Prentice
Ken Olsen

FROM George Wood

Attached is a copy of Lexington Laboratories report of consulting work done in connection with the ceramic module project (D/98/07027). I submit that the report is true and complete with the exception of the following corrections and additions:

PAGE 5

Subsequent, multi unit testing and careful analysis revealed 1) Englehard and DuPont pastes are comparable when used as directed, 2) A two to one difference in pin removal force can be attributed to inconsistancies in swagging, 3) Painting the feet prior to swagging aided only those pins that were poorly swagged and 4) Painting the feet with silver paint prior to swagging increased the bond strength of all pins by approximately 25%.

PAGE 7

Extensive tests of epoxy bonds have not been conducted at this date.

PAGE 8

1. Pyrex glass mixed with copper showed decidedly better bonding of the flame sprayed coating to alumina. Pyrex powders with selected particle size have been purchased for further investigation.

2. Kovar powder exhibited very poor adhesion to the alumina.

The problem solution is currently being sought as follows:

1. The mechanical strength of the pin will be accomplished by doing a better swagging job. Initial tests show greatly improved pin-to-substrate strength.

2. The electrical interconnection will be accomplished by

soldering conductive epoxy, or flame spraying a conductive coating (probably copper-pyrex).

3. Recently obtained information puts a new light on flame spray bonds using indium for the bonding agent. It will be tried, but the "dollars per ounce" price tag makes it unattractive.

Because of the change in status of the ceramic module, I recommend that contract employment of Lexington Laboratories be terminated at this point.

George Wood

CONFIDENTIAL SEP 21 1966

MEMORANDUM

TO: Digital Equipment Corporation
George Wood
Thomas Stockebrand

Lexington Laboratories, Inc.
W.D.Kingery
A. Waugh
R.C. Folweiler
H. A. Hobbs, Jr.

FROM: R.L.Coble

This memo describes the cooperative effort undertaken by Lexington Laboratories, Inc., for Digital Equipment Corporation to inprove the latter's products and processes. It is intended to cover the problems, progress and results to date.

I. Conductor Pins

The general problem was to examine the modes of failure of the conductor pins that are swaged into slots in a ceramic substrate, and subsequently solder-connected to the first conductor. Because of the poor adherence of the first conductor to the substrate, or low solder strength, pins were found to be extractable from production samples by bending in one direction. The initial goal was arbitrarily chosen to be a two fold improvement in pin extraction load.

Failures were generally accompanied by stripping of the first conductor from the strate, along with the solder connection and extracted pin. Failure of modules that had been assembled to circuit cards was attributed to displacement of the module in a lateral direction by bumping in handling. It was suggested that a thermal stress might have been imposed on the pins during soldering to the circuit card. The pins would expand due to rapid heat up from the solder wave, the solder freezes and the pins then shrink, generating a tensile force in them. Preheating the entire card to approximately the solder temperature would eliminate this effect because of the greater expansion coefficient of the plastic card, causing the card to shrink more than the pins.

Some failures might also be atributed to inadequate soldering, because there is difficulty in making the solder bridge the gap between the conductor and the pin in its socket. Frequently multiple dips were conducted during soldering in order to attempt to form a concave bead of solder over the entire area to be joined. Sometimes, the solder instead, would form a convex depression at the socket, and failure (at that region) would occur in the solder. In order to alleviate that problem, it was suggested that the surface tension of the solder might be lowered. Alpha Corporation was asked (by DEC) for information regarding solder surface tension and replied that they knew no way to lower it significantly.

Other failures with the solder to electrode connection were presumed to be related to the gold pick-up in the solder entering solution from the first conductor. Gold is known to embrittle solder joints. It was found by DEC that fresh solder did provide an improved bond and a schedule for replacement of the solder in the pot has been established.

The poor adherence of the first conductor to the substrate was hypothesized to result from several possible causes, each of which was then followed by a brief experimental program to determine which seemed most applicable. Upon first examination of the conductors under a microscope, it was found that there was no glass observable under the illumination conditions employed. It was hypothesized that the conductor might have been over-fired and that the glass might have entered solution in the substrate ceramic, leaving an unbonded film of gold particles weakly adherent to the substrate. Etching routinely printed and fired first conductors on substrates in hydrofluoric acid (HF) greatly diminished the adherence of the first conductor. Because of the fact that HF is expected to dissolve the glass; this was taken as evidence that there was glass remaining in the conductor powder. Subsequently, a photomicro-

of a cross-section of the pin-solder first conductor strate connection showed clearly evidence that a glass layer existed between the aggregate of gold particles suspended in a glass matrix and the substrate. Routinely printed, first conductors on substrates were fired at a succession of temperatures from approximately 650 up to 950° and showed no change in strength as a function of firing temperature. This was conducted in order to eliminate the absorption of the glass by the ceramic if that were the cause for the failure.

Samples prodded under the microscope showed that there was essentially no degradation in the adherence of the first conductor under the solder tab in comparison to the adherence of the conductor at locations far removed from the solder tab. This was examined because it had been hypothesized that gold removed from the electrode material might weaken it or reduce its adherence to the substrate. Thus, by mechanical prodding, there appeared to be no reduction in adherence due to the soldering operation. This also showed that there was indeed gold left in the first conductor pattern in the regions beneath the solder tabs. It had also been hypothesized that the flux used prior to soldering might have attacked the first conductor and reduced its adherence. All of the above hypotheses were eliminated with the observation that the strength was the same beneath the solder tabs as in regions outside the solder tabs. The conclusion was that there appeared to be poor intrinsic adherence between the first conductor and the substrate, inadequate to support the stresses required for the desired loads to be imposed on the pins. That inherent strength, however, did not appear to be affected by the solder, the flux or the heating cycle.

The reduced strength was then assumed to be related to the bonding between the gold and the glass as affected by the atmosphere in which the samples were fired. The best wetting of sodium silicate glasses on gold takes place in an oxidizing atmosphere. There is no obvious use to be made of this information, however.

Because of the fact that glasses in general adhere tenaciously to ceramics and that the structure of the first conductor appeared to be a loose aglomerate of gold particles interspersed with glass, it was assumed that the low strength obtained after processing was probably due to an expansion mismatch between the first conductor and the ceramic, giving rise to excessive shear stresses at the interface between conductor and substrate. Borosilicate glasses have been used routinely for glazes on alumina ceramics, therefore, it was presumed that the expansion mismatch must arise because of the presence of the gold. Alumina has an expansion coeffieient of approximately $8 \times 10^{-6}/°C$, while gold has an expansion coefficient of $14.9 \times 10^{-6}/°C$. It was assumed that a better match could be obtained using platinum, with an expansion coefficient of $8.9 \times 10^{-6}/°C$. Commercial platinum-glass mixtures #'s 6857 and the 7775, 9696 and 6082 were obtained from Englehard. The latter had been used by Lexington Laboratories, Inc., for platinum coatings on alumina rods for high temperature heating elements. Mixture # 6082 had been found to be particularly adherent. It was readily burnished with a knife upon scraping in contrast to direct stripping of the du Pont conductors in use by DEC. Two others, #6857 and 7775 are of the solution type, forming bright platinum layers of very small thickness. They consist of very low viscosity liquids and can be applied readily by a brush or in droplet form from a hypodermic needle. Others were routine silk screen printing inks. These, as well as #232 (which ended up not being a conductor) were applied in varying thicknesses to alumina sub-

strates and fired at 750 and 850°C. Some appeared to be more adherent than the production standards. Standard strates were then printed 1) up to the edges of the pin socket and 2) into the pin socket. Pins were then swaged into the sockets and the samples were soldered. Of these, 9696 exhibited the greatest promise with a pin extraction load of six pounds with the pin socket printed. For the other pastes, poor solder joints were formed between the pins and the conductors. In these the mode of failure changed such that the electrode was not stripped from the substrate, but instead the pin separated at four pounds by solder fracture at the pin socket edge. All of the most promising materials were then transferred to DEC for silk screen printing under more controlled conditions. Probing of the hand prepared variable thickness conductors showed that excessive thicknesses caused cracking as had been expected, and that the most adherent were the thin, bright finishes. However, bright finishes have low conductivity and would require over-plating or alternate procedures for electrical connections in order to give the electrical resistance desired. The conclusions to be drawn are: that Englehard pastes give slightly greater adherence than du Pont pastes (four versus two pound pin extraction loads) and that coating of the pin socket with conductor paste gave about a factor of two increase in the pin extraction load. If further improvements in strengths are desired a more precise evaluation of the actual stresses involved will be necessary in order to substantiate the condition of stress levels present.

It was hypothesized that the heat cycle in soldering might be a source of weakening the electrode to substrate bond. Alternate procedures for cold soldering and for more controlled soldering were considered. To avoid gold contamination and the variability in dip time by the operator, it was suggested that a focused optical heating unit be employed which could be used

to melt prelocated solder tabs on the electrode to pin connection positions. An available commercial unit with a 1/8-inch diameter focused spot which was reputed to heat steel wire to white heat in seconds is available at a cost of $550.00. It would appear that this would possibly provide a useful technique for fully automating soldering.

Reactive solders were also suggested such as a nickel aluminum mixture. This, however, has already been employed by DEC for flame-spraying directly on alumina substrates. Their experience with that material has been that poor adherence to the alumina invariably resulted (discussed further below).

II. Low Temperature Solders

A dental amalgam has potential as a room temperature metallic solder. It has been stated that dental amalgam does not stick to other materials (when used with teeth, they are mechanically held in place). However, it is not known whether they will adhere adequately to a pair of metallic parts to be connected.

Another alternate solder suggested was a metal loaded epoxy which could be cured at room or low temperatures. Mixtures of copper and of a colloidal silver (metals having been obtained from DEC) were mixed with Devcon clear epoxy glue and with Homalite "potting compound" in various proportions. These loaded epoxy glues were found to flow freely at metal contents which were too low to provide metallic conduction. At high metal contents the mixtures became quite thixotropic, they were difficult to apply and gave relatively low strength after curing. A succession of both silver loaded and copper loaded epoxies were applied to substrates on which the first conductor had been printed and fired and in which pins had been swaged. At high metal content, no improvement in strength was noted and the conductivities were barely adequate. At

low conductor content, the strengths obtained showed a significant improvement in that the pins could be bent over at right angles to the substrate at the point of immergence from the pin socket without stripping. The poor conductivity was attributed to the fact that particular conductors used were found not to exhibit metallic conductivity in the powder state but to require compaction in order to bring the metallic particles into contact.

Because of the improved strength, however, it was presumed that appropriate metal powders would give good metallic conductivity. Commercial epoxy-based solders were then purchased from Emerson and Cummings, labeled as Eccobond 56C, 57C, and 58C. The 56C was not mixed in the proper proportions and did not cure properly. Mix 57C is a two-part equal component mixture in paste form. It has good spatulating properties and was smeared out in varying thicknesses on substrates and also pressed between a pair of substrates to form a thin glue joint. 58C is a one-part epoxide which requires a fairly high temperature for curing (300-500°F). It also exhibited good spatulating properties and was smeared out on the substrates. In addition it was used as the solder connection on a substrate with swaged pins and first conductor. The materials 57C and 58C both exhibited zero resistance (with measurement accuracy on one ohm). The epoxy conductors were extremely adherent and burnished when scrapped. It is not yet known at what strength level the pin extraction with this solder will occur.

In view of the high strengths achieved with the clear epoxy with no conductor added, it was suggested that an alternate approach to the pin extraction problem be to encapsulate the lower part of the module (below the region where the diodes are attached) in epoxy in order to reinforce the solder joint and the pin connection to the substrate. This could be done either by potting with the rubber compound up to the base of

the solder tabs and filling subsequently with epoxy or to apply a strip of epoxy to the edge of the substrate over the soldered connections.

While prodding various printed strates under the microscope it was noted that the joint between the resistor and the first conductor exhibited much, much greater strength than did the first conductor pattern. It was suggested that the glass used for the resistor might also be used for a conductor strip as well, or that an alternation in the glass composition would yield a higher strength. Implementation of this alternative would require an appeal to du Pont for special formulations.

Another alternate procedure which was discussed was to employ nickel pins with a moly-manganese seal to the alumina as has been used in the electronics industry for high strength metal-ceramic seals. DEC's evaluation had been that moly-manganese coating was too expensive and that the nickel was of insufficient oxidation resistance to undergo subsequent oxidizing heat treatments. It was suggested that gold coated nickel wire might be used for this operation. The procedure assumed was that the nickel would be connected to the alumina as the first step in the operation prior to circuit printing and firing. It was envisioned that this alternative might also involve a soldering operation. Difficulty had been experienced in attempts to solder oxidized nickel wire. Nickel wire was secured by DEC subsequently and soldering by simple rosin core solder was found to be satisfactory on clean wire. It was poor for preoxidized wire. Upon use of Alpha solder flux number 830, easy wetting of preoxidized nickel by the solder was found to take place. Therefore, there would be no limitation to the use of that procedure employing either reducing atmospheres in so far as possible for the succession of firing cycles, or to clean the wire employing special flux prior to soldering.

III. Flame Spray

DEC has a commercial flame spray apparatus and has made or attempted to make conductor patterns from a variety of commercially available, Metco and Avco powders and metal-glass mixtures on alumina substrates. The general result found was poor adherence or easy scaling after flame spraying. Metal-glass mixtures had been found to exhibit very strong bonding to the substrate. Lexington Laboratories recommended the use of Pyrex glass for a lower expansion coefficient, in order to form a compressive stress in the sprayed material.

The problem of adherence of flame-sprayed coatings was analyzed and the distinctions between the easy application of oxides to metals in contrast to metals on ceramics was judged to be due to the differences in thermal conductivity of the respective materials. Upon applying a metal to a ceramic, the ceramic with the much lower thermal conductivity is not easily heated to the temperature at which the metal is deposited. Therefore, upon cooling to room temperature, the metal (with a higher expansion coefficient than the ceramic) at a higher temperature than the ceramic substrate will be placed in tension, upon cooling, a condition known to lead to poor adherence. In contrast, upon spraying an oxide on a metal, the metal approaches the temperature of the material being deposited. With the ratio of the expansion coefficients and temperatures inverted, upon cooling a compressive stress is developed in the ceramic layer. Lexington Laboratories suggested the use of Kovar for deposition onto alumina because of its low expansion coefficient. The Kovar powder was secured by DEC, but results from flame spraying are not yet available.

An alternate coating procedure for possible soldering or conductor applications is to use electro-less nickel or copper deposits as solder bases or for electro-deposition. Solutions have been obtained for experimentation but have not yet been utilized.

INTEROFFICE MEMORANDUM

DATE September 28, 1966

SUBJECT Module Orders

TO Ken Olsen

FROM Rod Belden

We have successfully bent the product lines to restrict their module orders to our production limits. I have been less successful with improvements in the module production mix and response time problems.

Although Cy is under a great deal of pressure and production is moving faster now, let's be certain we are moving in the correct direction.

Will you reconsider the implication and recommendations of my September 22 memo at this Friday's Manufacturing Meeting? A copy is attached. Thank you.

jeb

INTEROFFICE MEMORANDUM

DATE September 22, 1966

SUBJECT A Production Problem - Module Mix and Order Changes

TO Cy Kendrick
Galen Davis
Jack Smith
cc: Ken Olsen

FROM Rod Belden

The rate of module production has increased steadily during the last 6 weeks to a point where Cy is turning out a consistent 2,500 modules per day. As we start into October and November where the goal is 3,500 modules per day (70,000/month), I feel we should give more thought to how we can:

1. Improve correlation of the produced module mix with the ordered mix. (Mix problem) - felt most severely by computer production.

2. Reduce the through put time of a module request from approximately 8 weeks to more nearly 4 weeks or less. (Response time) - felt most severely by module sales.

Mix Problem

At a time when inventories are low, a correct mix of modules is more effective than a large volume of modules. Correct mix is closely related to good scheduling. To relieve the pressure of scheduling a production backlog of 80,000 modules in September, we forced the product lines to absorb the backlog during September, October and November. Instead of placing "new orders" for 60,000 modules during October, new orders were held down to less than 10,000 modules. In addition, both October and November requests were scheduled by week. Therefore, production should have little uncertainty of what to deliver, when.

However, I am not happy with the improvements in mix during the first 4 weeks of September. Excepting delays caused by material shortages, I think the continued poor correlation of mix arises from:

1. Incomplete control over scheduling
2. Large work-in-process inventories (Response time)

Production issues (starts) are not yet current and on a correct mix schedule because the circuit boards are not ready. But are the circuit boards being produced to the same schedule? Until this week, Galen Davis seemed to have little control over the schedule for the board department. The board schedule has been left to Herb Norton's judgment of the backlog and orders on Galen's sequence list. My theory is that module production should be treated as ONE CONTINUOUS PROCESS, and therefore should follow one schedule. A common schedule should not prevent each area manager from taking advantage of large lot size efficiencies (as in drilling and screening), it just means that the output of each production step (whether screened

today or two weeks ago) should follow the same schedule. If large lots of one board are being sub-contracted, this can also be anticipated by the overall schedule.

Response time

During the past few days I have discussed treating the November module requirement as fixed. Of course, this is not because we want to further restrict the product lines, but because I feel that the module work-in-process level is too high and the schedule backlog too long to permit a 4 week response to an order change.

Let me juggle some numbers to illustrate:

New order received:	October 4th - first Tuesday
New module production schedule ready:	October 11th - Second Tuesday

Result - 3 weeks left in October to respond to a change in module type or quantity for early November delivery. Production response time is headed towards:

Test time	1/3 week
Assembly time	2 weeks (longer if sub-contract)
Stock room for set-up	1 week (to cover for material shortages, G. Davis would like 2 weeks lead time for boards here)
Drill, Etch, Scrub, Plate	2 weeks (last week the work-in-process for board preparation was 30,000 modules)
Total	5 1/3 weeks

This is a low figure, for we are now sub-contracting both etched boards and hand assembly work with longer response times. And unless we start to check this now, when the rate rises from 2,500 to 3,500/day (a 40% increase) the response time may get longer.

If we have materials and working equipment, why should it take more than 2 weeks to schedule, drill, etch, plate, assemble and test a lot of modules? Cy has been responding to Jack Smith's "critical list" with that general response time.

With a 2 week cycle time (schedule to shelf) we could concentrate our $ in raw material inventories (where our hedge against the uncertainties of the outside world should be) and give product lines a 2 - 4 week delivery service. Finished goods inventories would remain at a low level. However, if we do continue to require a 4 - 8 week lead time on orders and cannot match the mix by week (even with a controlled volume), then I would expect that finished module inventories will rise back to the 4 - 8 week level.

Recommendations:

1. Galen Davis and Herb Norton follow the same schedule for boards, starts, and deliveries. Sequence is determined by acquired delivery date, time in process, and efficient lot groupings.

2. Drill and etch largest lots that drill capacity and etching time will permit.

3. Get better control of changes to modules. A rate of 11 changes per week at an average of 200 active module types gives an "average" tooling life of 18 weeks. This doesn't seem to be correct - what's wrong here?

4. Cy should weekly review the issues (starts) mix vs. the actual requirements.

jeb at the Manufacturing Meeting.

INTEROFFICE MEMORANDUM

DATE September 27, 1966

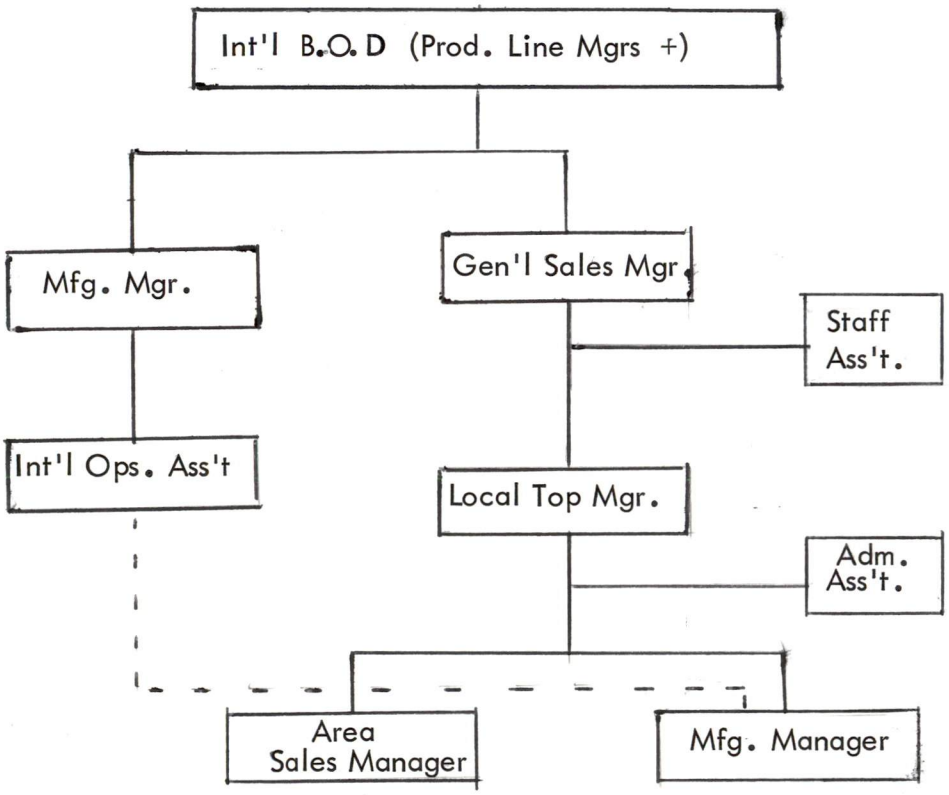
SUBJECT Proposal for Organization of Manufacturing Subsidiaries

TO Ken Olsen

FROM Ted Johnson

I believe it is important to begin the process of resolving the philosophy and modus operandi of operating our extra-plant manufacturing organization. It is to be expected that the organization may change, but I believe we have learned some valuable lessons relating to the value of placing responsibility with local managers and would advance the values of proceeding on a course which will take this into account.

I propose the following organization.



To the largest extent possible, I believe the principle of following the idea that we are a multi-national company and that foreign activities should basically be run like any regional activity, is a good one, substantiated by the experience of others.

INTEROFFICE MEMORANDUM

DATE September 27, 1966

SUBJECT Recruiting Literature

TO Ken Gold (Technical Publ.) FROM Bob Lassen

- - -

We desperately need a good recruiting brochure. The brochure I have in mind should tastefully introduce professional people, college students and if possible, technical school students to DEC's growth and career opportunities. It does not have to be elaborate (glossy pages, etc.,) nor does it have to contain 25 or 30 pages. I think we should be able to come up with an attention-getting, professional-looking 4 to 6-page leaflet.

As you know, we are constantly expanding our recruiting efforts, including engineering (24 colleges to be visited between now and April), and we are severely handicapped by the lack of introductory literature.

I would like to have the Product Line Managers and Ted Johnson review the copy and layout of the brochure before it goes to press.

cc -- K.H. Olsen
S.C. Olsen
W. Hindle
N. Mazzarese
T. Johnson

RTL/bjz

INTEROFFICE MEMORANDUM

DATE September 27, 1966

SUBJECT Drafting Committee Report

TO Ken Olsen

FROM Drafting Committee

In a series of introductory meetings, the drafting organization, its present operations and a display of example drawings which illustrated drafting problems were presented and explained in detail. The purpose of these meetings was to familiarize the committee with drafting and to provide a basis for establishing an agenda. Here is a general view of some of the problems that were discussed:

I. Planning, Scheduling And Controlling Drafting Effort

There should exist in drafting the necessary procedures and controls for the orderly planning, estimating, controlling and scheduling of drafting jobs. This would provide for a more meaningful commitment on completion dates and total manhours required to complete a task.

Many changes are now accepted during the various phases of drafting namely layout, assembly, detailing, wirelist, etc., delaying other jobs from being worked on. Thus the draftsman is kept on a job for a longer period of time than was first anticipated. In addition engineering is not totally aware of the affects the many changes have on the manpower and schedules. In some cases knowledge by engineering management of the impact of the changes may well prompt decisions to revert to some other plan. Moreover, management must decide what type of service is required of drafting. If the many changes are unavoidable drafting should then take this into account and provide the necessary service requested of them.

There also seems to be a universal tendency for engineering to underestimate the manhours required, or the time needed to complete a job. This results in drafting not meeting the delivery dates set forth by engineering.

Drafting should adopt a system of recording more thoroughly, data relating to manhour requirements for particular drafting functions. In this way a comparison of actual versus estimated time can be obtained to determine what variations have occurred, their extent and causes. Steps can then be taken to develope new or revised policies, and practices to eliminate conditions which are unfavorable.

II. Reporting System

There is little or no communications between drafting, engineering managers and product line managers. The committee feels it is important that the engineering managers realize the extent and cost of changes, especially when there is reworking or revising of engineering work already completed. If the scope of jobs become more complex requiring a change in the overall schedule, drafting should be able to go to the people concerned and forewarn them of the situation that has arisen and of the effect it will have on the manpower and the departments ability to meet the due dates.

As an engineering planning guide drafting could periodically provide the engineering managers with an estimate of drafting lead time.

Also no procedure exist for determining job priority. It was suggested that each task be given a priority number much like the modules are controlled.

III. Levels Of Documentation

The committee proposes that the company establish levels of documentation relative to prototype, limited production, full production and one of a kind items. The level of documentation for a single unit would be different than one requiring many hundreds. With regards to this, the committee would define minimum requirements. These would allow a unit to be made the first time, maintained in the field, and documented well enough so that it can be made again.

IV. Types Of Drawings

A suggested list of drawings with the help of all departments concerned should be established. And a definition of what their intended use is. It was brought out that manufacturing circumvents some types of drawings in the place of models. And that manufacturing provides their own drafting information whenever the drawings do not give sufficient information. Most of this, however, can be related to not knowing what production needs are, what type of drawing form is most conducive to transmit information to facilitate production and to what extent the unit should be subdivided so as to depict prime assemblies, subassemblies and parts list.

V. Part Numbers

There is a serious need for providing part identification for all usable parts. It should also be in such a form that departments requiring the information can have easy access to its contents. The Purchase Specifications Manual should include many additional

hardware items and be kept current. Because of this, many drafting hours are spent in digging up the information in catalogs or going to the stock room for the information. Drafting is not aware of the many items that are available in the stock room. This information is essential in making a complete and accurate parts list. It also provides the draftsman with the necessary dimensional hardware information needed to complete a drawing.

In Conclusion: The many changes in logic design, the many reruns of the wirelist, changes in electromechanical design, logic symbology, decisions, "Go Aheads" before design is secured does contribute to drafting's performing adequate service. However, it was pointed out that many of these so called deficiences can be interpreted either as a problem or as a service. In others it may reflect carelessness on the part of, or pressure on the engineer. Finally, it was noted that the Production Department is a bit undiciplined and does not always follow the drawings.

Committee Members:

Loren Prentice
Gordon Graham
Robert Savell
Saul Dinman
Pat Greene
Bill Segal
Clark Crocker
Edward DeCastro
Richard Richardson
Roger Melanson

September 26, 1966

Trichlorethylene Tank

Loren Prentice
cc: Ken Olsen ✓
Wally Mason
Ray Michel

Frank Kalwell

COPY

We are encountering some difficulty with the new system which houses trichlorethylene near the traffic dock. It seems weekly the excess trichlorethylene shoots out of the pipe near the outside of the traffic dock. Last Friday, it just missed the UPS driver.

I'm primarily concerned due to the pipe being level with an individual's eyes, the danger of blinding a person can easily occur.

A suggestion would be to mount the pipe in a different position or install a check valve, which can be checked by a responsible person daily so the excess can be drained.

FKalwell

INTEROFFICE MEMORANDUM

DATE September 23, 1966

SUBJECT Your Question on ASR-33's

TO K. Olsen FROM J. Smith

60 cycle units are available, and we are keeping up with delivery requests.

50 cycle units have been a problem for sometime. Current status is as outlined below:

Required for this Month's Schedule:	15
Available:	13
	-2

Nineteen (19) are owed to the field. Twelve (12) are owed to the PDP-6 Group.

The key problem area has been the delivery of 50 cycle motors from Teletype. Henry is writing a report on past delivery history and what we can expect in the future.

9/23/66

John Culkins Bob Lassen

SUBJECT: Janitor Service--Silk Screening

The people in Silk Screening have asked for more hampers for waste disposal. In addition, Ken has suggested that the Silk Screen people clean up around their own area and then our janitors could sweep down the corridors each day.

RTL/jfr
cc: K. H. Olsen
C. Kendrick

Ken
done
10/11/66

INTEROFFICE MEMORANDUM

DATE September 23, 1966

SUBJECT

TO K. Olsen
L. Prentice

FROM J. Smith

In reviewing the operation and organization of our future wire-wrap section, I am convinced we require a mechanically competent individual with managerial potential to head up this section.

I have been quite impressed in past working relationships with an engineer currently within the organization. The man is Ron Cajolet, who I feel has the potential of becoming a strong section manager once he gains experience in this area. Ron has been working directly with me for some time on our current wire-wrap sub-contracting project. He has shown initiative, imagination and a desire to get the job done.

If possible, I would like to offer this opportunity to Ron to work with us in my manufacturing organization.

The last class at Gardner-Denver was cancelled. They are in the process of scheduling a new class. I intend to send four (4) men to this class to train as shift operators.

Don Shaffer, the man we hired with machine operation and maintenance experience, should be with us in December.

Ken

I have done the ground work with Loren. With your OK I'm sure he will agree

Jack

dec INTEROFFICE MEMORANDUM

DATE September 22, 1966

SUBJECT PDP-10 Review

TO Ed Harwood
Nick Mazzarese

FROM Win Hindle

Thank you both for a conscientious review of the PDP-10 project. I appreciate the time and effort you and your committee members gave to the review. It has given us both a list of problems to solve and a higher level of confidence in our plans.

I think the process of review is one we should continue on new projects at the same stage of development as PDP-10, i.e. before public announcements have been made.

cc: Ken Olsen

dec INTEROFFICE MEMORANDUM

DATE September 22, 1966

SUBJECT Summary of visit to DEC August 28-Sept. 2.

TO Win Hindle
Stan Olsen
Nick Mazzarese

FROM Gordon Bell

CC: Ken Olsen

General

I enjoyed the above, but feel the exchanges could take place in 1-2 days. In the future, I will come for a short period to exchange, unless there is a large design to work at, or a program to debug. I would prefer to spend time outside Maynard on anything I'm asked to be a critic of. So, if there are needs along these lines, I would be happy to oblige.

I am interested in 3 specific projects to personally work on, in addition there are another few hundred which I feel only I can do well, but must allocate to someone else due to my physical limitations. Therefore, I'll contribute by memo, and would like to get on internal memos distribution regarding these subjects.

Specific Projects

Three projects that I would like to work on are:

1. Plan very low cost computer which costs .6 x PDP-8I and extends upward beyond PDP-10. Design and implementation of low machine, and specify high end point.

2. Design and implement logic design checking program to examine logic signals, loads, wires, etc.

3. Help specify PDP-8ITS (with 8K core, 680 system, fixed head disc, and tape back-up = $50,000) including software for time sharing.

I intend to start writing down solid ideas on the above 3 subjects, and will start conversing with people at Maynard and here.

Specific Memos (re. trip)

1. PDP-10
2. PDP-8 ITS, Desk Calculator
3. Publication of articles by DEC professionals
4. Doxiadis Associates
5. PDP-8/680/IBM 360/Message Switching/and Data Phone
6. PDP-8S, general comments
7. Problems in drafting program (to be sent)
8. G-15 Simulator
9. SDS Manuals
10. Loan of JOSS Console to Allen Newell, Carnegie

Misc. Discussions

1. The PDP-8/338 is to be used to tally election returns. I assisted in finding ways to avoid using the PDP-6 to help with the job, and making the display simple.

2. Finish Time Sharing paper.

MEDINET

Jack Brown asked me about the possibility of my designing a special purpose message switching computer, helping in disc selection, etc. A copy of my written reply to Jack will be sent to the above (not on DEC stationery).

Medinet currently has a loaned DDP-116 which they may use as a message switcher. Apparently there is one at Keydata which is more or less operational. He knows of the STC PDP-8/680.

Jack feels DEC has been aloof, and from the raiding by Medinet, there may be reason to avoid them.

Critics/Design Reviews

I feel that review of projects by sympathetic, patient reviewers can significantly contribute to DEC designs and designers. Doing it, is not an honorary job, and may require nearly the work of the original design. I've looked over some designs, and invariably:

1. Learn something of immediate benefit.
2. Contribute to savings at production and/or field service level.
3. Contribute by making suggestions about documentation which will aid future understanding.

The review hasn't been real effective yet at DEC because of attitudes, and production pressures, and unwillingness of reviewers to work. The specific projects which I feel can use perusals now are:

1. PDP-8S and its options
2. PDP-10 processor
3. Apparently 338

I think that Ed DeCastro, Larry Seligman, Al Kotok, and D. Gross could all be used effectively in logic review. In fact, not using Ed DeCastro to peruse the 8S is hurting it and Ed.

Modules and Integrated Circuits

I attended the first discussion on the above, and was happy to find the subject being considered. I'm certain this alone will have some good effects on customers. To show a more serious side, announce the power supply, pin configuration, DEC-DEC 1 Interface circuitry, and mount the integrated sockets (those that you plug IN LINES into). Users of present hardware can incorporate some of their own purchased integrateds into the DEC hardware.

For the line itself, probably the standard configurations will be used, but I believe only as an interim (2 years) because taking the IC's and mounting them on a board is not really an advance.

The group designing the configurations should look at Wes Clark's work, consult with him, and if possible hire him to specify the logic. His macro modules may not be ready yet, but at least in their preliminary or speculative state, they give the user an advantage inherent in IC's. With little interconnections a large function can be specified and implemented. Hopefully, this will provide the logic designer with the ability to program symbolically rather than in octal.

The present IC Module mounting companies provide lines with: simple gates, flip-flops, and lots of functional elements (like the old DEC 422X series with 8 flip-flops in a counter). I don't agree with this: simple gating (for control), plus 1 or 2 general elements with built-in adder, shifter, read-in, read-out, etc. that does all.

PDP-9

The software seems to have taken a very great turn for the better. Since there are so many nice fundamental features in it, I hope that question of shared users (fixed process plus one additional general purpose user) gets resolved. In discussing memory protection and device allocation for shared use, I hope the hardware proposal can be made firm (in the next day or so) so that software implementation can react. Almost all machines being marketed in this price and use range now do have this ability (IBM 1800, Sigma 2, CDC 1700, etc.). Enclosed are detailed programming manuals of Sigma 2, Sigma 7, etc. I'd like them back, but apparently there are no copies yet at Maynard.

PDP-9/338-9

Hopefully this can be avoided (but apparently there is lots of customer pressure). The most intriguing possibility is a rope programmed PDP-9 processor to implement the picture processor. At least remotely it seems great.

RAND Tablet to DEC Product Lines

Apparently the interface to a PDP-8 has taken place. It would be nice to offer it as a standard option, though the Tablet is very expensive. The 8S/RAND Tablet at least appears to me to be an interesting (but probably low volume) product, as:

1. General converter of graphical to tabular data (e.g. Bensor-Lehner equipment, etc.).
2. Evaluation of integrals of pictorial data (e.g. area of heart, etc.).
3. Conversion of hand-printed or hand-written characters to digital form.

8S + Other Discs

I was delighted at Ken Fitzgerald's confidence and progress on the disc. At its expected price it should be a real winner. From where I sit, the large disc is still an important ingredient of a system, and I hope they can go on to it. He attributes a fair amount of success (and he admits he's not there yet) to lower pressure, and goals which are easily attainable by state-of-the-art standards.

I hope that a 6 or so million bit fixed head disc will be settled on, because it seems to satisfy all requirements except carry away, and people should use tape for that.

INTEROFFICE MEMORANDUM

DATE September 22, 1966

SUBJECT Sign-Off List of Machines Shipped

TO K. Olsen FROM J. Smith

Per your request, you will start receiving a Zerox copy of the acceptance sign-off list of all machines and options being shipped. An example is attached. Is this sufficient, or do you require additional information?

TEST AND INSPECTION RECORD (Refer to Perm. Memo 1177 dated 11/18/64)

JN _____ ITEM _____

EN _____ CUSTOMER _____

Project Engineer assigned _____

Intermediate QC Inspections	Date _____	By _____
Checkout Completed	Date _____	By _____
Margins		
Room Temp.	Date _____	By _____
Elevated Temp. at _____ °F	Date _____	By _____
Final QC Inspections	Date _____	By _____
Released by Project Engineer	Date _____	By _____
Acceptance Test	Date _____	By _____
Final QC Approval and Release for Delivery	Date _____	By _____

Dear Mr. Olsen.

I just wanted to express our thanks for the lovely time we had Saturday.

The children were thrilled by it all and I was grateful for the opportunity to meet some of the other Digital families.

Mrs. Sherwood M. Kidder

Again, many, many thanks.

Cordially

Carol B. Kidder

9/18/66

digital MEMO

DATE 9/22/66

TO Ken Olsen FROM Bob Lassen

Notes like this are most gratifying. Sam Kidder is a new Engineering Assistant and a fine young man. We had been trying to attract him to DEC for several years and finally Clark Crocker persuaded him to join us.

RTL/jfr

dec INTEROFFICE MEMORANDUM

DATE September 22, 1966

SUBJECT Module tooling

TO K. Olsen
S. Olsen
R. Doane
D. White
R. Savell
D. Widder
N. Perryman

FROM C. Kendrick

It was decided this morning at a module guidance community meeting that we will make production tooling for existing modules in accordance with the following monthly usage broken down.

1000 and over
Drill and insertion plates as previously supplied to Area B.

250 to 1000
Drill and insertion plates as previously supplied to Area C.

under 250
Drill and insertion plates similar to the eyeball drilled plates now in use except they will be produced on the Moog.

Tooling for new module releases is still under consideration.

The following is a list of modules still not tooled as they fall in these broad categories:

1000+ monthly usage
R113
R123
W011
W021
W034

250 to 1000 monthly usage

A601	B204	G211	W005	W026	W033	W103
B141	B213	G603	W020	W027	W040	W501
B169	B301	R121	W023	W028	W050	W600
B171	G007	R122	W025	W032	W102	

100 to 250 monthly usage

A604	B123	B212	G009	G803	H900K	W031	W108	W607
A704	B131	B360	G010	G808	R131	W051	W300	W612
	B133	B620	G206	G850	R200	W054	W510	W700
	B168	G005	G207	G882	R405	W061	W532	W750
A704	B210	G008	G604	H161	W022	W070	W601	W989

W990
W994

under 100 monthly usage

	A202	A502	A706	B135	B165	B250
A101	A300	A605	A990	B137	B167	B310
A111	A401	A606	B124	B155	B200	B320
A130	A500	H702	B130	B156	B211	B401
A201	A501	A705	B134	B163	B220	B405

B681	G800	H905	W505
B682	G801	H906	W506
G002	G802	R105	W511
G080	G804	R115	W512
G081	G805	R208	W520
G082	G809	R303	W590
G210	G851	R402	W602
G250	G852	R450	W681
G251	G870	R613	W684
G252	G900	W007	W690
G260	G903	W024	W701
G261	G904	W036	W706
G262	G920	W038	W707
G277	G971	W042	W800
G278	G980	W052	W802
G279	G982	W053	W903
G250	G998	W071	W980
G283	H001	W073	W985
G370	H002	W100	W991
G601	H104	W101	W995
G602	H152	W310	
G609	H900	W500	
G620	H900J	W502	
G684	H904	W504	

INTEROFFICE MEMORANDUM

DATE September 22, 1966

SUBJECT -- Training Department Equipment

TO -- H. Mann FROM Bob Lassen

My major concern over the new non-capitalization (90-day roll over) policy of equipment used in the training department is that we will not be able to replace this equipment when it is needed. Training is not a production unit or a customer and therefore has a rather low priority when equipment is scarce.

We are willing to live with an occasional hardship but I do not want the group to waste a lot of time scrounging for equipment and I do not want to water down the effectiveness of our courses because of inadequate facilities.

I therefore feel that we cannot give up a computer or related peripheral devices unless we have a suitable replacement.

Attached is a memo dated September 13 from Bob Pate indicating the status of equipment currently being used by the Training Department.

cc -- K.H. Olsen
S.C. Olsen
N. Mazzarese
W. Hindle
J. Smith
M. Ford
J. Jones
J. Shields
R. Pate

Robert T. Lassen

RTL/bjz

INTEROFFICE MEMORANDUM

PERSONNEL

SEP 14 1966

DATE September 13, 1966

SUBJECT Equipment in Training Department.

TO Norm Anderson
Harry Mann

FROM Bob Pate

Re: Memo of same subject dated August 26, 1966.

The following is the current status of all equipment that was or is in the Training Department.

PDP-5--1	Not a saleable computer. Note serial number. There is no other PDP-5 like it in the world. It was returned from LRL. Reason unknown. It was in such poor shape that it took us over two months to get it running again. It would take almost a total rewiring to make it a saleable computer.
PDP-5--62	No longer in our possession. Mike Ford has this one in Building 6A.
LINC-35--18	Not in our possession. Mort Ruderman's area has this one.
PDP-8-77 CP-UNK MEM-UNK	At present not a saleable computer without major modifications. Returned from Chicago area. Reason unknown.
PDP-8--127 CP-167 MEM-140 Hi-Speed Reader-Punch-78-----	Saleable Computer. Punch and reader tied into this computer by Programming group to facilitate their assembly and editing work. Think it should be capitalized and not rotated the same as computers.
PDP-8--250 CP-306 MEM-271	Saleable Computer.
PDP-8-441 CP-522 MEM-459	Raw production computer. Presently being checked out by students as part of their training. Due to be returned to production for acceptance at end of course.
PDP-8--442 CP-476 MEM-468	Raw production computer. Presently being checked out by students as part of their training. Due to be returned to production for acceptance at end of course.

c.c.: Bob Lassen, Dave Edwards, Jim Davis, Jack Shields

PDP-8-441 and 442 raise an interesting question that should be resolved. Since they are being checked out by students who are logging G activity, rather than M activity, their (the PDP-8's) manufacturing cost will not reflect the checkout labor. Conversely, if they are required to log M activity, it will not reflect a true picture of the checkout labor since the students require a longer time to accomplish the same tasks done in the Manufacturing area.

Since these machines are the exception rather than the rule, I recommend that they be asterisk and not included in any cost accounting being done in connection with PDP-8's.

Quarterly rotation of saleable computers within the Training Department and Field Service can only become a reality if someone other than the interested parties is appointed to monitor the situation. Further unless the requirement to provide replacements is made directive in nature to manufacturing (i.e. Jack Smith) rotated computers will not be replaced in a timely manner thus causing great reluctance on the part of those required to rotate a machine to give them up.

c.c.: Bob Lassen
Dave Edwards
Jim Davis
Jack Shields

DIGITAL MAYN

XEROX CORP BOX 1540 RCXXX ROCHESTER NY SEPT 22

ATTN GOULD AND K OLSEN

PER CONVERSATION ENTER THE FOLLOWING ORDERS
663471 FOR 2200 PCS X002 NAND GATE BOARD
663472 FOR 330 PC/X003 INVERTER BOARD
663473 FOR 330 PC X004 BUFFER BOARD
663474 FOR 1100 PC X005 AC FLIP FLOP BOARD
663475 FOR 220 PC X007 .3A DRIVER BOARD
663476 FOR 330 PC X008 1A DRIVER BOARD
663477 FOR 440 PC X011 TRIAC DRIVER BOARD
663478 FOR 10DXXX 1100 PC X001 NOR GATE BOARD
AUTHORIZATION FOR SCHEDULING, KITTING AND COMPONENT PROCUREMTN OXXX IS HEREBY GIVEN. ACTUAL PRODUCTION OF BOARDS AND ASSEMBLY SHALL BE AUTHROIXXX AUTHORIZED BY SUBSEQUENT WIRE OR YOUR RECEIPT OF PURCHASE ORDERS WITH XEROX PRINTS.
BASED UPON, ABOVE INITIAL DELIVERIES AS DISCUCXXXX DISCUSSED WILL BE DELIVERED BY D E C ON NOBXXX NOVEMBER 14 UNLESS OTHERWISE NOTIFIED BY RETURN WIRE

ROBERT W BURNHAM

XEROX CORP

CRR 663478

dec INTEROFFICE MEMORANDUM

DATE September 22, 1966

SUBJECT A Production Problem - Module Mix and Order Changes

TO Cy Kendrick
Galen Davis
Jack Smith
cc: Ken Olsen

FROM Rod Belden

The rate of module production has increased steadily during the last 6 weeks to a point where Cy is turning out a consistent 2,500 modules per day. As we start into October and November where the goal is 3,500 modules per day (70,000/month), I feel we should give more thought to how we can:

1. Improve correlation of the produced module mix with the ordered mix. (Mix problem) - felt most severely by computer production.

2. Reduce the through put time of a module request from approximately 8 weeks to more nearly 4 weeks or less. (Response time) - felt most severely by module sales.

Mix Problem

At a time when inventories are low, a correct mix of modules is more effective than a large volume of modules. Correct mix is closely related to good scheduling. To relieve the pressure of scheduling a production backlog of 80,000 modules in September, we forced the product lines to absorb the backlog during September, October and November. Instead of placing "new orders" for 60,000 modules during October, new orders were held down to less than 10,000 modules. In addition, both October and November requests were scheduled by week. Therefore, production should have little uncertainty of what to deliver, when.

However, I am not happy with the improvements in mix during the first 4 weeks of September. Excepting delays caused by material shortages, I think the continued poor correlation of mix arises from:

1. Incomplete control over scheduling
2. Large work-in-process inventories (Response time)

Production issues (starts) are not yet current and on a correct mix schedule because the circuit boards are not ready. But are the circuit boards being produced to the same schedule? Until this week, Galen Davis seemed to have little control over the schedule for the board department. The board schedule has been left to Herb Norton's judgment of the backlog and orders on Galen's sequence list. My theory is that module production should be treated as ONE CONTINUOUS PROCESS, and therefore should follow one schedule. A common schedule should not prevent each area manager from taking advantage of large lot size efficiencies (as in drilling and screening), it just means that the output of each production step (whether screened

today or two weeks ago) should follow the same schedule. If large lots of one board are being sub-contracted, this can also be anticipated by the overall schedule.

Response time

During the past few days I have discussed treating the November module requirement as fixed. Of course, this is not because we want to further restrict the product lines, but because I feel that the module work-in-process level is too high and the schedule backlog too long to permit a 4 week response to an order change.

Let me juggle some numbers to illustrate:

New order received:	October 4th - first Tuesday
New module production schedule ready:	October 11th - Second Tuesday

Result - 3 weeks left in October to respond to a change in module type or quantity for early November delivery. Production response time is headed towards:

Test time		1/3 week
Assembly time		2 weeks (longer if sub-contract)
Stock room for set-up		1 week (to cover for material shortages, G. Davis would like 2 weeks lead time for boards here)
Drill, Etch, Scrub, Plate		2 weeks (last week the work-in-process for board preparation was 30,000 modules)
	Total	5 1/3 weeks

This is a low figure, for we are now sub-contracting both etched boards and hand assembly work with longer response times. And unless we start to check this now, when the rate rises from 2,500 to 3,500/day (a 40% increase) the response time may get longer.

If we have materials and working equipment, why should it take more than 2 weeks to schedule, drill, etch, plate, assemble and test a lot of modules? Cy has been responding to Jack Smith's "critical list" with that general response time.

With a 2 week cycle time (schedule to shelf) we could concentrate our $ in raw material inventories (where our hedge against the uncertainties of the outside world should be) and give product lines a 2 - 4 week delivery service. Finished goods inventories would remain at a low level. However, if we do continue to require a 4 - 8 week lead time on orders and cannot match the mix by week (even with a controlled volume), then I would expect that finished module inventories will rise back to the 4 - 8 week level.

Recommendations:

1. Galen Davis and Herb Norton follow the same schedule for boards, starts, and deliveries. Sequence is determined by acquired delivery date, time in process, and efficient lot groupings.

2. Drill and etch largest lots that drill capacity and etching time will permit.

3. Get better control of changes to modules. A rate of 11 changes per week at an average of 200 active module types gives an "average" tooling life of 18 weeks. This doesn't seem to be correct - what's wrong here?

4. Cy should weekly review the issues (starts) mix vs. the actual requirements.

jeb

dec INTEROFFICE MEMORANDUM

DATE September 21, 1966

SUBJECT PDP-8/PDP-9/680/IBM360/Message Switching/and Data Phone

TO N. Mazzarese FROM Gordon Bell

CC: H. Painter
J. Jones
D. Murphy
K. Olsen
M. Ford
S. Olsen
W. Hindle

Summary

This whole area is difficult to say the least, and I really sympathize with anyone trying to sell or interface the maze of equipment. Hopefully, there is a market which will justify it. My feeling is that DEC computers will be increasingly interfaced to large Time Shared Systems, especially when the 100 or so IBM 360 model 67's start being delivered. This type of communications equipment will be so important, I feel, that a Data Phone interface should be a low cost, simple option for PDP's-8, 85, 9.

Products

It looks as if there are several basic markets in the order:

1. Conventional DEC experimenter who wants to transfer results to larger system for computation or have a powerful terminal (2400 baud bit synchronous transmission).

2. Message concentration at a remote or computation center site for sending via 2400 baud data phone line or direct line to central machine.

3. Casual Message switches for transmitting data of varied forms (the Tally, and Digitronics market).

4. Serious message switching. (Like the 680 sold to STC.)

The amount of systems software support is approximately in the order shown above.

Item 2, if connected to the 360, could be programmed to be identical to the IBM 2701 or 2702 which do a similar job, but for 4 times more $.

Item 4 appears difficult, that only someone taking system responsibility should undertake the program.

I hope that Carnegie will use a PDP-8(s) to handle their message switching, in which case the development of Item 2 could be enhanced.

360 Interfaces

The interface being built as a special job will hopefully be available in the Product Line. It seems very expensive, but though there may be little hardware, the interface will be costly.

The three places I know of interfacing are:

1. The Multiplexor or Selector Channel.

2. The Direct Data Connector.

3. 2701 Direct Attachment.

IBM cost, increases in the order above, while DEC's interface cost decreases. The IBM System programming problems are probably least with #1. The degree of system isolation increases starting with #1. All in all, the interface mode will depend a great deal on the customer, his knowledge, ability, $, etc.

Dataphone and Teletype Interfaces

There seems to be about 4 types that are important:

1. Asynchronous 7.0, 7.42, 7.5, 10.0, 0v11.0 unit code operating up to 180 baud (Teletypes, IBM 1050's, JOSS, Typewriters). The 11.0 unit code is now most common, to be replaced by 10.0 unit code.

2. Synchronous transmission, one bit at a time which goes from 1200 to 50KC (Telepak), but all looks similar.

3. Asynchronous 1200-1800 baud.

4. Parallel 8 channel (may be obsolete).

These are ordered in decreasing use. Items 1 and 3 are nearly identical. Items 2 and 4 are the simplest to interface.

Aside from these data modes, there are a number of signal levels.

In summary:

1. The 680 handles item 1 nicely.
2. A simple, programmable 12 bit shift register which Don Murphy and I worked out handles item 2 (taking up about 3% PDP-8/line at 2400 baud). This could be improved by a mod. to the 680 instruction.

3. Item 3 can be done by either the 680 instruction at a large cost of computer time, or preferably using the new Teletype modules.

4. Item 4. Hope that it gives away.

5. Item 1 also requires the ability to answer the phone, and dial back.

There is an interface which has been delivered (of type 2). This seems to be desirable as a product, and it is hopefully the one which gets built into 8 or 8S. There is enough logic space in the Reader/Punch/etc. logic for it. All markets would use this type (item 2) of interface.

Product Confusion

This stuff is messy. There must be a primer somewhere by the phone company, which summarizes use various data transmission modes, signals, uses, etc. This is urgently needed, when this communication becomes more prevalent. Last year, the phone company did more transcontinental interconnection business with machines than people.

If a sufficiently enlightening 8 text can be written, it's worthy of a section in the Module Handbook, to say the least.

dec INTEROFFICE MEMORANDUM

DATE September 21, 1966

SUBJECT BTL GRAPHICS II DISPLAY SYSTEMS

TO Nick Mazzarese FROM Mike Ford

cc: Bill Long
Ken Olsen
John Jones
Dave Brown

Based on discussions with B. Long and D. Brown, I recommend that we do the following with regard to Graphics II:

1. Notify BTL today - 9/21/66 - that we definitely will build Graphics II.

2. Since we have had insufficient time to study the prints and the formats, we have not decided whether or not to plan Graphics II as a standard product.

3. The project will be the responsibility of B. Long's group, with D. Brown as an advisor, and a new man as project engineer.

4. I feel that within the next two weeks, we should be able to estimate a price and design a project plan for the systems. At that time, we will present a written proposal to BTL indicating the magnitude of product support we are willing to provide.

Mike

ejb

dec INTEROFFICE MEMORANDUM

DATE September 21,1966

SUBJECT NEREM Guest Tickets

TO Ken Olsen

FROM Tim McInerney

In the past, we have ordered a large quantity of guest registration tickets, which were distributed to our employees for the NEREM Show.

The normal registration fee to attend NEREM is $3.00 a ticket, but if we order a quantity of 1,000 or more tickets, our maximum cost, if all of them are used, would be $400.00 or $.40 per person. Any number under 200 of these tickets used will cost us $1.00 each. Last year, I believe we paid for 135 guest registrations at a cost of $135.00. Should we plan on ordering these guest registrations for this year at NEREM?

TJM/jdr

orig to Nick

DIGITAL MAYN

LSI EID ANMM
9/20/66 MSG. 274 8:10AM

MR. KENNETH H. OLSEN, PRESIDENT
DIGITAL EQUIPMENT CORPORATION
146 MAIN STREET
MAYNARD, MASSACHUSETTS

LSI/EID IS IN RECEIPT OF YOUR LETTER OF 9/14/66 RESTATING YOUR TWX OF 9/8/66 AND YOUR EXPLANATION OF THE DELAY IN THE SHIPMENT OF 338 BUFFERED SYSTEM, PURCHASE ORDER L-24177.

LSI/EID AGREES THAT ALL HARDWARE ITEMS HAVE BEEN DELIVERED SINCE YOUR FIELD REPRESENTATIVE, ED RIELLY PERFORMED ACCEPTANCE TESTS TO LSI/EID'S SATISFACTION 9/16/66 WITH THE FOLLOWING EXCEPTIONS TAKEN:

(A) VARIOUS SCRATCHES ON SLAVES (SHIPPING).
(B) ONE SECTION OF GRAPH PAD (WIRE MODE) NOT DEMONSTRATED TO CUSTOMER SATISFACTION.
(C) TWO 250 FOOT CABLES TO SLAVES HAVE POOR WORKMANSHIP, BROKEN GROUND LUGS, MESSY SOLDER JOINTS, ETC.
(D) L.P. SENSITIVITY KNOB MISSING.

AFTER VIEWING THE DEMONSTRATION OF TWO 338 MASTER AND SLAVE DISPLAY ON 16, SEPTEMBER 1966, IT IS THE OPINION OF LSI/EID THAT THE UNITS ARE ELECTRONICALLY PERFORMING TO THEIR STATED SPECIFICATIONS. HOWEVER, THE DEC DIAGNOSTIC SOFTWARE AND THE DEC DESCRIPTIVE LITERATURE TO SUPPORT THIS EQUIPMENT IS NOT COMPLETE NOR FINAL. LSI/EID CAN ONLY GRANT TENTATIVE ACCEPTANCE OF THIS EQUIPMENT AND MUST WITHHOLD FINAL ACCEPTANCE UNTIL SUCH TIME AS THE OVERALL SYSTEM IS TURNED OVER TO THE GOVERNMENT, OR UNTIL THE FINAL DOCUMENTATION AND SOFTWARE PACKAGES ARE COMPLETE AND TURNED OVER TO LSI/EID BY DEC.

LSI/EID MUST STILL CONSIDERS THIS PURCHASE ORDER OPEN AS "NOT TOTALLY DELIVERED" AS WAS INDICATED BY YOUR TWX OF 9/8/66.

LSI/EID MUST BE ADVISED BY LETTER TWX NO LATER THAN 9/21/66 WHEN TO EXPECT DELIVERY ON THE BALANCE OF THE SOFTWARE INCLUDING 338 MANUALS THAT HAVE NOT BEEN RECEIVED TO DATE.

DON REIDARSON, BUYER
EBU

INTEROFFICE MEMORANDUM

TO: Product Line Managers
Ken Olsen

FROM: Ted Johnson

SUBJECT: Translations

DATE: September 20, 1966

Jean Francois said both CDC and SDS (CITEC) used English technical manuals, not French translations. But he strongly recommended translations for seminars and the logic handbook. In other words, we should translate enough to help Frenchmen understand our literature. But, English is more efficient, generally. He claims IBM doesn't translate much of their material. In software, for example, English terms are used in the programs, so the literature best ties in by being in English.

TJ/mr

INTEROFFICE MEMORANDUM

DATE September 20, 1966

SUBJECT

TO C. Kendrick
N. Mazzarese
M. Ford

FROM J. Smith

cc: K. Olsen ✓
R. Belden

Attached you will find a detailed breakdown of the receival activity to the Small Computer Stock Room for the first three weeks of the month.

Outlined below is a comparison of receivals against requests.

Types Ordered: 146

Types Received: 85

58 Per Cent

Weeks' Request: 14,792

Quantity Received Against Request: 8,243

56 Per Cent

Once again, the total number of modules received was very good as indicated below; but the module mix situation continues to present problems.

Number Ordered: 14,792

Number Received: 15,223

103 Per Cent

MODULE RECEIVAL STATUS REPORT

Week Ending: September 16, 1966

TYPE	QUANTITY ORDERED (WEEKS 1, 2 & 3)	QUANTITY RECEIVED (WEEKS 1, 2 & 3)
A101	2	
A502	4	5
A601	23	
A604	8	
B124	3	9
B130	18	55
B131	22	28
B141	236	60
B155	1	33
B169	74	108
B171	88	195
B200	42	25
B201	233	100
B204	39	36
B210	73	47
B213	111	110
B301	15	20
B310	11	
B360	24	138
B401	15	12
B405	5	8
G002	128	183
G007	215	282
G008	32	37
G010	8	8
G081	22	46
G208	94	200
G209	362	380
G210	6	
G211	51	
G283	35	8
G601	10	10
G602	15	10
G603	327	150
G622	9	
G620	12	
G800	3	1
G802	15	
G804	6	
G808	29	
G805	13	
G850	68	
G851	83	
G852	48	
G882	20	
G903	5	
G920	7	
R001	36	30
R002	179	

TYPE	QUANTITY ORDERED (WEEKS 1, 2 & 3)	QUANTITY RECEIVED (WEEKS 1, 2 & 3)
R105	8	
R107	353	546
R111	35	381
R113	68	80
R121	47	66
R122	7	108
R123	93	439
R131	7	7
R141	260	550
R151	94	56
R181	5	
R201	323	487
R202	871	138
R203	93	299
R205	298	6
R210	597	294
R211	570	217
R220	288	24
R284	5	60
R302	171	
R401	83	124
R405	31	
R601	2	3
R602	99	87
R603	309	36
R650	416	207
S107	498	395
S111	83	
S181	35	
S202	47	
S203	139	110
S205	116	
S284	81	
S602	232	100
S603	932	395
W016	2	
W017	2	
W005	60	180
W011	207	784
W021	383	433
W025	255	122
W027	33	59
W033	41	191
W034	1400	1291
W040	129	203
W042	10	
W051	14	20
W070	150	175
W103	105	110
W300	67	175
W500	1	4
W511	17	29
W602	33	15

TYPE	QUANTITY ORDERED (WEEKS 1, 2 & 3)	QUANTITY RECEIVED (WEEKS 1, 2 & 3)
W607	56	62
W640	379	129
[illegible]81	3	10
W700	33	101
W750	133	140
W802	33	
W990	85	182
1011	11	
1113	3	
1501	9	1
1534	13	
1535	21	
1567	13	
1575	9	
1579	12	
1609	7	
1685	6	
1705	5	
4102	93	12
4113	111	5
4127	142	28
4151	9	
4215	40	
[illegible]21	3	
4222	38	
4227	5	
4228	33	
42281	18	6
4261	1	
4303	24	
4306	3	
4523	50	
4526	7	
4603	12	
4605	15	
4688	3	
4689	25	3
4903	20	
4905	54	
4910	23	
4912	72	18
6102	67	41
6122	2	
6202	1	
A704		34
B[illegible]04		25
B105		452
B113		22
B115		150
B123		46
B620		199

TYPE	QUANTITY ORDERED (WEEKS 1, 2 & 3)	QUANTITY RECEIVED (WEEKS 1, 2 & 3)
B681		13
[illegible]84		147
G001		52
G091		4
G900		8
R303		14
S211		200
W019		14
W020		99
W023		87
W026		200
W032		484
W050		89
W071		172
W101		24
W501		75
W505		1
W600		13
W601		10
W612		24
W701		83
W980		261
W989		38
[illegible]5		1
1802		4
4141		20
4301		10
4410		4
4529		7
4530		30
4680		21
4702		3
4707		4
6106		1

INTEROFFICE MEMORANDUM

DATE September 20, 1966

SUBJECT Desk Calculating and Editing - Special Purpose Time Sharing and the PDP-8/8S/8I/8ITS.

TO

N. Mazzarese
Mike Ford
H. Burkhart
S. Olsen

FROM

Gordon Bell

CC: W. Hindle
K. Olsen ✓
L. Portner

Summary

I would like to nominate Desk Calculators for the largest potential market for the 8S.

The chief problems appear to be the need of a large marketing/sales organization, and servicing. Hopefully, NCR, Xerox, etc. or some large (in number of outlets) might take on the task. The introduction of the 8I (at <$5000.) will require even greater numbers of sales, and therefore, applications oriented marketing (to supplement OEM) seems desirable.

I would hope that a programmer could be added now, whose sole job is the above. Conceivably the same goal could be accomplished by a system's programmer who specializes in the above application. I would expect the 10 and 9 to both have similar "fringe" programs.

Hardware Configurations - Desk Calculator

1 User basic 8S
2- 10 users basic 8S + 680 interface or low cost teletype interface.

>10 users PDP-8

A supplementary drum, as an option (the 32K word variety) would allow users to retain previously defined functions, and larger procedures.

Keyboard - Desk Calculator

This is the big sales point that the Frieden, and Mathatron etc. people make. My personal feeling is that a 33 KSR and/or 33ASR (use the tape to punchout long procedure definitions for re-use) would make a better console (compromise of: $, serial data transmission, hard copy, universality, no messy small screen TV to look at, etc.). The only problem, the keyboard lay-out, could be made an advantage, by re-arranging the keys for numbers, functions, etc. By using full duplex, any translation of functions, numbers, etc. to printing could be obtained.

Another alternative, still using a Teletype, full duplex, is to make an overlay, with its own keys which depress the other teletype's keys. This would have the advantage of key re-layout, re-shaping, and different color-shape coding.

Arithmetic Component - Desk Calculator

This is the most crucial part of the design, since users like decimal numbers which though they may be held in some other form, do not change in conversion both in value and form i.e. $.12 = $.12 and not 1.1999 X 10-1. An old PDP-1 program, Expensive Desk Calculator, handled the problem well, and its author, Bob Wagner (formerly at RAND), and now a doctoral candidate in computer science at Carnegie might be available to help or do the job. At any rate, the PDP-6 JOSS arithmetic routines are a starter for technique.

Functional Part - Desk Calculator

Here, the possibilities are unlimited, and range from:

1. Friden 1 SCM
2. Wang/Wyle/Mathatron

To Computer Forms:

1. PDP-8 Desk
2. PDP-6 Desk
3. Expensive Desk PDP-1
4. Carnegie Desk Calculator (enclosed)

5. CDC 6600 Desk (They have their own console kludge.
6. Quicktran
7. Glen Culler's (U. of Cal. - Santa Barbara)
   - can see it at Harvard.
8. BBN Telecomp (BBN's attempt to JOSS)
9. CAL (U. of Cal. Berkeley - JOSS attempt)
10. JOSS I
11. JOSS II
12. Something yet to be developed in the early 2000's.

Extended Functions - Desk Calculator

In a few years, it appears that a small machine will be able to solve algebraic integration, and differentiation problems. This should not be considered in the design but only a point of awareness for longer range marketing of a similar type of product.

Special Purpose Time Sharing

It is my feeling that one form that Time Sharing will take is to have many specialized centers which supply only one service. A message switching computer (a 680) can provide switching, supply desk calculator capacity, and may even do editing for larger systems.

Although I wouldn't want to be challenged yet, I have the feeling that a PDP-8(with a file) could take over the above three functions in the previous MAC system. Though this form of processing would apall the generalists, it may make a lot of sense from a cost standpoint. A proof of this will advance a lot when BBN's experience at TELECOMP, using PDP-9 and PDP-8 for the 680 are revealed, along with some real accounting of T-S Systems.

Editing

Editing (General Text, programs, etc.) will require about the same processing capability. File storage is required. Console of the Teletype 37 variety, JOSS II, and IBM 1050 will probably be used for more general editing, but a 33/35 will suffice for some.

DEC, to a certain degree, has pioneered some of the concepts used in editing, and though it isn't ready from a market, design file availability standpoint yet, this will be a big future market that works easy. The editors I know about are:

1. PDP-1 (MIT, BBN)
2. PDP-7/8
3. IBM - ATS (Administrative Terminal Service)
4. MAC 1 PDP-6
5. PDP-7 (a la Edinburgh)
6. TECO PDP-1, PDP-6, PDP-6(MAC), MAC Context

The file requirements of a small system can be handled by a 6 million bit (1 million characters) fixed head file of the type dreamed of by the DEC marketing people. This would allow a random access capability of:

$$\frac{\text{1 million characters}}{\text{1 Disc}} \times \frac{\text{1 WORD}}{\text{5 characters}} \times \frac{\text{1 page}}{\text{200 words}}$$

Or 1000 pages of text/Disc which would give users quite a good system. Backup for the disc should be on tape, magnetic tape, as a low cost, simple form of carry-away-storage.

Hardware for Dedicated Time Sharing System - PDP-8ITS

1 - PDP-8I (8K Memory)	K$ 20.
1 - 6 million bit fixed head disc	12.
2- user 680 System (without stations) + 2400 baud dataphone interface	5.
1 - Tape Unit	10.
	K$ 47.

In this regard, such a system would offer:

1. File creation and storage on disc with Manual Tape Sign on/Sign off.
2. Desk Calculator
3. Some running of small system's programs, e.g. FORTRAN, Automated Drawing, Hyphenation, etc.
4. Communication with other consoles, and other systems.

4K core would be devoted to common functions, I/O, and 4K core would be the largest data structure of a common procedure or single program to run. Protection trapped I/O, a clock, and a definition of system-user communication would be required of hardware.

The disc should transfer at a very high speed, and if there is a speed problem on the 8S, a programmable interleave mode could be added. DON'T SLOW DOWN THE DISC!

BBN Telecomp System

Program size is approximately 6K x 18 bits on a PDP-1. Each user area is 512 words. Thus a 16K system handles 20 users. Each 512 word block is a window in a linear data array for a user. The rest of the array is stored on their swap drum.

The system was hoped to provide a 30 min. wait for 10% of the users calling in, and 50 subscribers, so far, do not yet have this long.

They charge an initial fee + $12.50/hr. for use. The initial charge will be undoubtedly eliminated. I've their manual, and recommend its perusal.

Carnegie Institute of Technology
Computation Center

James B. McIlroy
Ralph P. Schneider
Roy R. Weil

October 26, 1965
CC086.

THE DESK CALCULATOR

The DC (Desk Calculator) is an on-line, conversational routine for use on the Carnegie Tech G-21 Time Sharing System. Its function is to evaluate algebraic expressions typed at a remote teletype and to immediately type back answers. Hence, the DC can be used to do a simple arithmetic problem or to do a hand simulation of a complicated program in order to locate bugs.

To call the DC, obtain type-in in the normal manner by dialing in to get line 0 or by pressing BREAK while in the WAITING state. Type in the control line

$ = LOAD : CALC <carriage return>

If DC is available, it will type back the vertical bars indicating it is ready to accept input. Otherwise, an error message will be printed.

The DC operates in upper core, so it can continue to operate while other programs are being run on both central-processors in the normal manner in lower core. Since upper core may be in use by other programs, there may be times when the DC cannot be called; if this occurs, a message will be printed out suggesting that you try again some other time. The DC itself, however, can be used by a number of users at the same time.

The general method of operation is as follows: The user types in a line of one or more statements, followed by a carriage return. The DC evaluates these statements, prints out any values that were requested, and gives the user type-in. The user then types in another line of one or more statements, followed by a carriage return, and the cycle continues. This back-and-forth action (conversational mode) can continue as long as the user desires. If the user presses BREAK , the DC will zero the variable region, printing out a message to indicate that this was done. If BREAK is again pressed, operation will be terminated. (Variables may be zeroed many times, if statemauts are processed between pressings of the BREAK .) If the user does not type in a new line within a certain time after the last operation of the DC (approximately 7 minutes), the DC will assume that the user has gone away, and it will turn the TTY off.

A statement is similar in many respects to an ALGOL assignment statement; however, conditional expressions (if---then---else---) are not allowed. There are available for use 26 real variables, represented by the letters 'A' through 'Z'. The following arithmetic operations are available, with heirarchy as indicated:

Done first:	↓	Truncation
	↑	Exponentiation
	*/	Multiplication, Division
Done last:	+-	Addition, Subtraction

Operations of the same heirarchy are performed left to right. Parentheses may be used in the normal manner to change the order of operation.

Seven standard functions are available, and are used by following the function name (listed below) by the argument enclosed in parentheses; the argument may be any expression except an assignment statement and may include other functions. The functions are:

ABS	Absolute value
EXP	Exponential, i.e., e^x
LOG	Log to the base e
SQRT	Square root
SIN	Sine
COS	Cosine
ARTN	Arctangent

Constants may be typed in as integers, decimal numbers, or in scientific notation, i.e., ALGOL numbers. Two fundamental constants are also available, typed as PI, and e, typed as EE.

A line of input consists of a series of statements separated by semicolons. A statement may be in one of the following forms:

<VARIABLE> ← <EXPRESSION> <TERMINATER>

The variable is set to the value of the expression.

→ <VARIABLE> ← <EXPRESSION> <TERMINATER>

The variable is set to the value of the expression and this value is printed out.

→ <EXPRESSION> <TERMINATER>

The value of the expression is printed out; no variables are changed.

→ <VARIABLE> <TERMINATER>

The value of the variable is printed out; no variables are changed. Note that → indicates that a value is to be printed out. A <TERMINATER> is either semicolon or carriage return.

Various errors such as illegal characters, improper constructions, etc. may occur in a statement. When this happens, an error message will be printed out. If arguments to a subroutine are impossible [i.e. SQRT(-4)], an error message will be given. An ↑ will appear with all error messages below the column in which the error occurred. Processing stops immediately on the first error. All statements previous to the one containing the error will have been evaluated, and any values requested printed out. The statement containing the error and the ones following it will not be evaluated.

The DC ignores all blanks and tabs (control characters). If CTRL-U is typed as last character, the line will not be processed.

Iteration Facilities in Desk Calculator

There now exists some very crude iteration facilities in desk calculator. It is possible to return to the beginning of a line of input for a specified number of times or because of a given condition.

At the point where iteration is desired, use the subroutine LOOP (N) where N is any expression. N will be evaluated once and the line will be repeated from the beginning to the LOOP N times. Caution: the card will be looped over a total of N+1 times.

Three conditions can be tested for: negative, positive, or zero. The three subroutines IFOM (E) or IFOP (E) or IFOZ (E) are used where E is any expression. E will be evaluated each time that the subroutine is executed. If the condition is met, operation will be returned to the beginning of the line. If the condition is not met, operation will pass to the next instruction.

NOTE: Due to the time-sharing nature of the desk calculator, it cannot calculate for long periods of time. In order to implement iteration, the part of the line that is repeated over must contain a request to print out some variable. If nothing is printed, the error message TOO MUCH TIME will be printed and the operation will be terminated when it runs out of time (anywhere from two to five times through the loop).

If you find that you are in an infinite loop and wish to terminate it, press BREAK which will then give you type-in for the next line. Pressing break at this time does not zero the variables.

NOTE: All four subroutines use the same switch. Therefore, it is meaningless to have more than one of these on the same line.

INTEROFFICE MEMORANDUM

DATE September 20, 1966

SUBJECT PDP-9 REVIEW

TO MEMBERS OF PDP-9 ENGINEERING REVIEW COMMITTEE

FROM Jack Shields

We plan to start on the review of the PDP-9 project on Friday, September 23rd. I am listing a schedule of the review and we will try to take events in this order.

1. Overall Design Concept, Logic Organization, Specifications, Interfacing
2. Schedule
3. Circuits
4. Memory
5. Reliability, maintainability, diagnostics
6. Mechanical Design
7. Production Engineering

Members from the PDP-9 group will be Larry Seligman, Ed Harwood, John Jones and Marv Horovitz. I have asked Don White to be a member of this committee at the suggestion of many of the people involved in this project. We feel that Don can contribute significantly with his experience in the PDP-7.

I have asked the PDP-9 group to make very brief comments in the various areas listed above; overall philosophy, etc. Larry Seligman has already issued documents which explain a number of these things.

I hope the committee can conduct the review without the need for formal presentation, as sometimes the presentations are voted on rather than the project. I ask you to pay special attention to the PDP-9 Sales notebook where interfacing and mechanical design areas are explained further. It is important that the members of the committee take the time to familiarize themselves with all of this material so an effective review can take place. We will supply prints to the committee members prior to our first meeting. The committee members are expected to take notes and submit a formal report at the wrap up session.

The first meeting will be scheduled between 9 a.m. and 12 noon on Friday, September 23rd in the conference room in Administration (H. Anderson's old office).

The second meeting will be held on Tuesday, September 27th from 8:30 a.m. until conclusion in the same conference room.

The committee will meet again on Thursday, September 29th at 8:30 a.m. in a wrap up session, same conference room.

K. Olsen

memo to PDP-9 Design Review Committee
re Engineering Presentation
from L. Seligman
dated Sept 19, 1966

Introduction

On December 13, 1965 I proposed, formally, the PDP-7X to the Works Committee. The PDP-9 described herein is that machine essentially unchanged. The major design goals have been met. This presentation is divided into several sections as listed below. The engineers participating in the design of that section are listed in ().

a Mechanical (Cajolet)
b Power supply (Bank)
c IO (Bank)
d Memory (Hughes)
e Processor (Vonada)
f Circuits (Sogge)

Mechanical

The new 31" bay is a product of the PDP-9 project. A better design than the 19" cabinets, it provides increased size at no increase in cost. Cable entry ports are simpler as is access to the modules and other system components. The color scheme is more in keeping with modern equipment design and the trim hardware has been redesigned to be more attractive, more functional, and lower in cost.

The front of the cabinet holds the maintainence area, the Reader/Punch, the power supplies, and the console. The DECtape, initially expected to mount in the basic IO frame, was removed for lack of space. Hence, the DECtape transports and control electronics will mount in their own cabinetry.

The console has fewer indicators on it than previous consoles yet is capable of displaying more information. This is accomplished through the use of a "register selection" switch which enables the selected register to the indicators. Those indicators meaningful during a running program are displayed continuously. These include the IO system status, the Link, and , for use in single stepping for maintainence, the MB. Since there are fewer indicators, there are fewer cables, greatly simplifying what is usually a rather difficult cabling problem. They have also been layed out for ease in installation. The hardware of the console, like the rest of the computer, is designed out of a number of independent, simple subsections which easily connect both mechanically and electrically.

The console is also more functional than previous small computer consoles. It is possible to stop the program, examine or deposit into a number of registers, and then continue the program, never having disturbed the AC or PC. Similarly, a dump program which saves the entire machine state can be loaded using Read-In. An IO RESET key clears all IO device flags at the loading of a new program.

The logic is mounted on the rear of the cabinet. Three sections are mounted to a hinged post, forming a door which swings out for ease of module replacement, test on extender boards, or access to the front of the cabinet from inside. Each frame is checked off line with its own cooling and power distribution system before being installed with the other two frames into the cabinet. Installation involves attaching the frame to the post with 3 screws, plugging in the cables, and attaching 7 power jumpers.. The original intention with the cabinet was to wrap as large an area consistent with good cooling as possible, however, the frames will be individually built and tested. Two frames may be wrapped simultaneously.

The cooling systems blow air across the cabinet rather than up into it. This permits the wrapping area to be unbroken from bottom of the cabinet to top. Since air need only pass through 8 rows of modules rather than perhaps 16 or 18, it is quite sufficient at room temperatures in the basic bay. Performance at elevated temperatures has not yet been tested. Measurements indicate that a plenum or the plastic strips will increase air flow over the top row of modules by an order of magnitude should this prove necessary. The goal is to ship systems without the need for a clumbsy plenum.

Power supply

As described in detail in a previous memo, the PDP-9 group has designed a new power supply and a new power control designed to eliminate problem inherent in earlier designs.

The power control is specifically designed to eliminate (or at least) minimize the entry of spurious signals from a noisy environment into the computer cabinet. It provides a 30 A service facility, properly fused. Features include indicators to warn of improper wiring at the installation site, convenience outlets, and a set connections permitting either remote or local control.

The new power supply is specifically designed for use in the 31" cabinet. Supplying sufficient power for the Link-8 or Big-8, two are required by PDP-9. Its most significant feature is that is useable on either 50 or 60 cps and at a number of line voltages from 100 to 230 VAC.

IO

The IO frame includes the following standard and wired-in optional devices:

Standard	Optional
Reader	API
Punch	34 Display
Teletype	Power Fail Sensor

The reader and punch have been slightly modified to include out of tape sensors to eliminate the need for programmed wait loops and to make it possible to change tapes while a program is running. The teletype and power fail sensor are essentially unchanged. The 34 Display, also unchanged from PDP-7, is capable of driving an X-Y (as opposed to incremental) plotter also.

The most changed option is the API (Automatic Priority Interrupt). The need to redesign it came about because of the introduction of the IO bus described below. The new options services interrupts at four levels of hardware and four levels of software priority, making possible simple programming of complex data gathering/reduction problems. The system directly identifies 32 separate sources of interrupt and yet only requires 12 wires on the bus.

The majpr change in the IO system from PDP-7 is the use of an IO bus to interconnect the perhipherals with the processor. Data transmission on the bus takes place at DC levels with both the device and the processor strobing data into registers. Of the 72 signals (and 72 grounds) on the bus, about half are required by devices using only program controlled transfers, the other half are used by devices connected th the API or the data channel. The bus is so designed that the effects of an electrical failure or worse, a short, will have minimum effect. For most failures, both the processor and the IO devices in the basic IO frame will continue to operate.

A new flip-chip connector has been designed for the IO bus. This connector contains 36 signals (and 36 grounds), plugs into the standard 144 pin connector block, and is mechanically sound. A locking screw holds it in place and a heavy handle both strain relieves the cable and facilitates insertion/removal. Two cables with connectors are required to transmit the IO bus.

The data channel, an extension of the 3 cycle data break used on the PDP-8, provides a multiplexed cummunication path between the memory and IO devices that is both fast and inexpensive. Each of the 8 devices possible on the channel has an independent set of word count and address registers in core. The channel transmits or receives data words from the devices under control of these registers as requested by the devices. There are no instructions to the channel itself, rather, all initialization of transfers is done through commands to the IO devices themselves. Since the data and control lines to and from the devices are identical to the lines used for program controlled transfers, a set of maintenance IOT instructions are automatically provided.

The data channel has special provisions making it even more useful in real time data collection. The channel may be used in a memory increment mode common in pulse height analysis work, or in an add to memory mode which facilitates use of the computer as a signal averaging facility. Address count may be inhibited for those devices (eg. DEC tape) which do automatic searches. Outgoing data transfers require 4 cycles, the additional microsecond is used to allow data to settle on the IO bus.

For the internal devices and certain perhipherals on the bus, it is possible to single step through the entire operation of the data channel or the IOT instruction and observe data in the AC (or MB), on the bus, and in the device register - all at the console without a scope. The API and data channel address word may also be observed. This facility should greatly simplify detection of errors in the IO system.

Memory

The PDP-9 memory represents DEC's first attempt to use a $2\frac{1}{2}$D memory system. Its operation is detailed in the sales notebook. The chief advantages are increased speed over 3D for any given core size as well as savings in stack costs. Higher speed results from improved current risetimes due, in turn, to shorter drive lined and from the freedom from inhibit noise during read. While the need to stagger digit and word read has an adverse effect upon speed, it makes possible signal to noise ratios 4 times better than 3D memories. The stack is inherently cheaper since it requires only 3 wires to thread each core and reduces stacking costs.

When the initial decision to make the memory $2\frac{1}{2}$D was made, the cost of 20 mil cores was prohibitive. Hence the goal of making as fast a 30 mil system as possible. Subsequent price reductions in the 20 mil stacks will enable us to phase in a 20 mil version of the memory. The increased cost of the stack will be more than compensated for by the decreased cost of the drive electronics. Both versions will run at 1 usec.

The need for a resistor pannel and special memory powersupply have been eliminated by the design of special modules which plug into the logic. The memory stack itself is completely pluggable, the vendor terminating cable ends in DEC connector boards as in PDP-8. The sense lines are the shortest, the drive lines the longest, permitting any one to be examined with a current probe.

Memory expansion is accomplished by adding another checked out memory frame to a PDP-9 system. No wiring changes need be made to either the processor or the original memory. Parity is offered as an option.

Central Processor

The design of the central processor evolved after many basic designs were evaluated. Redline design as in the PDP-8 was eliminated because the accumulator would not be fast enough for EAE operations. Conventional design, like the PDP-7, was eliminated since the integrity of pulse with and flip flop delay could not be maintained sufficiently well to insure reliable operation in production quantities. Both of the above designs suffered from the need for special register flip flops.

The design which eventually evolved is quite unconventional. All registers are composed of a standard flip flop which is buffered but has no logical delay. An extra register, the AR, has been added to make elimination of the delays possible. Since it is necessary to delay the memory as little as possible during a read/modify/write cycle, the register configuration was specially tailored to do so. The fast adder was disassociated from the registers so that it could handle incrementing the sense amps as well as other adding /counting functions within the registers. Once the design called for the disassociated, DC,adder it became possible to share shift paths amoung the registers. Most of this facility is unused in the PDP-9 instruction set.

The major advantage in the DC design is that no logical delays are required in any register operation. The only critical timing requirement is that input gates turn off faster than data paths change. THe major disadvantage of the DC design is the more complex set of control signals which must be generated to control the data paths.

To simplify this control logic and to reduce the number of active elements in the processor, a magnetic core control memory was developed. The memory,using the cores as pulse transformers, stores the sequences of control signals necessary to operate the processorfor instructions, for the console, for the data channel, etc.

Output pulses from the control memory are approximately 2 volts in aplitiude, bipolar about a -1.5 volt reference. They are strobed into the level input of the standard flip flop which also serves as a busdriver to provide the control levels.

Most of the hardware in the processor outside the register section is involved in generating addresses, controlling micro-programmed instructions, and general logical operations where the control memory is not particularly convenient to use. The machine also benefits from being small. The central processor requires a 320 module pannel while the PDP-7 required 512 module spaces for the same circuitry. Lead lengths are short and no twisted pair is required in the processor.

Circuits

Circuit design of the basic elements; the gate, the flip flop, the adder are quite conservative. While the flip flop is designed to operate at 10Mc under heavy loading, no register element is operated above 2.5 Mc. The amount of wire on each node in the register section has been minimized by careful layout. The adder module is a result of several months work, first to find a suitable organization and circuit geometry and then to design a circuit stable under changing temperatures, voltages, and component parameters. Designs using inverter logic, lookahead, special large gates, etc. were rejected; instead, current switching majority logic was chosen for both speed and number of components. While each stage of the adder can have carry propagate times under a nanosecond in the ideal conditions of the test bench, system performance under noise conditions, overshoot, ring, etc. brings the average propagation velocity up to over 3 ns per bit. The logic is designed to with with an adder averaging as high as 5 ns per bit worst case. Both the flip flop and the adder dissipate considerable power in achieving speed.

The gate model is basically a 2 ma input diode gate configuration. It is the prototype for the new diode gate modules proposed for PDP-10. The logic section of the processor uses the standard R111 diode gate with R002 expanders. To achieve high speeds, the internal clamp is tied to the node. Typical TTT's for these modules is on the order of 15 ns.

A final circuit of note is the new PA. Replacing both the W607 and equally unsatisfactory W640, it provides 2 output pulse widths. The narrower 120 ns pulse is sufficient to pull over a R202 through a diode gate; the wider pulse is as wide as possible from a transformer PA at a 1 Mc clock rate. This PA is used in the IO section, on the sense amplifier outputs, and in the processor.

INTEROFFICE MEMORANDUM

DATE September 19, 1966

SUBJECT Xerox Proposal

TO Ken Olsen
Harry Mann

FROM Robert F. Dill

As DEC has acquired additional space and personnel the problem of timely copying and proximity to copying machines has been a problem. Much time has been lost by secretaries in traveling to and waiting for a copy.

DEC presently has the following equipment in house:

Quantity	Type	Monthly Rental	Area	Building
1	914	$ 90.00	Purchasing	5
1	914	90.00	Sales Administration	12
1	330	90.00	Computer Admin.	5
1	813	32.00	Mechanical Eng.	4
Total		$ 302.00		

In addition to the above, there is a Dennison copier on the third floor of building 12.

The following is a list of buildings and functional units these copiers must service:

Building	Functional Unit
12	Corporate Administration, Programming, Technical Publications, Sales
11	Gold Plating, Design, Storage
8	Storage
8A	Storage
7	Crating and Shipping
6	Production D and Northeast Sales
5	Engineering, Manufacturing, Accounting, Purchasing, Personnel
4	Machine Shop, Sheet Metal, Drafting
3	Training, Semi-Conductor Processing

The personnel and administrative groups that use the Xerox heavily are located in building 12, 1st, 2nd, and 3rd floors, building 5, 3rd, 4th and 5th floors, and building 4 in the drafting area.

I propose that for $302 basic monthly cost (not to be confused with total cost which is basic monthly rental plus a per copy charge) DEC could rent eight 813 Xerox machines. This would allow greater proximity with less wasted time due to waiting for use of a machine, save hours of travel, and have a less expensive monthly rental (i.e., $302 vs. $224).

I further propose that the machines be located in the areas which have the greatest use based on existing log records. The machines should, I believe, be located as follows:

Building 12

Floor 1	None
Floor 2	One Type 813
Floor 3	Dennison Machine

Building 3

Floor 3	One Type 813

Building 4 and 6

Floor 3 of building 4
One type 813 to service both buildings

Building 5

Floor 1	One Type 813
Floor 2	Two Type 813s
Floor 3	One Type 813

This type of coverage would adequately service our needs for some time and would tend to decrease the cost associated with our present copying setup.

The 813 machine can service most of DEC's copying needs and does not have a multiple copying feature. This, I believe, is good and will discourage multiple copying in excess of requirements and will, hence, be a step in the right direction.

I believe that the machines should be assigned a control clerk as we currently have who will submit the Xerox log to the Treasurer's Department on a weekly basis.

I am aware that moves are contemplated which will shift personnel between buildings 5, 12, and 3, however, this has been taken into consideration in the above proposal with the final result that buildings 5 and 12 will still bear the heaviest use.

RFD/clw

dec INTEROFFICE MEMORANDUM

DATE September 19, 1966

SUBJECT PDP-8 S, General Comments

TO S. Olsen/S.Dinman

FROM Gordon Bell

CC: N. Mazzarese
M. Ford
D. Packer
K. Olsen

The packaging is great. At last a table top computer. It's too bad that you don't get an I/O device, according to the ads, for that price.

Options

At least, according to the ads, there are lots.

These options compromise and complicate the design. Do people really want extended arithmetic, and extended memory packages? Can any memory type be added? Especially when the incremental price difference is $8K between the 8 and 8S. The extended memory, and direct memory access plugs look like a bit tricky from a production standpoint.

The I/O options (standard 8 plus small disc) do seem very attractive though.

An alternative to the 3 cycle data break is to use the I/O Bus for data transmission, holding the AC (temporarily) in another register while the transmission takes place to avoid another box.

The communications of the ACM (June, July, or August) has an article about a computer glass delay line memory computer (about 50,000 bits, and 100 microseconds maximum cycle time).

The 8/S/KIT seems desirable for the home and school trade. If the Kit A-D's work out, this might be a good product. A few people have asked me about making them.

Market Strategy

Though it doesn't appear necessary to have a strategy other than order and ship it might be useful to treat a segment of the market as though it were being attacked instead of the market attacking DEC. This planning strategy could be used to reduce sales cost, and increase sales (though not needed now, the 8I may need it).

At its price there must be a few million potential applications. As sales are made, it might be useful for a tally to be kept of customers, sales costs, applications area, total installation cost, number of users of the equipment, etc. in order to assist future planning. The cards included in a toaster, washing machine, etc. sent in at warranty time are a good starter of the type of analysis.

I would like to see a matrix of market areas, size, costs, etc. to aid in future machine planning.

Design Review

I had hoped that either Ed DeCastro and/or Dave Gross could spend several days reviewing the logic. I've only looked at it 2 times sketchily prior to prints, and it seems a very worth while thing to do prior to production, since there will be a re-layout. Dave Gross and I have spent some time, but if encouraged, Dave could spend more time. We have made reductions each time we have looked at the prints, and feel more are possible.

The pulses which go to the AC from the AC switches, unless carefully routed may be a source of noise.

I found the prints a bit difficult to read because of errors, incompleteness, and not enough mnemonics, but these can get remedied easily if the maintenance manual writer works closely with Saul.

A "shake table" test at various frequencies might be valuable to see when the unsupported back panel wires will break off.

dec INTEROFFICE MEMORANDUM

DATE September 19, 1966

SUBJECT PDP-10 Review

TO Win Hindle FROM Ed Harwood

cc: K. Olsen R. Best
J. Shields L. Seligman
E. DeCastro R. Savell

This report is a summary of the comments of the review committee. I wish to thank Win Hindle, Bob Savell and the rest of the PDP-10 team for being so helpful. They were well prepared on a very short notice. I also want to thank my task force for responding so well and giving such well prepared comments. The future task forces should probably include a diagnostic programmer. The report will follow the format of the presentation given by the PDP-10 group.

R. Savell - Overall engineering plan and schedule.

The engineering plans are very thorough and well documented. Bob covered the PDP-6 problem areas and explained how they would not happen on the PDP-10. His schedule looks reasonable but we expect it to slip because of the lack of enough circuit designers. The fast memory looks like a problem. We believe they are starting it too late and might rush the design thereby causing production problems. We were unable to get a clear picture of the role of the new diagnostics in the total test system. A potential problem is the lack of a schedule for maintenance manuals.

Steve Mikulski/Jim Sullivan - Production Plans.

The production plans appeared to be very vague. If they expect to meet their goals of a PDP-10 per week, we believe they should have people actively engaged in tester design at this time. We feel that the CP should be tested in logical sections in order to meet their proposed rate. To check out one half of the CP (9 racks of logic) in one large chunk will be very time consumming and requires extremely high trained people.

R. Clement - C.P. Logic Design.

The C.P. design seems to be going quite well. The design is conservative and should not present to be a problem. Their plans to use the B131 adder at 2 ns per bit seems unreasonable in light of its 5 ns spec. and experience in the PDP-9 system. We would have liked to see more documentation on the choice of internal configurations.

J. Sutton - Circuits.

Joe is presently evaluating circuitry and this should be well documented and distributed throughout the company. We like the idea of using fast diode gating throughout the system. This should increase reliability and simplify checkout if they can minimize the number of types. The decision to use a single type flip-flop rather than specialized register modules is excellent however the decision to use delay lines instead of double ranked register was not convincing. We seriously doubt they can build their basic PA with a pulse width spec of $\pm$ 2 ns.

Dave Nevala - Mechanical

The overall cabinet design appeared quite good but also expensive. The console is quite impressive. The "extra panel" doesn't look good so early in the design. We would like to see an easier way to change a bulb. Their arguments regarding cooling, frame size and usable module space were not brought out clearly.

D. Chin - Memory

Memory design looks good but plans for system expansion were confused with Chin and Savell differing on what would be offered. There may be a marketing problem here. We take exception with Dereck's decision to use the G209 memory driver since it has been a troublesome in the Small Computer group. We suggest they spend some small amount of time looking into the possibility of building the system from several small pieces such as the Control Data 6600 system. Cooling system is different than rest of the computer.

General Conclusions

The project as a whole is well planned, well documented and seems to be progressing well. The only areas that really bothered the committee were the vagueness of the plans whereby the transition from engineering to production takes place and the unclear production plans.

There was some disappointment that a design effort of this magnitude did not produce any new and exciting technical developments which could be used throughout the company.

INTEROFFICE MEMORANDUM

DATE 16th September, 1966.

SUBJECT Your High-Throughput rate problem.

TO Gerry Moore. ✓
c.c. Ken Olsen
Nick Mazzarese
John Jones
Mike Ford
Dave Cotton
Howie Painter
Ted Johnson
Mort Ruderman
Bill Long

FROM John Leng.

In the U.K. we have come up against the same problem on two occasions.

Disc storage was not essential, simply a fast bulk storage system. In fact, I believe that this is not the best application for a disc as it quickly runs out of storage in many of these experiments.

The best solution at present, I believe, is a medium performance tape system. A standard reel of tape can hold approximately 23×10^6 characters at a 800 bits per inch packing density. This gives over ten million conversions of 12 bit accuracy which is adequate for the majority of experiments. If one runs this tape at 75 ips this allows a maximum throughput rate of 30,000 events per second, and a maximum running time of 6 minutes for a single tape. This is about as fast as our A to D equipment can go at the present time and therefore seems fairly well matched.

The new tape planned for the PDP-9 with its controller, at a guess, looks as if it could sell in the region of $25,000. Thus for $70,000 we can put together a very competitive medium performance signal processing system.

/ Cont'd.....

Gerry Moore. 16th September, 1966.

Our problem at Southampton required two A to D converters to get the processing speed on two input channels. Our 570 tape system was fast enough but unfortunately was far too expensive with the controller at around $50,000. Our solution here has been to engage the help of the Plessey Co who manufacture their own version of the 570. This has a higher performance with a top speed of 150 ips and with electronics sells for $15,000 in the U.K. Since the customer is not concerned with using the tape for general programming problems and in addition can tolerate the occasional error, it is possible to get away with a simple tape control system. It is hoped that Plessey will design this with our help and interface the system to our computer. As you can see the customer will be able to get a system of twice the performance possible with our tape units.

In a number of cases it will be possible to persuade other customers to relax their specs somewhat to meet our equipment, provided we're in there early enough. However, I believe there will be a real need very shortly for a reasonable cost tape system of the performance of the Plessey system to meet more of these requirements.

The added advantage of the tape system with full IBM compatability is that it provides compatability with larger computers. It doesn't look as if discs will ever fill this gap. In addition to this, unless one goes to a very large and expensive disc, then the experimental running time will be too short. For many test-bed runs on gas turbines and rockets, etc., it appears as if they'll need the capacity of a reel of tape and in some cases will want to use two tape systems for quick changeover on extended runs.

What I'm asking for then, is to receive the final details on our new transport and to know that we are working on a system capable of 150 ips and 800 bpi which will be available during 1968 and can be sold in 1967. There is, however, still a need for a disc system for other computing reasons, and I hope progress is being made towards this end.

John

dec INTEROFFICE MEMORANDUM

DATE September 16, 1966.

SUBJECT Entering and leaving building 11 during noon break

TO Ken Olsen

FROM Tony Bader

CC: Cy Kendrick
Loren Prentiss

Do to the inconveniences of entering and leaving building 11 at noon, we would like to propose the following system.

Upon entering at 8:15 and leaving at 5:00, all employees from board processing will continue to use either the Main Street or Thompson Street entrances.

During noon break, however, we respectfully request permission to leave by the back door located in the board processing area. Either Steve Olsen or myself will take the responsibility of opening the door at 12:00 to 12:10 and at 12:35 to 12:45, for people of board processing only.

We will assume all responsibility for safeguarding company property and guarantee that, at no other time during the day will this door be open..

AVB/tmv

INTEROFFICE MEMORANDUM

DATE September 16, 1966

SUBJECT Heating Traffic Dept.

TO Loren Prentice

FROM Frank Kalwell

With the winter months approaching, I'd like to insure that the Traffic Dock is properly heated and conducive to working.

This will be the first winter in operation, so perhaps we can install a canvas type closet around the dock door only, so when the door is open, cold air will not circulate throughout the floor.

A heater, similar to the one in purchasing, could also be considered.

Please advise me on your plans.

Thank you.

cc: Ken Olsen
Stan Olsen

dec INTEROFFICE MEMORANDUM

DATE September 15, 1966

SUBJECT PDP-10

TO
Win Hindle
Bob Savell
Bob Lane
Larry Portner

FROM
Gordon Bell

CC: Alan Kotok
Ken Olsen ✓

What a great machine! I wish that I had specified its console rather than the PDP-6 prototype for my leave of absence-going-away present.

Advertising

There was mention in the ads copies I saw of a PDP-6. Although the 6 reliability now may be reasonable, the ill feeling of initial un-reliability will probably swamp this out. If not, no matter how good or bad a machine is, everyone now wants a 3rd generation machine, in hardware, software, and system organization.

Third Generation

I would like to see it be a third generation machine because:

1. Increased reliability
2. Extended marketing life
3. Lower manufacturing cost
4. Extended marketing as third generation
5. Form basis for integrated circuits module product line.
6. Less circuit development. (Wow, will people pounce on this one.)

The reasons not to are:

1. More circuit development
2. Shift in schedule
3. Logic will have to be re-done.

At least, I would like to see a one hour objective discussion by people who can see no alternative than to go ahead as planned.

Logic Organization

How do the traps for non-existent ops (floating point and friends) work, so that a reasonable execution time can be had? How about an instruction pair which: ACMOVE(M) AC, POINTER

Where POINTER specifies the AC which is loaded or stored? Some quick way to get at the AC and op code specified, alternatively place the op code, AC, Effective Address in 3 separate registers.

The 6 monitor refers half of its UUO's to user area, could this be implemented in hardware, to decrease the overhead for user mode UUO's?

The RAND MODE for JOSS seems like a good way to get pure procedures. This costs very little in hardware, yet gets rid of 1 of 2 fundamental objections to the project/relocate scheme.

Some users of PDP-6 felt more PI channels should be added, is this debateable?

When the disc is available, memory tap is required. Would an acceptable form of transfer be to use the I/O Bus data transmission path to first send word count and address followed by data which gets handled in the processor? Thus only 1 memory cycle is required instead of 3.

Reliability

Other than starting with "perfect" circuits, building in reliability is a bit difficult. In changing to completely diode logic with no stacked inverters, problems still arise. The reliability of PDP-8's, according to J. Shields, is poor (< 1000 hours). It would be well to get an ordering of its problems to see if any are due to this type of logic, and/or Red Line gating.

dec INTEROFFICE MEMORANDUM

DATE September 15, 1966

SUBJECT Publication of Articles by DEC Professionals

TO K. Olsen

FROM Gordon Bell

CC: W. Hindle
R. Ward

During the latest session at DEC, with the help of Dick Ward, I submitted a paper for the December IEEE proceedings computer issue on Time Sharing. The paper was the 3rd draft or so, and though still rough, the information was there in a form clear to me. The paper was about 10,000 words, 150 bibliographic citations, 6 figures, and 2 tables, taken from an original 8000 line outline. I would appreciate comments on it from people at DEC. I spent about 6 weeks or so (2 weeks at DEC plus DEC typing) and may have another 1 or 2 weeks to spend.

Aside from being more work than I had hoped, and finding out how difficult it is to communicate, it did clarify a number of thoughts on the subject. In short, I recommend writing papers as a means of subject understanding. Survey papers are especially good.

With the possibility of a new line of modules, a paper could serve to summarize for all, the configurations, logic choices, needs, costs, etc. and if the paper is successful, provide a rather basic foundation for sales-development work.

A similar paper was recently written for discs, and appeared in DATAMATION, but was not too well organized with the exception of tables. It's probably time for one of these on tape systems, but specifying cost, reliability, too.

dec INTEROFFICE MEMORANDUM

DATE September 15, 1966

SUBJECT Space

TO Ken Olsen

FROM Win Hindle

Your memo of September 12 on space neglected to mention Bill Long's group and Mike Ford's group. My understanding at the space meeting was that the sequence was as follows:

1. You will lay out the top floor of Building 5 to accomodate Steve Mikulski's checkout; Jack Smith's PDP-8 checkout, and Bill Long's Special Computer Systems group. All offices will be housed in the current Accounting Department space (less part of the tab room which might become a stockroom for Mikulski). All other office walls will be taken out to provide more checkout space.

2. Bill Long's group moves to the top floor of Building 5.

3. Stan's group moves to Bill Long's area and uses the benches.

4. Mike Ford's group moves to Stan's area. Some of Stan's benches are taken out as Mike doesn't need them. The module stockroom might be moved to this area if benches are taken out. George Gerelds might take some of this extra space.

Win

CC: Stan Olsen
Nick Mazzarese
Harry Mann
Lorin Prentice

INTEROFFICE MEMORANDUM

DATE September 14, 1966

SUBJECT SUGGESTIONS FROM PRODUCTION SUPERVISORS FOR IMPROVING WORKING CONDITIONS

TO K. H. Olsen FROM Bob Lassen

1. Thompson Street Parking Lot to be repaired starting Wednesday, September 14.

2. The time clock near the cafeteria has been moved to eliminate congestion at noon time.

3. I feel that the best solution is to provide an entrance-exit in Building 11. Allowing employees to leave their work place 10 minutes early will have a bad effect on the others. We are rearranging time clocks to satisfy the proposed moves. We should do something about a new entrance right away, and I propose that you, Harry, Loren and I meet to discuss this. Security is the major problem.

4. The Saturday sign-out log has been eliminated.

5. The door to Building 5 is too narrow, but the cost of making a new entrance will be considerable. We may have to do something about this if we locate a significant number of additional people in Building 5. This is particularly hazardous from a fire evacuation standpoint.

6. We tentatively feel that we should hold the open house on a Saturday in November. We can do it in one day with good planning, and we don't have to serve food. I think we should not have an open house connected with the Christmas Party because we'll have hordes of very small children, and tour guides will be more interested in spending the time with their families.

7. Bob Pate will wrap up the fire plan, including the last few fire wardens that have not yet been appointed. He and Loren will inspect all the proposed emergency exits right away and show them to the supervisors. The new Plant Engineer will be responsible for the plan, and we should be able to have a fire drill shortly after he reports to work.

In the meantime we will advise all supervisors to evacuate their people in the event the alarm rings, and no previous announcement is made.

8. The Suggestion Box in On Line was a bad idea and a flop--no response. We have eliminated it, and I think we should let it die a natural death.

9. Handing pay raise envelopes out in the plant does create morale problems. An alternative system would be to indicate approved

increases for hourly people on a form to each supervisor. He can then use the form to advise the employee of his increase. If we send letters to the home, we can't be sure that the employee has received it, and we can't be sure that the supervisor or group leader has talked with the employee. I will get the opinions of our supervisors before presenting the idea.

Although I was very much in favor of anniversary date raises for salaried people, I'm a bit squeamish about using the same system for hourly people primarily because we have similar jobs (technicians, clerical, etc.) in various departments. We can insure more equitable comparisons by reviewing them as a group rather than individually. However, anniversary date reviews have several distinct advantages and should be considered carefully.

10. Unless we enlarge the cafeteria, we are eventually heading for two lunch hours. Setting up additional food lines will take too much seating space.

RTL/jfr

INTEROFFICE MEMORANDUM

DATE 14 September 1966

SUBJECT PDP-9 Review

TO J. Shields

FROM L. Seligman

cc: K. Olsen
R. Best
R. Savell
S. Dinman
E. DeCastro
J. Jones
E. Harwood
N. Mazzarese

Attached is a literature packet you would do well to study before a meeting of the PDP-9 review task force. The PDP-9 Sales Notebook (available from D. Cotton) contains a great deal more information on interfaces, options, etc. The meeting with the PDP-9 group can consist primarily of questions and answers since most information now exists in written form.

I suggest the following group to represent PDP-9:

J. Jones - Scheduling
E. Harwood - Production
L. Seligman - Engineering

Please, Jack, give us a few days' notice of the meeting date.

INTEROFFICE MEMORANDUM

DATE September 14, 1966

SUBJECT Meeting - PDP-10 Review Committee

TO Ken Olsen
Dick Best
Ed de Castro
Larry Seligman
Jack Shields

FROM Ed Harwood

There will be a meeting of the PDP-10 Review Committee in John Jones' Conference Room on Thursday, Sept. 15 at 2:00 PM.

All Committee members should have a written summary of the PDP-10 project which we will attempt to put into a report.

digital EQUIPMENT G. M. B. H. MÜNCHEN

INTEROFFICE MEMO

DATE Sept 13, 1966

SUBJECT Poor deliveries of peripherals

FROM Peter Herke

TO Nick Mazzarese

cc/ Ken Olsen
Dave Cotton
Mike Ford
John Jones
John Leng

The GmbH. office is experiencing poor delivery of peripherals. I don't know whether other subsidiaries and branch offices are equally affected but I think that in our case this leads to the following.

1. Expensive communication costs trying to get latest deliveries.
2. Waste of office time, consistently chasing long overdue items.
3. Very poor public relations. The best PDP-7 doesn't help people if they can't get fan-fold tape. Customers are irrational. Waiting for one add-on unduly long builds up a resentment against our company and all our equipment.

One of the starkest examples that springs to mind is III. Physikal. Inst. at the TH Aachen. They are one of our best customers with a PDP-8 and PDP-7 and one of the only 2 CRT 31 in existence (and did they have to be patient until we finally got that display going). Last November they ordered an ASR33. We passed the order on to Maynard ty telex and followed it with a written order dated Dec 1, 1965, Order No. KO/16/1165/8. This was acknowledged by Maynard on Dec 6, 1965, with DEC No. 13762.
A letter from the customer dated 8 Sept 1966 politely asks for the latest delivery information, accompanied by 2 module orders.

Quite apart from the demoralizing effect this has on the employees of a foreign subsidiary, this and similar incidents are accounting for a pretty hefty rumour that our delivery dates are meaningless and that our extremely poor service accounts for our relatively low prices.
We are selling in a country where competition is not as price oriented as in the US. Far more emphasis is put on service and support. The chances that a researcher will get a grant of DM 500.000 to buy a competitor's equivalent is about the same as they are for obtaining DM 450.000 to buy ours. If then he feels he'll get better service from someone else, he wont even look at us.
I know the heavens wont open and drop 50c transformers for our teletypes over night. But may I suggest that perhaps we were too lenient on our suppliers for too long? This particular order should have been filled long before our shortage arose; the shortage now only means we can't fill this immediately.
Finally this memo is not merely intended as a complaint about one poor delivery. I hope to have made you more aware of some of our problems here.

Peter Herke

Peter Herke

INTEROFFICE MEMORANDUM

DATE September 13, 1966

SUBJECT

TO K. Olsen ✓
C. Kendrick

FROM J. Smith

Our scheduled shipments of PDP-8's for this month is starting to fall behind schedule. In order to get us back on schedule as rapidly as possible, I suggest we concentrate on the below grouping of module types for PDP-8 options. It is important to keep in mind that all types in a group are required to be most effective. In most cases, partials of a particular group will still not allow us to start checkout; we must have the complete group.

I have discussed the problem with Cy; and he feels in order to assure rapid delivery in groups, he would most likely have to set three or four girls aside to work on the particular type and quantity of modules we require. This, he feels, could have an effect on the total number of modules we receive this month. Both Nick and I feel this is a compromise we must accept, if we are to get back on schedule.

I will use my wire-men to build any type or quantity of modules on the listing that Cy feels will be effective and helpful.

The below listing indicates modules required this week. Cy has a more complete list for the rest of the month.

Group 1	S603 - 4 R220 - 24	B141 - 30 R405 - 1 R205 - 4	
Group 2	R113 - 4 R202 - 20 R205 - 8 R603 - 6 G882 - 5 W103 - 2	R113 - 2 R202 - 12 R603 - 2 S603 - 1	Group 4
		G852 - 4	Group 5
Group 3	1304 - 1 4222 - 1	4222 - 1 4531 - 2 4102 - 1 1304 - 1	Group 6

	B141 - 30	S205 - 4	Group 15
	S603 - 5	S603 - 4	
	W640 - 1		
	S205 - 2	42281 - 3	Group 16
Group 7	R202 - 12		
	R205 - 4	B141 - 30	Group 17
	R405 - 1		
	R603 - 2	R202 - 1	
	R113 - 1	W103 - 3	Group 18
		R113 - 1	
Group 8	G852 - 16		
		R202 - 1	
	R113 - 4	W103 - 3	Group 19
	R202 - 20	R113 - 1	
	R205 - 8		
Group 9	R603 - 6	42281 - 1	
	W103 - 2	4605 - 2	Group 20
	G882 - 5	4102 - 6	
Group 10	B141 - 30	R113 - 4	
		R202 - 20	
	R202 - 12	R205 - 8	Group 21
	R205 - 4	R603 - 6	
	R405 - 1	W103 - 2	
Group 11	R603 - 2	G882 - 5	
	S603 - 2		
	R113 - 1	W103 - 3	
		W681 - 1	Group 22
	4113 - 3		
	4222 - 4	B141 - 30	
Group 12	1534 - 2	S603 - 1	Group 23
	1535 - 1	W640 - 5	
	1685 - 2		
		R202 - 13	
	1567 - 2	R205 - 3	
Group 13	S205 - 4	R603 - 2	Group 24
	S603 - 4	B201 - 1	
		S205 - 4	
	R113 - 4	S603 - 4	Group 25
	R202 - 20		
	R205 - 8		
Group 14	R603 - 6	R113 - 1	
	W103 - 2	W103 - 2	Group 26
	G882 - 5		

Group 27	4222 - 1 1534 - 2 1535 - 1 1685 - 2 4113 - 3
Group 28	4102 - 4 4113 - 1 4221 - 1 4228 - 6 4523 - 5 4912 - 1
Group 29	4102 - 4
Group 30	4102 - 4 4113 - 1 4127 - 6 4221 - 1 4228 - 6
Group 31	4102 - 4 4113 - 1 4221 - 1 4228 - 6 4523 - 5 4912 - 7
Group 32	4102 - 4 4113 - 3 4127 - 15 4222 - 4 4303 - 4 4407 - 2 4912 - 13
Group 33	4303 - 3 1534 - 2 1535 - 4 4102 - 7 4113 - 5 4102 - 4 4113 - 3 4127 - 15 4222 - 4 4303 - 4 4407 - 2 4912 - 13
Group 34	1534 - 2 1535 - 4 1685 - 2 4113 - 1 6102 - 1 G802 - 1 S205 - 6 S603 - 6 W640 - 1 R201 - 6
Group 35	W103 - 2 S205 - 1 S603 - 1
Group 36	W103 - 1 S603 - 1
Group 37	R202 - 13 R205 - 3 R603 - 3 B201 - 1 W103 - 2
Group 38	R202 - 6 R603 - 1

INTEROFFICE MEMORANDUM

DATE September 12, 1966

SUBJECT Gardner-Denver Wire Wrap Machine

TO
Ken Olsen ✓
Harry Mann
Jack Smith
Loren Prentice
Ron Cajolet

FROM John Trebendis

These are the latest progress reports from Gardner-Denver on our wire wrap machine. We will ship out this week the Card Reader, 20,000 feet Size 24 Solid Wire, and the 1,000 pieces of test terminals. Their anticipated shipping date is December 16, 1966.

John Trebendis

PROGRESS REPORT

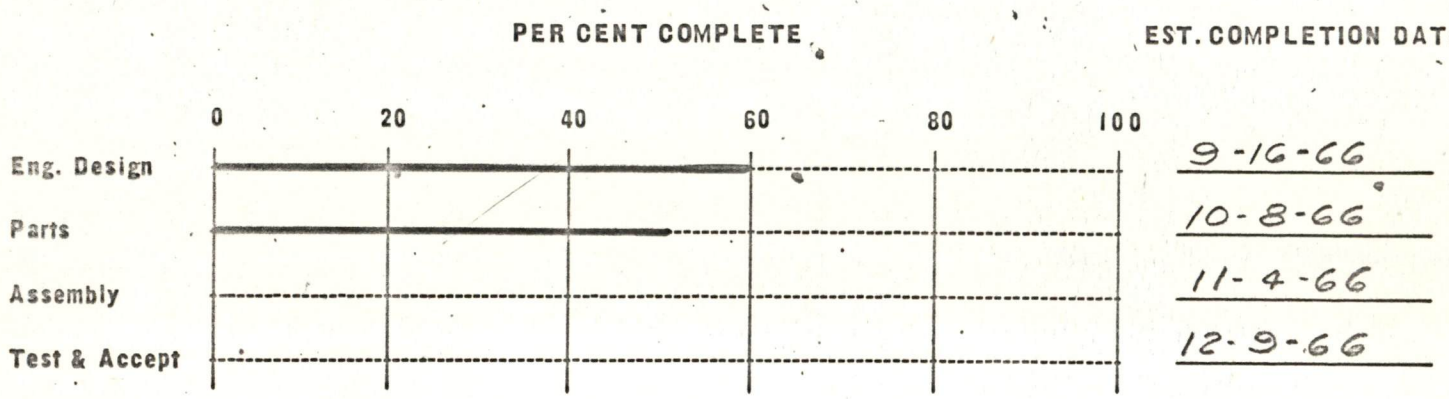
Gardner-Denver Company

"WIRE-WRAP" MACHINE

CUSTOMER:
DIGITAL EQUIPMENT CORP
MAIN STREET
MAYNARD, MASSACHUSETTS
ATT. H.J. CROUSE, PURCHASING DEPT.

QW 3328
P.O. NO. 58017
MACHINE SIZE 22X22 X.025
SERIAL NO. 899212

ANTICIPATED SHIPPING DATE 12-16-66.



INFORMATION REQUIRED FROM CUSTOMER	DATE REQUESTED	DATE REQUIRED	DATE RECEIVED	REMARKS
SPECIAL PAINT	9-6-66	9-28-66	8-30-66	STD.
CURRENT CHARACTERISTICS	"	"	"	220 VOLT
WIRE SPECIFICATIONS	"	"	"	24AWG TEFLON-E
CARD READER	"	10-11-66		
WIRE (20,000 FEET)	"	"		
TEST TERMINAL (1,000)	"	"		
FINAL HARDWARE DESIGN	"	8-26-66	8-30-66	REC'D VARIOUS
PALLET APPROVAL	"		"	PRINTS
TEST BLOCK APPROVAL	"			
DEBUG PANELS	"	10-18-66		
DEBUG CARD DECK	"	"		
FINAL CHECKOUT PANELS	"	"		
FINAL CHECKOUT DECK	"	"		
PIN CHECK LIST	"	"		
SHIPPING INSTRUCTIONS	"	10-4-66		
SPARE PARTS ORDER	"	9-28-66		

Date Issued 9-6-66 By T.D. Anderson

R

PROGRESS REPORT

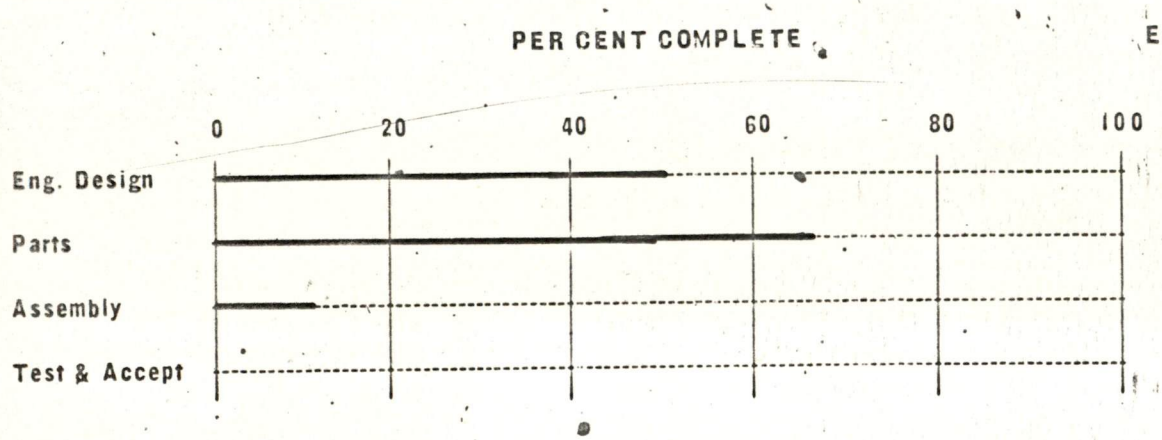
Gardner-Denver Company

"WIRE-WRAP" MACHINE

CUSTOMER:
DIGITAL EQUIPMENT COMPANY
MAIN STREET
MAYNARD, MASSACHUSETTS
ATT. H. J. CROUSE, PURCHASING AGENT

QW 3328
P.O. NO. 58017
MACHINE SIZE 22X22X.025
SERIAL NO. 899212

ANTICIPATED SHIPPING DATE 12-16-66



INFORMATION REQUIRED FROM CUSTOMER	DATE REQUESTED	DATE REQUIRED	DATE RECEIVED	REMARKS
SPECIAL PAINT	8-11-66	9-28-66		
CURRENT CHARACTERISTICS	8-11-66	9-28-66		
WIRE SPECIFICATIONS	8-11-66	9-28-66		
CARD READER	8-11-66	10-11-66		
WIRE (20,000 FEET)	8-11-66	10-11-66		
TEST TERMINAL (1,000)	8-11-66	10-11-66		
FINAL HARDWARE DESIGN	8-11-66	8-28-66		
PALLET APPROVAL	8-11-66			
TEST BLOCK APPROVAL	8-11-66			
DEBUG PANELS	8-11-66	10-18-66		
DEBUG CARD DECK	8-11-66	10-18-66		
FINAL CHECKOUT PANELS	8-11-66	10-18-66		
FINAL CHECKOUT DECK	8-11-66	10-18-66		
PIN CHECK LIST	8-11-66	10-18-66		
SHIPPING INSTRUCTIONS	8-11-66	11-4-66		
SPARE PARTS ORDER	8-11-66	9-28-66		

Date Issued 9-2-66 By T D Anderson

R

Enclosure file

INTEROFFICE MEMORANDUM

DATE September 9th, 1966

SUBJECT

TO Mr. Ken Olsen - Maynard

FROM Si Lyle - Toronto

Dear Ken:

I think that you might find the enclosed brochure about the Toronto area interesting. Judging from the way sales seem to be going it would appear that we are starting to get some advantage of this "middle third".

Hope you find it interesting reading.

Si

Si

Enc.

INTEROFFICE MEMORANDUM

DATE September 9, 1966

SUBJECT Publishing DEC Literature and Program Revisions in DECUSCOPE

TO Harvy Shephard FROM Angela Cossette

cc: Larry Portner
John Jones
Ken Olsen
Nick Mazzarese
Trudy Carr

Many occasions have arisen in the past where users have commented that they have not been kept informed of changes or new software or hardware developments from Digital, as well as new technical literature that might be issued. Some time ago, DECUSCOPE carried information about new programming and literature that had been made available by DEC. This information was submitted to me on a monthly basis by Jack Ridgeway, then Manager of Applications Programming. Upon his resignation, I contacted Len Hantman regarding the continuance of this procedure. Len stated that a DEC program library newsletter might be issued and that he would prefer deferring any future publication in DECUSCOPE.

A considerable amount of time has elapsed since the proposal of the DEC Program Library newsletter and users are still wondering why they are not being informed of new software developments. In a letter dated June 27th to Dr. B. E. Macefield, Chairman of the DECUS European Committee, Ken Olsen stated: "Errors in programs continue to plague us both. We hope to solve the problem of distributing correction information through a periodic newsletter (perhaps the DECUSCOPE). Distribution of correction tapes would then be on a request basis."

I had spoken to you personally the other day about this situation and recommended that either you or Ilse Peters submit information on current programming developments and literature to me monthly for publication in DECUSCOPE. I feel that the users should be kept up-to-date on DEC programming as well as DECUS programming, and until some time when a definite decision is made regarding a DEC Program Library newsletter, I suggest that DECUSCOPE be used for this purpose. I must have your cooperation, however, in submitting this information to me on a regular basis. Technical literature notices would probably come from Trudy Carr and I will check with her as to what arrangements could be made.

I informed the DECUS Executive Board that I had spoken to you on this and that it was now up to DEC personnel involved to initiate necessary information. The Board was quite in favor of publishing such material in DECUSCOPE and felt that it would definitely be of value to the users.

I would appreciate your opinion and decision on this matter as soon as possible.

Angela

AJC/bm

INTEROFFICE MEMORANDUM

DATE September 9, 1966

SUBJECT SPACE NEEDS - FIELD SERVICE DEPT.

TO Ken Olsen FROM Jack Shields

Field Service will require approximately 4500 sq. ft. of floor space in the next year. The space will be used as follows:

1200 sq. ft. for a stock room
700 sq. ft. for a depot repair facility
2600 sq. ft. for offices, secretarial area and files

As far as location in the plant, there are some basic needs which are essential:

1. Close to easy access for entering and leaving the plant.

2. Ample parking facilities for the Field Service people where we will not have to ask for automobiles to be moved in order to go on a service call.

3. Close to the Production facility due to spares needs and the fact that many of our people will be working in the Production environment as part of their training. As you know, we stress technical proficiency, and I feel strongly about the Field Service people being close to the hardware as it is being tested and manufactured.

In general, I think the area we are presently in fits all our needs perfectly, and we would not require any additional floor space than what we presently use. We have met all the criteria I previously outlined. In short, I would like to stay where we are if that's at all possible.

INTEROFFICE MEMORANDUM

DATE September 8, 1966

SUBJECT Status of U. K. Manufacturing Project

TO Ken Olsen
Ted Johnson

FROM Rod Belden

It has now been one month since our U. K. Manufacturing Proposal was submitted. Here is a summary of our progress to date.

July 31 — Discussion of project with Product Line Managers and foreign managers (at the Wayside Inn prior to their evening meeting). Present were: Stan Olsen, Nick Mazzarese, Win Hindle, Ted Johnson, Harry Mann, John Leng, Denny Doyle, Ron Smart, Jack Shields, Rod Belden.

August 5 — Proposal submitted to Product Line Managers and Works Committee.

August 15 — Project Approval by Product Line Managers. Proposal was discussed and questioned by Nick Mazzarese, Stan Olsen, Win Hindle, and Ted Johnson. Harry Mann was consulted later for his approval. Major questions raised were:

1. What is the schedule for U. K. assembly and checkout of peripheral equipment?

2. Will the cost for assembly and checkout be lower than Maynard costs?

August 17 — Presentation of proposal to the Works Committee as an introduction to spending the next six weeks with various committee members on the operating details. Major questions raised were:

1. How will manufacturing guard against relying on field service personnel for checkout?

2. Who will act as a Maynard liaison between Reading and the various production departments?

SCHEDULE HIGHLIGHTS

September	Hire first men for Reading checkout
October 1	W. Spittle joins Reading checkout group
October 5	G. Belden moves to Reading
November	First PDP-8 shipped from Reading

dec INTEROFFICE MEMORANDUM

DATE September 8, 1966

SUBJECT Corrugated Products

TO Ken Olsen

FROM Frank A. Kalwell

All corrugated products associated with Sales have been consolidated and I've submitted a work requisition to Dick Richardson so we can cage off the area. This will be accomplished within the week.

I also discovered that the programming group has 5000 cartons, used for software packages, stored near the advertising dead storage area. They also plan on caging off the area and maintaining all their supplies.

I have notified Henry Crouse to check with me prior to processing any purchase requisitions for corrugated products. Only in this manner can we standardize on cartons and use up all existing obsolete cartons.

Frank Kalwell

INTEROFFICE MEMORANDUM

DATE September 8, 1966

SUBJECT COMMUNICATIONS

TO KEN OLSEN, MAYNARD

FROM KEN LARSEN, PALO ALTO

Attached with this memo are copies of a series of communications between this Office and Sales Administration at Maynard. We at this office make every effort to deal in a very straightforward fashion with the Customer and have done everything we can to maintain a good relationship between the Customer and Digital Equipment Corporation. A great many situations have occurred recently that make it almost impossible to maintain a spirit of communication such that the Customer realizes that we are giving him reliable information. I believe these instances are much more numerous than they need be, and I have expressed this feeling to other people. As a result, I feel that I may have earned for myself a somewhat undesirable reputation. I am sincere, however and I believe the problems can be solved if dealt with in the proper manner.

I feel that the attached is a typical communications problem between the Palo Alto Office and Sales Administration, Maynard.

Page 1 is a copy of Ken Weir's communication with Tom Whalen and the cover memo to the purchase order from NASA-Ames Research Center.

Page 2 is a copy of the first page of the Government Contract Purchase Order No. A-77925. You will note that there is a credit for obsolete Type 137 A/D Converter which is the A/D Converter built into the PDP-5.

Page 3 is the purchase order from LRL-Berkeley for the Type 137 A/D Converter to be removed from NASA-Ames PDP-5 and turned over to LRL on an "as-is" basis.

Page 4 is the DEC internal order document which indicates June 28th delivery.

All succeeding pages are communications relating to the actual delivery status. From these you can see that it is very difficult for the Customer to take us seriously after our having made a series of commitments that were not met. I truly hesitate to give Tom Wempe this last bit of information calling for September 13th delivery.

I would like to have it understood that I am not attacking personalities. I am concerned that this situation seems to be repeating itself, and I am interested in working with anyone who is interested in working out a smoother line of communications. I feel this is essential to my trying to do a good job representing the Company here.

Your suggestions would be very much appreciated.

Ken Larsen

MSG. NO. SFO-2761-1

ATTN..... TOM WHALEN 4-29-66
SUBJ..... TRANSMITTING NASA AMES RESEARCH CENTER PURCHASE ODRDER FOR 138E A/D CONVERTER

TO CONFIRM OUR TELEPHONE CONVERSATION THIS MORNING.... WE HAVE NASA, AMES RESEARCH CENTER PO NO. A-77925 FOR ONE TYPE 138E A/D CONVERTER AT $2500 AND ADAPTER PANEL AS REQUIRED. SHIPMENT IS TO BE VIA DEFERRED AIR FREIGHT. DELIVERY PROMISED AS SOON AS POSSIBLE - 60 DAYS ARO (6/29) OR SOONER. ENGINEERING REFERENCE IS T. WEMPE. CONFIRMING COPY OF PO WILL BE FORWARDED WHEN RECEIVED HERE NEXT WEEK.

TNX
KEN WEIR - PALO ALTO

digital MEMO

DATE 5-9-66

TO TOM WHALEN FROM BETTY SWEDENBORG
PALO ALTO OFFICE

SUBJECT - N.A.S.A. AMES RESEARCH CENTER, MOFFETT FIELD
P.O. No. A-77925 for Type 138E A/D

Attached is the confirming copy of this NASA, Ames order as per your conversation with Ken Weir and Tom Wempe at NASA.

Ken tells me that he has discussed this Exchange Allowance with you.

Since you are familiar with this order, please will you see that it gets entered correctly in Maynard. They are asking for delivery asap, 60 Days AROor by the end of June. (See Ken Weir's TWX SFO-2761-1 of 4/29.

Thanks very much.

(1)

Appropriation symbol and title:

80X0108(66)

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER • MOFFETT FIELD, CALIFORNIA
PURCHASE ORDER CONFIRMATION

ORDER NUMBER
A— 77925
THIS NUMBER MUST APPEAR ON ALL INVOICES, PACKAGES AND PAPERS RELATING TO THIS ORDER

Requisition No.	Job Order No.	Invitation No.	Date
			5/4/66

To—

SELLER
Digital Equipment Corp.
2450 Hanover Street
Palo Alto, California 94304

Consignee and destination

SHIP TO
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

☒ PURCHASE ORDER PER YOUR _____ OF _____ SUBJECT TO TERMS AND CONDITIONS ON REVERSE
☐ DELIVERY ORDER
UNDER CONTRACT NO. _____

F. o. b. point	Ship via	Government B/L No.	Discount terms	Date Delivery Required
Item 1 - Maynard, Massachusetts				Item 1: OOB 28 June 66

FISCAL CONTROL NO. (FOR NASA USE ONLY)	ITEM NO.	SUPPLIES OR SERVICES	QUANTITY ORDERED	UNIT	UNIT PRICE	AMOUNT	QUANTITY RECEIVED
GLA1563 3DC603001B	1	CONVERTER, analog-to-digital, Digital Equipment Corp. Type 138E; complete with adapter panel, DEC model H904 , or equal.	1	EA	2,500.00	2,500.00	
01C	2	Installation Services, as required to install on an existing Government-Owned digital computer, DEC Model PDP-5.	1	JB	125.00	125.00 2,625.00	
		LESS EXCHANGE ALLOWANCE for obsolete Government-Owned Analog-to-digital Converte DEC Type 137				700.00 1,925.00	
		Installation: Installation shall be accomplished by the Contractor at NASA, Ames Research Center, Moffett Field, California, in the Life Sciences Research Facility, Bldg. 239, Analog Computer Room #180, 1st floor; Attn: T. Wempe, Man-Machine Integration Branch. The Government will notify the Contractor orally, or in writing within five calendar days after receipt of all equipment at destination to commence installation services. Installation of the converter by the Contractor shall then commence on a mutually acceptable date within five working days after Contractor's receipt of such notice to commence installation. Completion of all installation services shall be accomplished within two working days after the commencement date.					
		(Continued)					

DELIVER TO

DEPT.

The conditions on the reverse side apply to this order, except if this order is being placed against a Federal Supply Schedule contract, or a contract of another Government agency, as indicated above, in which event the general provisions of such contract shall apply.

You are hereby authorized to furnish the above in accordance with—

CONFIRMING TELEPHONIC ORDER BY R. SCHREY TO MR K. WEIR ON April 29, 1966.

DO-A-2

TOTAL AMOUNT $ See last page

Signature: Joseph R. Schrey
Name: Joseph R. Schrey
Title: CONTRACTING OFFICER

REC'D. 1 DATE 5/4
DEFENSE MATERIALS DEPOT

NASA FORM NO. 177-A ℗

VENDOR'S COPY (1)

SUBMIT CORRESPONDENCE/QUESTIONS TO ☐ BLDG. 80 RM. [illegible] BERKELEY, CALIF. ☐ BOX 808 LIVERMORE, CALIF.

BUYER	CODE	ORDER	SELLER CODE	DATE	
LLEWELLYN	128	4425002	31224	5/25/66	SB

RATED ORDER	CERT. UNDER D.M.S. REG.	THE ABOVE ORDER NO. & SELLER CODE MUST BE ON EACH PACKAGE, SHIPPING RECEIPT AND INVOICE	TERMS: (AS CODED) ↓ 7	FROM RECEIPT OF GOODS OR INVOICE WHICHEVER IS LATER.
DO E2	1			0. ½%-10TH & 25TH 5. 2%-10 DAYS 1. ½%-10 DAYS 6. 2%-30 DAYS 2. 1%-10 DAYS 7. NET 30 DAYS 3. 1%-30 DAYS 8. AS SHOWN 4. 2%-10TH PROX. 9. 1%-10TH PROX.

TO

DIGITAL EQUIPMENT CORPORATION
2450 HANOVER STREET
PALO ALTO, CALIFORNIA
ATTN: BETTY SUECKNBORG

MAY 31 1966

UNIVERSITY OF CALIFORNIA
LAWRENCE RADIATION LABORATORY

PURCHASE ORDER

FOR CONTRACT NO. W-7405-ENG. 48
WITH THE ATOMIC ENERGY COMMISSION
FOR RESALE—State Sales Tax should not be charged as the University holds State Sales Tax Permit C 135323

MAIL INVOICE IN DUPLICATE TO:
UNIVERSITY OF CALIFORNIA
LAWRENCE RADIATION LABORATORY
Accounting Office • P.O. Box 528
Berkeley, California 94701

SHIP TO

UC LAWRENCE RAD LAB
EAST END OF HEARST AVENUE 4425002
BERKELEY, CALIFORNIA 94720

CONFIRMING TELEPHONED ORDER TO BETTY ON 5/20 DO NOT DUPLICATE

SHIP VIA (as coded)	TRANSPORTATION TERMS (as coded)	F.O.B. (as coded)
1. PICKUP 2. PARCEL POST 3. UPS 4. RAIL EXPRESS 5. MOTOR FREIGHT 6. RAIL FRT. FORWARDER 7. AIR PARCEL POST 8. AIR EXPRESS 9. AIR FRT. FORWARDER	1. ACCOUNT OF UNIVERSITY DO NOT INSURE 2. ACCOUNT OF SELLER PREPAID 3. SEE BODY OF ORDER	1. DESTINATION 2. SHIPPING POINT 3. SHIP PT. FREIGHT ALLOWED
↓ 0 0. SELLER HAND CARRY	↓ 2 SHIPPING POINT MOFFETT FIELD,	↓ 1 4.

ITEM NO.	LRL CATALOG NO. IF APPLICABLE	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE	PROMISED DEL. TO CARRIER
1		ANALOG TO DIGITAL CONVERTER UNIT, DIGITAL EQUIPMENT CORP. TYPE 137	1 EA	700.00 EA	700.00	6/15
		USED EQUIPMENT PURCHASED ON AN "AS-IS" BASIS, NO WARRANTY TO APPLY.				
		LOWEST PREVAILING PRICE NOT TO EXCEED ABOVE PRICE.				

The Terms and Conditions On The Reverse Side Constitute A Part Of This Order

Authorized by D. A. Shaw
UNIVERSITY OF CALIFORNIA

UCRL 9-2554 (Rev. 1/66)

BUSINESS FORMS PRINTING CO.

(3)

DIGITAL

EQUIPMENT CORPORATION
MAYNARD, MASSACHUSETTS
Area Code 617 - 897-8821 - 646-8600 — TWX 710 - 347-0212

MAY 20 1966

D.E.C. NO. 16735

CUSTOMER ORDER NO. A-77925

DATE 5-12-66

SOLD TO
NATIONAL AERONAUTICS AND
SPACE ADMINISTRATION
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

SHIP TO (SAME AS "SOLD TO" UNLESS OTHERWISE STATED)

ORDERED BY

REQUIRED DELIVERY: JUNE 28-66

CUSTOMER CONTACT	PHONE	CREDIT
JOSEPH R. SCHREY		NONE

CONSTRUCTION SERIAL NO.	PROJECT ENGINEER	INST. CODE	WARRANTY
	J. SMITH	026	

PROD. LINE	RECEIVED BY	HOW RECEIVED	SHIP VIA	Conf. Rec'd.	RENEG.	CUST. C.	SALES	STATE C.
5-74	FAK	MAIL	AIR FRT.-PREPAID		1	5207	3	5

ITEM	QTY.	DESCRIPTION	MODEL NO.	MFG. NO.
1	1	ANALOG-TO-DIGITAL CONVERTER, 138E COMPLETE WITH ADAPTER PANEL, DEC MODEL H904, or EQUEL	138E	
2	-	INSTALLATION NUMBER		I-05-ITM02-16735

NOTES:

TRAINING YES ☐ NO ☐

SOFTWARE NO. OF COPIES

1. HANDBOOK
2. MAINTENANCE MANUALS
3. DIAGNOSTIC PROGRAMS
4. SYSTEM PROGRAM DESCRIPTION
5. SYSTEM PROGRAM TAPES

CONSTRUCTION REQ. BY:

CONSTRUCTION REQUISITION

(4)

MSG. NO. SFO-2855-4

ATTN..... MIKE NAPPER 6-22-66
SUBJ..... DELIVERY ON 138E A/D FOR NASA, AMES RESEARCH CTR.
PO NO. NAS2-3098 DEC #16735

PLEASE CAN YOU GIVE ME THE CURRENT DELIVERY STATUS OF THIS ORDER.
WE ARE HOLDING A PURCHASE ORDER FOR THE USED 137 THAT THIS 138E
REPLACES, AND CUSTOMER IS VERY ANXIOUS TO GET HIS USED 137.

THANKS
BETTY SWEDENBORG

DIGITAL EQPA

DIGITAL MAYN
MSG. 3366 6/23/66
TO: BETTY SWEDENBORG
FROM: MIKE NAPPER

REF: MSG 2855-4 NASA AMES RES. CTR.

THIS IS SCHEDULED FOR JULY DELIVERY.

MSG. NO. SFO-2891-4

ATTN..... MIKE NAPPER 7-15-66
SUBJ..... DELIVERY OF 138E A/D FOR NASA AMES DEC NO. 16735

PER OUR PREVIOUS TWXES ON THE DELIVERY OF THIS UNIT. IT IS NOW
JULY..... WHEN IS THE EARLIEST POSSIBLE YOU CAN SHIP THIS UNIT?
REMEMBER THIS IS THE 138E FOR WHICH WE ARE TO PICKUP THE L37 AND DELIVER
TO UC,LRL, BERKELEY. PLEASE, MAY I HAVE THIS REPLY BY TWX MONDAY?

THANKS
BETTY SWEDENBORG

END OR GA PLS

DIGITAL MAYN

DIGITAL EQPA

DIGITAL MAYN
MSG. 5931 7/18/66
TO: BETTY SWEDENBORG
FROM: MIKE NAPPER

REF: MSG 2891-4

I BELIEVE WE CAN GET THIS ONE OUT FOR THE LAST OF JULY.

WATS
7-29-66

MIKE NAPPER SAYS WILL SHIP MID-AUGUST.

CALL ON WATS 8-9-66 ARE YOU SHIPPING?????

8-17
WATS
Mike Napper — TRY for end of August 31

This is mid August:
Must have delivery on the 138E A/D Converter for NASA AMES

DEC # 16735

Give me the definite date you will ship.

MSG. NO. SFO-2944-6

ATTN..... NICK MAZZARESE 8-17-66

BUG 8-19

SUBJ..... NASA AMES RESEARCH CENTER PO NO. A-77925 DEC NO. 16735

ORDER WRITTEN 5-4-66
REQUIRED DELIVERY 6-28-66
TWX 6/23 SAID JULY DELIVERY
TWX 7/18 SAID LAST OF JULY DELIVERY
WATS 7/29 SAID MID-AUGUST DELIVERY
WATS 8-17 SAID SHOOTING FOR END OF AUGUST

NOW-- WHAT DO WE TELL THE CUSTOMER?

KEN LARSEN

END OR GA PLS

138E A/D.

dec INTEROFFICE MEMORANDUM

DATE August 18, 1966

SUBJECT attached memo

TO Nick Mazzarese FROM Mike Napper

This unit physically exists. Bob Diagnault has reasonably assured me that production will make the end of August on this item.

I'll continue to put pressure on Bob to see its out by the specified date.

Best regards,

Mike Napper

MN/kh

cc: Ken Larsen

7

MSG. NO. SFO-2949-3

ATTN..... NICK MAZZARESE 8-19-66

SUBJ..... 138E FOR NASA AMES
REF. OUR TWX MSG. NO. 2944-6

WEMPE AT NASA CALLED ME AGAIN THIS AFTERNOON. PLEASE, COULD THIS BE SHIPPED NEXT WEEK? TWX REPLY SO I CAN TELL THEM SOMETHING ON MONDAY

THANK YOU
KEN LARSEN

END OR GA PLS

MSG. NO. SFO-2959-8

ATTN..... NICK MAZZARESE MIKE NAPPER 8-30-66
SUBJ..... L38E CONVERTER FOR N.A.S.A. AMES RESEARCH CENTER
NASA ORDER NO. A-77925 DEC NO. 16735

THIS SUPPOSED TO BE SSIPPED TOMORROW WEDNESDAY. PLEASE ADVISE IMMEDIATELY WHEN SHIPMENT IS MADE - CARRIER AND BILL NO.

THANK YOU
KEN LARSEN

DIGITAL EQPA

DIGITAL MAYN
MSG. 6802 9/1/66
TO: KEN LARSEN
FROM: MIKE NAPPER

REF: MSG 2959-8 NASA-AMES RES. CTR. DEC 16735

PRODUCTION HAS SAID THIS UNIT WILL BE SHIPPED NO LATER THAN 9/6/66

CC N. MAZZARESE

MSG. NO. SFO-2970-10 9-7-66

ATTN ..... MIKE NAPPER
SUBJ ..... NASA- AMES RESEARCH CENTER - DEC NO. 16735
REF ..... YOUR MSG. NO. 6802

PLS CONFIRM IF THE 138E CONVERTER WAS SHIPPED 9-6-66 AS PROMISED.

ALSO, PLS GIVE DETAILED SHIPPING INFORMATION.

THA NK YOU
KEN LARSEN

138E for NASA

DIGITAL EGPA
MSGG@ALCA-2
TO: KEN LARSEN SFO
FROM: KKYE HEBERT
REF: YOUR MSG SFO-2970-L10

NASA AMES RESEARCH CENTER DEC 16735. RAN INTO A SMALL PROBLEM.
SHOULD BE SHIPPING SEPT L3 ACCORDING TO J. HAGERTY.

ALSO

DIGITA

THIS IS MSG NO CA-2 FROM KAYE HEBERT SHOULD READ SEPT 13

digital EQUIPMENT G. M. B. H. KÖLN

INTEROFFICE MEMO

SUBJECT The need for higher throughput rate and its relation to tape units, discs, and drums.

DATE Sept 6, 1966

FROM Gerry Moore

TO

Ken Olsen
Nick Mazzarese
John Jones
Mike Ford
Dave Cotton
Howie Painter
Ted Johnson
John Leng
Mort Ruderman
Bill Leng

Recently I ran into an old problem again. The problem: To get very high throughput rate from an A-D system onto a mass store so that the A-D system can convert voltages continuously (without pause), producing a total number of conversions far in excess of the capacity of core memory. This time, I ran into the problem twice in two weeks, once at the University of Groningen and once at the University of Leiden, both in Holland. In each case the customer feels that CDC can handle it with the 1700. Digital cannot, at least not with standard hardware we are prepared to offer. Total amount of money involved in these two systems is 1.68 M Gulden, or $ 460.000.

These are both biomedical applications and are both on-line applications. They should be right up our alley. Throughput, incidentally, seems to be a common problem in biomedical applications. Three years ago I quoted a PDP-4 - 570 system to U. of Washington for biomedical work. Throughput of 50 KC or so was important there (that was a biomedical system). In the case of these two systems, a 50 KC minimum throughput rate is necessary. Although these are possible PDP-9 applications, the next one might be a PDP-8 application.

I think Bill Leng will bear me out when I say the A-D end of the system does not limit us. It is not difficult to interface an A-D system to the direct memory access facility on PDP-9 or the 3 channel data channel on PDP-9 or PDP-8. The control to do this is relatively simple. And if the A-D converter itself is too slow, it is generally a small part of the cost of such a system to use two converts. The limiting factor is the mass store. Here we should keep in mind that 6 bit conversions will generally not suffice (for example, they are not sufficient in either of the above cases). Eight bits is a minimum. Ten bits may be desired. Eight bits is for example handled very nicely by the new IBM 9-track tape units.

digital EQUIPMENT G. M. B. H. KÖLN

INTEROFFICE MEMO

SUBJECT

DATE

TO

FROM

Such a tape unit with reasonable specs (i.e. 75 ips and 800 bpi) would probably handle the majority of such cases. Even with tape gaps, reasonable size buffer areas in memory will yield a throughput of 50 KC or more.(And that is no higher a rate than I was able to offer the University of Washington 3 years ago ~~abaty~~ attacf for 6-bit conversions).

Mr. Kooi at the University of Leiden thinks the CDC disc offered with 1700 is pretty hot. It will transfer words at a 70 KC rate continuously for 15.000 words without repositioning the heads.

I am concerned:

1. That we don't have anything to offer in this category right now (neither tape, nor disc, nor drum). We must send the customer to IBM to supply a tape unit for our computers for such applications.
2. That our long-awaited disc may not be fully competative as far as transfer rate goes.
3. That our present PDP-9 drums have a much slower transfer rate than should be easily possible with a drum-PDP-9 (or drum-PDP-8) combination.

I would appreciate anyone's suggestion as to what we might offer in cases like this. I feel we should be fully competative in all small-computer on-line applications.

I can't at this point adequately assess the likelihood of orders in the above two cases. However, delays in funding (common in Germany and Holland this year) has jeopardized CDC's position and previous CDC quotes may not stand firm. Also, I think we could offer systems for 100.000 to 150.000 Gulden less. And we have a lot more going for us now with the new PDP-9.

Gerry

Gerry Moore

dec INTEROFFICE MEMORANDUM

DATE September 6, 1966

SUBJECT FRANCE

TO Product Line Managers
Ken Olsen
John Leng

FROM Ted Johnson

1. SDS-CAE

I learned this week that CAE is only this summer beginning to deliver their manufactured items. I gathered there are only a small number of 920s and 92s delivered from Santa Monica. Now they have a fierce job. CAE must supply one 9300 (College de France - and the customer is nervous), about a dozen 930s (the easiest to sell on capability/price), and perhaps 6 - 8 92s (considered to be in an awkward category but price attractive). I suspect they will have their problems, and I know SDS has never trusted their capability.

A University in Hamburg (physics application), cancelled an order for a 92 last summer because they were misinformed by the salesman that the 92 had FORTRAN.

Apparently, SDS and CAE are tough negotiating partners.

2. The Market

Jean Francoise, who we hope to have start in Montreal, feels the market in France is good, particularly in physics. (Despite the Test Ban Treaty aspect).

3. Purchase Contracts

To get by the problem of red tape and no purchase order forms as such from the customer (a point which has frustrated the French office somewhat needlessly, I feel), CAE & CDC uses a purchase contract signed at time of order. They include penalty clauses for delivery. If the customer requires the latter to induce him to sign such a document, then it might be worth it, (using an automatic fudge factor and Maynard approval of the contract for dollar values exceeding some set amount). Francoise says that only one contract (the Hamburg one) was cancelled, due to gross misrepresentation. Apparently, if this is obtained, the customer lives by the obligation to buy.

TJ/mr

dec INTEROFFICE MEMORANDUM

DATE 2 September 1966

SUBJECT

TO Jack Smith
Cy Kendrick

FROM D. Doyle

This again refers to your memo of 15 August asking us to build up our capability to 100 boards/day (R210s and R211s). I want to cancel Bill's answer of 22 August saying we would do so.

Our meeting of yesterday clearly indicated that the flow of raw material to us cannot be smoothed out for another month or two. I see no possibility of us ever getting a backlog of 1000 units on hand here. Without this, I think it would be irresponsible on everybody's part for us to increase our capability. Our present capability is 50/day and we will leave it at that until further notice from you.

A formal long-term Canadian production proposal is being prepared, and will be presented to management within the next 2 weeks. Any inputs which you might have should be brought to the attention of either myself or R. Belden.

Denny

DJD:jp
c.c. R. Belden
K. Olsen

dec INTEROFFICE MEMORANDUM

DATE September 1, 1966

SUBJECT

TO R. Belden

FROM J. Smith

cc: K. Olsen

I feel it would help to expedite problem areas if the below items were placed on the Manufacturing Meeting agenda for awhile.

1. Report on Module Weekly Output
   (C. Kendrick)

   This report should include a percentage comparison figure of weekly type requests to deliveries for each product line.

2. Computer Schedule Status (J. Smith)

   Status of schedule of machines to and from Checkout.

INTEROFFICE MEMORANDUM

DATE September 1, 1966

SUBJECT Hodges & Associates

TO Dick Testa
Ken Olsen
Harry Mann
Ted Johnson

FROM Win Hindle

When Gerry Moore was here in early August, I asked for his comments on Mr. Hodges' letter of July 12, 1966, to Ken Olsen in which Gerry's name was mentioned several times.

Hodges stated "---we had moved our offices at the request of Mr. G. Moore." Gerry says there is no foundation for this statement. He did not request that Hodges move his office.

Hodges stated "---we acted in good faith on the assumption that we were acting on your behalf." Gerry states that this is true, i.e. Hodges was proceeding on the Witswaterand PDP-6 sale with our blessing. Gerry also sent a TWX in December, 1965, stating Hodges would proceed with PDP-7, PDP-8 and modules.

Hodges stated that Gerry "---promised me, personally, an agreement on which we could work." Gerry states this is true, i.e .we were at the time he visited South Africa expecting to send an agreement to Hodges.

dec INTEROFFICE MEMORANDUM

DATE September 1, 1966

SUBJECT

TO Ken Olsen

FROM Harry Mann

The Product Line Managers setup has certainly served DEC well, and no doubt has contributed a great deal to last year's success. Recently, however, there have been indications that we are overloading the Product Managers and I am concerned lest we lose much of the value these important Managers have and can contribute to success and growth.

As I view the Product Manager's role, he can be most effective if not tied down with a lot of day-to-day administrative chores. He should have effective marketing and design groups working for him directly. Through these people, he can direct the design and marketing strategy for his products, keep close to competitors plans, do longer range product planning, and current budget planning. At our present level of business, as budgeted for the coming year, the three Product Managers should be able to handle these functions without being overloaded. Future growth would probably necessitate the addition of one or more Product Managers.

The Product Managers should be supported by four top level functional managers:

1. The sales manager responsible for the field sales and service organizations.
2. A manufacturing manager responsible for all manufacturing and testing of products.
3. An engineering manager responsible for all central engineering, programming and technical writing.
4. An administration manager responsible for all finance, accounting, legal, personnel, office services, including printing, photography, data processing, etc.

This management would give an organization of seven key executives reporting to you, fix responsibilities clearly, and provide interesting challenges for key people. It is a setup which could cope with growth for the next several years.

Harry

ecc

INTEROFFICE MEMORANDUM

file

DATE August 31, 1966

SUBJECT PLASTIC SUBSTRATE - DISCUSSION WITH BEN ZINBARG (VICE PRESIDENT) AND JOSEPH LAW (FIELD SALES MANAGER), NEW ENGLAND LAMINATES COMPANY, INC.

TO Ken Olsen
Dick Best
Henry Crouse
Tom Stockebrand
Bob Brown
Stan Olsen
Loren Prentice

FROM George Wood/Dick King

These people were here primarily to better acquaint us with their Nelam (grades 300 & 305) laminated board for use as a replacement for G-10 epoxy.

In comparison, Nelam 305:

1. is 80% as stong as G-10
2. is punchable (punched holes can be thru plated - .0005 maximum punch looseness).
3. is non abrasive (longer wearing dies).
4. is flame retardant.
5. is resistant to chemical attack.
6. is heat resistant (260°C '500°F' for 30 seconds).
7. has good dielectric properties.
8. expands with heat equally in all directions.
9. is dimensionally stable (holes don't close in after drilling).
10. will not poison plating baths.
11. is more absorbant, but satisfies minimum MIL Specs. for G-10.

The material is presently 20% to 25% less expensive than G-10 in large runs and is available plain or with one or both sides

copper clad.

Plating thru can be accomplished reliably (refer to Shipley Company in Newton) with no cracking. As compared to eyeleting for thru connections, the operations should be compared in a mass production analysis in order to get realistic costs. In plating, the capital equipment and labor costs do not go up in proportion to the volume.

Printed circuits were discussed and they only know of one company (Photocircuits) who has had any hope of success - their CC-4 process. The process involves printing a conductive "bonding ink" on the substrate and then plating that. In five years of developing, the major stumbling block has been adhesion to the substrate.

George H. Wood

dec INTEROFFICE MEMORANDUM

DATE September 1, 1966

SUBJECT TRIP REPORT - SHIPLEY COMPANY - AUGUST 31, 1966

TO Ken Olsen
Dick Best
Tom Stockebrand
Loren Prentice
Henry Crouse
cc: Bob Brown

FROM George Wood

Bob Brown and I visited Shipley Company, Inc., Newton, Massachusetts and talked with Mr. Gerald Lordi and Mr. Jim Feeney in an attempt to learn more about applying conductive coatings to plastics, i.e., printed circuit modules.

In addition to discussing their own companies products and providing us with samples and a demonstration, both Mr. Feeney and Mr. Lordi made use of their own records, files and past experiences to provide several suggestions and cautions relative to all phases of module manufacture. These included:

Recommendations of books & periodicals
Tips for cleaning boards
Plating techniques for thru holes
Suggestions for quality control
Cautions on the affect of filler materials on plating bath solution

The demonstration included an electrolys copper plate on chemically conditioned ABS and on mechanically conditioned G-10 type material. The item of primary concern in this process is bond strength and to date, the ABS system is the only one in which the strength compares favorably to clad epoxy laminates.

INTEROFFICE MEMORANDUM

DATE : August 31, 1966

SUBJECT : NEW PRICING POLICY FOR CUSTOMER TRAINING COURSES

TO : Bob Pate

FROM : Bob Lassen

cc : K. Olsen ✓
H. Mann
S. Olsen
N. Mazzarese
W. Hindle
T. Johnson

The Product Line Managers have decided to establish a consistent pricing structure for all customer paid training courses. It is as follows:

1 week course - $300

2 week course - $500

3 week course - $650

These prices will apply to all courses for all product lines and should start immediately after fulfilling current commitments.

Please be sure that this information is passed on to all appropriate in-house and field people.

In addition, no courses will be given away without the express approval of the responsible Product Line Manager.

RTL/srb

digital MEMO

DATE 8-31-66

TO Ken Olsen FROM Jack Shields

For your information, attached is a copy of the signed customer acceptance for PDP-8-405 at Badger Meter Mfg. Co. along with the copy of the Field Service report on installation.

Enc.

DIGITAL EQUIPMENT CORPORATION
MAYNARD, MASSACHUSETTS

CUSTOMER ACCEPTANCE Ken Olsen-3

BADGER METER MFG. CO.

DATE: August 4, 1966

CUSTOMER ORDER NUMBER:	DEC. ORDER NUMBER:	INSTALLATION CODE:
87929	17999	1081

SYSTEM SERIAL NO: PDP-8-405

ITEM	QUAN.	STANDARD OPTIONS WITH SYSTEM	SERIAL NO.
1	1	Standard PDP-8 Computer, Rack Mountable version suitable for mounting in standard 19" relay rack	

EXCEPT AS NOTED BELOW THE SYSTEMS/OPTIONS LISTED ABOVE IN ACCORDANCE WITH THE ORDER NUMBERS, HAVE BEEN INSTALLED, AND SATISFACTORILY COMPLETED ACCEPTANCE TESTS, AS NOTED BY PERSONNEL BELOW.

HAS

DIGITAL EQUIP. CORP. REPRESENTATIVE

James L. Downs

CUSTOMER REPRESENTATIVE

EXCEPTIONS: 1 CABINET (CAB 8-13) WAS DELIVERED But not ORDERED

LENGTH OF WARRANTY FROM DATE OF ACCEPTANCE THREE (3) MONTHS

HOUR METER READING: 16

Ken Olsen

PDP- 8 /s 405

DIGITAL EQUIPMENT CORPORATION MAYNARD, MASSACHUSETTS

FIELD SERVICE REPORT

HOUR METER READING 1 6

FIRM BADGER METER CO.

DIVISION

STREET

CITY, STATE Milwaukee WISC

REQUESTED BY

DEC REP G.A. SLAW

WORK STARTED DATE 8-27-66 TIME 1630

WORK COMPLETED DATE 8-27-66 TIME 0300

	I-E NUMBER	TYPE OF CALL	EQUIPMENT AND SERIAL NO.	TRAVEL TIME	STRAIGHT TIME	OVER TIME	TOTAL 1/4 HOUR
A	1 0 8 1 0 1 0 0	P - PREVENTIVE MAINT.	I PDP-8				
B		C - CORRECTIVE MAINT.					
C		I - INSTALLATION					
D		M - MODIFICATION					

INDICATE STATUS OF ITEMS SERVICED AS NOTED BELOW — A I B C D

H - IN-HOUSE W - WARRANTY C - CONTRACT P - HOURLY I - INSTALLATION O - OTHER

ITEM: A B C D	QTY.	MATERIAL USED DESCRIPTION	P/N	AMOUNT
A	1	2894-1A		
		TOTAL MATERIALS $		

TOTAL CHARGES	
PRIVATE AUTO .10/Mi.	$
COMMERCIAL TRAVEL	$
PER. DIEM	$
LABOR 15.00 HR.	$
LABOR 20.00 HR.	$
LABOR 25.00 HR.	$
MATERIAL	$
TOTAL BILLING	$

A. PDP-8 INSTALLATION -

MEMORY WAS COMPLETELY LOSE AND WAS RESTING ON THE MODULES

FOUND SOME HARDWARE JAMMED BETWEEN CARDS CAUSING THE TRANSISTOR TO BLOW IN R650 AT MC 16

UNIT WAS SENT IN A CAB-8B But WAS ORDERED AS A STRAIGHT RACK MOUNT

CUSTOMER SIGNATURE	DATE	CUSTOMER'S PURCHASE ORDER NO.

White-Original, Green-Branch, Yellow-Engineering, Pink-Customer Copy

dec INTEROFFICE MEMORANDUM

DATE August 30, 1966

SUBJECT Employee Stock Purchases

TO Ken Olsen

FROM Harry S. Mann

Approximately 400 employees purchased stock in the recent offering. The number of shares purchased varied from a low of one share to a high of 1,100 shares. Except for the temporary employees, everyone who requested stock was accomodated including a number of people who came in after the closing date. Only 25 employees were assigned fewer shares than they requested. In all of these cases, they were short term employees mostly with less than one year's service.

I believe that you can feel satisfied our employees were taken care of very well in this situation.

Harry S. Mann

HSM/net

dec INTEROFFICE MEMORANDUM

DATE August 30, 1966

SUBJECT INDUSTRIAL LINE OF CIRCUITS

TO Ken Olsen
cc: Stan Olsen
Dick Best

FROM Saul B. Dinman

In reflecting on what to do about a low speed, high noise immunity line of circuits, an idea came to mind that is immediately applicable and lends itself nicely to a future generation of high speed modules that can certainly compete successfully with our current competitors.

Now that our trip to Motorola and Fairchild has indicated their willingness to sell us unpackaged monolithic chips, it appears that the approach I am about to propose, even has a competitive position against TO-5 and dual in-line packaged units.

Our biggest claim to fame in the module business is our understanding of the customers' needs and our willingness to translate these needs into a complete line of hardware that is purchasable at prices lower than the costs of developing such a line. From the work we have done with modules, we know that the interface series (W and A) will always be required by the user. Some of these requirements are for functional packages, such as teletype modules, address selectors, etc. These modules deal with a "hybrid" world and there is every reason to believe that a hybrid solution is the most practical solution. Most of us have already accepted the premise that these modules will remain discrete for a long time to come. Looking at our competitors' lines of monolithic modules, we find that many of these deal with a hybrid world even in pure logic. They are unwilling to eliminate the one shot, the adjustable clock, the pulse amplifier, etc. most of whose functions can be performed by multitudes of pure logic elements if people really wanted to spare no expense.

A slow speed line of industrial logic does not lend itself to monolithic technology as it is known today. We have found no easy way of developing such a discrete circuit line that would be cheaper than the more popular R series elements. What I am proposing is a line of hybrid circuits that utilizes the cost advantages of monolithics plus the technological and economic advancements we have made in our thick film work.

The basic element would be a DTL chip purchased from Motorola and/or Fairchild (they are compatible) mounted for the present on one of our ceramic strates. Wire bonded to the chip are a screened on integration capacitor and a clamp diode chip which have been added to limit the frequency response of the circuit and give it good solid logic levels which are not functions of fan-out. The DTL line itself has inherently good noise thresholds.

From a marketing point of view, we have an exciting, technologically advanced package with good industrial performance. There are no discrete components used except the inevitable pots and crystals here and there. The unit has definite possibilities of holding its own against any one elses current "Industrial" line (including Phillips) and certainly

gives us an edge on the competition. It also allows us to maintain the "Chip" image we have been developi ng and also capitalize on the use of monolithics.

For the long run, I propose exactly the same approach for our higher speed lines and even many of our W and A series modules. The approach fits well with a potted ceramic module approach and lets us develop a much more proprietary line of modules than would be possible by restricting our usage to the TO-5 or dual in-line units.

In summary, I believe that the approach is attractive and highly marketable. Alan Ricketts has been assigned to investigate the noise immunity characteristics exhibited by such a hybrid configuration and will have figures available shortly.

Saul

SBD:cc

INTEROFFICE MEMORANDUM

DATE August 29, 1966

SUBJECT ESTABLISHMENT OF A DRAFTING COMMITTEE

TO Ken Olsen FROM Roger Melanson

It was gratifying to learn that you are going to establish a group to discuss engineering documentation problems.

May I suggest that you consider inviting several people who work with drawings from a production users standpoint.

digital EQUIPMENT G. M. B. H. KÖLN

INTEROFFICE MEMO

DATE August 29, 1966

SUBJECT

FROM Andrew Allison

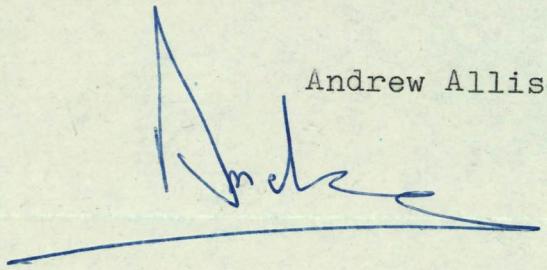
TO Ken Olsen
Dick Best
Jack Shields
Ken Senior

We have in Holland 3 PDP-7's. These machines contain 41 types of Flip-Chip-module, and associated with their peripheral equipment are no less than 55 types of system module. If you think that is bad, the figures for Germany are 4, 49, 64.

The spares problems are fantastic and I hope that some attempt is being made to rationalise the situation for the future (for example, if two existing modules will do the job of a proposed new one, use two!)

Incidently, despite six months of comment from here, no. 7 or 8 has ever, to my knowledge, arrived with any information on the system modules in the system. I should think that a system module handbook and relevant circuits would not be out of place.

Andrew Allison



digital EQUIPMENT G. M. B. H. KÖLN

INTEROFFICE MEMO

DATE August 26, 1966

SUBJECT Eng. News 304

FROM Andrew Allison

TO Elsa ~~Peters~~ Carlson

Hi Elsa,

I would love to come to Wednesday's meeting, but it might be a little difficult, however maybe I can provide a little long range input.

I have been interested in the development of integrated circuits for a little over a year, and in that time, have seen here in Europe, and particularly from SGS-Fairchild, an astonishing proliferation of circuits, coupled with equally astonishing reductions in price.

One year ago, simple configurations (and, or, binaries) could be made for less than the U.K. office could purchase modules from Maynard, and in the time since then, manufacturers prices have been reduced by between 15 and 90 percent - Fairchild's average being 40 percent. Since the major manufacturers are at present fighting for domination of a rapidly expanding market, these reductions must continue.

SGS ist the only family on which I have detailed information, and the DTL range is given on the attached sheet I.

I quote DTL since this is closest to our existing techniques and thus an easier step. The range is available in flatpack, with 7 leads each side, a system very amenable to soldering. DTL is slightly more complex and slower than RTL but permits wired oring, which is a requirement.
The optimum system for high speed systems is complementary transistor logic, which also permits wired oring. (see sheet 2)

Average price for CTL approx Ø 4, with next reduction, of 10-60% depending on device, due in October.

Now, it is obvious that to secure maximum advantage from integrated techniques, it is necessary to design a system with these techniques in mind, however, existing systems should be amenable to some modification (especially things like the option panels).
The major problem of mixing is of course the change in voltage levels, but, with our already developed W series we have a built in answer to this problem.
The logical attack would appear to be to separate logic into blocks, with considerable interaction but little input and output (this to achieve max. packing density while pin limited on cards).

digital EQUIPMENT G. M. B. H. KÖLN

INTEROFFICE MEMO

SUBJECT

DATE

TO Carlson

FROM

The next step is to combine several such blocks to form a major portion of logic, of sufficient size to justify the level conversion necessary to talk to the rest of "our world".

A further point on the viability of integrated circuits include the fact that they are manufactured in Scotland, Germany, France and Sweden as well as the U.S.

Incidently, Fairchild's estimate of price index for 1970 is 20-10, 1965 = 100.

Andrew Allison

2 encl.

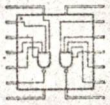
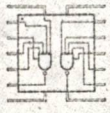
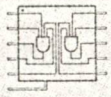
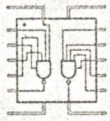
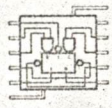
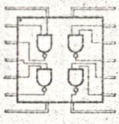
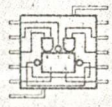
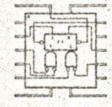
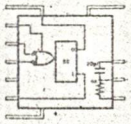
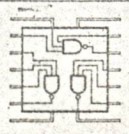
SHEET 1

@ 1.1.66

Diode-Transistor Micrologic DTμL

This family features high tolerance to electrical noise and ample driving capability.
Output "OR"-ing adds flexibility to logic design and reduces number of elements to a minimum.

Operating temperature range 0°C to +75°C
Operating supply voltage $V_{CC} = +5V \pm 10\%$

Type	Description	Typical Propagation Delay (nsec)	Power Dissipation (mW) typ.	Fan Out	Connection Diagram (Top) Flat Package
930 ●	DUAL GATE: Dual 4-input NAND/NOR gate with provision for fan-in extension	25	16	8	
932 ●	DUAL BUFFER: Dual 4-input NAND/NOR buffer with emitter follower gate output for high speed, high capacitance loading with provision for fan-in extension	35	27	25	
933 ●	DUAL-INPUT EXTENDER: Dual 4-input, high-speed diode array used to increase fan-in capability of 930, 932 and 944	n.a.	n.a.	n.a.	
944 ●	DUAL POWER GATE: Dual 20 4-input NAND/NOR gate for use as interface driver, high fan-out gate with OR-ing capability and low-power lamp driver with provision for fan-in extension	20	20	27	
945 ●	FLIP-FLOP: R-S or J-K clock-gated flip-flop for use in shift registers, counters and memory circuits, suitable for clock frequencies up to 2 Mc/s.	50	48	12	
946	QUAD GATE: Four 2-input NAND/NOR gate	25	32	8	
948 ●	FLIP-FLOP: R-S or J-K clock-gated flip flop for use in shift registers, counters and memory circuits, suitable for clock frequencies up to 8 Mc/s	50	50	11	
950 ●	A.C. TRIGGERED BINARY: A high speed capacitor-coupled flip-flop suitable for use in counters operating up to 20 Mc/s.	20	25	10	
951 ●	MONOSTABLE MULTI-VIBRATOR: 2-input monostable multi-vibrator providing complementary output pulses of 100 nsec duration, which may be extended by the use of external RC network	25	35	10	
962 ●	TRIPLE GATE: Triple 3-input NAND/NOR gate	25	24	8	

● New device

@ 1.1.66.

Complementary Transistor Micrologic CTμL

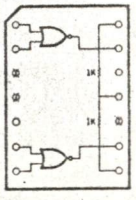
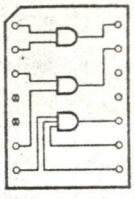
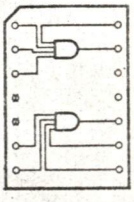
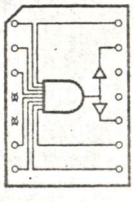
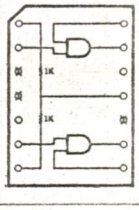
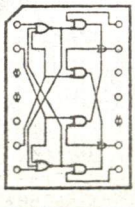
The CTμL family was designed for very high speed, low cost professional system applications. It features AND-OR-NOT logic. Special circuit design techniques have been used on CTμL to permit open transmission lines of 30-40 cm. and still keep operation in the 5-nsec speed range. Logic swings are typically 3 Volts. Noise margins are 0·5 Volt or greater.

Operating temperature range +15°C to +55°C

Operating supply voltage $V_{CC} = +4{\cdot}5V \pm 10\%$, $V_{EE} = -2{\cdot}0V \pm 10\%$

Available in dual in-line package

0°C → 55°C AVAIL.

Type	Description	Typical Propagation Delay (nsec)	Power Dissipation (mW) typ.	Fan Out	Connection Diagram (Top) Dual in-line package
952 ●	DUAL INVERTER GATE: Dual 2-input NOR gate for voltage level setting and logic inversion	9	75	12	
953 ●	TRIPLE AND GATE: Dual 2-input and single 3-input AND gate	3	100	15	
954 ●	DUAL AND GATE: Dual 4-input AND gate	3	65	15	
955 ●	SINGLE AND GATE: Single 8-input AND gate with two outputs	3	33	15	
956 ●	DUAL BUFFER: Dual 2-input non-inverting, level setting circuit used to drive high fan-out loads and as a line-driver	12	150	25	
957 ●	DUAL-RANK FLIP-FLOP: Multi-purpose, direct-coupled, dual-rank flip-flop suitable for counters, registers and other storage applications.	27	200	9	

SAME PRICE

SINCE 1.1.66 NEW ITEMS ARE:-

964 3,3,1 I/P GATE

● New device

965 4 INVERTERS

968 2 AC COUPLED J-K's

971 4 2 I/P GATES

9030 8 BIT REGISTER.

INTEROFFICE MEMORANDUM

PERSONNEL

AUG 9 1966

DATE August 19, 1966

SUBJECT Building 5 Reception Room

TO Kenneth H. Olsen
Robert Lassen

FROM Henry J. Crouse

In all the moving and reconstruction now underway, the reception room in Building 5 has been overlooked.

Jim Jordan designed the lobby and some of the changes have been completed. I think the last two major changes are installing a ceiling and furniture.

A considerable number of visitors, ie. customers, applicants and salesmen, entering through this lobby, which looks just like it is — incomplete.

May we have the rest of the job done during the second quarter?

Henry J. Crouse

Ken

We started improving the lobby some time ago but project was dropped. I agree with Henry that we should add the finishing touches.

Bob

dec INTEROFFICE MEMORANDUM

DATE August 18, 1966

SUBJECT IDENTIFICATION BADGES

TO Ken Olsen

FROM Bob Lassen

In the future badges will be made in-house using the Drafting Department Verityper. For ease of handling we will make them once a week giving Dick Ward one week's notice. We can get one day service if necessary.

For the time being, we will use the same design, color and numbering sequence.

When we decide to change all the badges, we will start a new numbering series based on date of employment, and we will also change the design and color. I feel we should change the badges the first of the year.

RTL/jfr

cc: D. Ward

INTEROFFICE MEMORANDUM

DATE August 17, 1966

SUBJECT Gordon Bell

TO ✓K. Olsen
N. Mazzarese
S. Olsen
L. Portner
W. Segal
R. Savell
M. Ford
A. Kotok
R. Best
T. Johnson

FROM Win Hindle

Gordon will be at DEC for 3 days, August 29-31, for consulting, and we should use his time here profitably. I suggest you sign up for time with him, if you want to see him, by calling Barbara Fiske, Ext. 276, who will make his appointments.

cc: Gordon Bell

INTEROFFICE MEMORANDUM

DATE August 16, 1966

SUBJECT PDP-4 EQUIPMENT FAILURES

TO Win Hindle
Nick Mazzarese ✓
Stan Olsen
Loren Prentice

FROM Roger Melanson

Equipment failure on the PDP-4 system has been greatly reduced since the equipment was installed in Drafting a little more than two months ago. The reason for improved operating conditions is due to the even room temperature, and better preventative maintenance from Field Service.

Actual down time during the 2 month period has only been 11 hours.

5 hours - Card Reader
6 hours - Paper Tape Punch

Other minor failures have occurred on the DEC Tapes, Mag Tapes, and Line Printer, but the equipment did not warrant the shut down of the system. The failures were corrected during regularly scheduled maintenance hours.

C.C.
Ken Olsen
Dave Packer
Harry Mann

NJM	
FILE	PDP-4

A good home means a good child

Nick

digital MEMO

DATE August 16, 1966

TO K. Olsen FROM J. Smith

This is a committee of "line" supervisors from the various manufacturing areas. I will review its progress periodically and re-evaluate its effectiveness for continual operation.

Jack Smith

REPORT

"WATCHDOG COMMITTEE" MEETING NO. 1

Attendees:

R. Chestna	:	Production; Inventory Control
A. Clockedile	:	Mechanical Assembly
F. Fortin	:	Large Computer Group
D. Grill	:	Small Computer Group
D. Kicilinski	:	Represented by R. Chestna

Subject: To discuss formulation of a permanent committee responsible for expediting critical supplies.

Held	:	8/9/66
Started	:	2:00 P.M.
Ended	:	3:25 P.M.

Agenda

To establish the following:

1. Permanent Members
2. A Name for the Committee
3. Operational Limitations and Policies
4. Presentation of problems covered through a period of time. (conclusions)
5. Place and Time for Future Meetings

1. A permanent member from each production area is required.

CONCLUSION: a) That Mr. Kendrick and Mr. Alexanian would be approached as to desire for representation
b) Representatives from various departments would be asked to attend meetings as the need develops
c) Permanent members will be expected to expedite matters pertinent to their own departments

2. The name of the committee is:

"Watchdog Committee"

3. Operational Policies

a) To expedite whenever and wherever practical all problem areas entered into this agenda
b) To establish the means for entering problem areas into the agenda
c) Weekly meeting reports will be distributed on a need-to-know basis
d) Prime problems only will be entered into the agenda
e) All agenda items entered as new problems will be dated and carried until the entire membership is satisfied that the problem is resolved satisfactorily
f) 1. Communications (lines of authority) will be established
2. Expediting will be internal and external when necessary
3. Co-ordination will be provided when necessary
4. All other areas will be recognized and acted upon as soon as is practical
g) All decisions affecting schedules will be brought to the attention of cognizant managers as soon as possible
h) The weekly reports will be numbered to facilitate future correspondence
k) Expediting will be through the means of telephone, or personal contact wherever and whenever practical
j) The committee will establish the order of priority for distribution of critical items

CONCLUSIONS:

a) The "Watchdog Committee" feels strongly that representatives from any problem area should try and attend meetings when invited
b) We (the Committee) hope that when an area is approached for cooperation, a positive approach will be evident at all times
c) Two problem areas have been immediately recognized for the agenda

1. Delayed output of the machine shop
2. Delayed output from Sub-Assembly

All problems recognized will be entered and dated under "New Problems". All carry-on problems will be listed as "Current Problems" with date of original entry shown. No one problem will be removed from the agenda until completely resolved
d) The "Watchdog Committee" requests that cognizant managers approach Field Service representatives and attempt to explain more fully the purposes and objectives of this effort and the need for representation
e) To restrict the distribution of this report when necessary
f) Meetings will be held weekly at 1:00 P.M. A permanent meeting area has to be established
The temporary date and location for the next meeting is: 8/16/66 - Steve Mikulski's office

NEW PROBLEMS
Entered 8/9/66

1. Delayed output from the machine shop

   Action: The machine shop representative was asked to prepare a report for the following meeting answering the following questins:

   1. Why are the components in question late?
   2. What is being done to satisfactorily clear up the problem?
   3. Is the need for additional help necessary to alleviate the problem before Sept. 1, 1966?

   Result: Pending

2. Delayed output from Sub-Assembly

   Action: Initial investigation indicates a possible breakdown in communication, causing a REAL Parts shortage.

   Result: All areas questioned are being investigated by the Small Computer Group. In some cases the problems are real.

3. The need for an input from Inventory Control when a real parts shortage is iminent, with a report covering corrective action if any, and the need for committee action.

   Action: Pending

   Result: Pending

Distribution List

Steve Mikulski: Large Computer Production
Dick Richardson: Cabinet Assembly
Jack Smith: Small Computer Production
Cy Kendrick: Module and Sub-Assembly

dec INTEROFFICE MEMORANDUM

DATE August 16, 1966

SUBJECT KEN GOLD

TO K. H. Olsen

FROM Bob Lassen

Attached you will find a sample of Ken Gold's publicity efforts.

Ken is doing an excellent job. He's quick and imaginative and gets things done.

His current efforts are mostly related to employee relations, recruiting publicity and employment advertising. These jobs keep him very busy, and I think interest him.

We have given very little thought recently to other areas of Public Relations in which you have expressed previous interest. Perhaps you and the Product Line Managers should meet with Ken sometime to review areas of Public Relations that are non-personnel oriented.

RTL/jfr
Enclosure

dec INTEROFFICE MEMORANDUM

DATE August 15, 1966

SUBJECT Possible 8/S Order from Baird Atomic

TO Ken Olsen FROM John Jones

cc: Stan Olsen
Charlie Kotsaftis

I met with Bill Langton (Vice President of Science and Engineering) and his people at Baird Atomic on Friday the 12th to talk about DEC's computer line. Mr. Kotsaftis from the Cambridge office was with me. The Baird people are very excited about the possible use of the 8/S in conjunction with their equipment. We actually did some interface design right with them.

Further work will be carried on by Kotsaftis with the project leaders that report to Mr. Langton. It is possible that we will get an 8/S order from them this month.

John

digital MEMO

DATE August 15, 1966

TO Jack Smith
Cy Kendrick
John Culkins
Dick Richardson
Bob Maxcy

FROM Ken Olsen

For Friday morning's Manufacturing meeting, I would like all of you to make a presentation on "Systems for Keeping the Production Areas Clean." After this is done, I will ask you to make a presentation to the Product Line Managers some Monday.

ecc

INTEROFFICE MEMORANDUM

DATE August 15, 1966

SUBJECT Module Handling

TO Ken Olsen

FROM Bob Savell

cc: Win Hindle

Sometime ago you requested that we take care in handling modules. We are trying to do this, but it is difficult to get people in my group to cooperate when they see how modules are delivered to us by Production. They come piled up in cardboard cartons with no covers on the modules and, in most cases, no separators between modules. This is especially true with FLIP CHIPS.

It seems to me that Production should be setting a standard for the rest of us to live up to.

dec INTEROFFICE MEMORANDUM

DATE August 12, 1966

SUBJECT Ken's Memo of August 9

TO Ken Olsen ✓
Jim Jordan
Display Booth Committee

FROM Howie Painter

I think that selecting a single display house to do the bulk of our booth designs is an excellent idea. Further, I have a suggestion for which display house that might be.

Atkins & Merrill, I believe, would be an excellent choice for the following reasons:

1. Their booth design and construction group is located within a half-mile of the plant.

2. The quality of Atkins & Merrill's work is, in general, better than any other I've seen.

3. Steve Ellis, the salesman who has visited us in the past, is an extremely honorable guy.

The only criticism of Atkins & Merrill that I've ever heard is that, in general, their prices have been somewhat higher than other exhibit builders. However, I understand that since they are attempting to get more and more exhibit business, their prices have come more in line with those quoted by other firms.

While we should certainly investigate other companies to work closely with, I feel that the convenience of doing business with Atkins & Merrill, as well as their basic ability in this field, would tend to outweigh other considerations.

Howie

Howie

ejb

INTEROFFICE MEMORANDUM

DATE 8/11/66

SUBJECT

TO K. Olsen

FROM D. Kuyamjian

cc S. Olsen
W. Hindle
N. Mazzarese
H. Crouse

A newly formed company, Compact Logic, is planning to offer peripheral and storage equipment with suitable interface to computer users at prices less than those which the computer's manufacturer offers. These people intend to sell to DEC computer users in addition to the others. They have contacted Anelex for pricing and contract agreements and are able to buy in quantities the same or larger than we do; they indicated an interest in disc files and printers in quantities of ten per month and larger.

I know of other instances where this is happening - mostly the users themselves contacting our vendors to purchase add-on memory systems etc. To date our vendors have been able to avoid competing with us by hiding behind high, single quantity pricing; this could no longer be the case with Compact Logic.

Most of our vendors have asked for our direction on this as they don't want to risk our wrath.

My opinion:

1) our stacks with or without electronics are DEC designs - I think we can restrain them from selling these.

2) standard products such as memory systems and printers - I don't think we can legally even intimate that we wish to restrain them from selling to others - restraint of trade.

I have applied for a D + B on Compact Logic; Dave Denniston has agreed to obtain information on their activities.

dec INTEROFFICE MEMORANDUM

DATE August 10, 1966

SUBJECT Fiscal Year 1966 Training Department Activity Report

TO Ken Olsen ✓
Win Hindle
Bob Lassen
Nick Mazzarese
Mike Ford
John Jones
Stan Olsen
Ted Johnson
Jack Shields

FROM Bob Pate

The following is a statistical summary of the Training Department activities for the period 1 July 1965 to 30 June 1966.

Number of Courses Conducted		101
Customer	77	
Basic Tech	4	
Advance Tech	19	
Twilight Tech	1	
Number of Students Processed		729
Customer	539	
Basic Tech	49	
Advance Tech	126	
Twilight Tech	15	
Total Expenses		$129,565.
Income (107 customers paid for space and a course at Lear Siegler)		$ 33,200.
Cost per Customer Student processed		$ 138.

dec INTEROFFICE MEMORANDUM

DATE August 9, 1966

SUBJECT

TO K. Olsen

FROM C. Kendrick

CC R. Belden

S.P.U. Connector Boards and Flip Chip Content in September, October and November Module Requirements

	SEPTEMBER		OCTOBER		NOVEMBER	
	QTY	% of Total	QTY	% of total	QTY	% of total
S.P.U.	7,069	10	5,160	8	4,418	5.5
CONNECTOR	8,769	13	7,019	18	9,624	12
FLIP CHIP	49,803	77	52,169	74	64,436	82.5
TOTAL:	65,641	100	64,348	100	78,478	100

INTEROFFICE MEMORANDUM

DATE August 8, 1966

SUBJECT Capital Budget

TO Ken Olsen ✓
Stan Olsen
Win Hindle
Nick Mazzarese
Ted Johnson
Loren Prentice
Dick Ward
Bob Dill
Bruce Garvin
Norm Anderson

FROM Harry S. Mann

On the assumption the Product Line shipping goals for fiscal 1967 will be achieved, we have calculated that our expenditures for fixed assets should not exceed $1,288,000. This amount must provide for leasehold improvements, equipment we will lease to others, and machinery and plant and office equipment.

The programs as now submitted approximate this goal and, therefore, I propose we set this up as our plan without further evaluation of the overall program at this time.

Regarding equipment leased to customers, Win Hindle estimates his group will sell $141,000 (book value) of equipment now on lease. Nick Mazzarese expects to lease new equipment with approximately the same book value. There would be no net increase in this category and hence no budget would be provided.

Leasehold improvements in Maynard have been estimated at $109,000.

It was agreed that no equipment for training or demonstration purposes would be held more than 3 months before sale to a customer. Hence, no budget has been provided for this purpose.

The figures include all subsidiaries as well as the Parent company.

I further propose that we release these funds at the rate of $100,000 per month and review the program in late December. At that time we can see whether or not our shipping schedule is being maintained and our fixed asset needs as we have now planned them. I also suggest that all requests for capital appropriations be submitted to my office and approved at the Product Line Managers' meetings. All proposals for leasing equipment, making leasehold improvements, or buying equipment should be prepared on the Request Forms now in use.

Harry S. Mann

HSM/clw

dec INTEROFFICE MEMORANDUM

DATE August 5, 1966

SUBJECT DEC PERMANENT EMPLOYMENT HISTORY SINCE 1959 and TERMINATIONS

TO K. H. Olsen FROM Bob Lassen

Per your request, the following is our employment history (semi-annually) since 1959.

Our net gain from January 1, 1966, is therefore 69 permanent employees. We lost 150 people during the period between January 1 and July 1, 1966. Total permanent hires during that period were 219.

Our Termination rate during this period was the highest in the Company's history. 80 of the 150 terminations were as the result of marriage, discharge, military service, return to school, domestic problems, pregnancy, travel and health. The remaining 70 left to go to new jobs. Most of the people in the latter group indicated they were leaving for more money and/or better opportunity. Approximately one-half of our terminations were people who have been with the Company less than one year. In addition, 30 of the 150 were salaried people.

Terminations seem to be spread fairly evenly throughout the company although Module Assembly, Digital Test Systems, Small Computer Checkout, Programming, Tech. Pubs and Drafting were hardest hit.

We have been fortunate in today's "pirating" market not to have lost very many engineers and technicians.

It is my feeling that our terminations will be reduced during the next six-month period, but not drastically. 50% will continue to be out of our control (marriage, service, etc.), and many of our young (first job) people will continue seeking greener pastures. However, I feel that the general morale in the company is improving steadily, and we will make every effort to avoid such crises as occurred a few months ago in Drafting and the Metal Shops.

I think that practically all of our mature professional people are enthusiastic about the major improvements in the organization and are pleased with the results. Some of our bright young engineers are still somewhat critical and, of course, very much aware of

salaries and benefits available in today's job market. Although this attitude is a bit immature, we should not merely consider it as just a nuisance factor.

I have confidence in Larry Portner's ability to maintain the enthusiasm of his people. Terminations in Larry's area will occur only if the nature of the individual's work proves less challenging than something offered by another company.

RTL/jfr
Attachment

TOTAL PERMANENT EMPLOYEES

July 1, 1966	-	1086	(+45 Technicians hired in June and reporting for work on 7/4/66)
January 1, 1966	-	1062	
July 1, 1965	-	932	
January 1, 1965	-	735	
July 1, 1964	-	634	
January 1, 1964	-	585	
July 1, 1963	-	413	
January 1, 1963	-	449	
July 1, 1962	-	423	
January 1, 1962	-	300	
October, 1961	-	279	
Year 1960	-	139	
Year 1959	-	70	

dec INTEROFFICE MEMORANDUM

DATE August 5, 1966

SUBJECT

TO K. Olsen ✓
L. Prentice
R. Richardson

FROM J. Smith

A meeting was held in my office yesterday afternoon to validate the figures presented in the attached memo. Present were Joe Monahan and Ron Chestna of my Production Control group, Dick Richardson and Loren Prentice. A complete review was made item by item checking the shop's records against ours.

It was found that the figures as presented in the memo were complete and accurate.

I am sure the percentages are somewhat of a surprise to both Loren and Dick. Method and procedure improvements have a way of creeping in without being noticed until presented in a format such as the attached. I am sure we are all relieved to see some of the improved procedures and methods we have been working on over the past months are beginning to show results.

INTEROFFICE MEMORANDUM

DATE August 3, 1966

SUBJECT

TO K. Olsen
L. Prentice
R. Richardson

FROM J. Smith

I hope the attached review of all open orders currently with the metal shops will once and for all clarify what kind of lead time projections are supplied by Manufacturing to the Shops. We ran through the same exercise about three months ago with relatively the same results.

Number of Open Jobs: 313

	Number of Jobs	Per Cent of Total	
Less Than 4 Weeks Lead Time	9	3%	30%
4 to 8 Weeks Lead Time	86	27%	
8 to 12 Weeks Lead Time	47	15%	70%
12 to 16 Weeks Lead Time	30	10%	
16 to 24 Weeks Lead Time	32	10%	
Over 24 Weeks Lead Time	109	35%	

You will note from the attached comments that virtually all of the jobs with less than one month lead time were due to new product releases or engineering changes and constituted only three per cent of all open jobs.

Seventy per cent of all open jobs had two month or longer lead times. Fifty-five per cent of all open jobs had three month or longer lead times. Wherever possible, lead times are extended out as far as it is practical.

I feel the review points out that more than adequate lead times are being supplied to the shops in order for them to schedule an efficient and effective in house sub-contracting relationship of open orders. Lead times will even improve more now that our Sales forecast procedure is beginning to show results.

not on list

6-27 7-22

6-23 7-22

6-23 7-15

12

316 | 10.00

939

2610

.031

316 | 10.00

939

2610

Elsa - Information Only

INTEROFFICE MEMORANDUM

DATE August 2, 1966

SUBJECT In-House Computers

TO Bob Pate
Ted Johnson
Bob Lassen
Stan Olsen
Win Hindle
Nick Mazzarese
Bob Dill
Ed Simeone
Norm Anderson
Bruce Garvin

FROM Harry S. Mann

At a meeting in Ken's office on August 1, it was decided that we would not capitalize DEC equipment being transferred for temporary use to the Training Area and to Field Sales Offices for demonstration purposes.

It will be the responsibility of the Training Department and the Sales Department to see that any equipment they have received from production is held in their possession for Sales and Training purposes not more than 90 days, at which time the equipment must be turned back to be shipped to a customer. The Accounting Department will be responsible to see that when such equipment is initially turned over to either of these groups that its cost is removed from the computer in-process inventory and added to the consignment and loan inventory. In like manner, the Accounting Department will be responsible to follow up these items on the 90-day cycle to be certain that the transfers to cost of goods sold are made as the equipment is delivered to a customer.

It is clear that by this procedure the equipment turned over to Sales and Training should be of such a configuration that it is readily salable to a potential customer. As a matter of fact, wherever possible, it would be desirable to have a specific customer in mind when the equipment is completed and turned over to these departments.

Any equipment which is currently in the hands of the Training Department or the Sales Department for demonstration purposes should be immediately listed on the Accounting records and Messrs. Pate and Johnson made aware of the equipment in their possession. Every effort should then be made to effect the sale of that equipment at this time so it, likewise, can be replenished with newer equipment on this roll-over basis.

Harry S. Mann

Harry S. Mann

HSM/clw

CC: Accounting Manual

INTEROFFICE MEMORANDUM

DATE August 2, 1966

SUBJECT Leasing

TO Ken Olsen
Harry Mann
Nick Mazzarese
Stan Olsen
Ted Johnson

FROM Win Hindle

In visiting Stanford Research Institute recently, I found that they had not purchased DEC computers for the sole reason that we would not provide a leasing plan. Perhaps others were aware that we had been cut out of SRI for this reason but I did not appreciate this fact. They now have some 20 computers in the engineering division of SRI and Bob Wing, business manager, commented, "We would have bought half of these from DEC if we could have leased them."

This memo is not to suggest we provide a leasing plan but we should realize that there are institutions like SRI where we are completely cut out by this policy.

Win

DIGITAL EQUIPMENT CORPORATION
MEMORANDUM

DATE August 2, 1966

SUBJECT FULL UTILIZATION OF TRAINING SPACE AND EQUIPMENT

TO Bob Pate FROM Bob Lassen

cc: K. H. Olsen
H. Mann

Per my conversation with you yesterday I would like you to take immediate measures to plan both day and evening classes and labs for the forthcoming year as dictated by the company's projected training requirements.

Because of the high cost of space and new equipment we are asking for, it is necessary to do as much as we can to prevent "downtime" of facilities and equipment.

Please prepare a schedule of your projected (double session) classes and labs for the forthcoming year and send copies to Ken Olsen, Harry Mann and the Product Line Managers. This schedule should also include the double sessions you are currently conducting for the large basic technician group.

I am extremely pleased with the way things are going in Training, particularly the way in which you and your people are handling the very large class and also the way Dave Edwards is organizing a much needed field service training effort. The Training organization has become much more flexible in recent months in keeping with the changing needs of the company.

It appears to me as though our technical employee training effort (particularly field service) will be of prime importance to DEC and that we must be prepared to improve and update our efforts with the advent of new equipment and the hiring of additional Technical people.

We seem to be handling our customer training pretty well, and the changes apparently will not be as dynamic although I would urge those who are paying for customer training to examine what we are doing. I have the feeling that we are taking customer training for granted.

RTL/jfr

INTEROFFICE MEMORANDUM

DATE August 1, 1966

SUBJECT Plant Layout

TO Ken Olsen

FROM Harry S. Mann

As you requested we discussed this matter at some length as part of our Product Managers Meeting on Monday morning, July 25. There was general agreement among the group to the plan outlined in your most recent memorandum. A few modifications were suggested, however, as a result of some of Larry Portner's comments and also in an attempt to accomplish this move with a minimum cost and upset to personnel.

The first point of modification to your plan was that we use the second floor of Bldg. 12 for the Programmers and move Ted Johnson and his people to the third floor of Bldg. 12 along with Tim McInerney who already has a substantial amount of equipment, supplies, etc., on the third floor. The next step coincidental with this would be to find temporary space for the PDP-6 people who are now in Bldg. 3 to make room for Dick Ward and his people as you suggested. Several possibilities exist in this regard and Win Hindle is going to look at these in some further detail.

The Training Department would be moved to the second floor of Bldg. 11 as you suggest and this could be accomplished as rapidly as practical without disrupting anyone. The space thus freed up in Bldg. 3 by the Training Department could be used for various activities including the expansion of Bob Brown's area as required and possibly for some book storage which has been taken from Jack Smith on the top of Bldg. 5 for offices for the PDP-9 group.

In other words, it is generally felt that there would be pretty much enough room on the third floor of Bldg. 12 to house Ted and Tim in total; that there would be more than enough space on the second floor for Larry Portner and his people; and finally, that the first floor would be used essentially as you suggested for the program library and the computers needed by the Programming Group. Of course, the top floor of Bldg. 12 will have to be properly air conditioned to meet Ted's requirements.

Another point that developed in the discussion was that Nick Mazzarese was very anxious to get the balance of his Marketing people out of building 12 close to his operations somewhere in building 5. This would again involve a number of offices and there is no apparent space available in building 5 at the moment for this plan. This means that these people would still remain on the second floor of building 12 temporarily.

Harry S. Mann

HSM/clw