dec INTEROFFICE MEMORANDUM

DATE December 31, 1965

SUBJECT IBM Disc

TO Roger Williams

FROM Ken Olsen

When you run out of material on the tape transport, I would like to have you draw up from the IBM manual, a full-sized drawing of the IBM disc with its plastic cover. You will have to guess at some of the dimensions but I think you can get an outside figure and the cross section fairly well. Someday when they are available, we would like to buy discs from IBM but we won't be able to see one for a year and I would like to have our designs made adaptable so that we can use them when they are available.

In addition, they have a picture of the spindle which it drops onto and I think that from your cross section of the disc package, you will be able to scale the spindle. From this cross section of the spindle, we can have Henry go ahead and look for vendors who can make up a spindle assembly like that for us.

Ken

ecc

INTEROFFICE MEMORANDUM

DATE December 22, 1965

SUBJECT Power Needs for the New Tape Transport

TO Roland Boisvert FROM /Ken Olsen

When you have a break from a few problems with the 570 Tape units, will you put down on paper for me your best guess as to the power needs for the new Tape Transport. I would like to consider the possibility of a special power supply and power control unit for this Transport but I would like to have the power needs and the power control specifications. There is a possibility that you may even use a PDP-8 power supply in this Transport.

I would also like to have a list of switches and indicators which are needed. I would like to consider making the panel somewhat like we do the PDP-8 console panel.

Ken

ecc

INTEROFFICE MEMORANDUM

DATE December 22, 1965

SUBJECT

TO Bob Maxcy
cc: John Trebendis

FROM Ken Olsen

Will you collect all of the capacitors, transformers, and completed power supplies from the reject stock room in Building 5 and from the reject stock room between Buildings 8 and 11. If they are all laid out in one place, I'm sure that we can find a use for much of the equipment.

There are a number of transformers and capacitors that are slightly damaged which are probably good electrically. We can probably use some of these if we reconsider our standards. We can use others in equipment which we are going to keep in-house. We might even substitute some of these for power supplies which are in our own computers. Then there are other capacitors which we might fix. Some of them have burns or breaks in the plastic covers. We could send these back to the manufacturer or get plastic covers from the manufacturer and then use them. We might even put them in applications where slight damage in the plastic cover won't show. We might even get cardboard cases from distributors which can be used to insolate these capacitors. We should also clear out the engineering stock room of miscellaneous capacitors and see what we could use there.

Those transformers and perhaps capacitors which are somewhat obsolete now, like the large number of -15 transformers we have, will probably be used if we lay them out in one place, inventory them and publish the quantity. When we make up special power supplies for the 7X or the new DECtape transformer, we might design them into the power supplies.

In addition, there are a number of models of power supplies which could be used. We engraved numbers and words into the panels but we might be able to use the whole power supplies as production items if we change some of the aluminum.

Ken

ecc

INTEROFFICE MEMORANDUM

DATE December 22, 1965

SUBJECT DECtape Transport Model

TO George Gerelds
cc: Roland Boisvert

FROM Ken Olsen

I would like to make a model of the DECtape transport, somewhat like the one Roland Boisvert and Phil Backholm are assembling, but I would like to use it to demonstrate automatic tape loading and a few simplified construction techniques. I keep thinking that I am going to sit down and draw it out in detail but I never get around to it. I would like, therefore, to start making a model and make it by sketches as we go along. Will you see if you can collect the following parts:

See if Roland Boisvert has two spare reel motors and hubs. If he doesn't have motors, we can just put two tight-fitting shafts through the panel but it would be nice if he did have some spare hubs. It would also be good if he had some spare capstans. If he had a spare capstan motor it would make the model a little more valid because there would be less danger of using the same panel space for two different things.

See if you can round up a reject PDP-7X cabinet. It will have to be built on one of these cabinets and if they have a spare one around it would be best. Otherwise, get a 6' relay rack and we will use that. The model will work better if we have vacuum in the column so if Roland has a spare vacuum motor it would be good to pick that up also. We can use a Sears Roebuck shop vacuum cleaner if we don't have a spare motor around.

Look through the Bodine gear motors you have in the grey cabinet along side your desk and pick out three of the same with the lowest speed.

Ken

ecc

dec INTEROFFICE MEMORANDUM

DATE December 22, 1965

SUBJECT Lost PDP-7

TO Jim Hastings

FROM Ken Olsen

Will you find out for me if there is a PDP-7 in the Los Angeles office. We have been looking all over for one for the new module tester and there hasn't been one available. I have a suspicion that there is one hidden in the L.A. office. Will you let me know if this is true or not.

Ken

ecc

dec INTEROFFICE MEMORANDUM

DATE December 22, 1965

SUBJECT Small Computer Inventory Items

TO Jim Hastings

FROM Ken Olsen

In John Trebendis' stock room, I believe there are a number of commercially bought power supplies which we bought for the PDP-7's. I think we have since designed our own power supply and have this large number of commercial units on hand. Will you check into why we have these on hand and if we plan on using them. If we converted before we used up inventory we had on hand, will you see if you can work out a system in which this will not happen in the future. You might look over the other small computer inventories which we have there and see what can be used.

There are a number of reject gates from PDP-8's and panels from PDP-7's which are in the reject stock room. Parts of these may be able to be used again if we looked into it before the whole computer is obsolete.

Ken

ecc

dec INTEROFFICE MEMORANDUM

DATE December 22, 1965

SUBJECT Use of Reject Items

TO Dick Richardson

FROM Ken Olsen

cc: John Trebendis

Will you look through the reject stock room in Building 5 and the one between Buildings 8 and 11 to see if there is stock which you should keep in the cabinet stock room. There are a large number of miscellaneous fan parts and fan blades which you should probably keep on hand and also small pieces of hardware such as pins which we have obsoleted at times. If you have them on hand, you might be able to use them or we might add them to new designs. You could make it a point to march the cabinet designers through your stock room to make sure they use the same old parts over and over again.

Ken

ecc

INTEROFFICE MEMORANDUM

DATE December 21, 1965

SUBJECT Device for our Automatic Crane

TO Loren Prentice FROM Ken Olsen

I think I discovered the device we should have used for our automatic crane for running the vapor degreaser. I was waiting in a car wash and studied the power door opener they had and concluded it looked like the device we want for operations like this. It consists of approximately 1/4 horse motor driving a large pulley with a V belt. It appears that this large pulley is also a slip clutch because there is a spring loaded hub. This then drives another step of speed reduction which consists of a simple chain driven pair of sprockets.

This unit is made by the Edwards Company and I think they cost only about $100. They have the advantage of having a slip clutch in them and also having readily available reversing system.

Ken

ecc

INTEROFFICE MEMORANDUM

DATE December 8, 1965

SUBJECT V Block Head Positioner

TO Ken Fitzgerald

FROM Ken Olsen

Here is the V block head positioner which I would like us to consider. If we had a 12 inch disc and use the outside 2 inches with 128 tracks, the center of the center distance would be 0.015 inches. With 8 inches inside diameter, the circumference is 24 inches with record and density of 1500 bits per inch. We would then have 36,000 bits per track. This then gives us almost 5 million bits on the disc.

If we allow the slo-syn motor 2 steps per track, the diameter of the pinion would then have to be about a half inch diameter. This then would allow us to try 4 steps per track and would cut the storage in half and give us about 0.030 inches between centers.

If we went to a 14 inch disc, we then could have half again as much storage or we could have 128 tracks with .022 centers which would make the pinion about .75 inches in diameter. We could use a standard round rack and grind the flaps on a surface binder. We could then make a setup which we could drive 24 hours a day for several weeks and test its accuracy. If we had a block on the end of the ram that would flip in and out, we could have it go against an indicator and in this way we would run the indicator only the times for running the test. If we leave the indicator in during all the tests, we'd probably wear the indicator out.

We should probably use the SS 25 motor because we have all the circuitry necessary for driving this and we even have some motors readily available. We may have to change the circuitry a little bit in order to get the units to reverse.

Ken

ecc

INTEROFFICE MEMORANDUM

DATE December 7, 1965

SUBJECT Schedules for the PDP-6 and PDP-7X

TO Win Hindle
Harlan Anderson
Nick Mazzarese

FROM Ken Olsen

I think that we should now have an up-to-date pert chart on the new PDP-6 and the PDP-7X. I suggest that we work hard in bringing our schedules up-to-date and present them at the Works Committee on Tuesday, December 14th. This will give us a good thing to talk about to our Board of Directors. Stan will not be at the Board meeting so instead of bringing a detailed discussion of the product line reports, it would be good if Win and Nick presented a report on new products in the computer lines.

I think we should schedule, for each of the three product lines, a report by Andy once a month on the competitive picture. I think this should normally go to the product line meeting but I would like to have Andy report on the competitive picture at next Tuesday's Works Committee so that he can then make the same presentation in briefer form to the Board of Directors meeting in the afternoon. We might also ask Andy to report to the product lines on a separate day, but probably also once a month, on our position with respect to the customers, which would be pointing out our weak points and also our strong points from his contact with customers. I think we should do this regularly or we'll wait until something comes up which we think is significant.

I would also like to suggest that Andy make a written report during each month on the competitive picture because, as he gets close to this, his reaction can't help but be subjective and change month by month. It would be very important to look at these reports over a period of time because a review of the attitudes will be more important than the attitudes of any one day.

Ken

ecc

dec INTEROFFICE MEMORANDUM

DATE December 7, 1965

SUBJECT Notes on Paper Tape Transport Design

TO Nick Mazzarese
Ed de Castro

FROM Ken Olsen

One of the reasons we're putting engineering under the product lines is to keep the pressure on for getting things in to the product line, and to avoid the infinite time they tended to spend when they were a central engineering group. It appears to me that we had a paper tape reader that ran at medium, or slower, speed but was ready for production. We are now spending a lot of time making a faster one, which is a real good idea, but I would suggest that, when we postpone the production of a designed reliable unit to make one which would be better, we let the rest of the Company in on the decision. If we let the engineers make these decisions, we would be the same as we were with the central engineering group.

Ken

ecc

INTEROFFICE MEMORANDUM

DATE December 6, 1965

SUBJECT Criticism of Disc and Tape Transport Development

TO Nick Mazzarese
cc: Dick Best
Jim Hastings
Ed de Castro
Steve Lambert
Dan Wardimon
Ken Fitzgerald

FROM Ken Olsen

It seems to me that the thing which terrifies most of us about any disc which we might build is all tied up in the operation of the disc itself, the head, and the availability of the two. It appears to me that all of our research is being aimed at the development of mechanical parts of the mechanism, and by people who have never designed anything mechanical before. In fact, we have no one in the house who has designed anything at all like this. If we can get the head, the disc, and the specifications, we can contract out the mechanical portion of this to people who are experts.

Let's lay out a plan which would concentrate on head design in procurement and disc design in procurement. When we're convinced that we have these, then let's figure out the best way to get the mechanical parts done. Dan and Steve have competitive systems -- we threw out Dan's because we didn't want to invest in the mechanical design but that really was relatively unimportant. We did give Steve the mechanical designer and the money to continue his design but most of his effort is being put on the mechanical motion portion of it and it is probably very good considering he has never done any mechanical design. If discs are important, let's set about to find out which of these two head - disc systems is best and forget the unimportant part for now.

We can probably modify our approach to tape transport design by taking this attitude into account. We are spending a lot of time and effort on the layout of the tape transport but we can get a lot of information on those parts which really worry most of us by life-testing the real motors, the capstan motors and other parts 24 hours a day. We can run these things 24 hours a day for half a year before we get a transport on a computer and we can find out whether it is going to stand up or not. Otherwise, we will again wait until the transport is in the field before we find out if the components are reliable.

Ken

ecc

INTEROFFICE MEMORANDUM

DATE November 22, 1965

SUBJECT Data Disc Booth

TO All those attending FJCC

FROM Ken Olsen

The local representative from Data Disc called me to say that they plan to have a booth at the Fall Joint Computer Conference and that they will be demonstrating their high density and reliability of their system.

ecc

dec INTEROFFICE MEMORANDUM

DATE November 22, 1965

SUBJECT Boeing Company

TO Nick Mazzarese
John Jones

FROM /Ken Olsen

I received a call last Friday from Ed Carlberg of the Boeing Company. He told me about the arrangement we are working out using a PDP-7 and scope for a Los Angeles demonstration of schedule presentation. This is to be given to NASA and JPL for the voyager program which they hope to obtain. This is to be presented on the 27th of December and will be used for two weeks.

They had just finished a meeting with management - who are very enthusiastic - but, because of the importance of this after they once made a commitment, they would like to have an ironclad agreement with DEC. I promised to call them early this week to give them a guarantee. If they get this contract, they think it will be an important part of it and they would need a PDP-7 with a 5 million word disc and a PDP-8 with a display. They are now preparing their letter of intent for these. If it goes well, they would also want to do the same at Denver with an Air Force project.

Would you write a very short letter that I could send to them, and maybe also a Teletype, assuring them that we will make the machine available. Phrase it very carefully so that we don't commit any more than we should. My name can be typed on the letter and then I will read it and sign it before it is mailed.

Ken

ecc

dec INTEROFFICE MEMORANDUM

DATE November 22, 1965

SUBJECT Items for Small Computer Guidance Committee

TO Nick Mazzarese
John Jones

FROM Ken Olsen

Here are some items I would like to have presented at the next Small Computer Guidance Committee.

1. I would like to have Dick Best and Ed de Castro discuss the susceptibility of computer systems to electrostatic charges, such as is picked up from rugs on dry winter days.
2. We should have a report on the status of the disc and tape systems on a regular basis, like once a month.
3. We ought to make a final decision on the color scheme for the new computers.
4. Tom Stockebrand has a complaint on the manuals for DECtape and I think we ought to air this at a Guidance Committee and have someone from the manual writing group there to defend what we have done.

Ken

ecc

INTEROFFICE MEMORANDUM

DATE November 19, 1965

SUBJECT Module Production Planning and Ordering System

TO Maynard Sandler
Rod Belden
Henry Crouse
Dave Packer

FROM Ken Olsen

I feel that we are making headway toward simplifying the module production planning and ordering system. When we regularly get a list of the parts needs well into the future and a list of the status of each of the parts in inventory, we will be doing much for building up the confidence of everyone in the system.

The next step which we have to develop is a simple system for ordering these components. I would like to have you four people get together as a committee and come next Wednesday, November 24th, to another ad hoc production planning meeting to present a proposal as to how parts should be ordered. The question is a simple one. Now that we are giving Purchasing a list of the parts several months ahead, should they have the responsibility of ordering them and supplying them as needed?

Ken

ecc

dec INTEROFFICE MEMORANDUM

DATE November 19, 1965

SUBJECT PDP-7X Control Panel

TO Nick Mazzarese
Jim Jordan
John Jones
Larry Seligman

FROM Ken Olsen

Here are a few comments on the PDP-7X control panel. I think we should have all levers which could destroy the program in a serious way actuate in the up position. The examine and deposit switches could be rearranged so that we "deposit" up in one and "deposit next" up in the other; then "examine" would be down on one and "examine next" would be down in the other. We may make I/O reset an up actuate switch if it is a dangerous one to touch. The key switch should be labeled control or panel lock, or else in some way describe what it locks.

The indicator layout is, in general, not obvious like I think it is in the PDP-8.

I get the impression from the panel that the link bit ties the program counter register with the accumulative register.

If we eliminate the aluminum trim from the bottom of the panel, it would make the whole thing less expensive and I think quite attractive, as we do on the PDP-8. We have to find a better way of putting the trim on the remaining three sides. It is heavy aluminum but the corners are always sloppy. Formed stainless steel may be a less expensive and neater way of doing this.

The control panel seems to be much more complicated than what could be needed on a simple computer. Some of the toggle switches might be combined, such as the start and stop switches, and the continuant and execute switches. Maybe the I/O reset and the read-in switches might be made into one. The speed and the power switches might be combined into one and in the speed switch there definitely should be labeled a normal position. The lock switch could be way off to the side and would still look attractive.

Ken

ecc

dec INTEROFFICE MEMORANDUM

DATE November 18, 1965

SUBJECT The New Logotype

TO Jack Atwood

FROM Ken Olsen

At our dinner with the Board of Directors and their wives this week, a poll was started as to whether or not people liked the new logotype. The new logotype lost overwhelmingly by a vote of 26 against and 2 for it until I claimed I held 30 votes and then the new logotype won. However, it is interesting that those people are just someone outside and felt so negatively about the change.

Will you send a copy of the sheet that shows the different forms of the logo to Dorothy Rowe. General Doriot would like to have her show it to Henry Dreyfus when she visits Henry to see what his reaction is. If you still have a sheet that shows the old logo, it would be good to send that along also.

General Doriot insisted that our logotype be trademarked. I was not able to tell him whether the new one could be trademarked or not. Will you let me know so that I can tell him.

Ken

ecc

dec INTEROFFICE MEMORANDUM

DATE November 18, 1965

SUBJECT DEC Directors Dinner

TO Harlan Anderson

FROM Ken Olsen

Our dinner with the Directors at the new Sheraton-Boston Hotel was probably one of the nicest we have had. Here are some suggestions which I would like to put on record so that we can remember to take care of them next year.

I think that we should insist on the hotel fixing the room and then not changing it afterwards. I think if we ask them to do this they will keep the room.

The room which we were supposed to have had the tables set up in a series of round tables without a head table. I think this arrangement would be a lot more pleasant. When there is a head table it makes it very difficult for the people at the head table to carry on a conversation. They always have one side of the table free of chairs and, in the case we had on Tuesday night, there was an odd number of people so that there was usually one person left out of the conversation at the head table.

Several people suggested that we have hors d'oeuvres.

Mrs. Barnard suggested that she enjoyed very much having the dinner out in Maynard because she enjoyed seeing the plant. We might consider this next year or the year after.

Ken

ecc

dec INTEROFFICE MEMORANDUM

DATE November 18, 1965

SUBJECT Patent Applications

TO Harry Mann

FROM Ken Olsen

When our engineers sign a patent application, the form says that they do this in return for $1. It would seem to me that we should pay this dollar in order to make it legal and because it creates a somewhat strange feeling when we say we do this and we really don't.

Will you let me know what you think about this.

Ken

ecc

dec INTEROFFICE MEMORANDUM

DATE November 18, 1965

SUBJECT

TO Harry Mann

FROM Ken Olsen

Arnaud de Vitry says that Bernard Haus has lost his list of fiscal month closing dates. Will you please send a note to Bernard, with a copy to Arnaud, listing the closing dates for each month.

Ken

ecc

dec INTEROFFICE MEMORANDUM

COMPANY CONFIDENTIAL

DATE November 11, 1965

SUBJECT Special Disc Files

TO Steve Lambert
Dan Wardlmon

cc: Stan Olsen

FROM Ken Olsen

I would like to hear your suggestions as to what the best way would be to obtain the following disc file. This is for a small drum computer which I am considering. Don't talk about this to other people because when they see the specifications they will be able to see what I'm thinking about.

This drum will have 4,096 32-bit words and we ought to have it rotate as fast as possible. There will be one circulating register on the drum of 432-bit words and a single timing track. In addition, if there is space on the drum, it would be nice to have additional 4,096 blocks available.

I think it would be best to break this down into 16 tracks, which would mean 256 32-bit words per track (one of the 32-bits is a spacer.) This would mean 8,192 bits around the track with an inside diameter of about 5 inches; we would have density of about 500 bits to the inch.

The circulating register would have 128 bits and so the distance between the heads would be about 1/4 of an inch on the inside and, if the outside diameter is 10 inches, then the space would be about 1/2 of an inch. It would be good to build the reading and writing heads as one unit with a thick spacing and the adjustments would be made by pushing it closer or farther away from the center of the disc.

The circulating register would have to be reading and writing simultaneously and so the shielding between the two heads has to be good. For the block of 16 heads, only one would be used at a time and that will be either reading or writing and so shielding it is not as critical there. It is, however, important to be able to change one word in the middle of the disc without disturbing anything else. The timing track head could be isolated from the rest and so shielding may be no problem there.

It would be very desirable to have as an option increase blocks of 4,096 words if it did not add significantly to the initial cost of the disc.

There is another disc which I would like to have you consider which would be used to keep a display alive. It would contain information for every bit on a television scan. For high quality tv, we would have 500 x 500 spot display or 250,000 bits. We could take advantage of a very high density storage here because a single error is not very serious. It would be nice to change a single bit during the display but we could insist on changing whole lines at a time. A 10 inch disc

with 1,000 bits per inch storage would give us approximately 25,000 bits per track. This means that the 10 tracks would take care of the storage.

We would need 250,000 bits every 30th of a second and so the pulse rate coming out would be 7.5 megacycles which, of course, is quite high. If we wanted to cut down the pulse rate, we could put alternate pulses on different tracks.

For a less quality display, we could put 250 spots in each direction, which would cut all the numbers by four. If we could get 2,000 bits per inch storage, we might get the whole thing on one track.

Ken

ecc

INTEROFFICE MEMORANDUM

DATE November 10, 1965

SUBJECT Head Return Positioning Mechanism

TO Phil Backholm
Roland Boisvert

FROM Ken Olsen

cc: Loren Prentice

The mechanism we have on the new tape transport to position the magnetic coupling plate and the photo cell mechanism seems like it might be expensive and difficult to make. I would suggest that you consider making two separate units, one for each head, that pivot on the shaft of a small gear motor. This would then simply be an arm screwed to the gear motor shaft with a coupling plate fastened to it.

For those transports in which we use only one head, we would only need one mechanism.

Bodine or Borg make neat enclosed gear motors which are stocked at distributors. George Gereids has a few of these in his cabinet. For production quantities, Barber ~~Coleman~~ Colman has a new neat reversible open frame gear motor which should be quite a bit less expensive. We could drive the motor with a resistor in series so that the arm could be driven to a stop without overheating.

Ken

ecc

dec INTEROFFICE MEMORANDUM

DATE November 10, 1965

SUBJECT Suggestions for Next Line of Computers

TO Bob Hughes
Dick Best

FROM Ken Olsen

For our next line of computers, we need some new components and I think we should start investigation to get them. First of all, we need a new control matrix so that we can make complicated controls in a very simple way. Matrix of diodes on a wafer sounds like a simple way if we can figure out how to make them or obtain them.

Another matrix is a rope memory but we have to figure out a way of making these in a very simple way. It might be possible to make other magnetic devices that are simple to manufacture.

The other device we need is a simple, fast memory. The most obvious one is the integrated circuit flip-flop memory but this is going to be expensive, I believe.

The most obvious one is a linear select memory because it might make a number of simplications on this to get several turns per board to keep the current down and the signal high. We could then use two cores per bit to increase the signal to noise ratio.

RCA has a monolithic linear select memory plate in which they have the conductors and a thin layer of magnetic material on one sintered plate. It appears that this would make a very nice linear select memory for the fast memory portion of computers. If we look into the manufacturing of this we might find that it is possible for them to print down magnetic material only in the areas where we have specified and this might make a good magnetic control matrix.

We might also use some of the special silicon storage devices like four layer diodes, silicon, and silicon thyratron.

We could also consider taking particularly complex but commonly reproduced packages such as Teletype units and reproducing them with integrated circuits. They are very slow and it would seem to me that it would be possible that integrated circuits might be useful in particularly complex modules that get used many times.

Ken

ecc

dec INTEROFFICE MEMORANDUM

DATE November 10, 1965

SUBJECT

TO Ken Larsen

FROM Ken Olsen

A year or two ago some students got in touch with you who were proposing a large inexpensive memory using electrets. If you have heard any more from them, I would like to hear about it.

Ken

ecc

dec INTEROFFICE MEMORANDUM

DATE November 9, 1965

SUBJECT

TO Sales Newsletter

FROM Ken Olsen

As DEC continues to expand, there is a greater need for senior men at the Company to work closely with me on overall corporate problems and policies. I have asked Harlan Anderson to spend full time in corporate responsibilities and, in particular, to help develop the Company's external relationships. Effective immediately, Win Hindle will be product line manager for the PDP-6 and Nick Mazzarese will assume responsibility for the LINC and computer aided design groups, which formerly reported to Win. Our sales policy guidelines for PDP-6 remain as outlined several weeks ago.

ecc

dec INTEROFFICE MEMORANDUM

DATE November 9, 1965

SUBJECT

TO Engineering Newsletter

FROM Ken Olsen

As DEC continues to expand, there is a greater need for senior men at the Company to work closely with me on overall corporate problems and policies. I have asked Harlan Anderson to spend full time in corporate responsibilities and, in particular, to help develop the Company's external relationships. Effective immediately, Win Hindle will be product line manager for the PDP-6 and Nick Mazzarese will assume responsibility for the LINC and computer aided design groups, which formerly reported to Win. Our sales policy guidelines for PDP-6 remain as outlined several weeks ago.

ecc

INTEROFFICE MEMORANDUM

DATE November 2, 1965

SUBJECT Cheap Light Pen

TO Ed de Castro
Nick Mazzarese
John Jones
Dick Best
Ed Harwood
Chuck Stein

FROM Ken Olsen

When I was at George Washington University, I saw a very inexpensive light pen which they had on their PDP-5. They took a simple photodiode and put it in the end of the plastic case from a cheap ball-point pen. They had simple twisted pair wire go from this to an operational amplifier they had laying around in another rack. This drove the A-D converter which was programmed so the light pen could be used in a normal way.

This light pen had none of the features which we now have, such as shutters, but it did have the advantage of being exceedingly inexpensive. I suggest that we consider adding one of these to our product line. We wouldn't want to use an operational amplifier because we don't need, nor do we want, the characteristics of an operational amplifier. We might, however, find a simple amplifier in our product line somewhere which will do the job.

Ken

ecc

cc: George Gerelds

Give me a call sometime to talk about making a very simple light pen like the one described in this memo. Meanwhile, will you try to see what you can find in very fine twisted pair wire.

KHO

INTEROFFICE MEMORANDUM

DATE November 2, 1965

SUBJECT Diode Matrix

TO Gordon Bell
cc: Ed de Castro
Nick Mazzarese
Dick Best
Bob Brown

FROM Ken Olsen

Bob Brown said that it is possible to make a very large diode matrix on one wafer of silicon. This would be made with a diode at each intersection and conductive stripes on each side to connect the matrix. This then could be made into a simple whirlwind type control element or a light once memory by burning out the diodes in those intersections which are not desired.

This would be a very nice way of making the whirlwind type control. One part of the matrix would be the construction decoding matrix and then the rest of the same wafer would be the diode instruction matrix. If the whole thing won't fit on one wafer, one could simply add as many wafers as is necessary.

Ken

ecc

dec INTEROFFICE MEMORANDUM

DATE November 1, 1965

SUBJECT Displays at Lincoln Laboratory

TO Chuck Stein

FROM Ken Olsen

Dick Kennedy, who used to be in our module sales group, gave me a call the other day saying that they are doing very interesting things in displays at Lincoln Laboratory. He says that the people there are disappointed that we, and other people in the industry, have not been more interested in their work. Dick suggested that we look into it because it might be of value to us and also because showing interest in the work at Lincoln Laboratory may help our ability to sell there.

The name of the man doing the work is Edwin Tarbox, and he is in Group 21. The phone number is VO 2-3370, ext. 5495.

I'm sure that Dick Kennedy would give us more information if we called him.

Ken

ecc

INTEROFFICE MEMORANDUM

DATE October 21, 1965

SUBJECT Business Cards

TO Jack Atwood

FROM Ken Olsen

When you have business cards printed up for me the next time, will you please have it done like the attached sample. With these, I can attach it to such things as our annual report and then people won't have to feel they have to write a thank you note. "No Acknowledgment Necessary"

Ken

efc

dec INTEROFFICE MEMORANDUM

DATE October 15, 1965

SUBJECT Production Organization

TO Maynard Sandler
cc: Harry Mann
Dave Packer

FROM Ken Olsen

Here are my present thoughts on how we should organize production. Please let me know your reactions and also point out inconsistencies and problem areas so that we can straighten out some of these things in the immediate future. I think we should combine all module production into one group, which I would like you to head. There would then be three production lines; the high production, the medium production, and the low production lines. I would like to see these three lines parallel with each other on one floor if we can get the rest of the third floor of Building 5.

There would then be a computer assembly group which would be headed by Jack Smith and would probably be located on the top floor of Building 5.

The metal shops would be a separate production group and would be of service to these first two.

There would be three production controls; one in each of the three production groups. Each would watch their own work in process and manufactured parts. Dick Richardson would take orders for, and deliver, complete cabinets and would take the responsibility for stocking all the components that would go into the cabinets.

The new concept which I would like to see us pursue is to have a materials control group that would combine the functions of purchasing, inspection, and stocking of raw materials. This would combine all the responsibilities necessary to have the parts available on the floor at the right time. I think Henry could supervise all of these responsibilities.

The module production group would then have three sections; the Production part which would be headed by Cy, Production Control which I would like to see Rod Belden head, and the Module Test which I think could be well supervised by Jim Cudmore.

Loren Prentice now heads a group called Mechanical Engineering which is production engineering and plant control on the side. I would like to change the title of his group to Production Engineering which would do mechanical engineering with plant control on the side. I would like to see a man report to Loren who would take much of Loren's responsibility for plant control, security, and take on the additional responsibility of watching the janitor service.

Ken

ecc

INTEROFFICE MEMORANDUM

DATE October 7, 1965

SUBJECT Re-design of PDP-7 and PDP-8 Table Tops

TO Jim Jordan
cc: Loren Prentice
Henry Crouse
Nick Mezzarese
John Jones

FROM Ken Olsen

I would like to see us re-design our PDP-7 and PDP-8 table tops. The inside curve on this table top is very difficult and expensive to build and I also suspect that it is somewhat fragile. Will you look into the possibility of designing a new one which should be much lower in cost.

During my study of laminates, I have fallen in love with the oiled type redwood Micarta. I think that this may add real economy to our production units because it does not show scratches. I would like to see you consider using this material for our counter tops. I know that it doesn't add the light color which we get so nicely from the white counter top, but I think it would wear longer and would be much more tolerant of manufacturing imperfections.

Ken

ecc

INTEROFFICE MEMORANDUM

DATE October 4, 1965

SUBJECT Works Committee Agenda Items

TO David Packer

FROM Kenneth Olsen

cc: Nancy Survilas
Elsa Carlson

As secretary of the Works Committee, will you be sure that all requests addressed to the Works Committee such as the one from Alan Titcomb on Module Delivery get put on the agenda and that some action be taken. We should also make sure those items on which action is postponed are taken care of at the next appropriate meetings.

Ken Olsen

KHO:ncs

INTEROFFICE MEMORANDUM

DATE October 4, 1965

SUBJECT DECUS Chairman

TO Nick Mazzarese
John Jones

FROM Kenneth Olsen

Be sure to let me know who is going to be Chairman of the Fall DECUS Meeting. David Brown use to be my boss at MIT and I think I might fill the Chairman in with some interesting and flattering remarks which might make the introduction a little more interesting.

Ken Olsen

KHO:ncs

INTEROFFICE MEMORANDUM

DATE October 4, 1965

SUBJECT Drum Type PDP-8

TO Pat Greene
cc: Nick Mazzarese
John Jones
Ed de Castro

FROM Ken Olsen

I'm not sure that a drum type PDP-8 is the best new project for you to work on, but I am enthusiastic about the usefulness of a machine like this in our product line. I do not want to imply any approval of your doing this project, but here are some ideas I have on the machine.

It would be nice if you could fit in the power supply section of a standard PDP-8 and use the basic PDP-8 control panel without so many indicators. The storage media could be either drum, disc, or tape loop. I don't think the storage unit has to be removable. There should be more than 4,000 words of storage because the words should come inexpensively now.

Union Carbide dropped their quartz delay line computer. One possibility would be to buy the design rights to this and re-do it to make it match the PDP-8. They bought the delay lines from Corning Glass and the nice thing about it is that the storage is very fast and one could use short glass lines for the serial registers. It would also be worthwhile to look up the older drum machines which were quite successful in their time. By now, some of the text books should have good detailed descriptions of these machines and also tell how to design the computers.

I think this would be the place to consider using integrated circuits. For small machines they made in large quantity, I think it is probably practical to use a small number of very large boards. The whole Teletype control could be on one large board, the arithmetic element on another control on one or two others, and memory circuits on another. For general use, I am convinced that our module approach is close to being optimum but for special cases like this, we should very definitely consider large boards and integrated circuits.

I think a machine like this would be great for schools where they don't really need high speed and for a number of control applications which need a computer but don't really need speed at all.

Ken

KHO:ecc

OCT 1 1965

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MSG 1681 10-1-65

TO BERNARD HAUS
FROM KEN OLSEN.

WE HAVE BEEN WORKING HARD TO SPEED UP DELIVERIES OF PDP-8'S BUT WE DO NOT EXPECT TO MAKE ANY SIGNIFICANT IMPROVEMENTS IN COMPONENT DELIVERIES UNTIL AFTER THE UNIVERSITY OF PARIS PDP-8 IS DELIVERED. I AM SORRY THAT ALL I CAN SAY IS THAT WE WILL CONTINUE TO WORK HARD TO IMPROVE THIS DELIVERY ON THIS MACHINE BUT ALL WE CAN NOW PROMISE IS THE DATE WHICH WE HAVE ALREADY GIVEN YOU IN DECEMBER.

END OR GA PLS

I CALL YOU BACK ABOT THIS IF THERIS AN ANSWER

dec INTEROFFICE MEMORANDUM

COMPANY CONFIDENTIAL

DATE October 1, 1965

SUBJECT Product Line Budget Approval Meeting

TO Works Committee
PDP-6 Group Managers
Dorothy E. Rowe, ARD

FROM Kenneth H. Olsen

On next Tuesday at 7 p.m. there will be a special Works Committee meeting at which time we will make the final review and approval of the Product Line Budgets for the next quarter. I have invited several members of our Board of Directors to take part in this meeting.

The budgets for the Special Product and the Module line are only small variations from the budgets under which they have been working so they will take very little review. The small computers have been under extensive review and balancing by Harry Mann, Jack Smith, and Henry Crouse, and I think all we can do is to report the results. The PDP-6, however, is proposing a radical change in the mode of operating and I think a very detail reporting of the budget is in order. In order to go into the details and make individuals feel responsible for their part of the budget, I am asking the four group managers of the PDP-6 to present their own part of the PDP-6 budget.

I think most of the company is enthusiastic about the new conservative approach to the PDP-6 with an emphasis on saving money and delivering to short term goals. I think it would do the morale of everyone good to have the managers convince us all that he is in the spirit of this plan.

Gordon will present the specifications and plans for the development of a new FLIP CHIP-6. I think everyone is enthusiastic about this but I think we all need some assurance that there is a firm program. During the morning Works Committee meeting, Jack Shields will present a detail schedule for retrofiting PDP-6's which are now in the field. If his schedule does not cover all engineering to be done on the present PDP-6, Gordon should include that engineering in his budget and schedule.

Larry Portner will present a budget for the programming group. If he wants to do the swapping programming for Stanford, I suggest he include it in his budget and sell as a part of his budget.

Pres Behn will present the budget for marketing. There should be very little marketing expense during this time because all we want to do is sell the machines which we now have underway. I don't think we will have to spend money on advertising or promotion during this period but I think most of the time should be spent on preparing for selling the new machine and laying out packages of equipment and software for different types of users. During this time we can get a lot done by leaking information to friends about our plans. I would like to see

a loose leaf notebook of packages which we would like to offer. One of the packages which I would like to see is the JOSS system. We could let the world know that it is part of our plans but be careful not to promise it, in case we should change our minds after we see how the drum system works for RAND.

The group which will need the most detail study is Production. I would like to see Bob Beckman present detailed production plans and also a list of all the major items he has in inventory. This is going to be important to have these inventory items always before us so that we can manipulate them as different opportunities come up. Bob should also include plans for incorporating new equipment which is now underway such as the new memory, new MICRO tape, and the new DATAMEC tape.

People within DEC have hinted to me a concern as to why the PDP-6 needs such a large organization to do production. This will be an opportunity for Bob to explain why he needs so many administrative types in his group.

Ken Olsen

KHO:ncs

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Ken Olsen

KHO:ncs

dec INTEROFFICE MEMORANDUM

DATE September 27, 1965

SUBJECT October Trip to Europe

TO Stan Olsen

FROM Ken Olsen

Here are a few things I would like to have you do during your trip to Europe.

Our delivery of modules has been poor for the last six months and I would like to have you be sure to stop at each sales office and let them know about our new production facilities and about our new production plan and to assure them of a good delivery and good quality. If you can't visit Sweden, I think it would be good to give them a call from Reading to let them know of your interest and to give them a chance to tell you about their problems.

If you can find the time, I would like to hear your opinion of the buildings which John Leng is considering in Reading and in Scotland. John is so enthusiastic about Scotland that I would like to hear your opinion of the facilities which are available and of the nature of the personnel there. It would be good if you could visit an American manufacturer located in Scotland and also talk to the local Chamber of Commerce.

When you are in Germany, would you consider whether we should have an office both in Munich and in Cologne.

Arnaud de Vitry has been very helpful in our French office, will you try to visit with him, if it is convenient for him, to express our appreciation for what he has done and also to try to get a feeling for the opinions he may have on the personnel we have in the office.

I am disappointed we haven't sold more computers and modules to CERN – if you are going through Switzerland, it would be well worthwhile stopping by to see what we can do to sell more and also to find out the effectiveness of our European personnel.

Ken

KHO:ncs

INTEROFFICE MEMORANDUM

DATE September 24, 1965

SUBJECT Visit to Motorola, Inc.

TO Works Committee Members
Cy Kendrick
Gloria Porazzo
Rod Belden

FROM Ken Olsen

Stan and I visited Motorola's television plant outside of Chicago on Wednesday to get ideas from a large production organization. We were particularly interested in automatic machinery and wanted to see how they inserted parts and etched wiring. We were surprised to find out that they have not gone into automatic insertion because of the productivity of their girls. We intend to go into automation because of the lack of productivity of our girls. It was fascinating to watch the girls work. They really move, and those that have to stand up on the assembly line because of the work they do are really active. In spite of the fact that everything is on conveyors, the morale is exceedingly high, everyone is enthusiastic, and there is absolutely no interest in forming a union.

They have a training area where they take in new employees and show them how to solder. They have a timing clock by each girl and if they don't get the soldering up to time they let them go. If they are good they put them on a practice assembly line to see if they can keep up with it. Then when they are trained they put them right on the production line, which is a continuously moving conveyor. Everything is done by conveyor. This sets the pace and the girls have to keep up. Many of the girls seemed to be bias toward the left because they were always slightly behind in their work. They were all happy though and excited and pleased in what they were doing. In a different plant where they make automobile radios they use rotary tables instead of conveyors because the units are relatively simple. They have six girls on a rotary table and each one adds parts to an etched board. The last station of the rotary table is a soldering unit and after they drop off to a conveyor they are ready for tests. Six girls on a rotary table turn out 1500 car radios in a day. They really move. I think we here in New England, and we at Digital, have a lot to learn from the Midwest where they know how to produce.

The final assemby is a long conveyor. The chasis comes in on one conveyor and the box cabinets come in on another. The cardboard slips off the box cabinet and goes to another conveyor which rides above this assembly line and drops onto the finished unit at the end. They install all of the parts of the TV into the cabinet and, still on the conveyor, goes into the lining up section. There half a dozen or so fellows line up the color TV in a shielded room with a mirror on one wall so that they can watch the set while they are making the adjustments. On the other side of the room the cabinet gets inspected, a box falls on top, it gets stapled up, and the unit is done. The fascinating thing about this is how fast the units move and everybody, including the lining up people, have to keep up with that moving belt.

They feel they have an unusual problem because of the engineering changes and model changes. If he hadn't mentioned it first, I would have said that we had an unusual problem because of the engineering and model changes. They have one interesting technique, however, which has solved a big problem for them. They seal their engineering model up in plastic with a seal over the opening so that when arguments come up with the engineering department they can prove that they are making it according to the engineering model. Even the engineering sample of a cable is sealed up in plastic so that their engineering department cannot accuse the production department of modifying the engineering sample. They do no automatic inserting but everything is done by hand. They do have a terrible shortage of girls.

They change models every six months and make engineering changes continually during the length of the project. The bulk of their components is tremendous so their raw material storage and control problems make ours look like child play. Because they are working on a production line, they have very little freedom to take people off the line and put them in another place so their inventory control has to work very smoothly. We, in general, use large numbers of a few types of components - they tend to use a large number of different parts.

These rotary tables are carrousels for a number of their subassemblies. Three to six girls sit around and assemble parts and the last station solders them. They often do spot soldering by having little shaped wells come up from the solder pot onto the circuit. There is a record card over every girl and each hour the inspection department assigns all mistakes to girls so that every hour there is a number put in the block on the girl's card saying how many mistakes she has made. Then there is a certificate over her on which she gets gold stars for accomplishing certain periods of no mistakes. There is no such thing as productivity and accuracy because every activity is fixed by the conveyor belt.

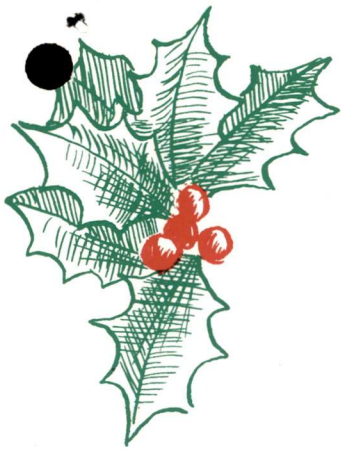
They have signs around saying, "Quality is our Business." Most signs seem rather corny but in this case it seems very appropriate and the employees seem to appreciate it.

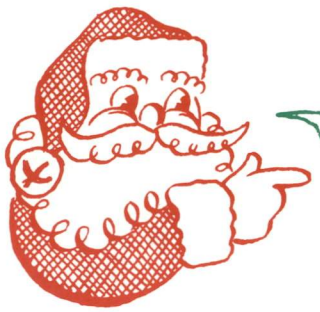
They have a profit-sharing retirement plan which seems to generate a lot of enthusiasm. It is a great honor to be one of the commissioners to this profit-sharing plan and they are now having election for these commissioners and it is just like a union election. There are posters printed and stickers around. Apparently, it is quite an honor to be elected. They also have a number of company organizations, such as foreman's club and boy scout organization. I, in general, got the impression of a pleasant atmosphere which I am sure comes from the competence of their people.

Ken

KHO:ecc

CHRISTMAS MAZUMA CHRISTMAS BOOTY





T. A. P.

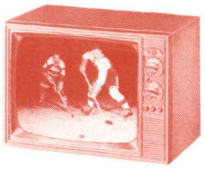
TELL-A-PAL + TAKE-A-PRIZE = MONEY AND PRESENTS FOR CHRISTMAS

What an easy way to TAP some extra money for Christmas holiday fun. $50 or more Christmas money can be yours. For every new employee you refer and who is hired during the month of September and who remains on the payroll for three months, you will be paid $50 ---- just in time for Christmas celebrating!

AND MUCH MORE ! ! !

As an added incentive, on October 1, November 1, December 1 and January 1, a drawing will be held for two MOTOROLA COLOR T.V. SETS and three MOTOROLA CADET T.V. SETS. For every person you refer and who is hired during the preceding month and is on payroll at the time of the drawing, you will receive one chance on winning one of these valuable prizes which you can use for

CHRISTMAS PRESENTS FOR YOURSELF OR YOUR FAMILY AND FRIENDS! WHAT A DEAL!



HERE'S WHAT TO DO

TELL-A-PAL introductory cards are available every Friday morning at plant entrances or they may be obtained at any time in your plant Personnel and Employment offices. This card must be presented by your referal to the interviewer at any Chicago Motorola employment office at the time of the employment interview for you to be eligible for any of these prizes.

THE TELL-A-PAL PROGRAM IS RESTRICTED TO OUR CHICAGOLAND FACILITIES ONLY.

INTEROFFICE MEMORANDUM

DATE September 24, 1965

SUBJECT Closed-Circuit Television for Training Classes

TO Bob Lassen

FROM Ken Olsen

Will you question a few of our students, after they have been out of our training courses for awhile, to see what suggestions they would have on improving them? Most people are bored and happy when they finish a course, but after they think about it for a few months their comments are very worthwhile.

At one time we had talked about considering a closed-circuit television with video tape recording for our courses to save on teachers. A certain amount of this would seem to be worthwhile. Will you consider it and figure out how many teachers you could save? Then, when we're ready to look at it, I'll arrange to visit Gordon College where they are using this now and we can look over their equipment to get an idea of the cost.

The idea of a closed-circuit television is not to eliminate the teacher, but to get the technical content across in the most efficient way with the very best teacher. This gives the students a chance to look at a close-up of the equipment and also to look at waive forms and signals which can be pre-recorded. The instructors can then be available for the question and answer period.

The big advantage of closed-circuit TV is that you then have the very best lecturer and the one who doesn't have to have the teaching personality can answer the questions and be the contact person.

Ken

KHO:ecc

INTEROFFICE MEMORANDUM

DATE September 23, 1965

SUBJECT Drills and Screws for Mounting Bars

TO Loren Prentice FROM Ken Olsen

At the Production Engineering Show I talked to people who make self-tapping screws and got the impression that it would be foolish to consider tapping these mounting bars now. There are four or five company who have obtained licenses from the Continental Screw Company in New Bedford to manufacture the tap type screws.

In addition, Parker-Kalon has screws which they claim are even better. They also have an automatic feeding screw driver which is fascinating. This is an attachment which will go on any power screw driver. It is an automatic feed mechanism which, one at a time, blows a screw through a plastic tube to the driver. I have a brochure on this and it sounds a little doubtful for our application because they want more clearance between the screws and the shoulder than we have in our present socket.

Shakeproof has a thread cutting screw and they too (of course) claim theirs is better. It might be good if, when you go to the Show, you took a sample of our socket along and go over the problem with all the manufacturers. Shakeproof also has an automatic screw driver.

I stopped in at the booth of Commander Manufacturing Company of 4225 West Kinzie Street, Chicago 24, Illinois. They have an adjustable multiple drill head which will drill an area up to 22 inches. The maximum number of heads it will take is 15 but the unit only costs $800 and is adaptable for many uses. We might consider doing our bar drilling with a head like this and indexing the bar three times in order to get in all of the holes. I have the literature and price list on this unit. The price starts at $420 but you need to buy extra things so it comes to $600 to $800.

The Avdel Corporation has several interesting fasteners. They have rivets that look like the USMC units but they come in an aluminum stick for automated insertion and might be faster to use in those places where now they put in USMC rivets one at a time. In addition, this company has what appears to be a less expensive blind inserting threaded bushing.

A number of people have indexing tables and when you are there it might be a good idea to make a study of all of them and collect all the literature in one place so that we know about indexing tables. I am particularly interested in those that have a hole through the center so that we can actuate things there or have a supporting tape on the center.

Some booths of companies I stopped in to see were Air-Hydraulics, Inc., 545 Hubb Avenue, Jackson, Michigan; Jackson Fluid Power Company, 8299 East Nine Mile Road, Warren, Michigan; and Snow Manufacturing Company, 435 Eastern Avenue, Bellwood, Illinois. I didn't pick up the Snow literature because they didn't have it available right then but they have a number of interesting indexing tables which are vertical, horizontal, and sideways, plus a number of actuating devices which would be very convenient to know about when we make automated equipment. I think they are simple and inexpensive but not necessarily very precise.

The Phillips Manufacturing Company has vapor degreasers which are no more interesting than anyone elses but they have an interesting conveyor degreaser which I think shows how to make a conveyorized unit without taking a large amount of space or losing much vapor. They have enclosed the top and sides of the unit and have used a conveyor like the one we hang our painted panels on but with power.

We visited the Slo-syn mobile exhibit and their milling machine seems to do what we want it to do. It references everything with a 0 in the same sense that a mooge does but they don't have to go to 0 at every measuring point. The information you give it at each point is how much it should move relative to the last point. If you lose track where you are, then you have to go back to 0 and start over again.

When you are at the Show, will you look at brakes which we might use in our tape transport. I am not acquainted with the problem but you should check with Roland Boisvert to see what his needs and worries are. Bendix Steel makes multiple disc brakes like we used to have in new departure bicycle brakes. These might be quite expensive but I would guess that they would last forever.

Ken

KHO:ecc

dec INTEROFFICE MEMORANDUM

DATE September 23, 1965

SUBJECT Ways of Improving your Module Production Area

TO Rod Belden

FROM Ken Olsen

In walking through your production area, I am afraid that we are developing some of the housekeeping attitudes which people get into and never get out of. I think it would be good if you assign one person, boy or girl, to make sure that modules are never laying around on the floors and not on trays. We have to be sure that people show respect for these modules and are very careful when they lay them on top of each other. Not only do we want to do this for the sake of good housekeeping and production standards, but we have to also show respect for our expensive modules as we bring visitors through.

I would like to see you work out a system for posting a record along side of every girl's bench showing how many of each component she inserted on the previous day, or some record like this. It was very interesting at Motorola to see how hard the girls worked and how happy they were. They had a chart over every girl and it showed every mistake she made in the previous hour. They give gold stickers to those who have good records. Their work rate was fixed by a conveyor belt. Some of the men who were doing stand-up operations at conveyors were really moving. We at Digital, and we in New England, have a lot to learn from the Middle West.

They also had a training area with timers and each girl is shown the operation. If they don't learn to do things fast enough, they don't give them a job. Then when they go on the assembly line they are working at almost full speed. We could put girls on probation and see how their timing is and then if they don't get up to the desired rate we could just let them go.

It is almost too late now to start this but we may still be able to get away with it. If we go any longer I'm sure we could never make a change. It will be particularly important to get it started before Cy Kendrick starts his new line because it could be put into that at the very start.

When we first started the Company, for the first year or so we didn't have time clocks because there were so few girls working. There was almost a rebellion the day we put in time clocks; not because people didn't believe in time clocks but because we were making a change. I now feel very badly that we didn't set higher production rates on your production line and keep after it. I am disappointed that Stan didn't keep after this because he had good ideas to get the girls working harder but he has lost interest in it and you haven't picked it up. I suspect that your girls are quite a bit less productive than Maynard's, even though Stan promised he was going to make them much more productive.

KHO:ecc

Ken

dec INTEROFFICE MEMORANDUM

DATE September 20, 1965

SUBJECT Suggestions for New PDP-6 Budget Plan

TO Harlan Anderson
Gordon Bell

FROM Ken Olsen

Here is a list of suggestions that I would like to have you consider for the new PDP-6 budget plan.

1. Immediately stop work on all processors which do not have most of their modules.

2. Assign a project engineer to every customer.

3. Lay out and schedule all obligations, such as fixing up hardware, completing programming, and the completing of those processors which we have not stopped work on.

4. Immediately stop all marketing expenditures.

5. Start the new FLIP CHIP PDP-6 and schedule it so that it will be completed, or well underway, by the date all other obligations are complete.

6. On the magic date, we will have completed all obligations and will have all the important information on the new 6. Then we will make an intelligent decision as to the future of the 6.

Ken

dec INTEROFFICE MEMORANDUM

DATE September 20, 1965

SUBJECT Suggestions for New PDP-6 Budget Plan

TO Harlan Anderson
Gordon Bell

FROM Ken Olsen

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Ken

INTEROFFICE MEMORANDUM

DATE September 20, 1965

SUBJECT Use of New Switchless Circuit Breaker

TO Irwin Jacobs

FROM Ken Olsen

Would you please, with George Gerelds, check into the availability of using the new switchless circuit breaker with a separate toggle switch to see:

1. If it would be worthwhile using in new designs, and

2. If it would be worthwhile changing present designs.

Ken

KHO:ecc

INTEROFFICE MEMORANDUM

DATE September 20, 1965

SUBJECT Airborne Instruments Laboratory

TO Nick Mazzarese
John Jones

FROM /Ken Olsen

I got a telephone call last week from Mr. Richard Close of AIL. He wanted to know if we would be interested in using their Cutler-Hammer affiliate in England to manufacture our equipment and to sell for us. I called him back a couple days later and said that we were not interested in considering it right now but would very much like to sell to them and I mentioned to him that our people are in contact with their English affiliate.

He asked if Airborne, Cutler-Hammer, and the English affiliate would get a quantity OEM discount. I said that we are very careful to make sure that we are honest when we say we offer everyone the same price and that, most likely, we could work out some arrangement in which they could fill the requirements for getting the quantity discount.

Ken

KHO:ecc

INTEROFFICE MEMORANDUM

DATE September 17, 1965

SUBJECT Visit to Motorola

TO Stan Olsen
cc: Henry Crouse

FROM Ken Olsen

As you know, on Wednesday I got a telephone call from Mr. Ray Kimball of Motorola in Phoenix who said that our visit to Motorola has been arranged. The two people who have to approve the visit are Mr. Walter Scott, Vice President in charge of Manufacturing, and Mr. Garth Heisig, Chief Engineer. On Thursday we will hear at what time on the 21st or 22nd they would like to have us visit. I intend to write a letter to each of them thanking them for the opportunity to visit.

Their address is: Motorola Inc.
9401 West Grand Avenue
Franklin Park, Illinois

If Stan and I run into trouble, we are to call Mr. Hugo Corn or Howard Bealmen, who are the local Motorola salesmen. Their phone number is SP 2-6500, ext. 752.

Ken

KHO:ecc

dec INTEROFFICE MEMORANDUM

DATE September 17, 1965

SUBJECT Chet Gadzinski's Report on Quality Control

TO Harry Mann FROM Ken Olsen

During the Spring, we had a consultant named Chet Gadzinski from the Reliability Dynamics Institute in West Acton, come in to study our quality control problems and, at the same time, he considered many of our manufacturing and inventory problems. I didn't feel that he came with a real definite set of suggestions but I think it might be interesting for you to read his report, which Elsa can get for you.

Ken

KHO:ecc

INTEROFFICE MEMORANDUM

DATE September 15, 1965

SUBJECT Reports for Variations of Budgeted Expenditures

TO Jack Atwood
Ted Johnson
Maynard Sandler
Stan Olsen
Harry Mann
Dick Best

FROM Ken Olsen

I would like, as a regular part of our review of the monthly product line reports, an explanation from each of the service groups as to why there are variations from the budgeted expenditures.

This information is most readily gathered by the person in charge of that service and any poor reporting or poor allocation of time can best be taken care of by the person in charge. Dick Best will report on central engineering, including the strate and semi-conductor development. Jack Atwood will report on advertising, technical publications, etc., and Ted Johnson will report on the expenditures of field offices and overseas offices. Stan and Maynard will report on deviations from standard module costs.

The individual service groups should feel the responsibility to make sure that a good overhead number is assigned to their operation so that the adjustments are small.

Next Monday, September 20th, I would like to have Jack Atwood and Ted Johnson report on the July and August expenditures because they were quite far out from budgets in their departments.

Ken

KHO:ecc

digital EQUIPMENT CORPORATION
MAYNARD, MASSACHUSETTS

SALES CALL REPORT NO. 9108

DATE 9/14/65

FIRM Airborne Instruments Laboratory, Inc. (Division of Cutler-Hammer)

STREET

CITY

SALESMAN Kenneth H. Olsen

OFFICE AREA Maynard

AREA CODE PHONE NO.

PHONE (OURS THEIRS) ☐ LETTER ☐ VISIT ☐

PERSONS CONTACTED	EXTENSION
Richard Close	AC 516
Ronald Howard	595-5870

EST. ANNUAL POT.	CK.		CK.	PRODUCT	CK.	TYPE
		NEW		MODULES		
UNDER $20K		OLD		A/D		
$20 - 50K		HIGH		COMPUTORS		
$50 - 150K		MED.		SPECIAL SYSTEMS		
$150K UP		LOW		OTHER		

REMARKS

Brookhirst Irganic Ltd., Lancashire Dynamo, and Lancashire Dynamo Electronics, Ltd., all of which are part of a Cutler-Hammer affiliate named Metals Industry, would like to meet with me on September 27th at AIL to talk about joint activities in England.

ACTION TO BE TAKEN

FOLLOW-UP DATE BY

SPECIAL COPIES TO

SALESMAN'S COPY

INTEROFFICE MEMORANDUM

DATE September 13, 1965

SUBJECT Combined Meeting of Small Computer Guidance and Module Guidance Committees

TO Stan Olsen
Nick Mazzarese

FROM /Ken Olsen

Late this week I would like to have a combined meeting of the Guidance Committees for both the Small Computers and Modules. It might be Thursday afternoon which would be a time independent of the two regular meetings. The two subjects I would like to discuss are 1) a combined advertising program, and 2) a coordinated A-D development and applications program.

I would like to see us lay out, by ourselves, before we talk to an agency, a program that we would like to see for our advertising. I think it would add a lot of strength if we combined both the modules and the small computers because it gives a much better company image. The type of program I'm thinking of is a full page for small computers and a single column on the opposite page for modules. There are a number of variations for this. One would be a two column add for small computers and a single column for modules all on the same page. Another variation would be to have a single column on several consecutive pages to cover such products as the PDP-7, the PDP-8, memory testers, and modules.

Stan needs a man and a programmer for developing A-D modules. We should, at a minimum, have all the modules we talk about in our A-D handbook. Nick needs a man to apply these modules and other A-D computers. Right now we have neither man and it is a good time to set up a coordinated program. When we do get the men, they will then be able to work together and at least use the same modules.

Ken

KHO:ecc

INTEROFFICE MEMORANDUM

DATE September 13, 1965

SUBJECT J-A Circuit Breaker

TO Henry Crouse

FROM Ken Olsen

Heinemann Electric Company of Trenton, New Jersey has a new series J-A circuit breaker which looks attractive. It should be easy to mount and takes tab connectors and looks like it ought to be less expensive. Will you look into this and see if it would make a contribution to our power control panel.

Ken

KHO:ecc

digital MEMO

DATE Sept. 13, 1965

TO Henry Crouse FROM Ken Olsen

Telephone and ask Henry for samples of cap tight screws from the Continental Screw Company (I think it is in Mass.). 832 screws for milling our Sylvania sockets onto mounting panels. Called 9/13 ecc

INTEROFFICE MEMORANDUM

DATE September 8, 1965

SUBJECT Product Line Responsibilities to Service Organizations

TO Works Committee Members
John Jones
Pres Behn

FROM Ken Olsen

I don't think that I have very often pointed out past failures to people, but I am afraid that for a while I am going to jump on people when they don't show appreciation for understanding the significance of our product line orientation.

Last week someone pointed out to me that they were disappointed at how little one student learned in one of our training courses and he expressed concern for what we taught in these classes. My immediate reaction was serious disappointment that his product line hadn't shown any interest in what was being taught to his customers and with his budget money. Rather than be critical, he should be thankful that someone didn't wait for the product line people to say what should be taught.

It is going to take us a while to get over the way we used to do things. People used to make commitments to customers and have the feeling that somehow, through some miraculous, mysterious means, the service organizations found out about these commitments and did what had to be done. Many of the people who made these commitments were much too important and busy to pass on information and specify what they expected from the service organizations. They were often critical, however, when it wasn't done the way they would have wanted it done if they had spent the time to think about it. That is over now and the people with a product line responsibility have to specify what they want from the service organizations.

KHO:ecc

dec INTEROFFICE MEMORANDUM

DATE September 8, 1965

SUBJECT

TO George Gerelds

FROM Ken Olsen

Will you consider the possibility of soldering sockets onto the educational line panels using pre-formed special 18 point soldering machine that will solder them all at one time.

KHO:ecc

dec INTEROFFICE MEMORANDUM

DATE September 8, 1965

SUBJECT Lock on First Floor Door

TO Harlan Anderson

FROM Ken Olsen

When we thought the PDP-1 and other computers on the first floor of Building 12 would be used to a large extent by outsiders, we put a lock on the far end of the first floor to keep the outsiders out of the Company. I believe this is a serious disadvantage to many of our own people who work there. Because most of these are PDP-6 people, will you consider the need for this lock.

Sometime ago I asked Bob Beckman to be on the Security Committee because I thought he would bring up the subject. He might have brought it up and the whole thing is in fair shape right now, but I just want you to realize that there is nothing sacred about that lock.

Ken

KHO:ecc

INTEROFFICE MEMORANDUM

DATE September 8, 1965

SUBJECT

TO Ron Wilson
cc: Henry Crouse

FROM Ken Olsen

There hasn't seemed to be much interest in putting our own paper tape reader on computers for quite a while but one thing you might like to look into is taking the present Digitronics reader and buying only the front panel and then putting in our own circuits. A good part of the expense of their reader is the power supply and we probably have enough power left over so that it won't cost us anything.

At one time Digitronics wasn't at all interested in doing this and they charged almost as much for the front panel as they did for the whole unit but now they have a whole new set of officers and they might be interested.

Ken

KHO:ecc

INTEROFFICE MEMORANDUM

DATE September 8, 1965

SUBJECT Notes on Skinny Computers

TO Gordon Bell
cc: Jim Jordan

FROM Anonymous

It has been pointed out in other documents that horizontal computers are rather impractical but this doesn't mean that computers have to be fat. In fact, skinny computers are often very nice to work on, as demonstrated by the MTC, TX-0 and TX-2 computers. Your observations on the attractiveness and simplicity of this layout seem very valid.

For small computers like the PDP-7 and PDP-8, there is an advantage of putting logic on a swinging door because it makes the system very small and easy to ship and it allows the mechanically-complicated console to be stationary. However, as you point out with the large computer, it cannot all be put on one door and it makes it difficult when you try to use several doors.

Several things have happened which might make it very practical for us to consider a skinny cabinet at this time. To take full advantage of this, people always wanted to cover them with glass. We were never able to do this in either the Sage or the TX computers but now modern technology has developed a technique for convenient lightweight glass doors. This came about in the development of new ovens with all glass doors. The design of these new stoves may be somewhat vulgar but the doors themselves are beautiful because of their inherent simplicity and strength.

These doors are made by putting two pieces of glass separated by 1/2 to 3/4 of an inch with a narrow frame. The glass is held together by a U-shaped aluminum or stainless steel stripping around the edge. The oven designers did this to gain insulation but I think they were surprised at how simple they could make a very attractive and rugged door.

We could make these doors by gluing two thin pieces of dark glass to a narrow frame of black Benelex and then covering the edge with stainless steel channel. We could then lift the doors off and on very much like we do on our present blue cabinets, except that instead of lifting the pins out we would lift the top stationary portion of the hinge.

For straight logic, the cabinet would only have to be wide enough to take a module, socket and wiring but we have to leave enough room to allow large numbers of cables to come out and also to take special devices like memory stacks. However, the glass doors should be very close to the module handle so that it will keep the cooling air flowing through the modules.

The second thing which we are doing now which makes the whole thing more practical is to build the power supplies all from the top surface. This means that we could mount power supplies inside the space and have no need to get into the back side of the power supplies. The power supplies could be all the way down to the floor because they need very little maintenance. If the base is about 20" high, we could put quite a bit of power supply in one cabinet. On the other side of the base could be the ventilating fans and filters. The whole front surface could be a standard furnace filter and could be very easily taken out and changed. Inside this base there has to be left a lot of room for cables. There could be a large gap at the top of the doors to allow the exhaust air to leave.

There are several problems, however. The unit should be consistent with peripheral equipment like magnetic tape units. Serious difficulty would be tieing this into a console because this is still the item which people look at much more than the cabinetry. The design should be such that it will look furnished and complete even when the doors are off because much of the time it will be operated that way.

This note is written anonymously to avoid any implication of enthusiasm for a new PDP-6 computer.

INTEROFFICE MEMORANDUM

DATE September 8, 1965

SUBJECT Stock Room Literature

TO Jack Atwood

FROM Ken Olsen

Will you, right away, sort out all the literature in the two stock rooms in building 11 onto skids and group it by product. I think that we will be moving the PDP-6 group into buildings 8 and 11 very soon and I would like to be able to move that literature out very quickly. I do, however, want them on skids by product line and in very neat piles with very little on each skid so that it can be carried easily and will not get into bad shape.

I think that it is possible to hire day laborers from agencies at a reasonable rate to do this kind of work and so it will probably just take one of your people to supervise them.

Ken

KHO:ecc

dec INTEROFFICE MEMORANDUM

DATE September 8, 1965

SUBJECT

TO Jack Atwood
Jim Jordan

FROM Ken Olsen

You are looking for a unique way of writing Digital that will still be clear. Please notice the Dodge sign at the Dodge dealer's on Route 117 because apparently Dodge had the same problem and solved it in a very pleasant way. It is sort of interesting that Dodge had approximately the same size name and it began with a D and had a g in the middle.

Ken

KHO:ecc

Ken Olsen September 7, 1965

Notes on Product Line Responsibility

Product lines perhaps should do their own testing of special modules. When they do this we can give them some of the personnel doing testing. This would be particularly true of Win Hindle and the PDP-6 group. One of the results of this would be that people tend to use more and more standard modules.

There are several 732 power supply testers in storage that should go to test equipment headquarters.

Teletypes in Field Service are not well taken care of.

The socket adapter on the PDP-7 in Field Service is not in good shape.

INTEROFFICE MEMORANDUM

DATE September 7, 1965

SUBJECT

TO Members of the Works Committee
cc: Loren Prentice
Dave Packer
Jack Smith

FROM Ken Olsen

We are now in a position of having a lot of unused space and yet many of our departments are crowded. Several of our Product Line Managers want very badly to get all of their operation together in one place so that they develop enthusiasm and cooperation between their people. In listening to the desires and requests of many people, here is one possible layout that I would like to have people consider.

LARGE COMPUTERS would be moved to Buildings 8 and 11. PDP-6 sales and administration could be on the 2nd floor of Building 11, engineering on the 3rd, and checkout on the 3rd floor of Building 8. The main entrance would be the front of Building 11, where a small landing would be built right at the door and stairs would go immediately to the 2nd floor where the reception area would be for the Large Computer Group.

SMALL COMPUTERS would go to the top floor of Building 5. Eventually the cabinet shop, the carpenter shop, accounting, and the PDP-6 will go and so there will be a lot of room for the Small Computer Group, even though we may also move in computer assembly, sales, and New England Sales.

MODULES would be moved to the north end of the present engineering floor and would include all module engineering, marketing, the model shop, the module finished goods stock room and shipping facilities. This means that we would do only receiving at the present shipping dock near the cafeteria and all shipping would be done either from the PDP-6 dock or from this module dock. We may want to move the model shop out to the center of the floor so that the finished goods stock room will be closer to the loading dock and so that we can put offices along the windows.

SPECIAL PROJECTS will share the 3rd floor of Building 5. Win would take over Ed Harwood's area which will give him expansion space for Pat Greene's activities and room for development of medical computers and automated drafting.

SALES and NEW ENGLAND SALES OFFICE might do best moving to the top floor of Building 5 where they would be close to at least three of the four product lines. We may want to move the mail room to the same place.

ACCOUNTING could then move to the 1st and 2nd floors of Building 12.

TECHNICAL PUBLICATIONS could then move into the air-conditioned offices now used by PDP-6. Those parts of Building 12, such as the dark room and Jack Atwood's offices which are not now fixed up, could be used for dead storage. This floor has been impossible to air-condition and it would be good to get the people out into Building 3 where it can be air-conditioned and put the literature in Building 12 where it can't be air-conditioned. I wouldn't consider moving the dark rooms to those areas which are already air-conditioned in Building 12. The technical writers may work more effectively if they have offices in the product line location.

PRODUCTION will stay where it is but we may want to move computer assembly up to the top floor of Building 5 and we could then build a semi-high production line where computer assembly is now. This would then give us three module production groups. High production for lots of 1,000, medium production for lots of 100 to 1,000 (FLIP CHIP only), and special production group which would do small lots, modification, experimental work, and build manufactured parts. I think module checkout should stay where it is but should organizationally be under the quality control group of the module product line. When I say module testing for very special modules, such as large PDP-6 modules and current drivers be turned over to the product lines, I mean that the personnel now doing the testing will be with the product line also, of course. I think this would do much to stop the product lines from designing exceedingly special and very difficult to manufacture modules. The high speed automated line for silk screening, etching and gold plating FLIP CHIP modules will be built on the ground floor of Building 11. We'll keep that facility now on the top floor of Building 5 for special work overflow and standby in case of emergency in Building 11.

SHOPS will move to the bottom floor between Buildings 3 and 4. There is a large concrete floor there which will very comfortably hold the sheet metal shop, machine shop, and paint shop and have an area for storage. In addition, we'll move the carpenter shop and the cabinet shop down there. The carpenter shop probably should be broken into two groups; one that does maintenance and builds partitions and walls and another which builds things for the products, such as formica tops and crates. In addition, we should have a plumbing and electrical shop where we store all the supplies, even though at the present we don't have our own plumber and electrician. Then, of course, there should be a general maintenance shop to take care of our other equipment.

CENTRAL ENGINEERING will stay pretty much where it is. Drafting seems well located at approximately halfway between the product lines and Jim McKalip's group seems comfortable.

STOCK ROOMS AND STORE ROOMS. When each group lays out their space, I would like them to lay out in their areas sufficient store rooms and stock rooms. Accounting should claim enough space so they can save all their records for as long a period as they think is necessary. Right now we have accounting records spread throughout the plant and I am sure no one knows where they are and they will never be thrown away because no one can see them. I want each group

to have an obsolete stock room where all obsolete equipment is put and then the group will have the responsibility of throwing it away when it is not worth keeping. When modules are not worth keeping in inventory they will be moved to the obsolete module stock room where they will be kept as long as there is any possibility for use. The second stock room will have to be neat and will have to have records kept. Otherwise, we won't know what we have and these are exceedingly difficult to keep neat. I would like an obsolete stock room for special things like displays, power supplies, and production tools. In addition, I would like a stock room for product line literature. This is all literature, current and obsolete, and it includes many dozens of notebook covers which we order so freely but which quickly become obsolete. These stock rooms may be located in Jack Atwood's area but separated by product line and locked.

PARKING has always been a problem for visitors because we have no control over the spaces near Building 12 but we do own the parking lot across from the Building 5 entrance and we can reserve as many spaces there for visitors as we desire. We have never fixed up the Building 5 entrance and if we move sales over there we may want to do this.

Ken Olsen

INTEROFFICE MEMORANDUM

DATE September 2, 1965

SUBJECT Proposed Construction for Extrusion

TO Roland Boisvert
Phil Backholm
cc: Loren Prentice
Jim McKalip

FROM Kenneth H. Olsen

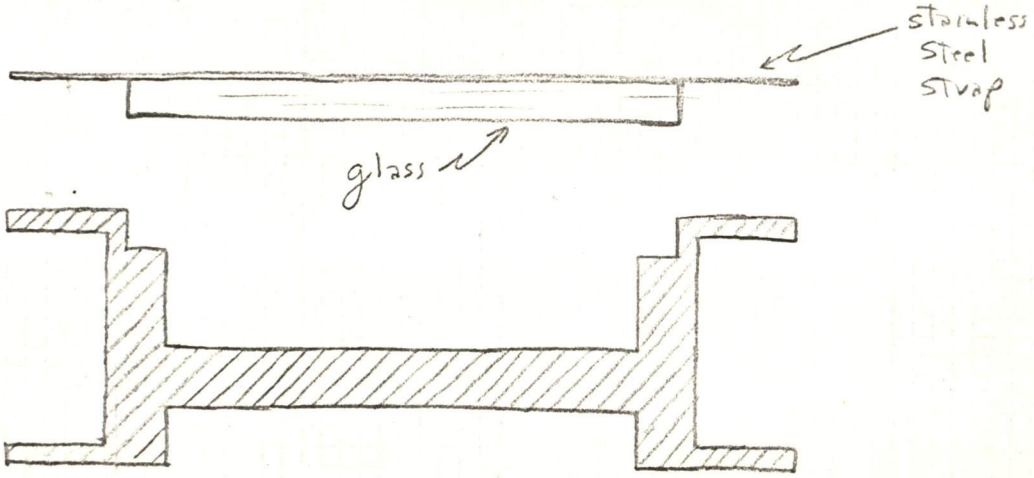
When we get to order an extrusion for our vacuum columns, here is an idea which I think simplifies much of the construction. We should decide, with the help of the people doing the extrusion, which is the best cross section for stability, straightness and precision. This should be the cross section of the main H frame.

If we then make a lip of the shape shown in the following sketch, it would then hold the glass from moving sideways and would make it relatively easy to install. Then, if we extend the lip sideways beyond that, we would have a surface on which to put a disconnect fastener. A piece of aluminum or stainless steel could be cemented to the glass with a fastener installed and one then has a very simple, inexpensive and straightforward way of installing the glass. The fastener which I would suggest is the Well-nut made by Rockwell, of which we have a small stock. This means punching a round hole in this lip but it puts very little strain on the extrusion because it is a rubber nut.

If a lip is extended out from the sides at the bottom, this would give us a good area in which to screw into the main column. We could simply put ordinary lock nuts behind this to avoid tapping any holes into the extrusion.

Ken Olsen

KHO:ecc


stainless
steel
strap
glass

INTEROFFICE MEMORANDUM

DATE September 2, 1965

SUBJECT Interface Between Product Lines and Central Engineering

TO Product Line Managers
Pres Behn

FROM Kenneth H. Olsen

An interesting misunderstanding developed between Jim McKalip and Gordon Bell on the memories at Rand Corporation. Gordon felt he was being very kind and generous in helping Jim McKalip solve his memory problems at Rand. Jim McKalip thought he was being very kind and generous in helping Gordon solve his memory problems at Rand. Now we always expect people to be kind, helpful and generous, etc., but in this case misunderstanding developed because they both thought they were not being fully appreciated because they thought they were being helpful and the other one had the responsibility.

We are very much dependent on having a casual, informal relationship between people and between groups, but I would suggest that every time there is a buyer - supplier relationship between product lines or between product lines and central engineering, that there be a definite understanding as to when things are being turned over. The relationship which I would suggest, in a case like a memory being developed for a product line, is that there be definite acceptance tests and a time when the product line accepts it and turns it into production, at which time it is then the product line's responsibility to take it from there. I would expect them to keep a good relationship with the original designer and that the original designer will feel an obligation to be helpful from then on, but the responsibility is then with the product line.

Ken Olsen

KHO:ecc

INTEROFFICE MEMORANDUM

DATE September 2, 1965

SUBJECT Visit to Automatic Radio

TO Maynard Sandler
Stan Olsen

FROM Ken Olsen

Henry Crouse has the name of the people at Automatic Radio that we can visit to see their production techniques. We should call them and see if we can visit them and invite them to visit us.

If you make arrangements to visit them, please let me know because I would like to go along and see it all.

This is a possibility of a subcontractor because I would guess they are in a somewhat seasonal business and they are probably rather efficiently run.

Ken

KHO:ecc

INTEROFFICE MEMORANDUM

DATE September 2, 1965

SUBJECT Data for Modules in New Assembly Area

TO Harry Mann

FROM Ken Olsen

We have to develop new methods of collecting data on modules being produced in the new assembly area. I think this is going to be much more extensively used because I think we'll make an identical production line to take care of those lots between 100 and 1,000 which ought to take the bulk of our production after a few months. Each tray holds 25 quad boards or 100 modules, and there is an extra slot in it for holding a record card. If each operation filled out the card with that tray, we might then make it unnecessary for the girls to fill out time slips in the usual way. The number of these trays is relatively small and it wouldn't be difficult to hand sort the information out from these cards in any form we want.

The people in charge of the line will like to have some measure of the productivity of the girls and of the machines and, of course, the cost information. There will not be very many cards coming through each day and so I think we will not have a problem in getting the information in any form we want. If we make 40,000 modules a month on one product line, this is just 2,000 modules a day, or 20 trays. The information on 20 cards can be sorted out any way we want by hand.

These are just some random ideas that I'm passing on to you, not because they are at all profound, but just to get them off my chest.

Ken

KHO:ecc

INTEROFFICE MEMORANDUM

DATE September 2, 1965

SUBJECT

TO Maynard Sandler

FROM /Ken Olsen

I visited General Doriot last week and, in his usual manner, after talking about specific problems he gives me some of his general advice on how a business should be run. This is usually advice which is contrary to what is normally taught in a business school or accepted in other areas. This time he expounded on the foolishness of a many-layered organization chart. He thinks it is a myth that any manager can only have some small number of people reporting to him. I like his general idea and I have been trying to modify our organization so that there aren't many layers between myself and people whom I would like to have some influence on.

I would like to suggest a new way of organizing the Production Department so that I, and the Methods Committee, can have a little more direct influence on the people doing the work, and I would guess also that it would allow you more influence in your own Department. I think some of the people working for you would then have narrower responsibility but would have more control and authority over the things they are doing.

I suggest that you consider something like this. Jack Smith not only assemble computers but also supervise the girls doing the panel wiring and cabling and report directly to you. Cy Kendrick start a new production line with some of the girls and machinery which he now has, but pattern after Stan's line that would take FLIP CHIP modules that are made in quantities from 100 to 1,000, or wherever the minimum level is for Stan's line. Gloria then would supervise a production line which makes small quantities or very special things and makes modifications. She then would report directly to you. John Viscogliosi would supervise the gold plating line, the strate production, and maybe the silk screening. He would also report directly to you. Gerry Bouthiller would report to John, or if he ran the silk screening and etching, he would report directly to you. Stan would continue to make high production modules and power supplies. We might have the other power supplies made in a somewhat similar production line under Cy Kendrick and real specials made under Gloria.

I don't understand production control but I would like to see a very strong man, who is considered the production control man at Digital, run the Department so that you are Production Manager and not production control man and manager. I guess that the stockroom should report to this production control man. I don't know if we have the man for the job here or not but he should be strong enough to answer directly to the product line manager and not be completely dependent on yourself.

Let me know what you think about this.

KHO:ecc

Ken Olsen

INTEROFFICE MEMORANDUM

DATE August 30, 1965

SUBJECT Cabinet for LINC - PDP-8

TO Win Hindle
cc: Nick Mazzarese
John Jones
Loren Prentice

FROM Ken Olsen

I like the idea of making a special cabinet for the LINC - PDP-8. You might get the PDP-8 group to share the cost of developing this because it might be the obvious way for making PDP-8's which are rack-mounted and contain more than the simple computer.

This could be a standard PDP-7X cabinet with a special door on the back to contain the two gates of an 8 plus room for an additional number of mounting panels. This, of course, would be easiest to do because the PDP-7X cabinet will apparently be quite standard. The gates could be checked out in a standard PDP-8, installed horizontally, and cabled together.

If we look at it carefully, however, it might be possible to fit it into a cabinet which is the width of our standard 20" cabinets or one which is just slightly wider than our 20" cabinets. Our present plenum doors fit inside the frame of the cabinet but if we had them directly behind the frame, we could then get a gate which is approximately as wide as the PDP-8 frames are high. The question is whether a special cabinet is worth saving a few inches in the width of the cabinet.

One interesting advantage of using the standard PDP-7 cabinet would be that we could then use the same mounting hardware that the PDP-7X uses. This might be a big advantage in the PDP-8. It might also mean that we could start putting the PDP-8 in the cabinet right away and develop a feeling for the cabinet before the PDP-7X or the LINC - PDP-8 are ready.

Another interesting advantage of the new cabinet is that it allows us to expand the PDP-8 into a LINC by either using this cabinet or by adding the new gate to a standard PDP-8 desk top cabinet. In this way we can add LINC equipment to a present PDP-8 with the addition of an identical table top cabinet and we might also add options to the PDP-8's in the same way.

Ken Olsen

KHO:ecc

INTEROFFICE MEMORANDUM

DATE August 25, 1965

SUBJECT

TO Engineering Newsletter

FROM /Kenneth H. Olsen

Bob Lassen is taking over the professional recruiting that Jim Hastings handled before transferring to the small computer group. All questions on hiring and salary administration of salaried personnel should be directed to Bob from now on.

INTEROFFICE MEMORANDUM

DATE August 25, 1965

SUBJECT

TO Sales Newsletter

FROM Kenneth H. Olsen

Bob Lassen is taking over the professional recruiting that Jim Hastings handled before transferring to the small computer group. All questions on hiring and salary administration of salaried personnel should be directed to Bob from now on.

digital MEMO

DATE August 25, 1965

TO Gertrude Loynd FROM Elsa Carlson

When the 1965 Annual Report is ready for mailing, please send one to:

Mr. Tad Kozlowski
Abraham & Company
120 Broadway
New York 5, New York AC 212 RE2-7200

Called on Jos to talk with Ken but I had Win talk with him. He's a security analyst.

DF100-21

5M9/62

INTEROFFICE MEMORANDUM

DATE August 23, 1965

SUBJECT Trade Show Equipment

TO Ted Johnson

FROM Ken Olsen

Please walk through the area in which we store trade show equipment and let me know what your suggestion is as to how we should keep it clean. One thing that would help would be to put back all equipment after each trade show and not wait for a general clean-up once every few years. We still have Teletypes and empty PDP-8 cabinets left from the IEEE Show.

Ken

KHO:ecc

INTEROFFICE MEMORANDUM

DATE August 23, 1965

SUBJECT Military Electronics Conference

TO Stan Olsen
Alan Ross

FROM Ken Olsen

You might want to consider the possibility of taking a very small booth at the Military Electronics Conference in Washington on September 22nd and try to push the educational kit.

Ken

KHO:ecc

INTEROFFICE MEMORANDUM

DATE August 23, 1965

SUBJECT Building 11 Storage Areas

TO Loren Prentice

FROM Ken Olsen

I am going to try to get people to clean up their junk storage in Building 11. Will you have the maintenance men clean up their area and throw out the stuff that was left over from Raytheon.

Ken

KHO:ecc

INTEROFFICE MEMORANDUM

DATE August 23, 1965

SUBJECT Stock Rooms for Product Lines

TO Jack Atwood
Product Line Managers
Henry Crouse
cc: Harry Mann

FROM Ken Olsen

We are all very pleased with the separate finished goods inventory for each product line and now I would like to suggest that we have a literature stock room for each product line. The people so freely order literature, boxes, and notebooks from Jack Atwood that I am sure they have no idea what is in stock and I would like them to feel an obligation for what they have ordered. In addition, the amount of stuff which Jack Atwood has accumulated is so far beyond his ability to control. The stock room in Building 11 is absolutely a disgrace! I am sure that we are ordering material which we have strewn around the floors up there.

In addition, I would like to have Henry Crouse take things such as string, notebook covers, and envelopes and put them into his stock room. He could use obsolete notebook covers for general uses throughout the Company.

The rest of the stuff which Jack should store, I would like to see him break into several stock rooms. Spiral binding equipment and other printing supplies should be in one area, obsolete components and storage for the dark room should be stored in another area. It would then be possible for people to walk by and see what is available.

Ken Olsen

KHO:ecc

INTEROFFICE MEMORANDUM

DATE August 23, 1965

SUBJECT Handle Numbering Machine

TO Ken Fitzgerald
Cy Kendrick
Stan Olsen
Henry Crouse

FROM Ken Olsen

I would suggest that we stop work on the combination number and eyeleting machine. It is so awkward to install the handle in the board with that machine that I don't think it is going to save any time over doing the two operations separately. I think maybe we should concentrate on making the numbering machine faster and perhaps order another one.

The machine we have could have several things done to it. First of all, the gibs are terribly loose and it wabbles very badly.

It could be made power feed or a foot pedal could operate it directly. Only a half inch throw is necessary to index the tape and the foot pedal with three inches of throw would give a lot of leverage.

Someday, when we have all of our other automatic equipment done, we might want to make our own. We could buy the head mechanism directly from them and mount it to an air press. The anvil for this might be mounted on a slide mechanism so that one handle could be installed while the other is being numbered. If the tape is indexed in the opposite direction, we could get four to six times as many numbers on each piece of tape. With an automatic press, we could control the timing and the pressure, in addition to the temperature.

Ken Olsen

KHO:ecc

INTEROFFICE MEMORANDUM

DATE August 23, 1965

SUBJECT Notes on Drilling Mounting Bars

TO Loren Prentice
Ken Fitzgerald
Dave Widder

FROM Ken Olsen

I haven't seen the proposal from Zagar for drilling and tapping bars but I suspect that $20,000 is too much money for the relatively small number of bars that we will use each year. I think what we should do is to approach it in a somewhat less automatic way.

However, it is clear that we have to do something which is relatively fast and very precise. The machine which indexes will probably have too much accumulative air. The machine also should take into account the problem of setting roll pins.

The whole problem would be simplified if we use self-tapping screws. The advertisements of the Continental Screw Company show a taptite screw. With a power screw driver, these should be quite a practical way of doing it. If we could use two diameter drills, we wouldn't have to tap more than a few threads with an aluminum bar.

One approach would be to buy a stock Zagar in-line drill head 30 inches long and mount it in a standard drill press with power feed. Each power would then be installed by hand, clamped with air cylinders and probably with permanently mounted drill bushings. The same drill head might also do the tapping.

A simple way to drive the roll pins in might be to make a long wide bed press to press all the roll pins in together. An operator could load this very quickly if each pin was held in a magnetic V block. He could distribute a handful of these very quickly and then turn on the power and the bar would be loaded.

Ken

KHO:ecc

INTEROFFICE MEMORANDUM

DATE August 23, 1965

SUBJECT Patents

TO Jim Hastings

FROM Ken Olsen

One part of your time which I would like to claim, unless you rebel strongly, is to look out for DEC's patent problems. I am sending on to you a photo clipping from ARD regarding a suit Honeywell is putting in against Control Data. Will you read it so that you have the background and then send it on to Bob Cesari.

Ken

KHO:ecc

dec INTEROFFICE MEMORANDUM

DATE August 16, 1965

SUBJECT

TO Stan Olsen
Rod Belden
George Gerelds

FROM Ken Olsen

I was pleased at the way the power supplies went together. I hope that as we polish up the techniques that we can cut the assembly time in half.

I think one way to make these in the long run would be to have a strong hard working reasonably well-paid man who would do all the assembly work. He should be willing to stand up and assemble them and also sit down and test them and take pride in his own craftsmanship and not be driven with the ambition of having an army working for him. He should be willing to set the rivot nuts in the panels himself and show initiative to get the parts necessary. He should also be willing to make all the subassemblies and wire up the power supply cover panels. I think that with the right man he should be able to assemble all the power supplies of these high production types that we need. He could also maintain the inventory records and production records because of its relatively small number of parts.

We have to continue working on the techniques and devices to speed up the production of these power supplies. We should get two power screw drivers to speed up assembly and we should develop a tool which will push the tab connectors on. Without a tool it's a job which makes for bloody fingers. I think we could make the tool which would do this very quickly.

For the very small power supply we should screw double tab terminals on to the small capacitors so that they can be assembled with the tabs also.

We should also consider ways for soldering of the output terminals on the power supply cover.

Ken Olsen

KHO:ncs

INTEROFFICE MEMORANDUM

DATE August 16, 1965

SUBJECT New Job Responsibility

TO Ted Johnson

FROM Ken Olsen

I would expect that you may want the responsibility under you broken down between Field Service, National Offices, and Foreign Offices. I can see where the responsibility of taking on this is very extensive and you will need a lot of help if you are going to keep your own health and do a good job.

However, regardless of how you organize your activities, I do want to insist on one thing – and that is that each of the Field Office Managers has direct access to you and also has the freedom to talk to me directly whenever they so desire. The nature of the people who run these offices is such that they can operate effectively with a higher arcade above them. I think that with some thought it is possible to set up an organization where you have help in taking care the activities but still have freedom to contact the offices directly and have them contact you directly.

Ken Olsen

KHO:ncs

dec INTEROFFICE MEMORANDUM

DATE August 16, 1965

SUBJECT Numerical Machine Tool Control

TO Stan Olsen

FROM Kenneth Olsen

There is a product line which we toyed with for many years but never spent the time or energy to go into, which I would now like to consider. This is the numerical machine tool control. This is a particularly pertinent time to consider it because we now have a significant price advantage with our modules and wire wrap panels and we should set a reasonably low price before others are ready to commit themselves to equivalent products with integrated circuits. It is also very interesting now because the same type equipment is developing a lot of interest in automated drafting machines. Boston Digital was set up by Gerber Scientific to make this type device. There is a number of variations of this type of device and the first step would be to outline them. The simplest would be the stepping motor control type and we already have a head start in that area with Saul's work with the United Shoe Machine work and with the work we have done on the Slow-syn motor in our paper tape reader. Pace Controls in Watertown has a steady motor which is used in the multiple head drill and in the Universal machine when their tape control motors are apparently good but their electronics are terrible.

Standard Electric puts their Slow-syn motors on Bridgeport Milling machines with the simple controls and sells them for a lot less than the Mogg machine which we have. There are 200 steps around a Slow-syn motor and milling machines have 200 steps around each crank revolution so that it looked like they designed this Slow-syn for this application. With our new simple low priced paper tape reader, and one panel of wire wrap electronics, we might be able to sell a package which will find many applications for stepping motor drive mechanisms of many types. There is a standardized format for paper tape for this type application that uses 20 characters for each position. This stepping motor drive might be the limit of our entering into the market but we should consider the other applications. The other general type of control is with a feedback from a measuring device. I believe the Mogg operates in this plan of view and Ferranti Electronics (optical company) has a system which is quite commonly used for measuring distance.

A still more complicated and sophisticated application is the three dimensional machining. This takes very elaborate equipment and has a computer in the loop. In this case, they generate a tape, feed it to a computer, which generates another tape, which is then fed to a device which generates an audio tape. The audio tape then drives the device which directly drives the machine tool. This is a major operation to get into this system. There are a number of things written on this and Gerry Moore should be an expert in it because Concord Controls picked that project up after MIT but I think General Electric has since walked off with all of it. The interesting possibility here is to use a PDP-8 to generate the audio tape from the magnetic tape. I think the special service device which now does this costs much

more than $18,000.

This is a special project which should be considered part of Win Hindle's group or should be considered as a module application under your own group. Because of Saul's Dinman's interest in this application it might be natural to encourage him to go into it under the module group. I think it is a good idea to have Saul make a study of this and then go to the Machine Show in September in Chicago.

Ken Olsen

KHO:ncs

dec INTEROFFICE MEMORANDUM

DATE August 16, 1965

SUBJECT Observations on Console Designs

TO Gordon Bell
Jim Jordan
Loren Prentice
Pres Behn

FROM Kenneth Olsen

In spite of the objectivity which most people feel are modern scientific civilization technical things, I suspect that the greatest influence in industrial design are the images which people and designers pick up in their early life. A past example of this is the affect generated on automobile design by the distortionist of early focal plane shutters on pictures of racing cars.

Insistence of many people on low computer consoles I think can be traced to the image of consoles which most of us had in our youth. At that time, the only consoles were those in large power generating plants. There most, if not all, of the important information was displayed on the wall-to-ceiling panels spread out many feet beyond the console in order to see that the console of course would be no more than desk height. Often the console is nothing more than a place to sit and hold papers and watch all the meters and colored lights.

When people made computers it was obvious that they should make the same kind of console. The cost was very high – 1) because it meant putting all the equipment underneath the console where it was not at all accessible and it also meant leaving out many things which people would like to have on it; and 2) because of the nature of the equipment and the tremendous number of cables which are very expensive, awkward to install, and sometimes unreliable. After these consoles were made their proud designers were in for a terrible shock. They sat down behind their beautiful consoles, looked over the top, and below there was nothing to see. Their racks of the equipment were so dull and the lights that were there were so small that they could only be seen if you were up close to them.

Everybody who first design computers did it this way except Whirlwind. If they survived the first blunder, they then looked at it more coldly and realized that they wanted as much as possible right in front of the operator. Right in front of the operator immediately means higher than the traditional console design and if they wanted to make a radius of reach around this point, it would come approximately six feet high and down to the table top. Once people agree to this they often realized that might this well be part of the main computer cabinets to avoid the problem of cabling.

With the success of these new consoles, Industrial Designers then were promoted to Vice Presidents and two generations of Industrial Designers come in and design consoles the old way and if they survive they come around to utilitarian design. This cycle probably continues for many years until a completely new generation comes along who are not instilled with an idea that consoles have to be low. There is also hope that the maintenance people might influence the design enough to avoid putting any equipment under the console table and someday people may observe that there is nothing to see over the top of the console and that with most computers (not DEC), there is not even someone sitting at the console during most of the computer operations.

Ken Olsen

KHO:ncs

dec INTEROFFICE MEMORANDUM

DATE August 9, 1965

SUBJECT Annual Report

TO Jack Atwood

FROM Ken Olsen

The annual report looked good before I left and I think that we have to just polish up the text, including my own contribution, lay out the photographs and we're ready to go. As soon as you have the text in the next draft, will you please send it right down to Dorothy Rowe and pass it out to each of the product line managers who are not on vacation. Then will you call Dorothy Rowe within a couple days and get her immediate comments. Also do the same with the product line managers and then let's get it set in type.

I would like to have a copy of the text myself and if we get a salt print, I would like to see that too. Elsa can send it on to me.

Ken

KHO:ecc

INTEROFFICE MEMORANDUM

DATE August 9, 1965

SUBJECT

TO Ken Fitzgerald

FROM Ken Olsen

I would like to have you look into the possibility of laying out a new etched board facility. I would like to make one which is so simple that it would never have a chance of having to be done over again. We could take the automatic silk screen machine and put it in a very small air-conditioned room and then feed a commercial conveyor oven. Henry Crouse has contacted people who have a very simple, inexpensive oven who would be willing to send us a sample to try out. I told him to hold up on this until you came back from vacation so that you could make suggestions as to which one we should borrow.

We would then order two more etching machines which could be in line with the washing station.

A good washing machine is still our primary need in this part of production. But if we go after a very simple etch line, that should slow down our washing machine project.

If we get rid of the resist with a good strong detergent, maybe with the addition of an abrassive in the water, it would be good to wash this off during the wash step immediately after etching. In fact, it would be good if we could carry out all our operations while they are racked in the plastic holder. If it were possible to get rid of the resist this way, we could then go on and wash, air dry and coat with anti-tarnish solution with machines that look like the after etch washing machine. It would be good to take advantage of the units while they are already racked.

Because scrubbing by hand with an inexpensive scrub brush is quite practical, except for the elbow grease used, I think it is obvious that it is theoretically possible to make a scrubbing machine which would not use expensive brushes or wear out brushes. Some people use a power rotary brush which they bring down by hand on the board. One simple version of this would be to have a rotary brush permanently mounted and push the boards under this on a wooden tray. This would still be largely manual but would eliminate much of the effort that goes into scrubbing now.

Ken Olsen

KHO:ecc

INTEROFFICE MEMORANDUM

DATE August 6, 1965

SUBJECT Notes on Power Conveyor for Vapor Degreaser

TO Loren Prentice

FROM Ken Olsen

Here are my ideas on the conveyor for the vapor degreaser. I suggest that we buy two heavy-duty sliding door hardware sets from Sears Roebuck. Catalog No. 99 G 6206 L2 sells for $9.49 and weighs 36 lbs. and is 12' long. I suggest that we separate them by about 18" and have a steel plate suspended from four hangers.

On the plate we would have two gear motors like Boston Gear's M109-40-AS which costs $78.00 each and have 43.8 RPM and a torque of 31 inch pounds. If we hung the rack on No. 41 roller chain, which has a pitch of half inch, and I think is a bicycle chain, and which will support 2,000 lbs., we could use a sprocket like Boston Gear's type KSU 8 at $2.10 with eight teeth and a pitch diameter of 1.13 and a bore of 1/2 inch to fit the ratio order. The speed of lift would then be 14.5 feet per minute.

The second motor would have the same sprocket on it and would be connected to another piece of roller chain which would be stretched along the ceiling. They would all then run on that chain as if it were a rack. The easiest way to run this would be to let the chain hang and keep it in contact with the sprocket by a nylon block.

Someday we will tie automatic controls to this so that man can just start it and then run through the cycle without any attention. For now we should have simple switches to control this motion. Part of the inventional system will be automatic stops so that it will be stopped in a quick position by dogs which are fastened to the chain.

Ken

KHO:ecc

dec INTEROFFICE MEMORANDUM

DATE August 5, 1965

SUBJECT

TO Sales Newsletter

FROM Kenneth H. Olsen

We have been very pleased with the results of our reorganization by product line. It has done much to define responsibility and authority, and to orient the service organizations with respect to the product lines. In order to further separate the service organizations from the product lines and to free Harlan Anderson and Stan Olsen to devote full time to their product lines, we have appointed Ted Johnson as Sales Manager. All sales offices in this country and abroad will report to Ted and he, in turn, will report directly to the President.

KHO:ecc

Module Production Rates

200	trays	=	5,000	quads	=	20,000	modules	per month per shift
10	"	=	250	"	=	1,000	"	" shift
1	"	=	25	"	=	100	"	" 40 minutes
			1	"	=	4	"	" 1.6 minutes
						1	"	" 24 seconds

320	trays	=	8,000	quads	=	32,000	modules	per month per shift
16	"	=	400	"	=	16,000	"	" shift
1	"	=	25	"	=	100	"	" 25 minutes
			1	"	=	4	"	" 1 minute
						1	"	" 15 seconds

400	trays	=	10,000	quads	=	40,000	modules	per month per shift
20	"	=	500	"	=	2,000	"	" shift
1	"	=	25	"	=	100	"	" 20 minutes
	"	=	1	"	=	4	"	" 48 seconds
						1	"	" 12 seconds

K.H.O.
8/4/65

INTEROFFICE MEMORANDUM

DATE August 4, 1965

SUBJECT Power Supplies

TO Irwin Jacobs
cc: Module Guidance Committee
Rod Belden
Dick Kennedy
George Gerelds

FROM Ken Olsen

I am pleased to hear that you will be the sales expert on power supplies. We have suffered seriously from not having someone who is an expert on all our power supplies. They seem simple and so haven't challenged people but the preparation of designs has been so extensive that it is now a complicated problem and it is a real challenge to straighten it out.

Above all, we need someone who knows all about our power supplies. You should know what we have in inventory and in raw material inventory and what the needs are for all of our customers and for our internal computers. You should be able to tell the implications and consequences in a design change and you should have a good feeling for the manufacturing cost of each and also what size lots and what should be carried in inventory.

It seems to me that we should manufacture in high production only two circuits and two styles that will cover the bulk of our needs. These will be the 728 and its 19 inch equivalent and the small power supply that goes on a mounting panel and its 19 inch equivalent. These supplies should cover almost all our needs and these are the ones we should inventory and set to manufacture in that quantity. If the customer or computer user wants to use one of the other supplies, we will then make it to special order and will raise the prices accordingly. The module users will have to put those power supplies in their own inventory. We should then try to sell the odd ones which we now have in our own inventory.

We should get this program going as soon as possible and also put a campaign on to let our salesmen know what power supplies to sell. We might do this by simply sending out a new price list which raises the prices on all the supplies except the four we're trying hard to push.

Ken

KHO:ecc

Ken Olsen August 3, 1965

DRAFT

During the past year DEC has successfully brought into production a complete new line of products. The facilities have been significantly expanded to manufacture these new products and the staff to sell and service them have been increased.

The investment in developing the products, expanding the facilities, and training the staff have been significant and have effected the product for this year but we are pleased to announce that as a result of this effort we start the new year with a backlog of $11 million. Digital's large high speed time-sharing computer, the PDP-6, was first delivered in the Fall and now a total of eight are in place and most of them are in use on a regular basis. Three of these are overseas, one in Australia, and two in Germany.

The PDP-7 was also first delivered this year. They are now being delivered one or two a month and a large part of the backlog is in this product. The PDP-7 is a modernized and speeded up version of the PDP-4. These two computers have been very successful in control and real time computer applications and we have a continuing program to improve and modernize this computer.

The PDP-8 is this year's most exciting product. It is an improved version of the PDP-5 which incorporates our newest technology and manufacturing techniques that we have. The result is a computer which is eight times faster than the PDP-5 and sells for only $18,000. The response to this computer is much greater than what we expected and we are now expanding manufacturing facilities to satisfy the demand. We think this is the first computer to have its components completely checked by a computer and then to be assembled on an assembly line. This year we also started the manufacture of the LINC computer which was designed by M.I.T. for the medical applications. This computer used DEC modules and, therefore, it was relatively easy to manufacture it. The interest in this machine is high not only in the medical profession but also in other research projects and so a program to continue the development of this program and to lower its cost is scheduled for this next year.

The memory test business continues to be a profitable line and it is expected to continue. It is planned to incorporate PDP-8 computers into testers during this year, which will make possible things which have never been done before.

The module business takes a large investment in engineering, tooling and inventory but it is a very profitable business and continues to be one of the most important activities at DEC. The new FLIP CHIP line was designed for high production and simple application. the FLIP CHIP modules were not received as quickly as we had expected but after an intensive advertising campaign we were caught by surprise and we are now embarrassed by the long delivery we are coding. We are now building a high production assembly line with much automatic equipment, including computer testing,and we expect in the first two months of the next year to catch up with the order rate.

We are very pleased with the results of our investments during this last year and we plan to continue to invest heavily in new product development, in manufacturing techniques, and in market development.

INTEROFFICE MEMORANDUM

DATE August 3, 1965

SUBJECT Reducing the Cost of the PDP-6

TO Gordon Bell
cc: Ron Wilson
Pres Behn

FROM Kenneth H. Olsen

Here are some random ideas for cutting the cost of a somewhat simplified PDP-6. No one idea is particularly significant, but I think if we pushed every little detail we could cut the cost of the machine by some significant factor.

Make a FLIP CHIP version of the transceiver and use round cable with no double-sided modules. Have each memory only drive one or two processors instead of the four we now have.

Simplify the AC and DC wiring. Use no spiral wrap or other binding. Use no distribution panels for either AC or DC. Put almost all of the power supplies on one door and jumper all the DC and all the AC together right on the surface without bringing them down to the edge of the panel for the beautiful type distribution we now have. Simple jumpering would look quite neat. Then tap into this periodically to bring DC to various parts of the system.

Use only 728 power supplies. These will be made in mass production and be rather cheap. It will soon become relatively expensive to use miscellaneous supplies like the dual -15.

Use a very simple power control panel and think it out so there is nothing wasted and nothing difficult to understand.

Build a marginal check power supply completely on the front panel. The supply should consist of a small variable transformer like we use in the PDP-8, followed by a triad F 41 X 26 volt filament transformer, followed by a bridge rectifier and one of our new plastic clusters, followed by a single smaller capacitor. The large expensive rotary switch can be replaced by a simple toggle switch. One time lapse meter per computer is all that is needed and leaving it on the back is the easiest place for it.

The indicators are a big part of the cost of this computer. We could first of all cut down on the number of indicators. If we could use the PDP-7X system of switching indicators, it would help. If we use the PDP-8 system for manufacturing indicators, it would be relatively inexpensive.

If we used the new PDP-7 reader and punch panel, we would save quite a few hundred dollars.

If we used the new single panel micro tape, it would take more panel space but it would sure make life easier when it comes to maintenance and installation.

Let's not crowd things into cabinets. Let's have no logic underneath the console. It would be a lot cheaper to pay a few hundred dollars for a new cabinet than it would be to install, check out, and maintain all that stuff under the console.

We made the console rather heavy and deep in order to fit an oscilliscope into it. We could make a lot cheaper console since we decided not to push the oscilliscope.

Ken Olsen

KHO:ecc

INTEROFFICE MEMORANDUM

DATE August 3, 1965

SUBJECT

TO Stan Olsen
Rod Belden

FROM Ken Olsen

When our high school fellows are free, I would like to have the power supply benches sanded and varnished.

It would be good to clean the conveyors that are covered with flux. We might stick them into the vapor degreaser or we might lay them on top and squirt them with tri.

The vertical stands we use in the conveyors would look a lot more attractive if we would spray them with our light blue tweed. We could bring them up two at a time and have them tweeded.

Ken

KHO:ecc

dec INTEROFFICE MEMORANDUM

DATE July 15, 1965

SUBJECT Notes on High Production Area

TO Stan Olsen
Loren Prentice
Ken Fitzgerald

FROM Ken Olsen

We should consider the possibility of keeping the high production module line in Building 4. I don't think we should make any significant investment in developing the facilities until we're sure, but neither should we commit ourselves to moving it to Building 5. It would show up well in Building 5 but Building 4 has one very big advantage in that it would be practical to air-condition it. In addition, we could make the facilities for the girls somewhat more pleasant. If we air-condition the floor, we could have all of the outgoing air go out the solder pot hood. In this confined area the price of air conditioning might be well worth the increase in production capability. With the expensive equipment and a small number of people, this should be practical to expand the operation in three shifts in emergencies. This would be a lot easier to do with everything air-conditioned.

We could make very pleasant and attractive work stations for the girls. They will be expected to sit in one position for a long period of time and to have their work faced by a production line and we might make up for this by having formica tables with soft foam swivel chairs and any other personal touches which we might think of. We might have separate loud speakers at each station hooked into our Muzak system. The girls could have a switch so they could choose either Muzak station.

Ken

KHO:ecc

digital EQUIPMENT CORPORATION
MAYNARD, MASSACHUSETTS

SALES CALL REPORT NO. 11513

DATE 7/15/65

FIRM Rank Data Systems, Div. The Rank Organization
STREET Woodger Road, Shepherds Bush
CITY London W.12, England

SALESMAN Ken Olsen, Nick Mazzarese
OFFICE AREA U.K.

AREA CODE
PHONE (OURS THEIRS) [ ] PHONE NO.
LETTER [ ] VISIT [X]

PERSONS CONTACTED	EXTENSION
Ian D. Brotherton	
Rudolf Biebl	

EST. ANNUAL POT.	CK.		CK.	PRODUCT	CK.	TYPE
		NEW		MODULES		X
UNDER $20K		OLD		A/D		
$20 - 50K		HIGH		COMPUTORS	X	-8-
$50 - 150K		MED.		SPECIAL SYSTEMS		
$150K UP		LOW		OTHER		

REMARKS

Mr. Brotherton contacted us with two main interests: (1) The possibility of marketing PDP-8's in Europe for us, and (2) the possibility of including in the PDP-8 as a part of their Xeronic Printing equipment.

We discouraged them on the first matter, of course, and proceeded to the second. The Rank Xerox is a jointly owned company of the Rank Organization and Xerox Corporation in our country. The Xeronic Printer is a 3,000 line per minute printer which is manufactured by Rank Data Systems and sold by Rank Xerox. The Xeronic Printer is basically a tape to hard copy system and operates off line. The ultimate printing process is a xerographic process or characters are generated on a CRT projected onto the sensitive paper and then processed as in the normal xerox process. The need for a PDP-8 is to act basically as a buffer between the tape units and the continuous stream of information needed for the rotating drum in the xeronic printer. A brief diagram of it is attached to this sales call report. The PDP-8 on an initial look appears to be ideal for their application. Initially, the configuration they might be interested in is:

Basic PDP-8	$18,000
580 Tape Unit and Control	20,000
100 cpm NCR Reader	4,000
Total	$41,000

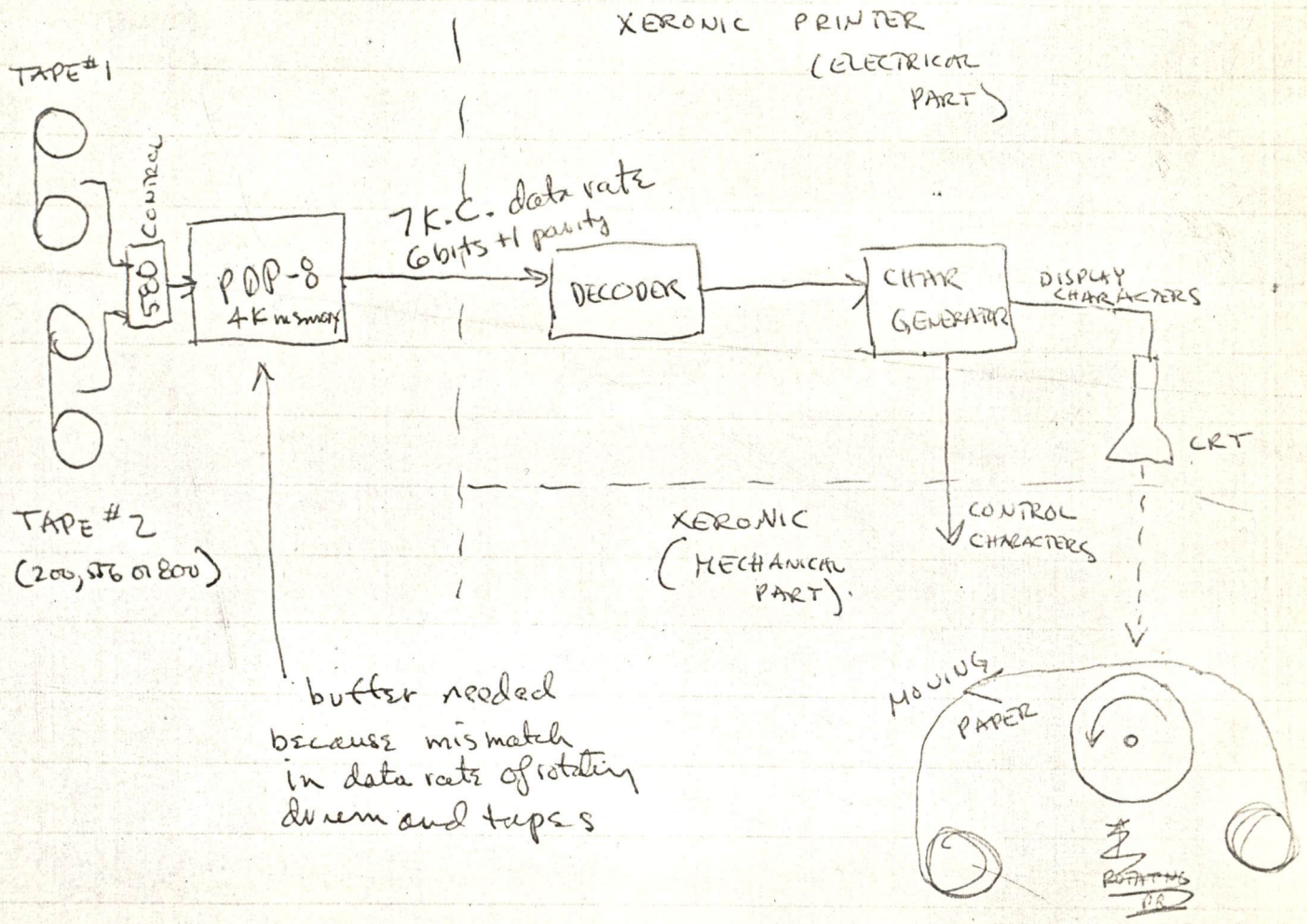
I mentioned the possibility of an OEM discounting arrangement and also the possibility that we might be manufacturing shortly in England. The two men to contact are Ian D. Brotherton who is the Managing Director of Rank Data Systems and B. W. Stallworthy who is the Chief Engineer. He may have already contacted you, he is currently talking to SDS as well.

ACTION TO BE TAKEN Contact both Brotherton and Stallworthy to follow up to send them module catalog and give them the module pitch, for, in addition to PDP-8's, they are also interested in modules

FOLLOW-UP DATE BY

SPECIAL COPIES TO

COPY


XEROX PRINTER
(ELECTRICAL PART)
TAPE #1
STD CONTROL
PDP-8
4K memory
7K.C. data rate
6 bits + 1 parity
DECODER
CHAR GENERATOR
DISPLAY CHARACTERS
CRT
TAPE #2
(200, 556 or 800)
XEROX
(MECHANICAL PART).
CONTROL CHARACTERS
buffer needed
because mismatch
in data rate of rotating
drum and tapes
MOVING
PAPER
ROTATING DR

INTEROFFICE MEMORANDUM

DATE July 15, 1965

SUBJECT

TO Stan Olsen

FROM Ken Olsen

cc: Dave Packer

I think we should set up the high speed production line so that it can expand into 2,000 boards per day. This would be 500 quad boards and if we put them in trays of 25 quads this would be 20 trays a day.

If we could figure there are about 400 minutes in a shift, this comes out to be exactly 6 hours and 40 minutes. This means that we have to do one board every 12 seconds, or one quad board every 48 seconds, or one tray every 20 minutes.

The 10 spindle drill will hold 5 x 10 or 50 quad boards at once, which means that it would need only 10 loads per day.

If the inserting machine will insert 400 boards per day, this is 4 trays per machine or a total of 5 machines to obtain this rate.

I would assume that one transistor inserting machine will take care of the whole line.

I think we should plan on using capacitors with resistor type bodies so that they can all be inserted on the machine.

This sort of machine will have to go to read one board every 48 seconds. It probably has two to three times that rate now.

The touch-up will have to be minimized and we'll have to make a guess as to what the rate will be for that.

I would guess that one person could operate the separating press and the handle numbering and eyeleting operation.

The tester has to operate at one board per 12 seconds and so we have to have some very quick way of inserting boards and recording failures. We also have to make a guess as to the repair time for modules. Inspecting and packaging will have to be done very efficiently.

Ken

KHO:ecc

dec INTEROFFICE MEMORANDUM

DATE July 15, 1965

SUBJECT Handling of Boards

TO Stan Olsen
Loren Prentice
Ken Fitzgerald
Maynard Sandler
Cy Kendrick

FROM Ken Olsen

We have to develop a better system for handling quad boards. I suggest that we vacuum mold a simple flat tray with raised edges on the side with grooves in them to hold quad boards. We can nail or cement this to a piece of 3/4" plywood which would give it the weight necessary for easy handling and so that it would run on conveyors.

I suggest that we make this hold 25 quad boards which would be equivalent to 100 modules and it would be about 10" x 20" if the boards run 3/4" centers.

There could be a handle on each end with a clip on one end for holding a record for that tray. The girls could pick up their own work but they would initial or rubber stamp their name after each operation which they perform.

Each operator would have a short conveyor feeding her station from one side which would hold several trays. She would then perform the work and drop it to a tray on the opposite side. When that tray was filled it would then be pushed onto an adjacent conveyor and would run to the end of that operation. This girl, herself, or the supervisor, would keep the short feeder conveyors filled.

Instead of doing a tray for the vapor degreaser, we could have a clamp come down and grab a batch of 25 quad boards and lift them off the tray. They would then go through the vapor degreaser cycle and be dropped onto the same or another tray for the next operation.

We also need a method for holding finished boards. After they are separated they should immediately have handles installed so there will be no need for handling between the two operations. A conveyor belt between the two might be worthwhile, however.

The holder for modules then could grab the handles. It could be a piece of C-shaped channel something like Uni-strut. The handles slide into the Uni-strut and these bars would then hold 100 modules and would be stored like we store blue prints on the checkout floor. These could then be a method for keeping modules in the finished stockroom that are not going to be put in plastic bags. A group of these bars would make a convenient method for storing modules that are going to be put into PDP-8 swinging gates. The operator could stand in front of a number of these bars and fill up the gate very quickly.

Ken

INTEROFFICE MEMORANDUM

DATE July 14, 1965

SUBJECT Notes on Large Module Order

TO Stan Olsen

FROM Ken Olsen

It might be a good idea to assign a job number for engineering for the large module order you expect. Even though we don't have the order now, it would be very good to know the cost involved in getting ready for this even if we don't get the order. Much of the activities which you are carrying on on Loren Prentice's floor should be charged to this number and then if we don't get the order we can decide all is overhead to the module production.

If we're considering a new die for making plastic handles which are 1/2" high, I suggest that we hold off the final decision until we know whether we get this order or not and we can have another name installed in the die for this production run. We could have the cost of the first handles cover the cost of this die.

We should consider the possibility of buying the laminated boards already blanked out. This might be cheaper than doing it ourselves and it would free one operator. It might be worthwhile if we get one large order because the cost of the new die could be observed in one large quantity order for boards. We should develop a pert chart for each of the devices which are important in this high production line. We should remember the automated beveling machine, the wire taper, the starter for the automatic silk screen machine, the finding of a solution to the solder touch-up problem, and the elimination of silk screen touch-up.

Now that you have all the parts in a row on etched boards, you do not need a separate steel templet for each board but could have one templet with a groove for each component type. You could paint the inside of the groove for each component type.

Ken

KHO:ecc

INTEROFFICE MEMORANDUM

DATE June 30, 1965

SUBJECT Items for Board of Directors Agenda

TO Andy

FROM Elsa

These are items that Ken mentioned that he wanted brought up at the Board of Directors meeting, but I imagine he mentioned them to you.

1. Budgets and marketing goals presented by the Product Line Managers.

2. Two more signatures for checks over $300. He suggests Stan and Win.

3. Stan's name put on signature plate so that you and Ken can both sign checks.

4. Approval to go ahead and sign a new 5-year lease with a 5-year option with Maynard Industries for all the space we have. (See letter attached.)

INTEROFFICE MEMORANDUM

DATE June 28, 1965

SUBJECT

TO Supervisors of Summer Students

FROM Kenneth H. Olsen

In past summers, we have invested a lot of money in summer students as a means of recruiting. We have been notably unsuccessful in recruiting the people that we have had here for the summer. It is not at all clear as to why they do not want to come back to us on a permanent basis, but people suspect that it is a result of lack of supervision. You have agreed to supervise part of a summer staff and I want to point out now the importance of doing a good job. We are investing heavily in this program and we want to make sure that we get significantly enough useful output during this summer and give the impression of being an on-the-ball well-disciplined organization.

I am afraid that part of the problem in the past has been that when supervisors have been busy they felt they could let the summer students slide because they are only temporary. I also hear that they have been afraid to discipline them. If you find you do not have work or time to supervise, or if you are afraid to discipline, please let Jim Hastings or myself know and we will assign the person to someone else.

Summer Student	Supervisor	Supervisor's Opinion of Student	Supervisor's Vacation
Andrew Achterkirchen	Russ Doane	Doing very well	no plans for a summer vacation but Don White will supervise if he does take one during the summer
Winthrop Gross	Russ Doane	very well	
Tim Connelly	Jim McKalip	just started so can't say	set a tentative date for August Dick Best will supervise while Jim is on vacation
Albert Avery	Jim McKalip	doing extremely well	
Philip O'Dowd	Tom Stockebrand	marvelous job	has no plans for summer vacation
Karen Tomlinson	Dick Sorenson	doing very well	last two weeks in July John Jones will supervise
Philip Crooke	Bill Segal	doing very well	last week of July and first of Aug. Larry Portner will supervise
Mark Eisenberg	Joe Sutton	excellent job	week of June 28th Pat Greene will supervise
David Wade	Don White	very well	plans a September vacation
Jim Wertz	Don White	very well	
Tim Coburn	Jon Fadiman	Mort has been supervising Tim until he goes to Paris on 6/25. Mort thinks he is doing a very good job.	
Martin Hoffman	Len Hantman	very fine job	last week of July and first of Aug. Rod Beldon will supervise

INTEROFFICE MEMORANDUM

DATE May 27, 1965

SUBJECT Summer Students 1965

TO Personnel
Accounting
File

FROM J P Hastings

The following is a list of summer students and the salaries and starting dates:

K Andrew Achterkirchen 37 Bay State Road Boston, Massachusetts	$150.00 per week	Starting June 7th	Reporting to Russ Doane
Albert M Avery IV Lafayette College P O Box 807 Easton, Penn. (Home address - Trapelo Road Lincoln, Mass)	$100.00 per week	Starting June 7th	Reporting to J McKalip
John A Berenberg 33-G Hasbrouck Apts Ithaca, New York	$130.00 per week	Starting middle of June	Reporting to Rod Belden
Walter Bilofsky 31-G Hasbrouck Apts Ithaca, New York (Home address 5210 Broadway New York, New York)	$137.00 per week	Starting June 14th	Reporting to Rod Belden
Tim Connelly 1140 Commonwealth Ave Apt 29 Allston, Mass	$130.00 per week	Starting June 21st	Reporting to J McKalip
Winthrop Gross Box 298 Phillips Exeter Academy Exeter, New Hampshire (Home address Concord Road Lincoln, Mass)	$1.55 per hr.	Starting June 7th	Reporting to R Doane

Philip O'Dowd 114 Highland Place Ithaca, New York (Home address 32 Bertson Ave W Roxbury, Mass)	$130.00 per week	Starting June 7th	Reporting to T Stockebrand
Mark Stein 1681 Commonwealth Ave Brighton, Mass	$3.25 per hour	Already on payroll	Reporting to N Mazzarese
Karen Tomlinson 290 Mass Ave Cambridge, Mass	$150.00 per week	Starting June 14th	Reporting to R Sorensen
David P Wade 39 Fairview Ave Billerica, Mass	$160.00 per week	Starting June 7th	Reporting to D A White
Barry Wessler 155 Bay State Rd Boston, Mass	$135.00 per week	Starting June 7th	Reporting to M Ford
James Wertz Box 3202 420 Memorial Drive Cambridge, Mass	$110.00 per week	Starting June 14th	Reporting to D A White
Mark F Eisenberg 16 Rockview Terrace No Plainfield, N J	$120.00 per week	Starting June 7th	Reporting to ~~A Hall~~ J Sutton
Martin Hoffman 706 So First St Champaign, Ill	$150.00 per week	Starting June 14th	Reporting to L Hantman
Jerry Wilcox 119 Bay State Rd Boston, Mass	$130.00 per week	?	Reporting to T Johnson
Philip Crooke III Box 381 Stevens Institute of Tech Castle Point Station Hoboken, New Jersey	$120.00 per week	Starting June 14th	Reporting to W Segal

Timothy B Coburn Stanford University School of Medicine Palo Alto, California	To report to Paris Office at rate of $600.00 per month	Reporting to J Fadiman

Brian Pease

Pat Greene

INTEROFFICE MEMORANDUM

DATE June 22, 1965

SUBJECT

TO Stan Olsen
cc: Maynard Sandler

FROM Ken Olsen

I like your idea of setting up a plan for an outside operation to mass produce certain FLIP CHIP modules. I suggest that you find a building and perhaps take an option on it that will give you enough space to make 5,000 modules a day. You should then lay out the floor space to do the complete operation, including computer testing and then install the equipment in the proper location, even though for a while you will be doing only parts of the operation.

The clean room, etching, washing, and gold plating should be rather straightforward to lay out now. You should right away order a beveling machine because we should have a standby for our present machine.

Eventually, you should have a punch press and die for blanking and one for separating. You will probably only be making single size modules so you won't need a press and die for separating double modules.

The 10 spindle Nashoba drill should probably go to this new operation after we set it up. I think this is already on order.

You should probably use only 4-headed Universal inserting machines. I don't think it would be worthwhile automating them or mixing components. This machine should be ordered as soon as we get the specifications. If we don't use it in our new plant, we can use it well in the present plant.

We should immediately have someone check with Universal on inserting mica capacitors and plastic transistors.

The soldering machine should also do the first washing operation so that after they are touched up they should probably go through vapor degreaser. We should have the handle and number eyeleting machine. It might be possible to modify the present number and eyeleting machine to make it automatic. We have one coming soon which will do both operations at one time.

We should consider having two or more automatic module testers. As they are building the tester, they should consider the possibility of building another one. The operation should be laid out in an in-line method and probably with conveyors going between them. We should work hard to avoid any touch-up of the silk screen before etching and the touch-up of the soldered boards after automatic soldering.

If you have an option on a building, a floor plan, and certain machinery on order, you then would be in a position to quiet any fears which a potential customer might have in our ability to produce large numbers.

Ken

KHO:ecc

DIOO2 PD MAYNARD, MASS. JUNE 14

BREWSTER KOPP, ASSISTANT SECRETARY OF THE ARMY
PENTAGON
WASHINGTON, D.C.

CONGRATULATIONS AND BEST WISHES FROM YOUR FRIENDS AT MAYNARD.

KENNETH H. OLSEN

END

RDIOO2WU TXS

dec INTEROFFICE MEMORANDUM

DATE June 11, 1965

SUBJECT

TO Harlan Anderson

FROM Ken Olsen

I got a call from a fellow I knew when I was a kid who is now a psychiatrist working at Princeton. He suggested that we give a call to Mr. Roland Buhler to see if the statistical package which they have developed for the 7090 would work on the PDP-6. Carl Helm had been talking with the University of Western Australia and was very enthusiastic about what he heard about the PDP-6.

After the telephone call, I found that I didn't know what he was asking. I don't know if he was offering this package for us so that we could add it to our collection, or if he was hinting that if this package worked well on the PDP-6, the Princeton Computation Center might be interested in a PDP-6.

Ken

ecc

INTEROFFICE MEMORANDUM

DATE June 9, 1965

SUBJECT

TO Anne Staples

FROM Kenneth H. Olsen

Once again, Anne, I would like to thank you and the cafeteria staff for your cooperation in preparing such excellent luncheons for us.

Your help is appreciated.

KHO:ecc

cc: John Tobin

INTEROFFICE MEMORANDUM

DATE June 4, 1965

SUBJECT

TO Bob Dill
Dave Packer

FROM Ken Olsen

Here are a few random notes from our conversations.

1. We have to immediately lay out new overhead centers. We'll call them Overhead Centers and not Cost Centers.

2. We'll include all foreign operations as if we were one company when we make up our product line P & L statements. We'll add all these up to get the company balance sheet.

3. We might also have the same foremat of product line statements for each foreign office and add those up to obtain another identical master P & L statement.

4. Field Service will be considered one of the product lines and so there will be the following product lines: PDP-6, PDP-7, PDP-8, Field Service, Medical, Digital Testing, and Automated Drafting, plus miscellaneous which will include the PDP-1, PDP-4 and PDP-5.

5. Technical Publications will be broken down into meaningful cost centers and their manufacturing services will be made as direct charges to manufacturing in things such as preparation of silk screens and production type photography. We will no longer do record photographs for engineering, although we might allow land camera pictures for that.

6. All labor slips shall be in by 9:00 Monday and shall be accurate. All those which are not in at that time or those which have significant inaccuracies, will be called by me personally.

7. We have to work out a record for keeping track of capital expenditures for our monthly report. They should also include capital expenditure commitments.

8. It would be good also to work out some way of charging product line every time they make a move in the building. Maybe we ought to charge them directly for all the expenses of the moving which aren't capitalized.

9. Our administrative costs run awfully high. I want to look into this in detail and see what we can do to cut it down. I think from now on we ought to call it G & A because it is more than just administrative costs.

10. Until we get a Treasurer, we have got to decide who is going to do the taxes and who is going to talk with the revenue agent when he shows up at our door.

11. Our monthly reports will be so current and so good that I think we don't have to make out that separate one page report which we now give to the Board of Directors.

12. Each product line P & L statement will compare the results to date with the budget to date but I think we should do this by weeks. The budget will be in quarters and we will assume that there are 13 weeks in a quarter.

13. Product line managers have requested that we assign travel costs by product line. Dave Packer feels that if we have the overhead centers broken down into small enough pieces it won't be important. We ought to look into this and decide how we want to do it and then make a formal statement so that everybody knows how they are done.

14. I don't know why Jon Fadiman is being paid from the home office and not from the Paris office. We should, for our records, transfer all this to the French office, I should think, for the long-term records.

Ken Olsen

dec INTEROFFICE MEMORANDUM

DATE June 4, 1965

SUBJECT

TO Jack Atwood
cc: Harlan Anderson
Stan Olsen
Win Hindle
Dick Best
Dave Packer

FROM Kenneth H. Olsen

I would like to have you re-do your Technical Publications budget which you proposed to the Product Line Managers. I would like to change the assumptions to fit in closer to what I believe we can do next year.

1. The gross billings will be $20,000.
2. We will need no more promotional activities than we are now doing and, instead, we will critically look at them to make sure that they are all effective and, hopefully, we can spend significantly less than we now are.
3. For the next six months or a year, we will consider no regular mailings. We are now spending a large amount of money on all possible ways of advertising and I would like to now start cutting back; the first one we will not consider is external mailings.
4. We will not go public in the next year.

I like your breakdown of overhead centers. From now on the name will be Overhead Centers and not Cost Centers because their principle reason for existence is to develop overhead in order to obtain the real job costs. I don't know why there will be any amount of indirect labor in the advertising and public relations. I think it all can be broken down directly into product lines or into G and A.

Because I don't plan to grow at all in the next six months, and little after that, I plan to terminate all space advertising for recruitment.

I would terminate all record photographs. I would economize enough to take a land camera picture, or maybe a 35 mm picture, without rearranging the equipment on the floor and without taking any time from checkout or delivery. I would carry no low lamps or special camera equipment and have no more than one photographer walking over and snapping a picture and someday making prints for the records. I have a feeling that we spend a lot of money on photography which isn't useful and I want to go over this with a fine tooth comb and take out all photographic expenses which aren't absolutely necessary.

All printing and photography will be made as direct charges to product lines or in particular job numbers.

During fiscal 1965, we were planning to do about $20 million and have been preparing our advertising and promotional for $25 million. Now that we are cutting down to $20 million, and now that we have time to evaluate our expenditures, we should be able to cut your budget drastically.

Ken Olsen

KHO:ecc

digital MEMO

DATE June 3, 1965

TO Dick Mills FROM Nancy Survilas

Received from Dick Mills, Controller, DEC on June 3rd, 1965, two copies of Harlan Anderson's DEC Sales Plan dated February 6, 1963.

Nancy C. Survilas

INTEROFFICE MEMORANDUM

DATE June 1, 1965

SUBJECT

TO Stan Olsen

FROM Ken Olsen

We never want to admit this, but the red line circuits didn't work out like we had planned. For a year we studied to find a line of circuits which would be completely foolproof and not have any complicated rules for their use. The original 5 mc line was expensive and it was marginal when stacked more than two transistors high. The 500 kc line had terribly complicated rules for the use. We needed a line which would be completely foolproof. The FLIP CHIP modules seemed to be the answer to this. We paid high for this feature when we put 5 diodes into a diode capacitor gate.

Never admit this to anybody, but the line didn't work out like we had planned. The most serious problem was over-shooting and we had to change the 7 diodes per gate and now we're having trouble with capacity of the diodes. I am very disappointed in our circuit engineers that they didn't find these problems and think about them a long time ago.

I suggest that you have Saul Dinman and/or Jim McKalip's friend from Raytheon completely re-evaluate our circuits. When we added two diodes to take care of the over-shoots, we could have instead added one NPN emitter follower which would have eliminated the over-shoot and made very high input impedance gate. This wouldn't have lended itself very well to our present FLIP CHIP technology but it would have made a tremendously better gate.

We should also evaluate our circuit philosophy. Maybe we should go back to the 5 mc circuits now. Now that the transistors are 25¢, maybe we ought to do that. Maybe the buffered flip flop would be cheap if we use FLIP CHIPS for the circuits. We might use diode NOR circuits instead of stacked diodes for logic gating. We do have to have a neat way of complementing flip flops and for generating carries.

Ken

KHO:ecc