Ken Olsen Interview

Interview Conducted at
Digital Equipment Corporation

Digital Historical Collection Exhibit

Transcript of a Oral History Interview with
Ken Olsen
Digital Equipment Corporation

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Division of Information Technology & Society
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David Allison (DKA): I'm interested in how you first became interested in electronics. I read that you set up your own radio station. Whether that's true or not, how did you first get interested in electronics?

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Learning About Radio and electronics

Ken Olsen (KO): When I was a teenager in the late 30's and early 40's, electronics wasn't a word. You were interested in radio if you were interested in electronics. Most of the information came from POPULAR MECHANICS and POPULAR SCIENCE magazine. The books in the library had very little on radio. I remember very clearly they stopped at a, the spark _____ transmitter which was approximately World War I time. Anything I could get hold of I seized and studied and read. And any chance to experiment. If anybody threw out a radio, which they didn't do very often during the Depression, I, of course, stripped the parts and used it to do experiments. The experiments were limited because we could never get enough parts to do anything very exciting. The war helped.

DKA: Ken, was this something that you did alone? Did you do it with other members of your family? Or was there a club?

KO: Most of this I did alone. I had a brother who was two years younger and we sometimes experimented together. One thing we did was make a one tube radio. Before that we made all kinds of crystal radios which were very limited in their selectivity. You could only get one or two of the local stations. We made a one tube radio. With this we could buy battery cells for a penny a piece on sale. And get up to twelve volts. The normal voltage of 200 volts or so was beyond our budget. But we made a one tube radio. It worked very well. We built it and rebuilt it and rebuilt it again. And learned a lot on the way.

DKA: Where was this, Ken?

KO: I was brought up in Connecticut, outside of Bridgeport. It was an area where machine tools were built, where you were normally expected to learn machine shop practice. And I did. But there wasn't much in the way of electronics going on. When I was drafted for World War II, I had the enormous opportunity to go to electronics school in the Navy. It was a great school. It lasted a year, or at least eleven months. It was set up by competent people and they gave an excellent education in electronics. They taught us all the tricks, manipulating, calculating circuits, the rules of thumb for electronics, and went through all of the gimmicks and tricks and things one should know about radio. And then radar, and counter measures. It was the most exciting thing a young kid, a lot of the electronics could go through.

DKA: How old were you when you went to school?

KO: When I was 18 I went off to the Navy.

DKA: Where was this school?

KO: After a few months at Great Lakes at Boot Camp, I went to downtown Chicago for two months. I lived in the high school [where] they taught us the basis of electronics. I'm not sure we even used the word electronics at that time. The program was set up for the Navy by someone named Captain Eddy who was, before the war, the one who set up television in Chicago. The Kukla, Fran and Ollie stories were, I think, one of his projects. We then went out to Monterey, California for three months, nine months in the middle of San Francisco Bay on Treasure Island. It was a dream for someone who loved electronics.

DKA: Ken, was this the first time you really had a group of people around you that you could talk to?

KO: Oh yes, yes.

DKA: What was that like?

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Radar and Vacuum Tube Innovation

KO: It was just exciting because everybody was thrilled with what could be done with electronics. Vacuum tubes were largely just for radio. The development of radar opened up the use of vacuum tubes in such wonderful ways that we never conceived of. We'd known what radar was in very general terms. But not in exactly the detail which how everything was done. And some of the inventions in radar just thrill me today to think about them.

DKA: Ken when were you drafted? You were drafted because you...struggled to get into radio electronics?

KO: The Navy gave tests to people ahead of time who wanted to go into this program. And if you were accepted you were then drafted. But my serial number always had on the end of it, SV, Selective Volunteer. That is selected ahead of time and then volunteered. So we went in a special program right away. And stuck with electronics all the way.

DKA: What were they grooming you to be?

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Electronic Developments at the Navy

KO: Oh technician...technician. Their goal was to train enough sailors to maintain the vast amounts of electronics that were being put on shipboard. The war demonstrated the importance of electronics. The radar, the radio, the sonar, the navigation and countermeasures were all very intensive use of electronics. There also were analog computers for antisubmarine work. And all of these needed large numbers of technicians. And so they set this massive program up to generate thousands and thousands of technicians. The result was, I believe, a major influence on the development of electronics in this country. After the war when we all went to school, everybody wanted to be in electronics. And out of that came I think the success this country has had in electronics.

DKA: What happened to you in particular? You went to your school in Illinois then out to the West Coast, and then what happened?

KO: We went through the usual red tape of sitting in camp and going on a troop ship. And by then the war was over. And I ended up in China and was assigned then to an admiral's staff and we lived on one cruiser and then another, maintaining communications for the admiral. While we were there we had an opportunity to see China and Korea but we had enormous time for experimenting. In the radio shack where most of the time we were on duty with nothing to do, the crew was broken into three groups. The card players, the sleepers and the experimenters. It sometimes rotated. We had access, one way or another, to all kinds of electronic parts, and we did some fascinating experiments.

DKA: Why do I not have to ask you which group you were in.

KO: [LAUGHS] Then there were things that always had to be done somewhat illegally. The bureau ships laid down rules on how things were to be done. But they didn't know what things were like 8,000, 12,000 miles away. And we had to make things and redo things and get our major projects and...

DKA: What's an example, Ken?

KO: Oh... the communications suddenly, within a harbour, were done on radios that were made for tanks, and ran on 12 volts. There's no 12 volts on a ship. Well, we could listen with 12 volts, alright, [but] when you transmit we need a lot of power. Everytime we went to transmit, we had to turn on a motor generator set. You couldn't call a technician in to turn it on everytime you're going to transmit. So we had to make a major switching system to allow an operator far away to turn on the _____ system automatically. None of this was legal by the rules but we got the job done.

DKA: You mentioned awhile ago growing up, Ken, [about] machine shop practices. I wondered if that began to pay off in your work in the Navy and later on.

KO: My father was a machine designer. He said it was okay to go into radio but it was a business you went into because you loved and therefore you starved. People in the radio business or electronics then really didn't make a reasonable living. So he insisted I learn machine shop practice first, and I did that afternoons when I was in high school. It paid off very well, in the Navy, because I was the only one who could sharpen a drill and do simple things like that. [And] when we started Digital I was the closest thing we had to a toolmaker, not a good one, but I made the original tools. We used cutting sheet metal in making parts. I can at least carry on a conversation with people today.

DKA: When you were in the Navy and had all this time, were you prepared when the war ended? Were you ready to function? Were you ready to go to work in a big way? Or were you still in training?

KO: The plan was obviously to go to college. After the war, we had developed a lot of self confidence that we could fix anything. Part of it was true because we were trained in a way. And other parts were very naive. But we didn't understand. We had to go to college. The government did wonderful things in encouraging people to go to college with the GI bill of rights. So almost all of us had the ambition to go right into college.

DKA: The feeling must have been very strong to see all this development in a field that you loved. And we'd won the war. How did you feel coming out? Did you feel about opportunity?

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Electronics After the War

KO: Oh, yes. We felt a lot of opportunity. We felt electronics was going to revolutionize industry. We could see so many opportunities for electronics. It was discouraging to see how slow it picked up. After I had been in college I thought I'd find a summer job that could be useful. Electronics just was not finding a place in industry. It took a long time.

DKA: I want to go back to that transition from training when you were in the Navy to your working. Was going to China the first work? That admiral's staff, was that the first time that you were deployed?

KO: Yes. Being on shipboard was the first time we really had an opportunity to practical measure use our training. We probably learned technology but also learned enormous confidence, maybe way out of line for our skills but we'd tackle anything. Except once. I remember that the ship's navigator wanted me to fix this flashlight. And I said, any electronics, yes, but a flashlight, no. [LAUGHS]

DKA: What were you good at in the Navy? I don't really have a picture of what you did. I know you were fascinated by all the stuff, but what did you find yourself doing individually the most?

KO: The job I had in the Navy with a group of two dozen people, was to keep all the electronics going. And we always had someone on duty. When transmitters had to be changed, we had to do the changing. When anything went wrong, we had to fix it. When preventive maintenance was needed, that was our job. When there was some

logistical problem in the operation of _____, that was our job. So the area of troubleshooting particularly fascinated me because it was an interested puzzle. Finding out was wrong and fixing it as soon as possible.

DKA: What did you think of the quality of Navy equipment?

KO: Most of it very good. At that time, now looking back at it, it was heavy and somewhat crude. But that time it was beautiful, elegant, magnificent, with a few sad exceptions.

DKA: Was it well organized?

KO: Yes. Very sturdy and very well built. With a few pieces that they should have left on shore. I was still in school at Treasure Island when the war ended. I finished soon afterward and after a number of stops on the way, I went to sea for eight or so months.

DKA: What were you on? Was it a destroyer or battlewagon?

KO: I ended up on a cruiser because that was a cruiser because that was a flagship. And when the war was over we didn't really think about going out. We knew we still had a long time to go. People joked about the war lasting many, many years. [I] never really thought about getting out, you know you're just there forever almost. When it was time to get out the first idea was to relax for awhile and then get ready to go to school. But I think most people really planned to go to school. Some people had no preparation for it at all. Tried... because the spirit, because of the GI bill, was unique, I think of all previous wars the drive was to go to school and get education. And I think it made that generation of, from that war, different from all others. People really drove to go to school. I went to work at General Electric which was in town, where they were making radios. We made very expensive FM radios. I was a troubleshooter on the end of the line, [doing] mass production troubleshooting. I loved it, it was fun. This was in '46. My folks were still in Connecticut. After they mustered me out I went home and spent a month or two going to the beach and then went to work for General Electric who were hiring anybody they could get who could do work in electronics. They had a whole war time of backlog to catch up with. They were making very expensive FM radios. I enjoyed it and learned a lot. At the same time I was studying for a college entrance exam. I applied only to one place, MIT, took the exam and was accepted.

DKA: Why did you only apply one place, Ken?

KO: There was only one place I wanted to go. My grades weren't all that great but I... [PAUSE] didn't think far enough ahead to think of an alternate.

DKA: What did you know about MIT to have made you want to go?

KO: It had a good reputation in electronics from the war and I suppose that was all.

DKA: And what was it like to be at MIT as a student compared to today?

KO: We were a extra class brought in February. Largely of veterans so we fit right in. And we kind of ran the place.

DKA: What does that mean?

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The M.I.T. Experience

KO: Well there was nobody who was young and scared, you know. Very serious in a way and yet very carefree also. I went there in February of '47. And then went four terms straight without vacation. The first two years were a standard course for everybody. Interestingly, when it came time to select the major, many people went into electronics, wanted to go into electronics because they had exposure to it during the war. MIT set about to interview everyone with a goal of talking a certain percentage of them out of electronics, because there really wasn't room. They had calculated that there wasn't going to be that much future for electronics, so they tried to talk people into going into chemical engineering. I remember the questions in the interview, and I remember the professor who interviewed me. I was accepted to stay in; course six of electrical engineering. Electrical engineering was particularly useful for the future, our future in computers because many of the people who laid out the course of study came from the radiation lab and the war time experience. One of the things they clearly said they had in mind was that if another war started, there was going to be somebody able to design magnets. Because when they tried to use the magnetron in World War II, they couldn't find anybody to design magnets. So, out of these classes came a large number of people who had some simple basic theory of magnets. And out of that came very useful knowledge for us in the development of the core memory, the key part of computers. People who came from other schools without that background were at a serious disadvantage.

DKA: Did you study from the radiation laboratory textbook series that became so famous, Ken?

KO: No, I don't think there were ever classes. There may have been. They did develop a number of classes, though, where you could see the influence of the people who wrote the rad lab series and who took part in their work. One interesting experience, when we studied circuits, probably the first course in electrical engineering, I had learned all the tricks and all the ways of doing fast computation. And manipulation in...in one's head in the Navy. We could do X, Y transformations and do parallel series networks of components and do it very quickly. And for several weeks [in] the MIT course, I could do all the answers in my head. Suddenly it got beyond what I could do in my head. And with a panic I had to go back and learn the systematic approach to it that I had just lost in those weeks. Fortunately I caught up and I was able to do it. But I almost lost out completely because I had learned so much before I got there. But I didn't learn the systematic approach that would take you to the really complex questions. There was quite a bit of laboratory work at MIT at this time, very much so in physics and in chemistry. The most memorable laboratory which I feel badly has disappeared is the motor laboratory. They had a very large room, very high ceiling. Quite dusty and dark. Large generators and motors. Oh, six feet in diameter that you'd set up and run and learn by the sound of them and by the sound of the sparks and the dramatic result of making a mistake and the wire would evaporate. A feeling for electricity that too many students missed today because it's all simulated on a computer. It's not quite the same as hearing a motor run away and about to explode if you don't dive for the switch and turn it off. So we did learn some things there that are missing in today's education, I think.

DKA: Are you the kind of guy that liked to spend lots of time in the lab at this period?

KO: Oh, I enjoyed it. The electrical engineering laboratory experiments took a lot of time. Many nights we literally stayed all through the night working on the experiment, writing up the experiments. So you never went and did any more of those than you had to because they were so time consuming.

DKA: I haven't heard anything about what you were getting interested in.

KO: [My interest] was still in electronics. Oh, I didn't know what a computer was. One of the fascinating things was electronics were medicine and healthcare. Also machine tool control. Being brought up in the machine tool industry, the control of machine tools with electronics was interesting.

DKA: It's numerical control.

KO: Numerical control, the like. MIT was making a numerical control milling machine. When I was out looking for a job, I went to the head of that project who later became head of the department and I said, I'd like to go to work here. And he said, "Well, we don't have a contract. We don't have any money, so we can't hire you." About then I got an invitation to come join the computer laboratory. They hired only the top ten percent of the class to the computer laboratory which I think I wasn't quite there. But my love for electronics had caught the

imagination of one of the professors and he recommended me even though I wasn't the top ten percent. And I accepted. And a day later Gordon Brown, head of the numerical control machine was running down the hall and saying, "Ken, Ken, we got money." I said, it's too late. I've already got a job.

DKA: Probably the most lucky lack of funds in the history of computers.

KO: Yeah. At least for me.

DKA: How'd you feel to be able to go? What did you know about the computer lab?

KO: Oh, I knew nothing. Nothing at all. It was classified. It was military. So no one knew what was going on inside.

DKA: Did you know it was Navy at that time? Was it still Navy?

KO:It was Navy but nobody outside knew what it was except those who had legal access to it. I was graduating and going on to graduate school and needed a job as a research assistant. That was 1950.

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Undergraduate Studies

I'll make a few more comments back in the undergraduate area. Some of the things that I found particularly exciting and fascinating in the undergraduate study is the technology or the techniques for testing, proving or learning things. In physics they would say, suppose you looked at an area like a pill box and it got skinnier and skinnier and skinnier. What would happen? Or in the shape of a tube and it got skinnier and skinnier and skinnier, what would happen? Or suppose something went to zero, what would happen to the rest of it? Or went to infinity, what happened to the rest of it? And looking at problems this way. It is ingrained in you. [It] is surprisingly useful all through engineering and also in business. That part of the undergraduate training is still one of the most fascinating and one of the most useful mathematics. A lot [of] time was spent in complex mathematics. But the key part of mathematics is the simple concepts of calculus where one looks at everything in terms of slopes, simple derivatives. It gives insights into so much phenomena, including business phenomena. You never talk of business in terms of calculus, but it sure is a handy way to look at it because the balance sheet is an inner glow of the P&L statement. You really have to look at the derivative of the P&L statement in order to gain knowledge. And sometimes a second derivative. All of this helps in looking at phenomena we work with every day outside of the academic world.

DKA: Are you [saying] that calculus gives you a sense of trends in business? I'm not sure I get the parallel.

KO:If the company is growing, you look at the derivative of the P&L statement. There are factors there that, for example, show that it costs to grow. You stop growing, the cost disappears. And the usefulness is, for example, if you stay at a constant growth, that cost should stay constant. But if that rate of growth is changing you have to take another derivative. And there's another cost which should go up and down. Looking at it that way you can draw conclusions, simple conclusions on a financial statement which are not immediately obvious unless you think of it in those terms.

DKA: So it's a kind of discipline of thinking?

KO: It's just mathematical tricks at looking at things. Now that's of probably no general interest but... There are a number of things that are taught in engineering and science that sometimes aren't taught very much today and I think are lacking. One thing still taught in many places that's still very important is that every engineer keeps an engineering notebook. Everything you do, everything you learn, everything you run into, even if it's a phone

number or a piece of data you collected, you write in a notebook. You never correct it. If it's wrong you cross it over and do it again but leave record of what you had there. Everything is kept there permanently. It may be written poorly, but at least it's there. Then there is the belief that [there is] absolute honesty in what you're doing. If a piece of data doesn't come out right you flag it as it didn't come out right. But you never adjust it so it looks right. In any experiment, you may have mistakes in it. But no one would ever waiver or even, the thought of having any dishonest is...the tradition.

KO:Part of the ideas of science were traditional [and] came from many years past and from reading and being exposed to scientists. I bought a recording barometer and a recording thermometer a few years ago, and I felt this overwhelming obligation to keep all the records of temperature and pressure perfectly dated and filed. For no reason. It's just that if you're taking the data, you're just supposed to do that. I knew it was foolishness because there was never no need for me to have it. But it's just part of that tradition. This comes about from reading of scientists and how things are done. The other idea that I developed before MIT and afterward is the parallel between Christianity and science. The books written before those years often were about the conflict of Christianity and science. But it's obvious that the main theme of both is the same, which is searching for the truth, which implies a certain humility. This has turned out lately to be a very important idea, I believe. The traditions of the church were never absolutes, but searching for the truth. The scientist says there are very few absolutes but searching for the truth. Today the scientist, because he's on some kick for ecology or something, will talk about absolutes he knows nothing about. And we've been exposed to so many people in the church who are absolutely sure about things they know nothing about. It's interesting to see how in both cases we've deviated from the original traditions. Some of the people in the church today would say by the way they act. St. Paul and Christ were of course, in ignorant times, but we know. And scientists today will say, "All those old scientists who always cautioned that they didn't have the final truth." That was the old times. Now we know. It happens all the time today.

DKA: I guess I'm curious that you talk much about scientist and not about engineers in your training. Do you see a distinction there, Ken?

KO: They blend together. Engineers should follow the tradition of the scientists. The engineer is the more practical scientist based on data....[NOISE]

KO: Very few people do much philosophical thinking after they leave school. When you're in school you think, when I have time, I'll think about these things. When I was ready to graduate and I was accepted into graduate school, I had to find a job as a research assistant.

DKA: You were going to graduate school at MIT?

KO: At MIT. Do you remember [in] "Fiddler on the Roof," they asked "Why do you stay in this town?". He says, "It's home." That's part of it. Interestingly, the class in those days didn't like MIT. Afterward they did, but I never thought of leaving and go[ing] anywhere else.

DKA: What do you remember about learning about what was going on in the computer laboratory? What had you heard?

KO:We heard nothing about the computer laboratory. No one knew anything about it that I had any contact with. Students tend to know a lot about what's going on. We had the equivalent of hackers who had access to the telephone system. People had access to all sorts of things. We knew nothing about the computer laboratory. There was nothing particularly military going on there. There was no real project except make a computer. But we knew nothing about it because the security was that good.

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Description of the Whirlwind Computer

DKA: Was there any doubt in your mind what the computer was?

KO:Oh, I had no idea what it was. The concept of the computer, I had no idea. Entering the laboratory was a little bit like going into a religious order as a neophyte. They had an attitude about reliability and how you build electronics which they believed religiously. You had to follow the rules. It was almost a fixed procedure that you had faith in rather than something you knew worked. The problem they had is very obvious. They're building a ten thousand vacuum tube computer with vacuum tubes that had a design life of 500 hours. So, if you do a simple arithmetic, you could easily conclude the thing should never work under any circumstances. Very special care had to be taken to make things work. The vacuum tubes were never turned on. They were slowly turned on. They were never turned off then. The designs were done with utmost care. Everything was tested and wide margins were held in every component so that anything could vary and the thing would still work. Then to top it off they built this whole computer with ten thousand vacuum tubes in a room, oh, twice as big as this one, [THE INTERVIEW SITE IS 2500 SQUARE FEET] with long racks. The racks are 22 inches wide, 11 feet high. Each rack was a digit, so there were 16 of them plus a couple on the end, filled with vacuum tubes. Every vacuum tube had one grid, the screen grid, which was brought back to a large telephone switch. So any tube or any collection of tubes could have that screen grid voltage varied until the computer failed. You could tell in that grouping if anything was deteriorating. That way the beginning of the day you could replace any tubes that were turning weak. The utmost care was in reliability. That was one of the secrets [of] Whirlwind, and it was one of Whirlwind's contributions to the world of computing with that extreme care for reliability.

DKA: So you got in the Whirlwind project and you began to see the whole project. What was your feeling about recognizing what they were attempting to do? Was this brand new to you?

KO: Oh, it was brand new. I was awestruck. And I loved it. Anybody who put 10,000 vacuum tubes together, I used to tell my wife it was a bridge builders personality that would build anything that big. Imagine 10,000 tubes in a room.

DKA: Had you ever seen anything that big electronically before?

KO: Oh, no, you see, during the war a radar set with 150 tubes was amazing. 150 tubes was just out of this world. You couldn't conceive of that. That building, what with 10,000 tubes, that just was way out. Now a large part of it was war surplus equipment. Many of the tubes were war surplus. One way of getting large numbers of things at an inexpensive price. The history of Whirlwind goes something like this. I joined there in 1950. It started during World War II. The government wanted a computer to run a wind tunnel. They started off, [while] the war was still going, to make an analog computer. I have one of the parts of the analog computer in my office. Analog comput[ing] was too slow and they built a serial digital computer. In time it was discovered it was too slow. So they built a parallel computer, which is what Whirlwind ended up to be. It had to be exceedingly fast. Whirlwind had just [a] 16-bit word length, which in those days was considered ridiculously small. But they were working on physical phenomena which 16 bits described as very well. People doing mathematics had 48-, 64-bit word length. But the circuits were made very fast. Exceedingly fast. Each circuit was intensively engineered and put together in very simple logic to maintain the speed. The thoroughness to the engineer and the insight into how he did use vacuum tubes, I found fascinating. I found out who the smartest designer was and sat on his side and learned from him immediately. It was Dick Best, now at Digital. [Dick Best] would design things in a way that everything was tested, and then draft in a way that anybody could see how it worked. Instead of having drawings made, all the data is there and then forget it, he would study it until it was in the form that anybody could look at it and figure out how it worked. Exceedingly objective. One of the problems we had in those days was that there was no oscilloscopes to look at high speed circuits. Tektronix was not yet in business. We had war surplus, Sylvania cyncroscopes which were quite a large box with almost nothing in the box. The five inch cathode ray tube, and in order to use it we cut a hole in the top. Every engineer did his own. I learned from Dick Best how to do it. Cut a hole in the top and put the wire right into the deflection plate with no amplifier. The deflection plates had sensitivity as 60 or 70 volts per inch. So if you were looking at 10 volt pulses, you would see about a sixth of an inch high pulse on the screen. You also had problems, if you used wire to do this it would

ring and you'd get all sorts of spurious signals. But with that we developed a technique, or I probably learned it from others, where we could measure a fraction of volt and amplitude even though the picture was that small because it was all technique for making measurements, and there being no amplifiers available to make a bigger picture.

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History of the Whirlwind

Dick [Best] was a great designer of circuits. When he was working I'd look over his shoulder and learn from him. Others were logic designers and there was something to learn from [them]. The difference between Whirlwind and the other computers at the time, there were about three or four being built, they were all six months from completion. Every year they were six months from completion. All three or four of them. There's a story which my friends at Harvard say was apocryphal. But the story says that, Professor Aiken at that time said, "When all the computers then being built were complete, they take care of all the computation needed in the world." And he, or whoever said that, was, of course, looking at the computation then being done and divided that into the capability of a computer and [it] look[ed] like you didn't need very many. Nowadays we have thousands of times more computing on a desk and we're still looking for more because as we get it we find more uses for it.

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The Basis for Computer Design in the 1950's

[The logic for] the computers then being built was designed by using boolean algebra. It was the mathematics used to design large networks and switches. And it was directly _____ to computer type work. However the people doing Whirlwind, Bob Everett, probably being the leader, approached it differently. They approached design of mathematics and the logic of the computer as if it were a puzzle, considering all possibilities and picking out the best ones. The result was exceedingly simple, elegantly simple way of building a computer. The boolean algebra people ended up with very complex computers. They had simple circuits and complex logic. Bob Everett's approach was very complex, thoroughly engineered circuits, but very simple logic and very fast. I like to think that we, Digital, were missionaries to the world to convince them that the MIT way was the best way. Because the MIT way is what's commonly accepted today. And I like to think we helped sell the idea. But it definitely was unique. When we started Digital, we sold modules, little blocks of logic that people could use. People would ask us how many levels of logic we could do in the speed we said we could do arithmetic. We couldn't answer that because we followed the MIT tradition where you did it all in one step. Everybody else did it in several steps and therefore it was a lot slower.

DKA: You mentioned that sometime in this period you got married. Do you want to say a word about that?

KO: While I was still an undergraduate, before my senior year, the neighbor next door to my parents had a Finnish girl visit them for the summer who was a student in this country. I didn't make out well with her at all. She went back to Finland and the summer between undergraduate school and graduate school, I got a job in the ball bearing [factory] in Goteberg, Sweden, as an excuse to go to Finland and see how I would do with her. So that summer I got there and in two weeks, became engaged to her. My approach to things often is [to] be somewhat systematic. I kept a notebook of all the things I wanted in a wife for a number of years. Every time I heard a preacher preach on the subject, when preachers used to preach on practical things, you see, not like today, or anybody would have a lecture, or any ideas [would] come, I'd write down what I want[ed] in a wife. And when I found her, she kicked off perfectly on every point; I knew she was the one. She didn't agree that

quickly. She was a Finn, [a] very nationalistic Finn. Leaving Finland was a just strange idea. When I went there that summer, her brother wouldn't shake my hand because Finns are Finns and they don't leave. But she agreed to marry me. Then we had a terrible time getting her into this country because the rules were very strict. We couldn't get her in as a tourist or as a student or any other way. The Iron Curtain was expected to come down and then close. The Korean War was on and I had a friend from MIT who went over to Europe with me but couldn't get his wife out of Poland and [was in the] terrible position of being engaged [with] no hope of ever getting his wife out. So I went home, engaged, with a concern whether I'd get my fiance out. I went back in December at Christmas vacation, and stayed six weeks til I got permission to bring her in. And got behind in school. [But] with the generosity and patience of MIT I kept my job there. And with her patience, [I] got the work done at MIT. It was an important part of getting anything done I got done.

DKA: Is it true that the term Whirlwind came from your romantic affair and that was applied to..[LAUGHTER]

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The Whirlwind Computer - Origins of the Name

KO: Oh, no, see Whirlwind was well underway by the time I showed up. The story, before my time, was that its military code name was "tricycle" or "kiddy car." Something trivial like that. Jay Forrester, the boss, one day came by and said, "That name has to go. From now on it's Whirlwind." So that's the only story I know. And it was a good name for it.

DKA: Your fiance must have been amazed. Did she know you were coming over to work on?

KO: Oh, we exchanged mail so she met me there, yes. We bicycled around Finland together.

DKA: She must have known you were serious if you'd come across the world for her.

KO: Yes, yes. She never went back to Finland for 16 years. People can't understand why, [but] if you saw the film, "Dr. Zhivago" you realize that in war time you had idea[s] never to leave your family. Once she had a new family she wasn't going to leave. Once she got back she saw the world was different and she went back every year to see her mother. But when the memory was of wartime Finland, she wasn't going to take any chances with the military or immigration people of ever getting separated again.

DKA: Back to work in the lab, what was your work? What were you doing yourself?

KO: First I was doing small projects. My first job was to make a digital to analog converter to drive the cathode ray displays. This sort of thing we take for granted today on our personal computer[s] where we have pictures on a cathode ray tube. At that time [it] was a rather unusual idea, one of the developments that came out of MIT and influenced the world of computing. Converting the signal from a Digital number to an analog voltage to drive the cathode ray tube was one of the devices I'd had. My contribution was to, here was a clever little circuit that used very few vacuum tubes and made a precise unit. This circuit then became a very important part of the core memory.

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Core Memory

KO: The core memory was invented by Jay Forrester, a brilliant idea. The core memory idea was not the idea of storing information in a core. That had been done before. The clever idea of Jay Forrester's invention was the way of selecting the core. So you could put thousands of cores together and select them very quickly and easily. It still took a large number of current sources to drive it. The number of current sources stifled the future development. No one had the nerve to build that many current sources. The [original] memory for the Whirlwind computer was a storage tube. The storage tube was quite large with a neck coming out of it about 8 inches in diameter. It was really a cathode ray tube with two guns coming into it. Stored on the face, on the form of dots on this, were the ones and zeros. And when it was working well, (and it was hard to get 32 of them ever working together, all you got was 256 bits per tube which meant when the whole thing was working), you had 512 bit words of memory which is a joke today, [and] even then was marginal. It took great cleverness to solve problems without much memory. The pressure was really developing more efficient memory. Jay Forrester came up with this brilliant idea of using cores. His first idea was a gas discharge where you have a big bottle of neon and near, crossed wires a spark would develop. Would stay there for one and would disappear for zero. This idea then was to put a core at each intersection. And use that for memory. And this progressed as great excitement.

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The M.I.T. Lab

KO: The laboratory had some very productive ideas, or ideas that made the laboratory very productive. There was a lot of trust, a lot of freedom, a lot of competition between very bright people. But a lot of openness. And with that communication was free. And we all had to write a report every two weeks, maybe only one paragraph or a few sentences. Even if we did nothing we had to write down that we did nothing. With that the communication was very open. When you had an idea you immediately had everybody knowing about it. And if it was a good idea you had support. And if it was a bad idea you quickly realized you should just quietly go away with it. So with the idea of how to do a memory, there was no problem of getting it across. We started a single plain memory, 16 by 16 cores. Each core was a ceramic bobbin, about a quarter of an inch in diameter, maybe an eighth of an inch diameter inside. Wound on that was a very thin foil of magnetic material and then heat treated to make sure there were no tensions in it and that was the core. There were four wires strung and then in order to drive it, it took 16 current sources times four. Two for each coordinate and that same thing again for reading and writing. The idea worked but it still had so many vacuum tubes in it scared people. People still didn't feel bold enough to build a big core memory. I had an idea for using a magnetic switch to eliminate all the current sources. Get rid of all the tubes and drive them with magnetic switch or drive them with cores which were selected the same way memory cores were selected. So when I quick changed my thesis, somebody else finished the original one. And it worked. It never was a great success. It never really contributed an enormous amount to anything except for one thing. It was a great academic interest. At least to me. But what it did do was, for awhile, got rid of the hangup people had about having too many tubes. So there was a spurt of interest in core memories. It solved the problem in people's heads. They went off and built it with vacuum tubes. But the contribution of the core switch was it got people's hangups to disappear long enough to get enthusiasm. The story [that] goes parallel with that is (and I didn't know about this until just lately), IBM's next generation of computers use core memory _____ switches. But I never knew that. The problem we had with the core memory, (the first one was going to be 16 by 16 or 256 words, and 16 digits long), was how to test it. We understood from experience that you really had to test every possible combination. Because [no matter] how thoroughly you designed things there's always something that might go wrong or some combination of things that might be wrong. And people were not about to trust the core memory unless it was truly tested in an environment that was tested. So we set about to build what we called a memory test computer. It was supposed to be an honest to goodness computer that would really run and test the memory, but not a computer that designed to be useful. I was given the job of building the computer just as soon as my thesis was done. I think I was still a graduate student and it cost a million dollars. I can remember being impressed of how much a million dollars was. How much work it took to spend a million dollars. Now I'm impressed at how little effort it takes to spend a million dollars. So we built a 16-bit machine. My way of showing off was to build it in a room in a

straight row of racks with a console in front of it, with enough room for the photographer to stand back and take pictures of it. We naively showed off by saying, look how easy it is. That's kind of the young academic approach. The problem with that was that people believed it was that easy and never took it seriously. We learned later, for the next machines I was responsible for, to do it with a little more flair than that. We made a homemade wooden console with cabinets from the local distributor. Afterward we learned to put color in it.

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Listening to the Computer Late at Night

KO: The machine ran well. The first night it ran, my wife was out of town. And we stayed late at the lab and it finally worked. Everybody else went home and I stayed there and listened to it work. We put a loud speaker on every computer we built because you always wanted to be able to play music or make it do things. So I had the computer on the loud speaker and as long as the tone was constant I knew it was working. So I went in the ladies room and laid down on the sofa with the door open and fell asleep with my ear tuned to that sound so I knew that it went all night long without a glitch and that was a significant test. As soon as the machine was truly completed and within one day of it being working, the people in charge made the decision to shut down the storage tube lab and switch everything over to the core memory. The second memory was started immediately. The first one, we painted everything. The second one was bare aluminum because we weren't going to take the time. So we had two memories there. Whirlwind, the memory test computer was there without a memory. The machine we worked so hard on suddenly, instantly was sitting there with no memory. And therefore quite useless for awhile.

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Modular Computer Design

KO: Today we tend to build computers by putting them on a small board and designing everything right there. But an important part of the early development of computers was to make them modular so that things that were used many times were made identical and used over and over again. It wasn't always obvious. Not everybody agreed with it that way, but one of the first modular approaches was Whirlwind. This is one of panels of Whirlwind. [HOLDING RACK FROM WHIRLWIND COMPUTER] There were probably 16 of these all in a row, all identical. The original theory was, if one went bad, you took it out, replaced it. At Whirlwind it never quite worked that way because it was easier to troubleshoot in place because you could reach behind, take out a vacuum tube. Those tubes had the advantage because they didn't fall out easy, but they didn't come out easy either. You could change a part and troubleshoot without turning off the power. There was 250 volts positive, 150 volt negative. You could learn by touching it, approximately [what] the voltage was. But shutting it down was such an operation you never thought of shutting it down. You did things carefully, you never thought of hurting yourself, but [because] you could ruin something if you did it poorly. The parts today looked antique. The capacitors were mica with foil between them embedded in plexiglass. The resistors were carbon and normally not very precise. The terminals were, for some reason I can never explain, silver-plated. It sounded quality. But they corroded, were impossible to solder and created all kinds of problems. But that was the tradition of the day. The Whirlwind was made up of these modules. I don't know what this one did. This one was a program counter. This was one digit of a program counter. So, as your program went step by step, it kept track of what the last step was and set up the next step. I think there were twelve digits of the program counter so there are twelve identical units. They're put in a row and they would keep track of how many steps the program went through. Supposedly there was a spare and you could have swapped it. It just happened to never to be done. The next step in modules development at MIT was to make true modules where there was a large number of the same thing and they look something like this one where you not only made it easy to swap units that were

defective, but you also gained density in the third dimension so that you could get a lot more stuff in a much smaller area. This was a module used for building MTC computer out of...

DKA: How many tubes did the MTC have?

KO: Thousands of tubes.

DKA: And this was the reason why because you had thousands of these components?

KO: Yes. So there was hundreds of these components. Most of them had just two tubes in them. With transistors it was much easier because with these, each tube had approximately five, ten watts of filament power. That meant that every time you built something, you had huge transformers just to drive the filaments. The voltage on the plates were 250 volts. Any current of 250 volts had a lot of power. With transistors, life became easy. The first transistor computer we built at MIT was the TX-0 computer. I didn't have faith in putting [transistors] in circuit boards. Maybe poor judgement on my part. But we built them into a tube like this. [HOLDS BOTTLE FROM TX-0] There was one transistor. They were fit in a small socket. Then you could have a high density, and they had color codes on the top so that if a red one went bad, you'd just put another red one in. These transistors were made by Philco. They were the last of the high speed transistors. No one else could make high speed transistors. So we grabbed hold of and designed circuits to match their characteristics. They were so delicate that if you combed your hair and touched one, you burned it out. It took a special set of circuits to do it. They cost several dollars each. The next computer module we built was the TX-2. We had printed circuit boards. [HOLDS TX-2 MODULE] This module we designed for high density. We had real solid, secure sockets we thought at the time. The printer circuit boards were here in special metal size. It looked quite attractive. It also was color coded with colors on a handle. The transistors are through that hole there and other components are laid out and you can see the components become more moderate now. They're more compact. They look a little more professional. The connector is solid and rugged and shows our lack of faith in connectors at the time.

DKA: Ken, is this again something that you designed all the circuitry on?

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Making Test Equipment

KO: In general [the design of] the circuits involved many people. The idea [of] these circuits, I probably did when I was all alone on a project. But in time many people got involved. One of the ideas they had at MIT before I showed up was to make what they called test equipment. It was a set of modules that would do single operations like a flip flop, a gate, a delay unit. With those you put on your experimental bench, develop an environment for testing a circuit. That detail[ed] testing of circuits was possible because of testing equipment. When we started Digital, the first product we had was the equivalent with transistor computers and this is one of those. [HOLDS DEC LAB MODULE] You could arrange these in a rack and do specific operations at a speed that no one else could accomplish at the time. But you would wire them together with these pig tails and make a counter, set up pulses or anything you want to do for testing. That was our first product. It allowed the rest of the world to design the logic they needed for military projects and other computer projects. When we wanted to make something permanent like a computer, our first computer, we took the same circuits and put them into a frame which could be stacked quite densely without the cover. These we called our system modules. They were a key part of the business for many years. The transistors had changed by this time. The components had gotten smaller. We had a unique idea in driving these. We said we would make a simple rugged power supply and design the circuits to tolerate the variations in the power supply. We also used diodes to generate three volts, the base voltage right on a board which meant this was almost completely tolerant of noise on the power line, lightning or anything else that wiped out computers at the time. That made our computers very rugged. When some of the space programs, everybody's computer was down. Ours was still running because we generated our base voltage right on the board.

DKA: You were talking about what service that component provided. Could you go through a bit of that again.

KO: We had a box for every circuit you'd want to build a computer or computer environment. This one happened to be a pulse amplifier. If you look at the diagram, there's a gate and an amplifier. So, if you put in two signals here and they were in the right combination, you'd get a pulse out here at a standardized size. Other boxes would be a flipflop that would store information. A complex set of gates which would allow you to do logic and delay units that would allow you to accomplish other activities. With that set of pieces, people could do almost anything they want to do at high speed.

DKA: The degree to which you did modular thinking, was that unusual in this business at this point?

KO: No, no. By this time it was quite commonly done.

DKA: And what's unusual is the ruggedness with which your components were designed?

KO: On almost anything someone does in the computer business, you can go back in the literature and prove someone had done it earlier. In the case of going in the business selling modules, there was 45 people doing it at that time we went in business. All doing poorly. Our contribution was first of all we had the circuits we took from MIT which were fast. No one else could do fast runs. We also had an interesting business idea. Most of them went into the customer and said we will charge you ten percent less than what the other guy offered to sell the same thing for. We went in and said, here's our literature, tell us everything we know about the circuits and here's a fixed price list. And there's no dickering. With that we changed the industry in a year. Everybody had a set of literature and everybody had a price list. That was our main contribution besides speed.

DKA: You had good circuits but you also had a winning strategy.

KO: Yes.

KO: The chronology, as I remember it, this [HOLDING WHIRLWIND MODULE] was probably designed in '48 or '49, well before I came to Whirlwind. Probably [at that time] the first module was built as part of the control element of Whirlwind. This module then was designed about 1950, '51, for more or less high production. The transistor work, the transistor computers we started '55 or so, '54. We were working on air defense system. I spent a year at IBM representing MIT. As a rest cure, they allowed me to work on transistors, outside of the defense part of the business which everybody else was working hard on. I could have no staff or space. And then these came [HOLDING TX-0 MODULES] probably '54, '55 and this one '56 [HOLDING TX-2 MODULE]. And then as we started Digital, this one [HOLDING DEC LAB MODULE] was '57, '58 and then on. We felt quite confident with the way we were building computers. We knew we could do almost anything we wanted to do, but the big limitation was the memory. Storage tube memories weren't reliable, worse than that. And they would never be big or fast. [When] the idea of the core memory came along, it just raised the possibility of making real computers. Here's a plane from one of the first ones we built. [HOLDING WHIRLWIND CORE PLANE] You can see there's a thousand-twenty-four [1024] cores arranged in a square array. The way it worked was quite simple. The direction of the magnetization in a core decided whether it was a one or a zero held there. If you put current on one line it never was enough current to switch the core from one state to another. But if you put current in two lines, where the current went from two wires to the same core was enough to switch it over. With that you could select a core and read a one or zero into it. This meant, however, 32 drivers on this side and 30 drivers on this side for just one direction of current. Plus another 32 and another 32. That meant 4 times 32 drivers. You can see those on the memory here. Here's 32 drivers. And here's 16 drivers times 8 around here which ended up being able to drive 32 lines, 4 directions. Each driver just contained one tube and one small tube. That drove a good half ampere into each wire. This plane comes from one of the first two core memories built. And right here we have a complete memory which happens to be the third one. [POINTS OUT WHIRLWIND CORE MEMORY STACK] By the time we made the third one, the plane's a little smaller. But you can see there was one plane for every digit of the memory stacked up here. The drivers going in each direction came from these four sides top and bottom. There's a wire for each of the digits here. This made a thousand twenty-four [1024] quite reliable core memory, and this made computing truly possible.

DKA: How many numbers could you store?

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The Impact of Core Memory

KO: The 16-bit word, they called two bytes. So there's a thousand words, or 2,000 bytes, which then was a large number. Today a kid with a personal computer would laugh at you for having that small a memory. The core memory revolutionized computing because it gave the promise of great things. At the time we never dreamed of large memories because every core has to have five or six wires put through it. But in time, as the demand grew, the capability of making them grew. People invented all kinds of machines to do this automatically. But to the very end, the bulk of it by far was done by girls stringing wires with long needles. We at Digital at that time were a small part of the computer industry. But at the peak of the core business, we alone made four billion cores a month. We had girls in Taiwan string each one of those with five wires through them. Now I have in this little salt shaker some of the cores we made. [HOLDS SALT SHAKER CONTAINING CORES] When it was full it held a million cores. They are so small that I can't see the hole in them, even with my glasses. I think they're about 8-thousandth of an inch in diameter, and the hole is about 4-thousandth. And they're the size of pepper grains. I can see the hole, but the idea of putting four wires in there and doing it with 4 billion a month is just astounding. Here's the specifications for its size and its chemical mixture. Now with that, people made big memories. And the computer business spurted forth. The minicomputer business became practical because we could make inexpensive, very powerful, quite large machines for very little money. Since then, the semiconductor memory has taken over. It is just so much easier to use. It's so inexpensive and when you hear about one, four, eight, sixteen megabyte memories, they're made up of little tiny chips of ceramic doing the things that we used to do with cores. So as miraculous as these little cores were, the miracle of the semiconductor memory is much more so. And it continues to get better every year. The prices go down, the size goes down and there seems to be no end. The little things that we take for granted, now we have computers in our automobiles and computers, in our microwave ovens, and computers in our washing machines. It comes about because the memories now are so cheap. But a key part in the history of computers was this ceramic core memory. The first core memory we made, we only made an experimental one plane one. It had metal cores. It made a very thin foil to make them fast. We knew that it was possible to get magnetic ceramics called ferrite that would have the characteristics we wanted, but the builders of ferrites didn't think it was very promising. One day a company in New Jersey brought some samples made on a washer dye, about a quarter-inch diameter. We jumped at those. My thesis came out of using those. And with that small, then very large, about a quarter - we call[ed] them Cheerios because they're the size of the breakfast cereal ring. From that came smaller and smaller ones and the small ones I still get stuck to my hand, are the limit in how small they got. But developing the material was a different story. MIT set about the traditional scientific way to pick the best mixture of materials to make these. There were three components to the ferrite; ferric oxide, ferrous oxide and magnese dioxide I believe. They all cost about a dollar a pound. But the mixture of the three compounds took a long series of experiments. They tried every combination, plotted them out, fired them, tested them, and decided what the mixture was. The ceramics company in New Jersey, an old German ceramacist who by guess or by intuition, or years of experience, mixed up his first mixture and hit exactly the same spot as all the research done at MIT. It shows a place for science and there's also a place for intuition.

DKA: Describe this computer for us.

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The TX-0 Computer

KO: [STANDING AT THE TX-0 COMPUTER] When I was given the opportunity to work on a transistor computer, the idea was kind of new, it was exciting and we had knowledge of the very fast _____ transistor _____ which we had built a very fast computer. The rules were, I could hire nobody and have no space. I studied the rules carefully and found all the loopholes. I somehow was able, one way or another, to get three or four people to work with me. We discovered that hallway was not space. So we moved my office into the hall and put walls around it. We then traded that space for a space in the basement which was less desirable but bigger. With that we were able to do our work. We discovered that part of the basement in Lincoln Laboratory was nonfinished. It was just dirt. We talked people into pouring concrete floor there and then we talked people into putting a light colored floor. When they discovered what we had done they said, never again. We talked them into twice the light level of anyplace else in the laboratory. And when they found that out they said, never again. And then we had the walls with different color. The walls there are just normal military type. I can't remember if it's beige or green, you know it was just a bland color. We had a bright color. And then we set about to make a computer that would attract attention. We discovered with the MTC [MEMORY TEST COMPUTER] computer, that blah looking computers, never really attract attention. People, you'd think, particularly scientists, would be interested in the specification, the capability. But things have to be colorful to attract attention. So we set about to make as modern a design as we could. Now it looks quite naive. But this is it. You know it had rakish lines like race cars were supposed to have because of the way they took pictures of them. And we picked a color which is just as opposite from the traditional black wrinkle finish which was World War II. The modern color used by the laboratory was gray hammertone. It looks so military and blah. So brown and beige just seem like a dramatic change. And that's why we picked this color. And we tried to make it look a little modern. About as modern as we could. The result was when head of the laboratory had visitors he of course brought it to our laboratory because we set the computer back from the door for good pictures and showed it off with a little bit of flair. It was the place they took visitors. Even though we didn't break any rules, we exploited all the things they didn't have rules on yet and made one that was more exciting. The construction of it is all the things we had learned to put in computers. There's a loud speaker and amplifier underneath the table for playing music or anything else you want with the computer. The cathode ray tube we automatically built into the computer. At that time there were 4,000, I think 4,000 lines because we focused on one spot at a time instead of a raster like we do today. We use the light pen which is the equivalent of the mouse [or joy stick] we use today. This is what we use in the aerodefense system. With that you could draw, play games and all the things you do for the house today. We used to have a light bulb for every flip flop. We used Japanese model rail road lamp bulbs. We were joking that we probably confused the industry watchers over there with that order for lamp bulbs. The model rail road business was booming. The machine is made of these little tiny bottles and larger modules. It made it quite easy to make the unit. The transistor was fast but very fragile. The circuits had to be designed around the transistor. It took 12 transistors to make a flip flop. I believe it is the design that grew into that integrated circuits logic which has become very popular. Because they have exactly the same problem with the power and the transistors as we had there. And so these circuits, I think, were the basis for the modern computer circuits.

KO: The circuitry in this computer was built around the Philco surface barrier transistor, a magnificent piece of design for a style transistor which was just about to become obsolete. It was very expensive but very fast, and very intolerant of power or spark or discharge of any kind. But we designed the transistor circuits around this. And we made them very fast and the circuits, I believe, were the basis for the commonly used T-squared-L [TTL] logic that people build computers out of today. The reason for building the TX-O computer, this was about 1955, was to demonstrate how efficient in power, how fast in speed, and how easy it would be to build a computer for a defense. Now the project wasn't classified. We published everything. We told everybody. Had a lot of interchange with the rest of the world. But the goal was clear that if we had a chance to make defense computers over again, it's obvious that doing it with transistors would just save so much heat and so much space and be so much faster. This is a very close to being equivalent to the modern personal computer. Someone sits down in front of the oscilloscope, with a light pen and plays games, does things, is creative. Word processing wasn't yet developed. Games weren't yet well developed. But in general it was, you might say, one of the first personal computers. We designed it as a demonstration but then people did computing on it. When they had a problem that would lend itself to this they used it for computing. They'd bring it [THE PROGRAM] in the form of a paper tape which they generate on a flexowriter. As they typed it, the paper tape would write the information. In the same way we store things on a disk today, the high speed photo electric tape reader would read that tape very quickly and then they would go ahead and do programming.

DKA: When you say this is kind of a personal computer and you talk about pictures, [CREATING IMAGES ON A CRT WITH A LIGHT PEN] it really confuses me because it so little resembles the PC and I still don't know.

KO: Oh it's exactly the same as a PC. You see what you see in a PC is the keyboard. The cathode ray tube and the light pen. So this is indeed a PC. This [THE TX-0] was designed to be a demonstration of the reliability, the capability of transistor circuitry. And making a fast, inexpensive low-powered computer. The unit itself really could do what a personal computer does today limited only by the fact that the memory was small. You could make pictures on the cathode ray tube, change them, modify them. Read your program in, take your program home, play games, do the things you do today on a much smaller scale because the memory was very small.

DKA: Did you see text on the screen?

KO: Oh yes, the text was very commonly done on the screen. Now as I remember this was an 18-bit machine. All the machines we had up until then were 16-bit. It was 18 because we stored a character in 6 bits. Therefore we could in one word store three very efficiently. So we went to 18 bits just to store characters. When we started Digital we also had 18 bits because we could store 6-bit characters. The world standard later on became 8-bit characters and we all went to 16-bit or 32-bit computers, interestingly, which was the ones we had originally. So this is in a very real sense a personal computer. You could even say that of Whirlwind. It took 2500 square feet. The console was a walk-in room as big as this loft here. But in a real sense it was a personal computer and did personal computer things.

DKA: Do you want to talk, Ken, about how some of the ideas and some of the thoughts and plans that you had when you developed this computer led you to think about your own computer business?

KO: When this [THE TX-0 COMPUTER] demonstrated the usefulness and [the ease of making] computers we started a bigger one called TX-2. People often ask what happened to TX-1. TX-1 was the first one designed and I said, "no way are we going to build that one. It's too complicated for a first one." So we built the simplest possible machine which was this one and then skipped TX-1 as a name and went to TX-2 which was a very large machine. I was building the hardware. Somebody else was designing the logic and they couldn't settle down. So after a year or two of that I got impatient and left. That was '57. There [were] a number of reasons for leaving. One was we [had] published what we had done, demonstrated that you could make computers very effectively, much better than anything done with vacuum tubes by far. The commercial world just smiled at us and said we were just academic. Of course, today, we smile at people at MIT and say they're just academic. So just showing them it could be done was one of the reasons for going into business. The things we took from MIT were first of all, the idea of an interactive computer which was unique. In those days you dropped your problem in the form of a stack of IBM cards in a slot. It went into the IBM machine. The next day you got your answer back, and it usually was [that] you'd made a mistake. With interactive computing, you put a problem and you'd try something and you [were] instantly told it was a mistake. You could interact, get things done fast, the things we see in personal computers all the time. That concept was strange and the idea that that concept should be introduced in the world. Even more important than that, however, was the demonstration we had at MIT that where you had a group of people who were bright, wanted to work hard, but if you showed trust and openness and confidence and let them work hard, they could turn out amazing work. So the human ideas that came from MIT were probably the most important. These are the ones we tried to maintain at Digital where we hire the best and we can hire the best because we have the ideas. And then trust them, set the general goals so they know where they're supposed to go, but then give them freedom to be creative. Propose, argue, and then show great trust and great confidence and they do wonderful things. Those are the ideas we had at MIT. There's one other reason, too. I always thought that what I wanted to do was experiment with electronics. I'd gotten to the point where I thought I could talk people into any project I wanted. That probably wasn't true but I had that feeling. There was one thing missing which I never thought of before, and that is nobody cared. It was important to do something they would care about, so we set about to do something in business that people would care about. And that's how we started Digital.

DKA: What was it that people didn't care about? And what was it that made people care about?

KO: We demonstrated all the ideas of high speed transistor computers, and we thought the world would be waiting in open arms for this. Nobody cared. And it turns out that it takes more than ideas. You've got to sell your idea. So we set about to sell the idea. Now there's some lessons there for people. One of them is it seems like being left alone doing research would be satisfying. Basically it's not. Unless somebody notices it. And secondly, getting an idea, no matter how good it is, isn't enough. You've always got to sell the idea. Putting color into this thing was part of selling the idea. And that's what we set about to do at Digital. The idea of starting a company was not well developed then. It was strange. A number of companies had started during the Korean War. A number were no longer in existence. In 1957, many of them were in trouble. A recession was starting. The idea was not a popular idea. We were told that the American Research and the Development Corporation were set up just to do this so we went to see them. That's the business they were in. But they were worried because some of their investments hadn't paid off very well. But they were fascinated enough to listen to our proposal. They told us we could go to their board of directors and present it and see what happened. They gave us three bits of advice. One was, don't use the word, "computer." Because FORTUNE magazine said no one was making money in computers and no one was about to. So we took that out of our proposal. We were going to make modules first, anyway. And they said, "don't promise five percent profit." You see we looked in the library. All good companies seemed to make about five percent on sales. The staff said that if you're asking someone to give you money, you've got to promise better results than that. So we promised ten percent. And we made about ten percent most of our history. If we had looked for five, or aimed at five, we probably never would have made much more than five. The third thing they said was, "most of the board is over 80, so promise fast results." So we promised to make a profit in a year. The other side of the story is that we really did, after 12 months, make a profit. It was so small you couldn't tell if it was plus or minus. But it was like $3000 plus. And we brought it down to General George Doriot. [HEAD OF AMERICAN RESEARCH AND DEVELOPMENT] We dropped the financial statements on his desk. He looked them over and looked up and scowled at us, which kind of set us back. He said, "Sorry to see this. No one has succeeded this soon and ever survived." His lesson of course, was, success is the worst danger in business and in everything else. Maybe because of his warning we're still here. But that's also proved to the rest of Digital that success has done more harm to people than anything else.

DKA: Who is General Doriot?

KO: General Doriot was a Frenchman, came to MIT, but went to Harvard instead. And became a professor at Harvard Business School, for many, many years, in the 20's. [During] World War II he became a general in the American army with a terrible French accent so that when I met him I didn't know which army he was a general in. But he was very popular as a professor. [He] has a strong following still through the business world, his lessons being very practical. Integrity, quality, honesty, doing the right thing. He also then became President of American Research, just to start new companies. His contribution to us was to encourage us, give us support and show patience and encourage the characteristics which he always taught in his classes.

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The American Research Company

KO: American Research was unique in a number of ways, probably all based on General Doriot. First of all, they were the granddaddy of all risk capital companies. Since then there have been many risk capital companies. None of them have accomplished what American Research did. Some of them are financially more successful, but they never made the contribution. American Research, the General, had the belief that they made the long-term investment. They wouldn't buy and sell companies at the first opportunity. They would stick with, [and] work with, the company until they were successful, or until they failed. This sounds obvious, but it's very hard for someone who owns a major part of the stock to be patient. The General really preached this and really practiced it. It was his contribution. We did well for most of the years. Any other company would have attempted to sell when somebody was doing well and clean up on the profit. When things were going poorly, people would be tempted normally to sell to get rid of the problem. The General was patient then, too. He also

had a lot of simple rules for running a business which are always helpful to keep in mind. Most of his ideas he didn't present in a way you had to accept. He presented them in a way which, after it was done, you thought [you had thought] of them youself. Or if you didn't accept them, there was no hassle. There are a few exceptions. He said you never want a lawyer on your board, you never want a banker on your board. These are black and white and you'd have to definitely go against the General to pick either one of them. He was always there as a mentor and for help.

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Digital Equipment Corporation - The Early Days

KO: When we started Digital there were three of us. I had asked a friend from Lincoln [Laboratory] whom I had worked with to work with me on a proposal. I pretty much had the technology worked out and Harlan Anderson and I studied history of other companies and the financial statements and laid out a proforma, financial plan for the company. And then proposed it. When we started, my brother [Stan Olsen] joined us the first day. We bought the machinery and started the processes and made the silk screens, and etched the boards and dipped them in solder. We did everything, the three of us. In time we hired secretaries and a few other people. We grew quite slowly. American Research gave us $70,000 and that lasted eight years. The nice thing about $70,000, you can watch each one of them. We bought things in the hardware store. We were very cautious and very careful, and learned a lot. We learned a lot about accounting. We learned a lot about manufacturing. And we grew consistently. The opportunity to do everything is something exciting in itself and very satisfying, an important part of starting a business. That part I would recommend to anybody [who] had the opportunity to do.

DKA: You said you learned a lot of things. I assume the things you learned helped you succeed.

KO: Well, we learned a lot of things. Some were useless and some were... how to keep pigeons out of the building. Not particularly useful afterward. But just understanding how accounting systems work and personnel problems. How you hire and how you fire. How you purchase. How other companies work. [These] are all things you learn when you're small.

DKA: What did your customers think?

KO: The potential customers were readily easy to define because they were people who wanted high speed circuits. And so we went to trade shows and we'd call on the people we knew. It was always touch and go. We were profitable every year but you very rarely have so many orders that you feel completely secure. It's just the nature of business.

DKA: What was it you were offering?

KO: To start with, we were offering modules for laboratory use that were faster than anyone else [was making]. So people would buy our modules and experiment with high speed computer technology or test devices they were building. This was our first offering. Later on we offered modules people would use to build things they were going to sell to others. Then we offered computers made out of these modules; called the first one our PDP-1.

DKA: What else do you want to say about these early days? How did your wife, for example, feel about your going into business? Did she feel worried that you were taking this big step? Or was she supportive?

KO: I can't tell you why, but she was never worried. We probably came from a different world. You never had much in the Depression and you didn't worry about having much. She had come through two wars in Finland, and much of her life, never had enough food to be completely satisfied. You never really worried about failure because you know, it didn't make any difference. So we didn't have anything, we didn't worry about anything. So

that was part of it. The pay was what I had gotten at Lincoln Laboratory. So the risk we never really worried about. Now the risk in business is the different risk. And that is, when companies fail, it's a miserable death. They fail and if anyone has an emotional involvement, it really is agony. But it's not the risk you think of normally, the financial risk or something. It's the risk of watching something die. So that risk we didn't worry about. We didn't think of.

DKA: What was your own personal challenge? What was the demand on you that was most acute in those very early years?

KO: The excitement, the fun, the thrill was to do everything. This also, of course, put certain demands on. There's only so many days of the week and so many hours in the day. Balancing that with family was always a challenge. But it never really got out of hand. I never really felt overworked. In general it was very exciting. I came home for supper every night, spent the weekends with my kids. There's always a list of things to do. And you just systematically go through the list. Early in the morning, walking in the woods. Just generating that list of things, keeping on balance. And then click them off one at a time. And as long as it's approached systematically there's no great tension. If they ever jumble up in your head and you get behind there can be quite a bit of tension. But in general it's quite clear what should be done. And not trying to do things that are impossible. And not worry about the pressures that other people would like to impose on you. The pressures on someone in business are to take part in every outside activity, go to dinner for something or other every night of the week. Most of them are useless and most of them have nothing to do with the business. Saying no to them is a major operation, a major key to survival. Another story which I tell when people ask me what they should do to learn to run a business, I say, jump at the chance to run something. If you're working, offer to run the cafeteria, the parking lot, things nobody else wants to run. If you have an opportunity to run something in town or in church, just run something. Manage it. You learn to manage by managing. But don't think management comes from a book and then you're suddenly going to do it. I told the story of how I got started from an MIT point of view. The other story I tell was that when I was 30 I was drafted to run the Sunday School of a large Boston church which to me looked kind of large and stuffy. Everybody was old. They must all have been fifty. Some of them quite a bit older. I accepted the job. The first thing I did was go to the Lexington library and take out all the books on management. I can remember what I learned then. I can't remember anything I learned since then. But approaching every job because it was a management job, and learning, it's an excuse to learn something. My taking that job was probably a key part in learning and being interested in taking on a management job. The other thing is that getting people to work enthusiastically is always a challenge. You obviously can't do very much yourself. But if you can get others to feel it's their job, their invention, their contribution, they can get an enormous amount done. Making sure they feel that way is a key part of it.

DKA: I wondered if you wanted to talk this morning about the team of people that you brought together to work with you and the principles that you had them follow as you moved towards this first product, the PDP-1.

KO: Developing and managing an organization like Digital is a compromise or a set of paradoxes, or conflicts between leadership and giving responsibility to others. It's obvious that leader, myself in this case, can never be expert in everything. We have to be dependent on those people who are. They obviously have to do the design, set the goals. They have to have the motivation that comes from them, setting the goals. And yet we have to have a common goal and that's obviously the job of the leader. What I did for good, or for not so good, is probably demonstrated many of our products. Here we have our PDP-1. The background I had, the experience I had was the design of circuits, the design of logic, how you did arithmetic with transistors. But early in the history of Digital we could hire people who were expert in that. The area we couldn't hire people were the making of power supplies, the putting together the packing, the industrial design. So, in that case, I gave the responsibility for the things I had been expert in to those who[m] we could hire.

DKA: Ken, what would you say was the overall goal in making the PDP-1?

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Digital's PDP-1 Computer

KO: The goal of the PDP-1 was to introduce a new type computer to the world. In the tradition that was developed at MIT where the computer was very simple, very fast, relatively inexpensive. In this case, [the price was] $110,000 with only 4,000 words of memory. Because it was simple, easy to use, interactive with the cathode ray tube and light pen, it could be used by an individual. Someone could afford to sit there and use the computer like we do [with] a personal computer today. You could also use the same equipment interactively with equipment, that is, with a machine or a telephone system because the price was relatively low. $110,000 thirty years ago was a lot of money, but computers then cost one, two and three million dollars, so it was relatively inexpensive. And it did open up new applications that people hadn't thought of before.

DKA: Why hadn't anybody done this?

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The Concept of an Interactive Computer

KO: First of all, we had experience with the technology. After years at MIT it was just natural to us. The concept of an interactive computer was strange. Some people thought it was wrong. Almost spoke in ethical terms. Computers are serious, you shouldn't treat them lightly. You shouldn't have fun with them. They shouldn't be exciting. They should be formal and distant with red tape involved. That was the atmosphere at the time. So it was a strange idea. The other motivation we had was that we believed computers should be fun. They were exciting. They could do so many things. The opportunities were just without bounds. This was a great motivation in building a computer. But it was not commonly shared in the industry. Now, the other reason of course, was that using vacuum tubes in the older technology, the machines were big. They were huge. And they were expensive.

DKA: As you look at the history of computers in this period, you see people focusing on operating systems and getting batch processing and more efficient use of computers. Was there a thought that this wouldn't be an efficient use? Was that part of the concern?

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Real-Time Data Processing

KO: The original computing was based on the way people had done computations before. You'd collect all the data, bring it together, process it and send the answers back. The idea of processing it, real time, took a long time to develop. In the world of commercial processing, it's just in the last few years that batch processing has started to disappear. The replacement for it is now called transactional processing, where if you make a transaction with a bank, it is instantly taken care of. Your accounts are updated. And you could have a new transaction almost immediately. So, 30 years later, it has influenced the commercial market. That was dependent on software and large computers that were fast.

DKA: Did this PDP-1 conceptually have any relationship to what you've just described?

KO: The PDP-1, we like to think, along with the circuits we were selling, was a vehicle for introducing the MIT ideas into the rest of the world of computing. The idea of fast simple machines was strange in those early days, and we like to think that we helped change the world. The MIT tradition came about because we were working with physical phenomena. In aerodefense we divided the country up into 16 bits and that was close enough for

defending it. For most physical phenomena, 16 bits is enough. The rest of the world ridiculed anything [with] that short word length. And, as you well know, 16 bits is the most common of the powerful personal computers today, and up until just lately, most minicomputers. So even the word length probably came out of the MIT tradition, and the PDP-1 tradition.

DKA: Ken, did your whole team have a common feeling about this objective, or was there difference in opinion as to which direction you should go in computers?

KO: When it came to details, we had all kinds of opinions. We spent a lot of time arguing, and openly exposing all the differences. But the firm belief that the world needed fast, inexpensive computers that were interactive was just accepted, without question. We also believed, now maybe this sounds a little naive, that every computer had to have a cathode ray tube. I mean it was inconceivable. But that you wouldn't have one with a light pen. Also, every one had an audio output. I think somewhere, under this console there's one. Because it goes with interactive computing. If you lost interest in everything else and you were alone with the computer, you could always write music at night. So that sort of thing was just accepted in the environment. Along with the idea that computers are fun, exciting, and that anybody can learn them. From a young child on up. When we asked for money we may not have mentioned that computers should be fun. But every time we reported to them, we reported that computers should be fun and exciting and therefore very productive. The demonstrations we put on in the stockholder's meeting of American Research, which owned almost all the stock, demonstrated the fun and the interactiv[ity] and the responsive[ness] and the productivity that came from it. So we openly presented this.

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M.I.T. Students Learning Computing on Digital's PDP-1

KO: When we were at MIT, we at Lincoln Laboratory gave to the educational part of MIT at the TX-0 computer. Then when we started Digital we gave one of our first PDP-1's to MIT for use by the students. The students could then have opportunity to use that machine anytime, 24 hours a day, and they could sign up for it months ahead and do anything they wanted. They learned more about the computer and how to do things with it than probably anybody had before that because you had dozens of bright people spending all hours of the day studying this. Out of this came what we know of today as video games. We had played fixed games before in an oscilloscope like kalah and the Asian games that you could demonstrate here. But what we know of as video games came out of that group at MIT. These always made great demonstrations. Spacewar! being the most exciting one. It's] still showing in the [Computer Museum] museum. And very close, you can just see that out of that came what we know today as video games. This made a great demonstration for stockholders. We also played music. I think we had a four part Bach we could play. We did feel passionately that we had an approach. We were too much scientists to say we invented anything or it belonged to us, or uniquely ours. But we did have this missionary zeal to introduce these technologies to the world. And we got great satisfaction to see it develop, both in the world of human interaction and machine interaction. Interacting with machine tools or laboratory devices or telephone lines. It was the goal we set out to do. It was a goal we formally stated. And this worked out very well.

DKA: Ken, you talked a lot yesterday about the modules that DEC first made as being your initial product. What's the relationship between the modules and this initial computer?

KO: Digital devices are made up basically of just a small number of circuits. Flip flop holds two states which it holds the _____. Gates, you'll put various combinations of signals in and if the right combination is met, the signal gets through. Then there are amplifiers and things to allow you to run by drive things, or run distances. In making up modules out of these building blocks our original customers could build up computer like devices, or actually computers. We then used them to build the PDP-1. This is the back of the panel but those modules plugged into the back. [POINTING OUT PARTS OF THE MACHINE] These were all wired up and soldered by hand. But the correct modules plugged in the back. If they were defective you could change them easily. If you

designed them once and tested them thoroughly and then you used the same ones many places. I think there were probably 20 across, 20 times 20 or 400 modules. Maybe it was 600.

DKA: How did you make it so fast?

KO: The approach to the circuits which evolved at MIT was to set about to make the circuits fast and then the computer simple. It meant very expensive circuits. The transistors cost $12 each. Maybe by the time of the PDP-1 they were down to $6 or $8. That's very expensive. So that the circuits in the modules were very expensive. But the result was basically a very simple machine, and one we could readily build and that operated very fast.

DKA: Tell me about the sales of this machine. Who wanted it and what did they think about it when they got it?

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Digital Customers Developing Software

KO: We had contracted with some professors at MIT to do the software for us. They didn't come through. We then announced the machine as the machine without much software. So, this was a challenge to a group of customers who wanted to do their own software. The applications normally went to the scientists. [REFERENCE TO MACHINE ON EXHIBIT - This machine here is not as good looking as the original one. The frame over the cathode ray tube is for hanging a camera on. This ugly bracket was for holding a camera. And it probably was used for high energy physics experiments. They could take the data, project it on a tube and photograph it. And that was the general application.] The American International Telephone & Telegraph bought a large number of them to collect teletype messages, stored them and then distributed them to the phone lines that were free at an optimum rate rather than storing on paper tape and doing it manually like they did before. So that was an obvious application for it.

KO: [Our early customers] jumped at the chance to [develop their own software] for their special projets.

DKA: One of the things that DEC is well known for is working closely with customers. Was that part of what you had to do then almost as a necessity?

KO: One of the exciting things about this business is that you have such an interesting, diverse set of customers with very interesting problems. Each one is different. Most of them are quite exciting, all the way from physics to telephone controls...education to medicine. Working with them is important. Through our history, many of the ideas came from our customers. We obviously were never limited by my knowledge or my ability to come up with ideas. But we also were not limited by even the people who were responsible [for] various parts of the technology. Customers, when you're close to them, often have ideas. Sometimes [they] actually do the development, and are excited if we take them and produce them. Being close to the customer was very important.

DKA: Is that a sort of philosophical principle that runs through your company?

KO: It's much simpler than that. It's an obvious philosophy. It's very productive. Computer people sometimes think more highly of themselves. So there's a tendency to not be humble enough to take someone else's idea. But the idea itself is so obvious you should just jump at any opportunity to get better use out of your computers.

DKA: You were mentioning several of the uses of the PDP-1 and you mentioned the telephone usage and the scientific usage. What else were people doing with these new machines?

KO: Some of the things we didn't know. Some of the things people wanted to keep to themselves, either because they were government applications or things they wanted to keep private. In the laboratory area you could do

things that were so tedious before. One of the first applications for this type of computer that gave dramatic results were to automate the x-ray defractometers. These are devices where people would put a specimen in, take pictures and then take days or weeks analyzing the results. The computer would give them results immediately. If the experiment wasn't done right, they could do it over again. But they could run through many experiments very quickly just because the data was processed automatically. Another time we put these machines, or one like this, on a Coast Guard ship doing oceanography work in the ocean. It revolutionized their work. They could collect data, process it, [and] if the data wasn't coming out right, they could do the collection over again. The thought that devastated them all throughout a cruise was, if things weren't going well, they wouldn't find out until they were home and it was too late to redo the data. So, it just revolutionized their enthusiasm. [There were] just an infinite number of applications.

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Selling Computers to Government

DKA: We hear so much about the Defense Department in the early days of computers, particularly the large computers as being their principle sponsor. Did this new, less expensive device, open up new areas of markets for you or was it still mostly defense and defense-related business that you got into?

KO: When we started, we had the policy that we wouldn't sell to the Defense Department. [For reasons of] the accounting they demand, not [that we were] pacifists. And the products they develop are just contrary to commercial activities, the commercial way of doing business. We felt and still feel, still very clearly, that doing business with them hurts one's position in the commercial market. Now we do a lot with them, we sell to them freely because it's our duty to do so. We normally do it on commercial terms, because we still are afraid of changing the nature of a commercial company if you aim your business to satisfy their way of doing business.

DKA: Can you characterize a little bit more the difference between working for a defense market and a commercial market? Is it flexibility and freedom or is it something else?

KO: The government business...the way Congress sets it up and the way that people want to run things...worr[ies] about you making profit. They worry less about what they get. That's absolutely contrary to the commercial activity. Most commercial customers want to do business with you only if you make a profit, and like you more if you make a good profit because it shows you're doing things wisely and you'll be around for awhile. The commercial companies always want to buy the best product and they have learned, those that are successful, to trust their suppliers. There's a relationship between the suppliers. The way government business is set up it's always distrust. The supplier is always the enemy. There's always someone who wants to find something. You're treated like a criminal. It's just not a good way to do business. Their accounting is contrary to common sense and contrary to commercial business practice. If you set it up that way you're really not competitive in a commercial market. So we originally made the rule we would sell nothing to them. They, in time of course, insisted because they needed what we had. And we, to this day, limit our business with them to commercial terms.

DKA: In the early days of computing when the business was government, [that must have been a] risky principle, wasn't it?

KO: No, it was just common sense. It was risky to do anything else. The financial community didn't understand this. We said we wouldn't do business with them. The financial community thought that if you took government money to do your research it was free research and then you had a head start. It doesn't really work that way.

DKA: Why not?

KO: The red tape they put in and their goals are just contrary to commercial goals. Therefore they're always behind.

DKA: As I look at this equipment, I'm curious to know how this differed from what other companies had out. Was this innovative? Was this bringing something to market the market wanted but couldn't have before?

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Unique Features of the PDP-1

KO: The thing that's unique about the equipment is the fact that it's simple, very fast, and interactive. The market wasn't demanding this. People had never seen it, didn't know about it, and didn't ask for it, with very few exceptions. Some of the students who had used it at MIT when they got to their new company they said, where's the PDP? Our generosity at MIT paid off very well. But in general, the market wasn't asking for it. Market surveys came to the conclusion that people wanted exactly what they had. That's because that's all they'd ever seen. And that's why you get into trouble if you believe market surveys all the time because they never come out with anything useful on new products. So we had to, in general, sell the idea to most of the customers. We are not considered a marketing company because we don't spend money on _____ markets. We don't exaggerate. We try tediously, sometimes boringly, not to mislead or be dishonest. Therefore we're not considered marketers. We refuse, when we have the opportunity, to sell to someone who doesn't need our equipment. If it won't do the job for them, or won't do it optimally, we don't want to sell it to them. That's considered non-marketing. But on the other hand, the goal we set about was to sell this product to people who needed it. It often didn't look flashy but it worked for 30 years. Now there was a certain other flashy marketing which did help. It turns out that physicists love color and a little bit of spirit. Now this machine [THE PDP-1] today is a little naive from industrial design. But the color, the consistency did give a little more pizzazz and jazz than most computers; people loved it just for that sake. So that was part of the marketing. The shape of the monitor in that time was unusual. The console really was designed to look good, to have something you like to work with and would attract people. That was part of the marketing.

DKA: Were you involved in the looks of this stuff yourself?

KO: My job was to make sure we had goals and to make sure that people knew them and that we were all running in the same direction, and running with enthusiasm. And then quietly to pick up the pieces that other people left behind, or that we didn't have people to survive. The mechanical design was one of those. So, yes, I was involved in that. It normally is not one of the things people notice, but because I did some of it, I of course will talk about it. It's relatively unimportant. But some of the ideas are interesting. Early in computers people built a console on the table with all the instruments and lights in front of them, very much like you see in a power plant. Our first PDP-1 was that way. It had all the controls on the table, and big heavy cables going over the computer to connect the tube. Finally it dawned on me. Maybe the first in the industry. Something very simple. In the control, in the power plant, they have a console that way so they can look over at that big array of lights and heaters(?). Sitting at a computer console, the only thing you look over at are dull racks. So the whole thing's stupid. We got the idea of putting it on the end of the computer. After that everybody followed. Now that's a trivial thing, but maybe that was a contribution I made. You never can say for sure because somebody else might have done it first. We got the idea from them. But that's a small contribution. Picking a color, picking the logo type, this sort of thing. There was no one else to do it so those were left for me. I did have a little machine shop practice so I knew how to design. I know how to use a drafting table.

DKA: What's PDP mean? Where did that come from?

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PDP - The Origins of the Name

KO: When we were almost finished with the computer, before we had picked a name for it, we had a request from the government to build a machine to look for earthquakes. To collect the seismographic information. We didn't quite believe the story that people were that interested in earthquakes but we were willing to let it go at that. The Congress, in their wisdom, said that no more computers will be bought until all the computers in Washington are used 100 percent of the time. Now it seemed unlikely that earthquakes would wait until the accounting machines were unused before they went or the Russians would be so helpful as to not try out a bomb at the time when the machines were available. So they needed a machine but they couldn't buy a computer to run their seismographic machines just because Congress had this rule. We said you could call it something else. It's really a Programmed Data Processor. So we called our machines, PDP, for Programmed Data Processor. They were able to buy the machine, hook up their seismographic devices, and not [have them] break, and not be challenged on their purchasing of the computer. It was a good name and that's where PDP came from. The job of the leader is to fill in those tasks which no one else is going to do. But never claim credit for them because that's just contrary leadership. You're supposed to be getting everybody else to work and if you pick up some of the pieces, you should never brag about it. The story I tell people who get confused on this is [a] fable. It used to be in THE FIRST GRADE READER, "The Turtle That Wanted To Fly." He talked the crows into putting a stick between their mouths, and he held on the center of the stick and flew with them. Someone on the ground said, "That's a clever idea, who thought of it?" He couldn't keep his mouth shut. He had to say, "It was me." So my advice to people who want to be leaders is, remember the task as a leader is not to claim credit, but to be the leader and get the job done. The other advice is you've got to make sure everything gets done. And so the logo type, we... I did. I did it myself and I can tell you pretty much where it came from. The first one had a vertical of DEC. It was very clever.

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DEC's First Trademark

KO: Our first trademark was the vertical DEC. I got the idea for that right from the cover of a magazine. It was a magazine that's probably changed its name two or three times since then. I don't remember which one it was. But having the "D" reverse color at the top of the square I thought was clever. So we simply adapted it to this. We silkscreened our printed circuit boards. We made up screens with a trademark on it and the name on it, and then we did it everywhere. We put it on our doors. We put it on our used Volkswagen bus. Once the screen was going, you know, we'd put it up everywhere. In time we found that people called us Digital and not DEC. So we made the decision quite formally to change our name to our shortened name, our trademark to Digital instead of DEC. Another magazine, I think it was called machine design at the time, had their name in blocks like that. It looked attractive. Those days lower-case letters were the smart thing to do. So we designed this logotype, and it became the standard. It might also have been that the rest of the machine design magazine used the rest of the word like this. But the ideas came right from the cover of a magazine.

DKA: I've often heard that it had something to do with the storage register of...

KO: No. Not at all, not at all. Now one time our experts suggested that lower case letters were passe. That these were hard to read. There was a newer alphabet. They proposed a variation of this with more modern letters. We brought it to our Board of Directors and I said we want to do it and they said yes. That night we happened to have dinner with the wives and the directors. One of the directors said, "I'd like to call the meeting to order and re-open this question." He was sitting with my wife...my wife doesn't take part in business except a few times and [this] being one of [those times], where they proposed that that may not be the best, but it's Digital, and they proposed we stay with the old one. So we stayed with Digital.

DKA: What did your wife have to do with that?

KO: At dinner, the question of changing it to a more modern type face came up and she and this director connived together to raise the issue again. When they called for a vote, wives don't have any vote, but we counted 18 together in this informal vote. I said I claim 19 votes and we're going to stick with the original decision. The next day of course we formally went back to the original and never changed it since.

DKA: On signs, there was another story. We put signs outside of buildings and after awhile the sign people had very complicated signs. They had Digital Equipment Corporation, and then the name of the location and something else on it. It didn't feel right. So, as I drove with my wife we looked at signs. We concluded that the most effective signs like Mobil or Esso were just the simple name. So we decided to use that, and that alone, for our signs. It's very presumptuous because not everybody knew who Digital was. But challenging them by being a little presumptuous was also a fascinating idea. It is sure more effective to just [use] that simple word than have a whole lot of other words. So the other story is people still call us both DEC and Digital. There's always the challenge, the question by our people from all over the world, we should go back to DEC because their people use that. I of course answer, no way. We've got so much invested here I'm not going to raise the issue again. If you look carefully, it's about 50/50. And if you listen to me, I may say half the time "Digital" and half the time "DEC." It's not worth changing. The press uses whatever they want to use regardless of what we call ourselves; they're going to use what they want anyway. So, that's it for a long time to come. If people say they propose changing it, I'll say you can bring it to the Directors. You won't win.

DKA: So those little rectangles behind each lowercase letter do not have anything to do with modularity?

KO: No, no they just look good from an artistic point of view.

DKA: Ken, let's go back and talk about the software issue for the PDP-1. You mentioned initially it came out with very little software. As the machine started to sell, what was the company's position on software development? How did you tackle that problem?

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Software for the PDP-1

KO: In time we invested as much in software as we did with hardware. For a long time we had the same number of people doing both software and hardware. The concentration on the software was never in applications but on the systems to make it easy to write software, also on the discipline to make the software very robust and very reliable. One of the results of this is that almost every year of our history, except the very start, there has been someone who's had a faster computer at a lower price than we have. By concentrating on the discipline, both the hardware and the software, but even more on the software. Extreme discipline. And every year making it better and better. Keeping the hardware architecture roughly the same so that things were compatible. And just building on more discipline and more security and more robustness. In time every one of those quick upstarts who offered something faster have disappeared. The belief there is that in computers you really want, above all, reliability. You don't want to lose things in a thunderstorm. If everything goes the power disappears. You want all the things you worked on, all your data tucked away nicely so when power comes on you can get it back again. This has been our approach in software and the thing that's made us unique in the last number of years is this continuation in an organized way of discipline documentation and sticking with standards. So our approach to software has been quite consistent, but it's been in the area of discipline and documentation. For many years we made the same two computers, the PDP-8 and the PDP-11. We kept that design consistently so that software the customers wrote would continue to work on newer models and the software we wrote would continue to work and get more and more robust. By that we mean, regardless of what happens it will be safe and secure. This was dependent on a high level of discipline and organization and documentation. Software is something which you can't look at and understand right away because it's a series of numbers, and pages and pages of them.

You never know if parts are even used. You might have a million instructions and in no way can someone tell whether parts of it or most of it are just left over and never used at all. When people have trouble transferring software to new machines, they hate to admit that it's often the lack of discipline in the software. So by adding this discipline and the systems to it, we've gotten people to be dependent on our machines and because they have the commitment from us that we will stick with it and continue to maintain it and with discipline. When the Russians want to steal a computer they want to steal a VAX. The reason they want to steal a VAX is that's where the software is. The reason the software is there is that it's disciplined and easy to use, and built upon for many years. In today's world of software, we have our VAX system. We call the software VMS. We have basically one system. It has about a 12-foot long shelf of books to describe it. Anything you want to do you'll find in there if you look long enough. Every change is tested and retested, and everything is safe and as secure as we can do. The problem with this is that it is a 12 foot long shelf. To take advantage of it all takes some time. Another system was developed even before we developed VMS called UNIX. It was designed in reaction to complex business systems. It was designed for one person to work alone. It was designed to be without discipline, freeflowing, and it became very popular in the academic world because it was easy to learn. It's easy to do simple things in workstations. And we've sold more of that than anyone else has partly because it was designed for our machines. We've been the biggest player in that market, and encouraged it because there's a place for that casual undisciplined work, and a place for the discipline work. So today, UNIX is very popular for workstations where one man works alone, where if he loses everything because of a thunderstorm, he'll feel bad. He's lost a whole day's work. But it's not the same as a bank who just under no circumstance can ever, inconceivably lose anything. These are the two different realms of discipline and security. Now the promise is we promise that we'll make UNIX secure, and robust, and formal and disciplined, with a lament secretly that when we do, we will lose that free-wheeling, fun, casual, easy-to-use UNIX system that made it so popular.

DKA: I'd like to take you back to the PDP-1. One of the things that you've said is you learned a lot from your customers. What went right with the PDP-1, and what went wrong? What did you want to do different as you moved? Or did you just want to do more of the same? As you saw the company growing, which direction did you want to take it?

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Managing the Success of the PDP-1

KO: We had large orders from ITT, for telephone, telegraph type systems. They decided to go out of that business, which left us with more production than we had orders for. At the same time, NASA was getting ready for their big projects and they wanted to buy 100 computers. And I said, no. The engineer who designed it left us after that because 100 machines would have made it a great success. But growing that fast would have ruined the company. We were making 2 or 3 a month. Getting an order for 100, we couldn't have tolerated. Then if that order disappeared, we'd be in terrible shape. So I said, no, we won't bid on it. It must have taken years before NASA got over that.

DKA: That must have been a hard decision, Ken?

KO: No, it was an easy decision. Suicide is something you don't have to do. My first rule of business [is] you don't have to commit suicide. People think it's a hard decision. [It's] not a hard decision at all. It's like hanging over a cliff on a narrow piece of rope. That's not a hard decision. Some people felt it was hard because the short term result could have been exciting. But we had to grow slowly and consistently or we would lose everything. Now each step of improvement afterward was quite obvious. The technology got better consistently as time went on and we understood more how to build machines.

DKA: What was getting better? Can you be a little more specific?

KO: The old typewriters which we bought were crude and expensive. As we got better typewriters it just made the computer available to the masses. The transistors got better. Eventually, circuits came into play. We learned how to put more on a printed circuit board. We learned better ways of packaging and as computers developed, more and more of every kind of component with better quality and lower price. That meant we could cut the cost significantly and increase the power. The industrial design was always important because people did buy [computers] for looks. They liked something, it was easy to use, it was very productive, but the looks were important. We always had either a rented industrial design[er] or part of our own staff. And this [THE PDP-1] we thought was quite good looking. The console had the same general shape as the display. And [the] layout of switches was studied very precisely. We made special knobs for it. It was readily accessible to the tape reader. The tape storage was obviously patched in later on. But it did make a very efficient way of doing it. The punch tape came out here. It made a very efficient and attractive system, we thought.

DKA: Ken, was it all paper tape or did you have magnetic tape at all for the PDP-1?

KO: The software people brought to the machine with them was paper tape. There was magnetic tape for storage but people didn't normally bring the [magnetic] tape with them. They usually brought the paper tape, or they'd bring a tray like this [DEMONSTRATING PAPER TAPE TRAY]

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Running a Program on a PDP-1

DKA: Now what would it be like for somebody to run a program? How would they set it up?

KO: [DEMONSTRATING USE OF PAPER TAPE READER] They would take the tape out and put it inside here, string it through the tape reader and set it up so it would fold here and the tape would come off and this fanfold. When he left he would have all his tapes put in a tray like this or several trays like this. Any new tape he generated while working on it, he put in trays also.

DKA: What was he doing on the control panel below? What would a programmer do?

KO: As he was debugging his system, he could watch what was happening all through the computer by looking at the lights. He could introduce information through six switches which the computer would sense. If you wanted to play a game, you'd play it by entering information in the switches. The computer would light up lights here, special program lights to tell him various things, or tell him what was going on if he was playing a game. These were just start and stop and continue. [POINTING OUT SWITCHES] If he examined, he'd press this one that would stop the program. He could see from the lights what was going on. He could step the program along one step at a time, and just watch what was happening with his program as he went through. In time, slowly over a period of many years, we got rid of all of this. Now people don't need that at all.

DKA: What was the relationship between what people saw on the control panel and what they saw on the CRT?

KO: The control panel showed exactly what was going on in the computer. The CRT would present pictures that someone worked hard to generate. At that time you couldn't debug from what you saw in the cathode ray tube. Today you don't need this because the cathode ray tube does it so well. We always had very good documentation. [For the] PDP-1, we worked very hard on a manual, and it wasn't very big. People loved it. The competition thought they'd do the same and were dismayed to find out how hard it was to write a simple small manual. Unfortunately, not being a normal user, there's always one thing we left out. We never told which way you put the tape in. I never figured it out. I never remembered it. So there's one weakness in our literature. There's another literature story: by policy, we would write everything we do in book form for the customer. We formally decided we would print things in a paperback format, and put in everything we knew about a computer. We put a manual out that told absolutely everything. At that time we could have that book printed for twelve

cents. Our experts in publishing thought it was a disgrace. Paperback books were inexpensive paper, obviously not glossy and polished photography. But the difference was, a brochure which could say almost nothing would cost a dollar. A paperback would cost twelve cents and we could tell everything in it. One time after meeting on a Friday afternoon, my brother, [STAN OLSEN] to demonstrate something, ripped one of the paperback books apart, and laid it on a table. [Then] he ripped some literature apart and laid it on the table. Come Monday, the janitor had thrown the ripped literature away but carefully put the paperback together. Everywhere you went in the world -- India, China -- engineers had those paperbacks on their bookcase because they were that popular. We gave them away freely and we got a lot of information out. They were very valuable even to those people who couldn't afford a computer; [they] educated them about every single detail of our machines. So, since then we've been free in literature; we print everything we know [about the system] and [the handbooks] make a real contribution to the customer.

DKA: Is DEC more open with its information about machine design than other companies?

KO: Probably so, because of [our] academic background. But even more important, it takes a lot of discipline to get people to write. After you're finished with a job, it's very hard to write about you've done because you're ready to go on to something new. Getting people to write down all they know about the project they worked on takes discipline and effort. It's one of the things we're never satisfied with but we keep trying to do a better job. As [computer] software became developed, it [software] helped him [the programmer] find the problems and correct them in this interactive way. This is very much more productive than getting your results back once a day. Getting your results immediately allows you to fix it immediately. As you get clever, it allows you to use the computer to help you fix it.

DKA: Ken, did you use card readers at all with the PDP-1?

KO: In general, we used paper tape. The scientific users used paper tape. We always had a card reader available because commercial users or some people whose data came in punched card form did have to have access to punch cards. But the paper tape was much easier to use for the casual user.

DKA: [Was] memory an important consideration of the PDP-1?

KO: Yes. The memory, for many years, was the limiting factor in a computer. We decided to build this PDP-1 a little earlier than we had budgeted because our friends at RCA called us one day and said we have a thousand word memory the customer ordered and doesn't want. We'll sell it to you cheap. So we quickly bought it and said, now we've got to make our computer. The computer was designed around the thousand word memory. That was the impetus to get going. We sold that 1000 word memory many times. It deserves a place in the museum. We don't know where it is though because people would buy the machine with a 1000 words. Before they got it delivered they needed more. And they needed eight; four, eight or twelve thousand words. And we'd then sell the machine, that 1000 words over again to someone else. Now those numbers are ridiculously small. But the price and the size of the memory has been growing, the size has been growing, the price has been going down dramatically. It probably is the most serious limitation in the computer at any one period in the history. Every component has to work and be available. The typewriter, transistors, and the memory. Every single piece has to be available. Probably the hardest one, the most serious limitation in any time was the memory. So as we learned to do memories better, as the people that made the cores learned to make the cores better, and to assemble them better, and at lower prices, it just opened up whole new opportunities for computers. In time we bought RCA's core making facility and the facility in Taiwan for stringing them. And when we were going at our peak, we were making 4 billion cores a month, and stringing them in Taiwan. At that time cores were cheap, memories were bigger than we ever had dreamed, and then we were able to make a large number of computers.

DKA: Did the development of this machine, once you got the idea and had the core and decided to go ahead, did it go smoothly? Or did it have, was it a rocky road? How do you remember the development path?

KO: The first one we built we bought standard cabinets from a supplier. They were rounded and kind of plain and ugly, with a separate console. It became obvious we had to make a better looking cabinet. One that was more modular, we could increase the size of and that would look unique and more colorful. So, the first one was

really plain. But in time we came out with this design and going through that transition frustrated some people because it did take some time. But it probably took less than a year to build the machine. [SETTING IN FRONT OF THE PDP-8 COMPUTER]

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Designing the PDP-8

KO: One time in the 60's, the Atomic Energy Research group in Chalk River, Canada, asked us to bid on a specially designed digital device to control an atomic pile. They gave us a whole list of equations they wanted built into it. We looked it over and decided we didn't have anybody with enough patience to design a special device to do those, solve those equations. We told them that we would sell them a very simple computer, at a price as if it were a production machine and that they could then program it to do these equations. They liked the idea because they said they didn't really know what the equations were anyway. We then, with that contract, designed our PDP-4 [PDP-5] which at the next go round was called the PDP-8. This machine was just 12 bits long, the shortest we could conceive of. It had the simplest order code and the simplest organization that we could think of. It was not designed to compute, it was designed to control something like... like a pile. Customers bought the machine and started doing programming with it. The great appeal it had was it was inexpensive. We did a number of bold things. First of all it was bold to make one that simple. The competition laughed at us. It didn't have the characteristics of the computer. We also standardized a teletype printer which was not designed for continuous use. We very formally made the decision that we would gamble on that teletype and work hard to make it reliable enough for continuous use. That one gamble, and that one small success, probably was a key part in the introduction of minicomputers and personal computers. [REFERRING TO THE ASR-33 TELETYPEWRITER] Printers before that were very expensive. You could not have an inexpensive machine just because of the printer. That machine was quite an expensive, very cleverly designed but made for offices where it was used intermittently. Computer users are continuously at a very high rate. And so it was a very important development in the history of computers from our point of view. It was a bold thing. Because teletype [manufacturers] said, don't do it. It's not designed for this. In time they appreciated it and together we made it reliable enough for this use. People fell in love with that machine because of the cost. And because of the simplicity, it was easy to teach people. Out of that came very sophisticated software. It could safely be said that for many years that the PDP-1 was the one machine that introduced computing to much of the world who had any contact with computing. That's because it was readily available and inexpensive.

DKA: Were you surprised at how successful?

KO: Oh, yes. We were brave making a machine at all. We never were brave enough to think that it would become such a popular computer to do computing. The PDP-4 [PDP-5] was built like the old machines. When we were going to redo it and call it the PDP-8, we wanted to introduce new technology. Sylvania had made a new socket that IBM used and it took modules like this. [HOLDING FLIP CHIP MODULE] We went one better than IBM in that we used glass boards with high tolerance on the boards. We had 18 connections instead of 16. We had a clever looking handle that really became our trademark for many years. [HOLDING A PDP-8 FLIP CHIP MODULE] We then had a set of technology that last[ed] us for 15 years or more. Maybe 20 years. It was something we just built on from there. The modules became quite long and quite high, in time. But for the PDP-8, this was the module. We also set about to use the technology that was developed for home appliances and automobiles. The technology we used before that was basically built upon military technology. So with this machine, we set about to study all the technology used for appliances. I went to several discount stores for hours, studying every single washing machine, dryer, stove, to see how they built things and what we could use. The [idea for the] switch handles came from a Maytag dryer. Using a glass panel without separate lights showing was the technology used in appliances. The silkscreen on the back looks quite attractive. Inside we used the slip-on connectors that were commonly used in automobiles. We tried every way we could to take the technology that made mass production possible in appliances. The design of this has no screws showing, it is

basically held together by these two lock switches. We always had a lock on our computers but only one. We obviously needed two in order to hold this together so we invented a use for the second switch. This one turned the thing off and on and this one disconnected the console so you couldn't mess up things. The fascinating thing is that after[wards] every computer had two switches. Even the Japanese computers had two switches. No one ever knew why there were two switches; it was to hold this panel together. But they just followed.

DKA: When they looked at some of the home appliances, what was the driving reason?

KO: The technology we used was expensive. There's very few inventions that come out of the blue completely. Most inventions come from adapting ideas from other people. This goes for ideas of organization, motivating people, how you do things mechanically, how you do things electrically, and just being exposed to all the things that people are learning in the appliance industry. Opened up new sets of technology to make things inexpensive. They mass produce things at very low price and we had to do the same. They also had more years of industrial design experience. They, every day, sold things on looks. And it was more important to us. So this was part of that. We had an industrial designer who said we should show off our new plastic handles by covering it with smoked glass, smoked plastic. I didn't like that idea but it turned out to be great. It helped sell. We had rosewood formica on the side which added a richness to it. This machine became the standard for industrial design for computers for some time. It opened up nicely on a hinge so you have access to the inside. It gave people the feeling it was put together with thought and easy to fix and easy to assemble. That machine then made a very important contribution to the company and to the industry. There's another story with respect to this that you could tell many times over. Our first PDP-4 [PDP-5] was laughed at by the competition because it was so simple. So naive. But in time, they learned to respect it. We knew they were coming out with an equivalent. We also knew that they were making the classic mistake that is made over and over again which is to look at someone's old product and think you can do better than that. The thing they've forgot and they should have known better is that we also were working on new products. So one came out with their announcement, two weeks later the other one came out with theirs. And a week after that we announced this one at a much lower price and a much more elegant machine. That story happens so many times in business where people forget that their competition is not the old machine but the one the competition is working on. The computer is made up of hundreds of modules like this. [HOLDING A FLIP CHIP MODULE] They plug in from the front side into sockets which are assembled in the rack. And these sockets then are automatically wired by a very large automatic machines. [REFERENCE TO GARDNER-DENVER WIREWRAP MACHINE] So, all that wiring was put on automatically and it was one of the new technologies that were available at this time. So this panel we put into a machine and [could] take it out all wired. Put the appropriate modules in the appropriate slots and assemble two of them and we had a computer. The one gap which maybe you can see is the memory itself and the circuits that drove it are also on these same modules. The modules filled the whole area except this one area which is core memory. [POINTING TO BOX WITHIN] It's got a fan on to keep it cool and is driven by circuits also on these modules and together it makes a whole computer. In the MIT tradition, we had the system divided into sections. With these switches we could separate one section and vary the voltage to see if any section was deteriorating and check the margins and replace it if it was in trouble. The power supplies were in the bottom. The whole unit was quite heavy. But as machines went, it was very small and very light. People then had opportunity to have a machine that was all their own and operate it in the same way we operate a personal computer today.

DKA: How is the business changing? Is the computer business a different business at this point?

KO: In one sense the computer business stayed the same. It's just that as things got less expensive, more and more people were able to buy equipment and to use it. With a $110,000 machine you couldn't afford to give one to everybody. At $18,000 [THE PRICE OF THE PDP-8] you were getting close. As this machine got down to $12,000 and $8,000, it became possible to give it to every technical person to use. He'd could use it to do all sorts of operations.

DKA: Who were your customers?

KO: Schools were one important customer. Because with this you could really give students the opportunity to understand what a computer would really do. It was also very popular in controlling instruments and machine

tools and medical devices. Anyplace where you had simple operations, this was just ideal.

DKA: Are people starting to use your equipment by this stage for word processing, or any type of business application?

KO: We believe the first word processor was done on a PDP-1 at MIT by the students. They called it "Expensive Typewriter" because it would tie up a whole machine and an expensive electronic typewriter. It would do many of the wonderful features we take for granted today. In time we offered word processing on every machine that people bought. The technical world had been using word processing long before the commercial market showed any interest in it. The DEC computers were the standard for word processing. We were slow in getting into the commercial area because the technical area kept us busy for a long time.

DKA: As your company was growing, Ken, in delivering more and more products, was the nature of the company changing?

KO: The company changes consistently and regularly. The people we hired initially of course were not trained in computers. They came from all kinds of backgrounds. Musicologists was surprisingly popular. Then in time we could hire very well educated and trained people in computers. This made it change. The initial applications didn't need all the formality and discipline because they were small. The operator kept them in his head and he understood them all. In time, many people had to work on them. The applications had to last longer than individuals stayed on the job. This meant a lot of formality and discipline in the software and the hardware also. So the business changed over a period, many years from getting the fastest, most exciting thing out to supplying all the discipline necessary to make sure it worked forever. The question's often asked what part the military or the US government play[ed] in the development of computers in developing the advantage the US has to the computer market. In general, I would say they played little part. Obviously, Whirlwind was financed by the military. But during its development, it really didn't have an application, so it wasn't driven by the military. The big drive came because of the high demand in the competitive situation in computers. The advantage the U.S. had was with a few exceptions. Not the fact that the government was involved in the computers or financed things. But the fact that our government never could catch up and try to help us. Most other countries' government stepped in and tried to help the industry, and once the government did that we knew that that country was not in competition. Every time our government tries to step in, (and they're frustrated often because they can't run things and they can't tell us what to do), they mess up everything. Fortunately the industry has been running so fast they couldn't grab hold of things. When they tried before they did, they were left behind. I'm sure it's the goal of people to run the whole industry, and if it disappears and goes somewhere else in the world, they'd love to see that, too. But the biggest contribution our government's made is that they never got up with the computer industry in order to help. No one else except the Japanese have been successful. I think a big part of that is that their government's helped and they tried to be dependent on the government and that always sets them back.

DKA: So that relates back to your philosophy of commercial independence.

KO: Yes. The military is always several years behind in computers, and getting farther and farther behind. They're not in a position to lead the computer industry just because of the way they're organized.

DKA: Does that mean that you don't think your relationship with the Japanese government to that industry is a threat to our way?

KO: The Japanese government appears to be the only government that can help industry. It might be because they don't consider industry an enemy like western governments do, particularly our government. But somehow, most of the time they do, they help. But I'm not sure that it's helped them to compete in general. Good commercial competition is what drives industry. We may be losing that now, unfortunately. We may lose it because the government wants to control things. We may lose it because the attitude today is stockholder's rights, they call it, where you take all the resources and give it to the stockholders immediately and invest nothing in the future and get rid of all the assets. [You] don't invest in research at all and that's the fad today. That's considered the ethical, American, moral way and if we continue that way we're sure going to lose it to

anybody because there won't be anything left. But if we can avoid that somehow, we should be able to stay ahead.

DKA: What's your view of the right recipe?

KO: One has to believe in capitalism, not the rampant, stealing, robber baron type capitalism, but competition in order to do a good job and continue to grow and develop. When our government tries to resort to protectionism, or thinks they're going to control the world supply of memory chips, they just do no end of mischief. If they continue that way, you don't know they'll stop in creating mischief. If you believe in competition, you will buy from whatever part of the world does the best. And they'll buy from you where you do best. But if you lose one part to somewhere in the world because the cost of capital is less there or because they concentrated, because they worked harder, because they have some natural assets, if you try to change that by laws, you get up into an impossible situation and you'll destroy the advantages of competition. A politician inherently doesn't believe in capitalism because it doesn't make good politics. Our biggest danger I think in technology is not the Japanese, it's our own politicians. Their claim to their constituency is they're going to manipulate everything. They just aren't able to do that in a wise way. All that we've gained we could lose very quickly by just following our trend of protectionism in the technical area, and also our trend in looking out for short term interests.

DKA: As an international company, does your worldwide reach protect Digital from that type of influence?

KO: We do have the advantage of having access to every part of the world. We freely buy from any part of the world. We trust the Japanese. We have operations there. They are part of Digital. We'll trust any company or country that makes good products and is a reliable source, because we buy and sell internationally. This is what we say our country believes in, in theory, and it works well and we follow it.

DKA: Going back to the PDP-8, was this one of the machines that people then began to network together? When did that notion get started?

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Networking PDP-8 Computers

KO: One idea we took from MIT was the idea of networking. The aerodefense system was made up of 23 sites; each one having a very elaborate, very high performance local area network. There was a large number of display terminals. Then each of these 23 [sites] were networked to two arrays of radars across northern Canada. Airborne radars on the coast, human being spotters on top of the tall buildings. It was one very large network. So networking became a theme in everything we did. We always were able to hook our computers together and for almost all our history we were able to hook to IBM. Networking was always part of it. The big change in networking came 15 years ago or so when we decided that we'd have to network in a very standardized way. Everything we did we used the same networking protocols, and the same networking technologies. That really made networking a major part of our organization. It's these standardized ways that we've been encouraging the world to accept so that we and they can all work together on the same network. We're well under way in that and the new standards will make that possible.

DKA: Ken, were you unique in the industry pushing for that type of discipline?

KO: I think we were quite unique. There's a normal tendency to keep everything you do secret so that others can't come into your area, just like the railroads in Europe used to have different gauge railroad tracks. The reason they did that, was that if someone was invading them, they couldn't drive their trains into your country without stopping to reload. This created an enormous bottleneck for any invader. People tried to maintain their own standards so that anybody coming into their customers would have a terrible time. We had a different idea. It was clear to us that we never could own every computer a company had. It was clear that ideally everybody's

computer would be on the same network. So we've been pressing for standards to make this possible for along time. The standards that we've had with great discipline within our own company means that we can tie anything we make together, anywhere in the world quite easy and simply and elegantly. As other people accept the standards, we can accept them in the network. Eventually if all the plans now follow through, the major companies will all accept the same standards.

DKA: How are all the companies reacting to this?

KO: They all have great plans. Some of the standards were basically ours, some of them were IBM's, and some of them were generated independently. There seems to be common agreement that once they're accepted, everybody will follow them, independent of where they came from.

DKA: Thinking about networking on one hand and the type of hardware development that goes along with that, it seems that you followed a pattern in Digital starting with the modules, [and] state of the art memory systems that continued through the PDP-8. How did that hardware pattern continue into your later machines? Or did it?

KO: The hardware continued to evolve as technology evolved. If you look at what we do today, it bears no relationship to the early modules. But step at a time you can see the evolution was quite clear. Today we tend to build things on large boards with large integrated circuits, and the amount of handwork decreases every year. In the last six years I think we doubled our size twice, approximately, and we increased a number of people in production by almost zero. This comes about because our way of building things gets to be more and more efficient, and more and more gets built into the integrated circuits. If you look at it that way, things have changed dramatically. But if you look at each step, each step was a small one.

DKA: What resemblance do integrated circuits bear in terms of logic to the earlier modules?

KO: At first, integrated circuits would have maybe the equivalent of this. Now the integrated circuit has the equivalent of ten of these. I don't know, maybe it's a hundred of these. Because they're so cheap they're used differently. We had to be very economical on how we used these because they're expensive and took a lot of room. The logic is so cheap with integrated circuits that you use it freely and do things that are inexpensive because you use so much of it. So it's a little hard to weigh the differences. But it's created a revolution, a slow revolution because they started off small and now they include so much. But as they get bigger we want to do more. As they get bigger we have the problem of cooling them, connecting them together and the technology puts new demands on how we do things. We even cool some of them with water because they get so much concentrated on one area that takes different ways of cooling them. So things are, over a period of years, quite different. Even though any one year they don't change very fast.

DKA: And as you move from the PDP-8 to the PDP-11 family, was that a major shift in your computer company?

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Developing the PDP-11

KO: The PDP-11 was a machine we took a long time to design, and worked hard to make it one that would last a long time and have innovation in it that would make it unique for a long period of time. It's still a major product for us, and it must be 15 or more years old. We set about to continuously improve it but still keep it an 11. We had many software systems, each one did unique things. One of them was the predecessor for the common PC software today. Others did other things especially well. The difference in the 11 is that it became the center of the corporate strategy and the resources were all put on it and yet it was maintained with discipline so that the same software played on each machine.

DKA: When you say it became the center for corporate strategy, what does that mean?

KO: Before that, we had several computers going at one time. Almost all our work was concentrated on that one. We also had a very large machine, called the PDP-10. But the small minicomputer area was concentrated on that 11. The next go around with computers, we carry this to a farther degree. The VAX computer was done with a lot of planning before it was started. It was planned so that eventually it would span a range of sizes from very tiny. It was designed so that the same software written ten years ago would play today and ten years from now. It was designed so that any part of it could be taken out, improved, redone and a new one put in and it wouldn't upset the whole system. It was designed with just one software system. It also did UNIX, ten percent of our machines were sold to do UNIX, but the basic software system was only one called VMS. This is obviously very productive, everybody works on it. It gets better and better every year. If the whole company works on one [operating system], it gets to be quite good after a period of ten, fourteen years. But it is contrary to the normal inclination of engineers. With our PDP-11, and like most other companies, the tendency is to say, with a new software system I can make something special. It does things so much better. Having discipline to avoid that made everything so much better just because we could concentrate on the one thing we were doing. That's what made the VAX very popular.

DKA: And that was a discipline that was hard to maintain in your company?

KO: It was easy for me because someone else did it. Our strategy said we would have one protocol for networking which the idea is somewhat unique to be, have only one. One computer architecture which was the VAX, one software system which is the VMS, and one way of doing local area networking which is Ethernet. The discipline came automatically. Parts of it I really had to take part in because without corporate discipline, people would use different kinds of networking, and you would lose the whole strategy. So it was not my job to develop the strategy. People did that very well without me. Even forcing it through and getting corporate approval wasn't my job. But in time it was clearly my job to make sure we followed it. In general people liked to work with a clear strategy. They like to know where the goals are. The basic decision on projects are already made. That gives them great freedom to be creative in the areas where we need creativity. Not everybody likes it. When we finally got around to enforcing the strategy we had all along, a large number of the vice presidents quit because they wanted freedom to do what they wanted to do. But the result of the whole company working in one direction was obviously very good.

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The Role of the Personal Computer

DKA: Most people think about computers as having fundamentally changed. When the personal computer came, truly to be on their desks at home, at work, how did the advent of the microcomputer effect your business? And how did you see it and how did you respond to it?

KO: The goal we set about when we started the company was to introduce interactive computing. We did that first with the PDP-1. Then with timesharing, where one computer has many terminals and each person thinks he has a computer to himself. With the timesharing end of the terminals, people then were able to do those things which we see with personal computers today. As they did word processing, they did computation. They eventually did spreadsheets and many, and did games and other things. At one time at my home we used to play Scrabble on a terminal plugged into the telephone with a VAX at Digital. When you had a terminal you had everything that we see now on a personal computer. So that's been around for many years. We saw in the early 70's that it was going to be easy for people to make computers. The type of computers, we had made more powerful than this one, were going to be able to be made by anybody very simply and very cheaply. At that time we set about to do something more difficult which was to integrate or network a whole organization around the world together. Within one room, within the building, within a campus, a city or the world. And that was our thrust. We concentrated on that because the PC, as it was being developed, was so easy there'd be many people

making it. So, we in general avoided it and [instead concentrated] on the problem of networking them but not planning to be the large producer of PC's. We concentrated on the making of networks of small computers and large computers which is a much more challenging job and devoured all the resources we had. The PC itself was a component to the network. We made some PC's designed to be part of the networking but the general PC market was not for us. There were too many people in it and it turned out to be true. At one time I think there was 500 or 700 people making PC's. Anybody could build them. You could build them in your basement. That was not for us.

DKA: Was there doubt about that decision? Or debate about that decision?

KO: No, because you see our goals were clear and when anybody can do it and there's nothing particularly unique that we can contribute, it's clear it's not for us. Now we had PC's demonstrated here long, probably long before anybody else did. Individually people would make them. But we very formally decided that was not what we were going to do. It would basically be a very good decision. The IBM success in that business was, for a number of reasons, partly happenstance, partly luck, but to a large degree because they had the size, the resources and the experience to set up the infrastructure to deliver millions of these. It was not a matter of invention, it was a matter of management and resources. They were the ones who could do it. After they had done it, it became easier for others to enter the market. But their contribution was good, competent management. And we were off doing other things. Now the argument we have today is an interesting one. We believe in PC's. We encourage them. We network them. We use them in large numbers. But we still believe that most people in an organization want terminals. Terminals you don't have to worry about data management, you don't have to worry about floppy disks. You just sit down and it does the work for you automatically. So our most experienced, educated computer scientists and my secretary who has access and experience with everything, always want a terminal. It's just so simple to use. There's nothing there. And the secretary doesn't want to take her hand off the keyboard and run a mouse, so the terminals we feel will always be important. That's a major part of our business. We do supply PC's, we will supply more PC's, we integrate and work with other suppliers, all the suppliers of PC's, to network them. They have a very key part in this system. Now there's the large expensive, very competent PC called a workstation, offering a whole new realm of things. That's a very important market. These cost twice as much as PC's. They have a very beautiful display, sometimes with beautiful colors, always with fine detail, and are used for designing automobiles and airplanes, and for many things for which you want very precise pictures or a lot of material on this display. They get to be powerful when they're hooked up to networks. Now there's an interesting mistake that people make, the press makes out of innocence. Six years ago they announced that the PC's in a operation have enough computer power to replace the big machine. That turned out to be foolishness. Now they're announcing that PC's, that workstations networked together, have more power than a big computer, and they'll replace the big computers. That's nonsense too. They replaced some of the things big computers were doing because they can do the jobs, but they don't replace the big ones because in any organization you have data that you cannot afford to lose under any circumstances. The last thing you're going to do is have your key data in somebody's workstation where somebody can mess it up. All the protection for precise data has to be separated in a place that can never be lost, never be damaged. And no way are you going to leave it out in the open on a small machine. So there's a place for everything. The PC's will play part of it, terminals another part of it, workstations another part of it, medium computers and large ones other parts of it. There's a place for all of it.

DKA: You've been in a relatively unique position for the past three decades, four decades maybe, to watch this industry, and to think about where it's going. What really stands out as the key developments in a large social sense in the elevation of the computer and the way it's effecting our society. What do you see as some of it?

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Observations About the Computer Industry

KO: I think the interesting thing to observe about computers and computer technology is that the most significant changes people don't notice. Things they worry about never become a problem. For example, the hand calculator really was a revolution. No one predicted it, no one worried about it. It sneaked up on us and suddenly we all have them, we all use them, and we never thought of it as revolution. It just sneaked up on us. All through our life there are computers. Our cars, our homes have computers, and so many things, and we don't notice it. We worried about privacy, worried about computers running our lives, and those didn't happen. The issue of privacy is that with computers you can specify, society can decide exactly what level of privacy we want. You can have anything you want, which you didn't have before. You're going to run your private finances with [the personal computer]. They're going to run your menu. They're going to run your social affairs...didn't happen. You don't want it and it didn't work. The things we feared usually don't happen. The things of significance sneak up on us and we take them for granted like they always were there. When I was young in the Boston area, you had one charge card in the big department store in town. Always in trouble. They never got anything right. And always patching up something. Now you couldn't carry all your credit cards, and very rarely do you have trouble with them. That's a revolution. Now we expect not to have trouble with our credit cards. We don't expect them to make mistakes. That's the computer revolution that we just take for granted. And it goes on and on and on. We have a long way to go. When we ever straighten out medical billing, it will be computers that do it. And after it's straightened out, we'll never remember that it wasn't straightened out. There's two things I would say to people about computers. One is, don't fear them. Most of the time they're doing good for you. The other thing is, don't ever become lazy. Remember that you only have fun in life and you only can stay ahead if you keep learning. Calculators are not an excuse for learning how to do arithmetic. As for things that computers do, you've always got to be sure that you can do a certain amount of things by hand and know something and learn something. Always learn, and don't ever let computers fool you into thinking you don't have to. I tell our people when I'm asked to lecture, look at the old people you want to be like. I can tell you ahead of time that if people continue to learn, are excited and know about things, and the ones who are boring are those who stop learning and don't think about things. Just don't let computers cause you to get in the trap of not losing things.

DKA: What's coming?

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Future Computer Inventions

KO: From a technological point of view, I think we can be confident that computers are getting more powerful, and less expensive. This means that we can do things we never thought of doing before. It means that people can use techniques for doing computation which are wasteful, devouring memory and devouring computation and doing things in a way which is so much easier because the computer does all the work. But what it means to the private citizen? It means that your automobile will run better, your house should run better, and it means that we can, little by little, get better service from all the things we struggle with today. And for the people who really have a use for the computers, they'll do things a much more exciting way. It also means that every student should learn to type. Anyone who does any writing at all should have a word processor. It means that people shouldn't be afraid of computers even if they don't have any need to learn. But anyone who has any reason to learn, in all young students, really are in that category. They should have a feeling for computers. It will just continue to be a contribution to society.

DKA: Does anything scare you about what's coming ahead?

KO: I used to think that computers could do no harm. But there are some things which do worry me. Some people study computers and don't learn anything else. Computers are just tools to do something; you better be expert in something and consider the computers the tool. The computers are fun and exciting but they're just tools, and we better make sure that we know something about what the computers are supposed to solve not just the computers. Computers also produce an enormous amount of data and people get confused with that. Data is not information. That's been pointed out. You put the data in a form which is useful and you have some

information. But a large amount of data isn't information. I think in business making graphs is a menace. Very few people know how to make graphs. They don't know why they make graphs. They make graphs because they think you're supposed to make graphs, but they don't know what they're trying to get across. They don't know the reason for it, and if they had the reason, most of the time they wouldn't do it. In that way, computers are a menace to business. We have more graphs that mislead or cause confusion than we ever did before. But, in general, I think computers do a lot of good. We have too much information, but it's so much better to have free flow of information even though it turns out to be a little too much than limiting information. Computers are going to revolutionize business and society, even maybe in particularly the closed societies because with a free flow of information, it just changes the way we do things. Looking at the big old machines, there's almost no relationship to, or no indication of what a computer will do. Computers will do almost anything you want. If we can't afford to do it now, it can [be done] in the future. The one thing to learn about computers is that they do give us the opportunity to accomplish things we've never been able to do before. This means that our big problem is we've got to decide what we want to do. Most people don't know what they want. Often in society we don't know what we want. But if we decide what we want, most of the time the computer will play a key part in giving it to us.

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Mass High Tech: The Journal of New England Technology

Tuesday, February 8, 2011

Ken Olsen's career at a glance

By James M. Connolly

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Ken Olsen, co-founder of Digital Equipment Corp., **died on Feb. 6, 2011**. His legacy in the industry spans the 35 years he spent at DEC and includes the estimated 100,000 employees working for the company at its peak. Here, Mass High Tech gathers a time line of Olsen's career highlights.

Born in Bridgeport, Conn. on Feb. 20, 1926.
Raised in Stratford, Conn.

Military service: U.S. Navy, 1944-1946

Education: Bachelor's degree in electrical engineering from MIT in 1950. Master's degree in electrical engineering from MIT (1952)

Early job: Engineer with MIT's Lincoln Laboratory

Founder of Digital Equipment Corp.: Founded DEC with Harlan Anderson and brother Stanley Olsen in 1957, reportedly with $70,000. Venture investment came from Georges Doriot's American Research and Development Corp., considered a pioneer in the VC sector.

Early patents: Saturable switch, a diode transformer gate circuit, magnetic core memory, and the line printer buffer.

DEC computers: DEC's first minicomputer series was the PDP (programmable data processor) family, starting with the 18-bit PDP-1. The PDP's were designed to support departments or teams of scientists without significant assistance from the data processing team and supporting infrastructure. The most successful PDP was the 16-bit PDP-11, which remained in common use for 20 years, well into the 1980s.

DEC's next generation machines were the 32-bit VAX systems introduced with the popular VAX 11/780 in 1977, and in use through the 1990s. A key development in the VAX line was the use of a virtual operating system known as VMS.
Later in its evolution, DEC developed the reduced-instruction set computer architecture known as Alpha, designed for high-end 64-bit systems.

Evolution of the technology: As DEC matured, the company branched out with networking tools, including an Ethernet-based architecture, and software such as a relational database management system and an e-mail package. Despite Olsen's claim that there was no need for a home computer, DEC did introduce several PC models for business use throughout the 1980s.

DEC the company: From three employees in 1957, DEC peaked at an estimated 100,000 employees and a market value of $14 billion in the late 1980s. At that time it was the second largest computer company behind IBM. With the growth of Windows-based and PC architecture servers and competing high-end servers appearing at a time when DEC's new products were late and flawed, DEC's growth slowed in the early 1990s. The company had its first layoffs in 1992.

Olsen leaves DEC: In 1992, Olsen was replaced as president by Robert Palmer, and resigned from the board a short time later. DEC was acquired by Compaq Computer Corp. in 1998.

Later career: Olsen became chairman of startup Advanced Modular Solutions and also served as a trustee and benefactor of Gordon College in Wenham, which named its science

center after him.

Sources: Varied, including Wikipedia.

About Ken Olsen

"Even though I have been an entrepreneur, I have always been a scientist first and foremost."
***—Ken Olsen** (1926–2011)*

In Remembrance:
Leave a memory or comment about Ken Olsen

Kenneth Harry Olsen, known around the world as founder and former CEO of Digital Equipment Corporation (DEC) and one of the 20th century's great leaders in computer science, passed away February 6, 2011. Born in 1926 in Bridgeport, Connecticut, he was educated at M.I.T and, while a graduate student, worked on a team that developed air defense technology and core memory, the precursor to today's RAM.

During Olsen's 35-year leadership tenure, DEC pioneered the concepts behind interactive computing, and created one of the first digital "mini-computers" for commercial use. Along with these milestones in technology, Olsen's leadership style and entrepreneurial philosophy have also been foundational for today's information and computer networking industry.

"As an inventor, scientist, and entrepreneur, Ken Olsen is one of the true pioneers of the computing industry," wrote Bill Gates, founder and chairman of Microsoft, in a letter on the occasion of the groundbreaking for the Ken Olsen Science Center, in 2006. "He was also a major influence in my life and his influence is still important at Microsoft through all the engineers who trained at Digital and have come here to make great software products."

Mr. Olsen strongly believed that science is "more than a study of molecules and calculations; it is the love of knowledge and the continued search for the truth. The study of the sciences promotes humility, leaving us with a clear sense that we will never understand all there is to know. At the same time, science provides a defense for truth, authenticates Christianity and stems from the nature of God."

Inspired by the openness with which science is taught at Gordon as well as with the critical thinking and empirical approaches of the faculty, he joined the Board of Trustees in 1961, and helped launch the Heart of Discovery campaign at Gordon with a lead naming gift for the new science center.

"Ken Olsen was a pioneer of the computer age, but beyond that, he was a good man," said Tom Phillips, former chairman of Raytheon and fellow board member at Gordon College. "He was a major philanthropist who did his giving quietly, never seeking recognition or thanks. Ken's many

Resource Links

VIDEO: THE GENIUS OF KEN OLSEN
Produced by Televerse Productions.

VIDEO: THE LEGACY OF KEN OLSEN
Produced by Televerse Productions.

contributions to business, leadership and technological innovations were unmatched. He cared deeply about his family, his faith and of course, his work, and sincerely expected that each would help make the world better. That was his legacy and I'm proud to have called him friend."

FIND OUT MORE

- Read a remembrance of Ken Olsen.
- Watch "The Legacy of Ken Olsen" video produced by Televerse Productions. *("The Genius of Ken Olsen" is displayed above.)*
- Read the Spring 2006 STILLPOINT article "Ken Olsen Brings Entrepreneurial Leadership to Science"
- Read the Summer 2006 STILLPOINT article about the June 17 2006 groundbreaking ceremony for the Ken Olsen Science Center: "A Salute To Ken Olsen, Servant Leader."

Former DEC employees, friends and colleagues of Ken Olsen can make a donation in honor of Mr. Olsen.

Gordon College in Wenham, Massachusetts, is among the top Christian colleges in the nation and the only nondenominational Christian college in New England. Gordon is committed to excellence in liberal arts education, spiritual development and academic freedom informed by a framework of faith.

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Digital Equipment Corporation:

The First Twenty-five Years

KENNETH H. OLSEN

"Were American Newcomen to do naught else, our work is well done if we succeed in sharing with America a strengthened inspiration to continue the struggle towards a nobler Civilization— through wider knowledge and understanding of the hopes, ambitions, and deeds of leaders in the past who have upheld Civilization's material progress. As we look backward, let us look forward."

—CHARLES PENROSE
(1886-1958)
Senior Vice-President for North America
The Newcomen Society
for the study of the history of
Engineering and Technology
(1923-1957)
Chairman for North America
(1958)

This statement, crystallizing a broad purpose of the Society, was first read at the Newcomen Meeting at New York World's Fair on August 5, 1939, when American Newcomen were guests of The British Government.

"Actorum Memores simul affectamus Agenda"

This address, dealing with the history of Digital Equipment Corporation, was delivered at a "1982 Massachusetts Meeting" of The Newcomen Society in North America held in Boston, when Mr. Kenneth H. Olsen was the guest of honor and speaker on September 21st, 1982.

"Computers are making work more interesting, making it more fun, making it more satisfying."

—KENNETH H. OLSEN

Digital Equipment Corporation:

The First Twenty-five Years

KENNETH H. OLSEN

PRESIDENT

DIGITAL EQUIPMENT CORPORATION

MAYNARD, MASSACHUSETTS

THE NEWCOMEN SOCIETY IN NORTH AMERICA

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INTRODUCTION OF KENNETH H. OLSEN IN BOSTON, MASSACHUSETTS, ON SEPTEMBER 21, 1982, BY GENERAL GEORGES F. DORIOT, U.S.A. (RETIRED), MEMBER OF THE BOARD OF DIRECTORS, DIGITAL EQUIPMENT CORPORATION AND MEMBER OF THE MASSACHUSETTS COMMITTEE OF THE NEWCOMEN SOCIETY IN NORTH AMERICA

My Fellow Members of Newcomen:

WHEN I face a nice audience like this, I get strange ideas—one is that the world is upside down. I shouldn't be introducing Ken Olsen—you all know him, know what he has done, respect him and admire him.

You know, Newcomen was a lucky man. If Ken Olsen had been alive in 1712, he would have designed a better engine and today this would be called the Olsen Society.

As some of you know, I have been trained to talk non-stop for an hour and a half or two hours. So you must be worried. But worry not. Of course I could spend an hour and a half saying nice things about so many of you who are here tonight—who have done so much for me, for American Research and Development Corporation, for my careers and for helping Ken Olsen start and operate Digital Equipment Corporation. However, let Ken tell you about DEC. I am just a director and that means I am just a slave to Ken. No question about that.

When you have a strong president, your directors should be very peaceful, very quiet and very fortunate, and I try to be just that. So I am going to follow all my principles. My introduction will be name, title and serial number. I am going to introduce two people. Now I am sure you are wondering who the other person is. So I would like to introduce her first.

Her name: Aulikki Olsen. Job description: devoted wife, charming mother, perfect wife for a very imposing man. Serial number: 1.

Now my second introduction. Name: KENNETH OLSEN. Position, title: respected and admired president of Digital Equipment Corporation. Serial number: 1A.

KEN OLSEN, PRESIDENT, DIGITAL EQUIPMENT CORPORATION, ADDRESSING THE NEWCOMEN SOCIETY IN BOSTON, SEPTEMBER 21, 1982

Members of Newcomen and guests:

TONIGHT, I'd like to tell you a little bit about the history of Digital and some of our ideas. Our ideas aren't applicable to everybody, but they give you some insight into what we were thinking.

At dinner tonight, Dorothy Rowe asked me how I ever got to this point in my career? I said I only wanted to do some research and I progressed a step at a time. Back when I was at MIT, I was perfectly happy—I had all the things I had ever dreamed of, and I thought I could talk them into any project—thought I could get all the money I wanted for research, not for pay, and this is where it developed.

A couple of things happened along the way. When I was a young man, I was asked to be Sunday School superintendent at Park Street Church in Boston. It was a very imposing job for a thirty year old because everybody at the church looked ancient. But I accepted the job and immediately went off to Lexington library and took out all the books on management. It was my first taste of management. I can tell you all the things I learned then, but I can't tell you much I've learned since.

Another important thing happened while I was doing research at MIT. I discovered there was one thing missing in research. Nobody cared. That really set the idea that we had to show people at MIT how to make transistor computers, but nobody paid any attention to us. So, we decided to go into business.

In 1957, we went to American Research and Development Corporation, a risk capital company in Boston. General Georges F. Doriot was president, Dorothy Rowe was senior vice president and treasurer. They were a conservative organization because the recession of 1957 was underway, and they were worried about us because we had no business background. I'd asked Harlan Anderson to join me, and we worked together on the business proposal. American Research was fascinated. Andy (Harlan Anderson) and I went to the Lexington library again, took out a lot of books, and wrote a proposal. We went through *Moody's* and studied all the companies that we felt were reputable and made out our pro forma financial statement. Then we made the proposal to American Research Development.

Their reaction was concern. Some of the more senior vice presidents were very worried. But they said "We'll let you go to the board of directors," and they gave us three bits of advice. First was, don't use the word computer because *FORTUNE* magazine said no one had made any money in computers, and no one was about to. So we took that out. We said we'd make modules which were the pieces we had to make first anyway. Second, they suggested that five percent profit wasn't enough. You see, when we looked through *Moody's* it seemed that all the good companies made five percent. I think Dorothy Rowe said, "If you're going to risk somebody's money you've got to promise more return than RCA." So we promised ten percent. And, of course, the lesson is obvious. If we aimed for five percent, that's all we would have made. So we aimed for ten percent. Lastly, they suggested, promise fast results because most of the board is over eighty. So we promised to make a profit in a year, which we did.

Our first profit was so small the accounting could have made a difference between profit and loss. Andy and I went down to see the General. We were so proud after twelve months, and we laid our financial statements down. The General looked at them and looked up and scowled. He was rather imposing then; still is. And he paused and said, "I'm sorry to see this." He said, "No one has ever succeeded this soon and ever survived." So with that challenge we still survive.

American Research gave us $70,000 to start the company. The nice thing about seventy thousand dollars—there are so few of them you can watch every one. We found space in the old woolen mill in Maynard, Massachusetts, on the second floor, with a narrow stairway and no elevator. A discount store had just moved out. We paid twenty-five cents a square foot per year with watchman service and heat. And the next lease was fifty cents a square foot, so it was extravagant. There were nine thousand square feet. It seemed tremendously large when there were just three of us—my borther, Stan, joined us just as we started. So the three of us moved in.

American Research suggested that we get a downtown lawyer, downtown bank and a downtown accounting firm. The first thing we did was call in our downtown accounting firm. This was Lybrand Ross Bros. and Montgomery. When we invited them in we said we wanted big company accounting. In our rather humble offices, with Andy's lawn furniture and a leftover rolltop desk, it took a little bit of con-

GENERAL GEORGES F. DORIOT, U.S.A. (RETIRED), MEMBER DIGITAL'S BOARD OF DIRECTORS, AND FORMER PRESIDENT OF AMERICAN RESEARCH AND DEVELOPMENT CORPORATION, THE VENTURE CAPITAL FIRM THAT INITIALLY FUNDED DIGITAL

DIGITAL'S THREE FOUNDERS: (L TO R) KEN OLSEN, HARLAN ANDERSON, STAN OLSEN

vincing to let them know that we really wanted big company accounting. When they set up this system we discovered it cost us more to do the accounting than it did to do the manufacturing.

We learned a lot in those early days. We did everything ourselves, from building the offices to moving the equipment. We did the photography in my basement, and printed our circuits with real silk on wooden frames and etched them in aquarium tanks we bought from the five and ten. We frequently spilled the etch solution onto the furniture store below—I think we bought the same set of furniture several times. We had the opportunity to learn accounting, and all the steps in manufacturing. Things which, in time, became very valuable because we became sensitive to people in many different jobs.

We initially thought we were going to use circuits we had developed at MIT, but just as we started, we had to make a difficult business decision because a new transistor had just come out. We decided to go with the new transistor, design all new circuitry, start from scratch. It was a much better one, but a terrible gamble. They cost $12.50 each and we bought a thousand of them. So out of $70,000, twelve and a half thousand went into one little box, that you could hold in your hand. Before we used any of them, the price went down to around eight dollars . . . we had a four thousand dollar inventory loss before we did anything.

By planning everything and doing it carefully, we were able to design and build modules that sold well. For a while we had a monopoly. Not much of a market, but a monopoly.

Financial Responsibility

We had a number of ideas that were quite unique at the time but are rather normal now. First of all, in those days there was a belief that making a profit was bad. That sounds strange now but at the time it really was true. Companies would hire an engineer and say, "We're hiring you for the good of science; we're going to hire you to develop yourself professionally." Secretly, they hoped he'd help them make a profit but they wouldn't say that to the engineer. We had a very straightforward relationship. We'd borrowed $70,000 of someone else's money, with an understanding that we would try to give a return. With that simple relationship, most of the people in Digital understood

that our obligation was to make a profit. That basic premise was a very definite advantage and it's paid off quite consistently.

We had another idea that appeared strange at the time. At that time most people who came from research environments looked down on manufacturing. They were researchers, and they would contract out for manufacturing. We immediately engraved our letterhead with the statement that we were designers and manufacturers. It's obvious today but at that time it was unusual.

The other idea we had was that we didn't want to take military contracts. We weren't pacifists; in fact, we came from a military part of MIT, but we felt it limited our efforts to become a civilian company. At that time, some of the research money just seemed too easy to come by.

Trying to explain our ideas to financial analysts was impossible. We tried to explain to them why we wouldn't take free money from the government, and they didn't understand. We also told them that we didn't think growth was a goal. At that time all you had to do was grow and sell your company. Explaining to Wall Street why growth wasn't a goal was impossible. We gave up and just mouthed the words because they wouldn't understand.

We also brought some organizational ideas from MIT. There was an attitude and environment at MIT that we wanted to duplicate. It's hard to describe but MIT was and, I think to a large degree is, a very generous, a very trusting, and a very challenging environment. That environment was one of the things we wanted to capture and bring to our own company. We had so much confidence in MIT that we even followed the MIT operations manual. We took the same hours, we took the same vacations, we paid the same holidays. The state came by and said you can't pay on those days, it's illegal. We said MIT does, the state said we can't control MIT, but we can control you.

Interactive Computers

We also had some very unusual computer ideas. The computer developed at MIT by Jay Forrester and Bob Everett was quite unique, partly because it was very simple. Most computers at that time were designed by professors who had an obligation to make things com-

DIGITAL'S EARLIEST COMPUTERS WERE A SIGNIFICANT DEPARTURE FROM SYSTEMS OF THAT ERA. THEY WERE PHYSICALLY SMALL, INTERACTED DIRECTLY WITH THE USER THROUGH A VIDEO OR KEYBOARD TERMINAL, AND BROKE THE MILLION DOLLAR PRICE BARRIER

plicated so they would have something over their students. Jay and the crew were not professors and had a vested interest in making it simple—they hired retired television repairmen to do the work. The other idea was that computers had to be very fast. So all the complexity given up to make the machine simple was put into making it fast. This was also the opportunity to make an interactive computer—one that would interact directly with its user through a video or keyboard terminal. Out of that idea came the computers that we've been selling for twenty-five years.

The idea of an interactive computer, where both machinery or people can interact, was one of the key concepts at MIT and was really the basis upon which we built Digital.

The advantages of an interactive computer were never more apparent than at MIT itself, when we gave them one of our very first computers. It was in a room on the second floor above an IBM machine. The contrast was quite interesting. On the floor where the IBM machine

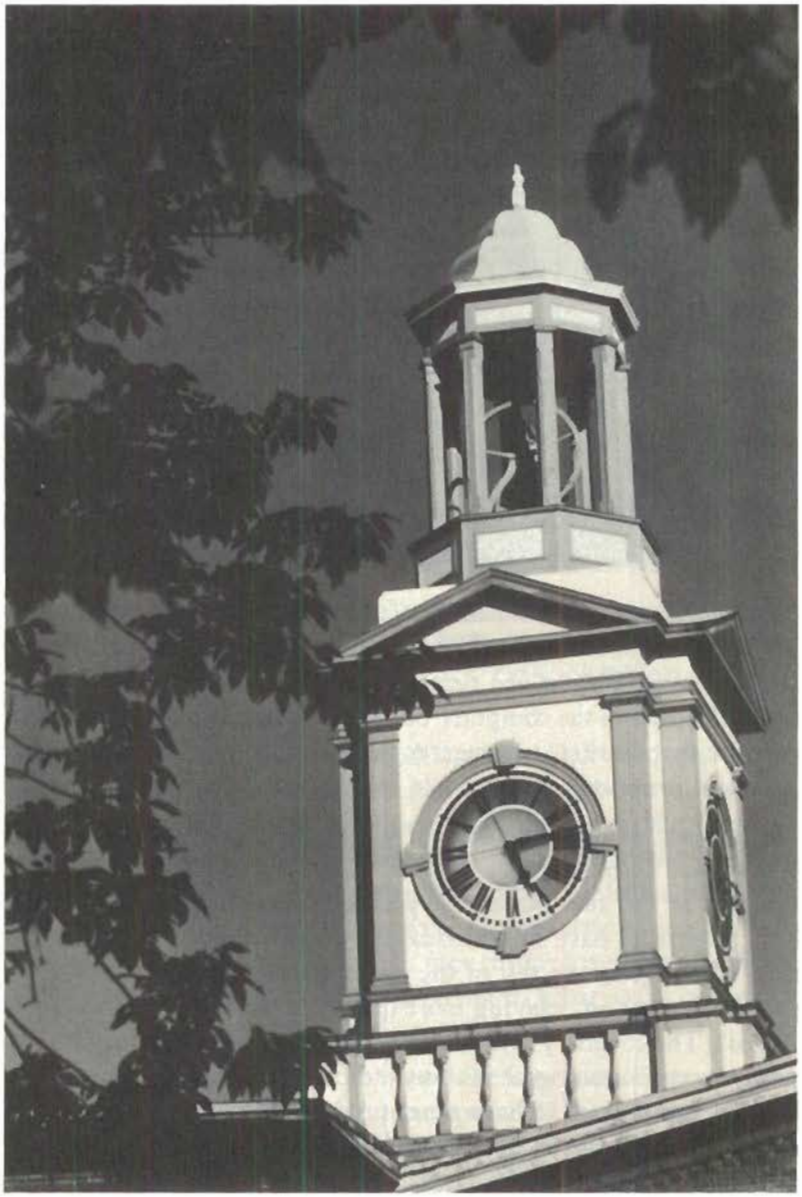
was installed, there were two layers of glass in front of this very imposing machine. People entered their problem on a batch of IBM cards. The next day they got their answer back, and it usually said you made a mistake. On the floor above the students could use the interactive machines any hour of the day or night, for any reason, and they could sign up for it months ahead. The reaction was quite different. If you walked in there at three o'clock in the morning, the kids were doing what they do today with personal computers. They were all involved. These computers were so captivating that a number of times the administration thought of getting rid of them because people stopped washing, stopped eating, stopped their social life and, of course, stopped studying. But out of that group of bright students came so many of the things which we take for granted today, including timesharing and even video games. Many of the key people in the industry today came out of that group, and many of the things that we know about computers were formulated during that period.

Decision Making

Throughout our career, some of the most important decisions we made were negative ones—things we decided not to pursue as a company. For example, at one time we pretty much owned the cathode ray tube market in the computer business. We decided we just couldn't dominate that market, no one company could, so we decided to offer a range of products but not try to dominate the market.

Sometimes we are ridiculed for not exploiting all the opportunites we have. Jay Forrester once said you're either going to have too many managers or too few managers, you're never going to hit it exactly right, so plan to have more managers than you can use and let some of the others go to the rest of the industry. It seems obvious that you never hit it right on. Having more qualified managers has always been our goal. The corollary says you're never going to be as good as people think you are, so our goal is always to be better than people think we are. We always want to have more products than we can use and sell because the only other alternative is to have too few. Sometimes it looks like we have more products than we've exploited, but it is just so much safer to have more.

We're also financially conservative. I believe that if we are to grow this fast, we have to be very safe financially. In general, we raise our



THE ORIGINAL MILL CLOCK OVER DIGITAL'S CORPORATE HEADQUARTERS IN MAYNARD, MASSACHUSETTS

money before we expand. Over the years we've been criticized for not understanding what the word leverage means. We may be researchers, but we do know what leverage means, and having a few million dollars cash in the bank is much nicer than being heavily leveraged.

Responsibility

There was a major change in the company back when we were just a fourteen million dollar company. Coming from a research environment we ran the company like a research project. Everybody got together and we made decisions. But it stopped working well. We had twenty people on the Works Committee then, and they all had ideas, for example, on how to spend money. I was the only one to say no. People started to think I was a little dictator; some even complained to the directors. It got to the point where one day I said, "We're a new company. You all now have responsibility." We broke the company into product lines and service groups to the product lines. The product line managers made the budgets and everybody else budgeted to serve them. Miracles started to happen. We gave them responsibilities, told them to establish a budget, and said they would be reviewed once a month against their budgets. When the managers asked how many people they could hire, I told them they couldn't hire anybody, because that was the only simple rule. I admit it was unfair, but they doubled the profit of the company in the first year. When they were telling others what to do things didn't work out well at all, but when they suddenly had the responsibility, it's amazing how smart they were. When they had the responsibility, things became very clear. The company was doing well financially before then but suddenly there was a sharp increase in growth and in profit when we assigned responsibility. That's been the basis upon which we've been running the company.

We've had particularly good results in a number of plants we built even though when we built them it appeared to be quite risky. For example, we built a plant in Springfield, Massachusetts, in the old Armory that George Washington built. It was in a depressed area where there were a few problems. Good people, but a depressed area. Our approach was not to say, "We're do gooders from Boston going to help you poor people." We said, "We're going to hire you if you're

good and fire you if you're bad." We gave them responsibility, and the results were just beautiful. We also did it without any publicity.

We had the same experience with our plant in Puerto Rico. Originally we only expected to assemble parts there, but as our employees got better they made complete computers and they're very good. They're good because we trusted them to learn and take responsibility.

We also built in Ireland. Again, in a somewhat rural area in Galway where we had showed confidence in the people, gave them the chance to do what they wanted to do, the results are magnificent.

When we don't do well with people is when we don't give people clear responsibilities or when one person doesn't share responsibility.

Today, many of our leaders come from our manufacturing, field service and sales organizations—not areas of a company where you typically expect to find good managers. Managers normally came from marketing and engineering, but we choose the other disciplines because they break out responsibility, delegate it, measure it regularly. They learn to take responsibility and measure it and grow with it. Those creative areas, where it's more inspiration and art, are often harder to measure exactly.

Success

The past five or six years have been boom times for Digital. I said publicly, "We're big enough now, we don't need recessions to straighten us out," but it's not true. I don't think human beings are made to survive one good year after another, with all the flattery and success that goes with it—at least we're not. If we go many years with too many orders and too much appreciation we become weak individually and as a company. This recession, even though it's a strain and a worry, has made us strong. We've developed more products recently, and we have strengthened our organizational structure at the same time.

Henry LeMaire, one of our vice presidents, died a few years ago, and it had a significant effect on our managers. When the company was doing well, many of our senior managers really thought they were good. They were driving to get ahead. After Henry died, it started to sink in. Henry was never a driver, never pushed others, never

THE LATEST PERSONAL COMPUTERS FROM DIGITAL ARE AIMED AT BUSINESS PROFESSIONALS IN MANY DIFFERENT MARKETS. THEY USE ADVANCED SMALL COMPUTER TECHNOLOGY, AND CARRY ON A TRADITION OF BRINGING COMPUTER POWER TO THE USER

proud, never cocky, never confident. He was well-educated but quiet, thoughtful of others and hard working. When people realized the effect he had on others and how he grew in his responsibility within the company by these human characteristics, it had a very serious, sobering effect on all of us.

There's a story I tell sometimes which has an effect on me and I'd like to pass it on to you. Someone wrote that the Puritans were successful because they had some unusual ideas about God. They believed that God proved their position with Him by their economic success so they worked very hard for economic success. I was a little suspicious of this so I did some research. A book called *The Puritians* said that the Puritans had two characteristics. First of all, they believed that mankind was fallen. This did not make them cynical; but they believed that you should never be disappointed with mankind. If you believe this, it has a very important meaning to your relationship with others in business and how you approach business. For example, our mar-

keters will say engineering is always six months late. Now, if you know that to start with, you should never be disappointed because you know what to expect, and that won't change. Therefore, you should always have a positive point of view, and never be disappointed.

The other thing the Puritans believed was that every night they should systematically review what they learned that day about their fellow man, their relationship with their God and themselves. Now that's a very unusual idea, particularly in business. So often, we blame the government, those "other" people, or the boss, or anything. For example, one of our people made a proposal which we turned down. It was a terrible proposal. He was misleading, and he made a poor proposal. He slammed his briefcase, walked out and quit, and went to work for another company. A thoughtful person would have assumed that maybe he hadn't done his homework and tried again.

Office Automation

Enough of a sermon, let me end on an up note. The future of the computer industry is still ahead of us. One of the biggest challenges and opportunities is office automation. Office automation is a wonderful thing because it makes the office an easier, more pleasant place in which to work.

For example, when I come back from a week end I might have eight or ten memos I want to send out to all the vice presidents. Before word processors, my secretary would type each memo, make corrections, type it again, give to me, I'd make more corrections, and she'd type it again. With ten memos and fourteen people, she'd spend all morning at the Xerox machine, not to mention addressing and mailing. With word processing, she puts the memo up on the screen, edits it herself, corrects my mumblings and poor grammar. Now I don't feel guilty about making changes because there is no tedious retyping. To send it she just pushes a button and by eight-thirty in the morning all the vice presidents have received ten memos. What they do with them, I don't know, but my secretary feels much better about her work and doesn't have to operate like a robot.

Anything I write and anything I get is all electronic. Many times I ask my secretary for things I wrote or that were written to me. She goes to her terminal, scans the mail, picks it out, and it gets printed

instantly. I also get 200 contribution requests each month, and 200 job requests (they're all classmates of mine). I obviously don't have a chance to see them, so when somebody calls my secretary to follow up on a letter they sent, while they're talking, she can scan through her files, find the letter and to their amazement she tells them exactly what happened to the letter before they finish asking the question.

Over and over again, we see examples where office automation has improved the work environment with computers. Computers are making work more interesting, making it more fun, making it more satisfying. That's the business we're in—we're having more fun at it than ever before, and there is no end in sight.

THE END

"Actorum Memores simul affectamus Agenda!"

THE NEWCOMEN SOCIETY IN NORTH AMERICA

IN APRIL *1923, the late L. F. Loree (1858-1940) of New York, then dean of American railroad presidents, established a group now known as "American Newcomen" and interested in Business History, as distinguished from political history. Its objectives center in the beginnings, growth, development, contributions, and influence of Industry, Transportation, Communication, the Utilities, Mining, Agriculture, Banking, Finance, Economics, Insurance, Education, Invention, and the Law–these and correlated historical fields. In short, the background of those factors which have contributed or are contributing to the progress of Mankind.*

The Newcomen Society in North America is a non-profit membership corporation chartered in 1961 under the Charitable Law of the State of Maine, with headquarters at 412 Newcomen Road, Exton, Pennsylvania 19341, some five miles east of Downingtown, Pennsylvania, and 32 miles west of the City of Philadelphia. Here also is located The Thomas Newcomen Memorial Library and Museum in Steam Technology and Industrial History, a reference collection, including microfilm, open to the public for research and dealing with the subjects to which the Society devotes attention.

Meetings are held throughout the United States of America and across Canada at which Newcomen Addresses are presented by leaders in their respective fields.

The approach in most cases has been a life-story of corporate organizations, interpreted through the ambitions, the successes and failures, and the ultimate achievements of those pioneers whose efforts laid the foundations of the particular enterprise.

The Society's name perpetuates the life and work of Thomas Newcomen (1663-1729), the British pioneer, whose valuable contributions in improvements to the newly invented Steam Engine brought him lasting fame in the field of the Mechanical Arts. The Newcomen Engines, whose period of use was from 1712 to 1775, paved a way for the Industrial Revolution. Newcomen's inventive genius preceded by more than 50 years the brilliant work in Steam by the world-famous James Watt.

The Newcomen Society in North America is affiliated with The Newcomen Society for the Study of the History of Engineering and Technology, with offices at The Science Museum, South Kensington, London, S.W. 7, England. The Society is also associated in union with the Royal Society for the Encouragement of Arts, Manufactures and Commerce, whose offices are at 6 John Adam Street, London, W.C. 2, England.

Members of American Newcomen, when in Europe, are invited to visit the home of Thomas Newcomen at Dartmouth in South Devonshire, England, and to see the Dartmouth Newcomen Engine working.

"The roads you travel so briskly
lead out of dim antiquity,
and you study the past chiefly because
of its bearing on the living present
and its promise for the future."

—LIEUTENANT GENERAL JAMES G. HARBORD,
K.C.M.G., D.S.M., LL.D., U.S. ARMY (RET.)
(1866-1947)

Late American Member of Council at London
The Newcomen Society
for the study of the history of
Engineering and Technology

Ken Olsen, Who Built DEC Into a Power, Dies at 84

By GLENN RIFKIN
Published: February 7, 2011

Ken Olsen, who helped reshape the computer industry as a founder of the Digital Equipment Corporation, at one time the world's second-largest computer company, died on Sunday. He was 84.

Enlarge This Image

Chitose Suzuki/Associated Press
Ken Olsen, the pioneering founder of DEC, in 1996.

His family announced the death but declined to provide further details. He had recently lived with a daughter in Indiana and had been a longtime resident of Lincoln, Mass.

Mr. Olsen, who was proclaimed "America's most successful entrepreneur" by Fortune magazine in 1986, built Digital on $70,000 in seed money, founding it with a partner in 1957 in the small Boston suburb of Maynard, Mass. With Mr. Olsen as its chief executive, it grew to employ more than 120,000 people at operations in more than 95 countries, surpassed in size only by I.B.M.

At its peak, in the late 1980s, Digital had $14 billion in sales and ranked among the most profitable companies in the nation.

But its fortunes soon declined after Digital began missing out on some critical market shifts, particularly toward the personal computer. Mr. Olsen was criticized as autocratic and resistant to new trends. "The personal computer will fall flat on its face in business," he said at one point. And in July 1992, the company's board forced him to resign.

Six years later, Digital, or DEC, as the company was known, was acquired by the Compaq Computer Corporation for $9.6 billion.

But for 35 years the enigmatic Mr. Olsen oversaw an expanding technology giant that produced some of the computer industry's breakthrough ideas.

In a tribute to him in 2006, Bill Gates, the Microsoft co-founder, called Mr. Olsen "one of the true pioneers of computing," adding, "He was also a major influence on my life."

Mr. Gates traced his interest in software to his first use of a DEC computer as a 13-year-old. He and Microsoft's other founder, Paul Allen, created their first personal computer software on a DEC PDP-10 computer.

In the 1960s, Digital built small, powerful and elegantly designed "minicomputers," which formed the basis of a lucrative new segment of the computer marketplace. Though hardly "mini" by today's standards, the computer became a favorite alternative to the giant, multimillion-dollar mainframe computers sold by I.B.M. to large corporate customers. The minicomputer found a market in research laboratories, engineering companies and other professions requiring heavy computer use.

In time, several minicomputer companies sprang up around Digital and thrived, forming the foundation of the Route 128 technology corridor near Boston.

Digital also spawned a generation of computing talent, lured by an open corporate culture

that fostered a free flow of ideas. A frequently rumpled outdoorsman who preferred flannel shirts to business suits, Mr. Olsen, a brawny man with piercing blue eyes, shunned publicity and ran the company as a large, sometimes contentious family.

Many within the industry assumed that Digital, with its stellar engineering staff, would be the logical company to usher in the age of personal computers, but Mr. Olsen was openly skeptical of the desktop machines. He thought of them as "toys" used for playing video games.

Still, most people in the industry say Mr. Olsen's legacy is secure. "Ken Olsen is the father of the second generation of computing," said George Colony, who is chief executive of Forrester Research and a longtime industry watcher, "and that makes him one of the major figures in the history of this business."

Kenneth Harry Olsen was born in Bridgeport, Conn., on Feb. 20, 1926, and grew up with his three siblings in nearby Stratford. His parents, Oswald and Elizabeth Svea Olsen, were children of Norwegian immigrants.

Mr. Olsen and his younger brother Stan lived their passion for electronics in the basement of their Stratford home, inventing gadgets and repairing broken radios. After a stint in the Navy at the end of World War II, Mr. Olsen headed to the Massachusetts Institute of Technology, where he received bachelor's and master's degrees in electrical engineering. He took a job at M.I.T.'s new Lincoln Laboratory in 1950 and worked under Jay Forrester, who was doing pioneering work in the nascent days of interactive computing.

In 1957, itching to leave academia, Mr. Olsen, then 31, recruited a Lincoln Lab colleague, Harlan Anderson, to help him start a company. For financing they turned to Georges F. Doriot, a renowned Harvard Business School professor and venture capitalist. According to Mr. Colony, Digital became the first successful venture-backed company in the computer industry. Mr. Anderson left the company shortly afterward, leaving Mr. Olsen to put his stamp on it for more than three decades.

In Digital's often confusing management structure, Mr. Olsen was the dominant figure who hired smart people, gave them responsibility and expected them "to perform as adults," said Edgar Schein, who taught organizational behavior at M.I.T. and consulted with Mr. Olsen for 25 years. "Lo and behold," he said, "they performed magnificently."

One crucial employee was Gordon Bell, a DEC vice president and the technical brains behind many of Digital's most successful machines. "All the alumni think of Digital fondly and remember it as a great place to work," said Mr. Bell, who went on to become a principal researcher at Microsoft.

After he left Digital, Mr. Olsen began another start-up, Advanced Modular Solutions, but it eventually failed. In retirement, he helped found the Ken Olsen Science Center at Gordon College, a Christian school in Wenham, Mass., where an archive of his papers and Digital's history is housed. His family announced his death through the college.

Mr. Olsen's wife of 59 years, Eeva-Liisa Aulikki Olsen, died in March 2009. A son, Glenn, also died. Mr. Olsen's survivors include a daughter, Ava Memmen, another son, James; his brother Stan; and five grandchildren.

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Downtown Skyscraper for the Digital Age

Computer pioneer Ken Olsen dies

By Bryan Marquard and Hiawatha Bray

Globe Staff / February 8, 2011

Ken Olsen, who cofounded Digital Equipment Corp. and built it into the second-largest computer company in the nation by creating small but powerful machines called minicomputers, died Sunday.

He was 84, and his death was announced by Gordon College in Wenham, for which Mr. Olsen was a longtime trustee and benefactor. The college did not provide a cause of death or information about where Mr. Olsen was living.

Mr. Olsen launched Digital in 1957 in a defunct woolen mill in Maynard with $70,000 in venture capital. For a time, Mr. Olsen, his partner, Harlan Anderson, and his brother Stanley Olsen were the company's only employees. With innovation after innovation, Mr. Olsen and Digital helped create the computer industry. At one point, the company was valued at about $14 billion.

In the 1960s, Digital pioneered a smaller, less- expensive alternative to the hulking mainframes that dominated the industry.

Mainframes were usually run by specially-trained operators and were off-limits to everyone else. Users stood in line, handed over their computing tasks, then waited for minutes or hours for the results.

But the minicomputers developed by Digital were so inexpensive that companies could buy several for scientists, engineers, or business managers, then let the workers use the computers themselves.

Digital and Wang Laboratories, along with their spinoffs, were widely credited with playing a large role in the Massachusetts Miracle, the period of economic growth in the 1980s.

Even when his own net worth was measured in the hundreds of millions, Mr. Olsen looked more like an engineer than an entrepreneur, favoring thick-soled work boots and preferring to drive a 1963
Ford
Falcon because he admired its design and found it easy to maintain.

Under his leadership, Digital endured financial ups and downs. But after the company surged in the mid-1980s, Fortune magazine ran a cover story on Mr. Olsen, calling him "arguably the most successful entrepreneur in the history of American business.''

Adjusting for inflation, Fortune said, Digital was bigger than
Ford Motor Co.
at the death of its founder, Henry Ford, and also larger than
US Steel
when Andrew Carnegie sold his company or Standard Oil when John D. Rockefeller stepped aside.

Digital was second to
IBM
in the computer industry, though it was less than one-sixth of IBM's size.

Digital's fortunes foundered when it was slow to enter the burgeoning personal computer market. Mr. Olsen stepped down as president in 1992 and resigned from the board a few months later, severing ties with the company. The company was acquired by
Compaq Computer Corp.
in 1998.

“While I didn’t know him personally, I did know him as the founder of one of the Commonwealth’s and the country’s great companies and an example of our spirit of innovation,’’ Governor Deval Patrick said in a statement last night.

Peter Zotto, who spent 23 years at Digital and was vice president of its European operations, called Mr. Olsen an excellent manager.

“The one word I would use would be empowering,’’ Zotto said. ’’Every chance I had to listen to him and work with him was a special treat.’’

Mr. Olsen delegated responsibility at Digital and was known for creating a decentralized management structure that became fodder for business textbooks.

Gordon Bell, one of the key designers of Digital’s minicomputers, said Mr. Olsen’s style of management generated creativity and fierce loyalty.

“We all remember him as a great leader,’’ said Bell, today a researcher at
Microsoft Corp.
“I certainly learned a lot and was very honored to work for him.’’

A Christian who for many years attended Boston’s Park Street Church, Mr. Olsen grew up in a household where his father taught Bible class and his mother played piano at a local church. For Mr. Olsen, faith was as important as his work.

“I’ve never seen a guy talk so much about philosophy in management meetings,’’ Dennis Burke, a former priest who worked at Digital, told Fortune magazine for the 1986 story. “He was really brilliant at that. It was like church. There would be absolute quiet in the room.’’

Dan Bricklin — the inventor of VisiCalc, the first spreadsheet program for personal computers — said Mr. Olsen was “the entrepreneur we all looked at; he was the prototypical one.’’

Bricklin, who now runs Software Garden Inc. in Newton, said Digital’s success established Massachusetts as a world center of computer engineering. “The stuff we all used for many years were Digital computers,’’ he said. “They were the Apple of their day.’’

Kenneth Harry Olsen was born in Bridgeport, Conn., and grew up in the suburb of Stratford. His father held patents and designed equipment such as a safety-pin machine and one that made universal joints for cars.

Mechanical even as a child, Mr. Olsen read technical manuals, rather than comic books. He began studying electrical engineering in the US Navy, which he joined in 1944, and continued his studies at the Massachusetts Institute of Technology. At MIT, he received a bachelor’s degree in 1950 and a master’s two years later, in electrical engineering.

Afterward, he worked at Lincoln Laboratory until deciding to start his own company in 1957, getting seed money from the early venture capital firm American Research and Development Corp. The financial backers did not want the word computer in the company’s name, and Mr. Olsen settled on Digital Equipment Corp., or DEC.

The company had sales of $94,000 in its first year. By 1977, when sales topped $1 billion, Digital had 36,000 employees.

In 1986, a Wall Street Journal reporter interviewed Mr. Olsen in his office in the building that formerly housed a woolen mill and dated to the mid-1800s. One wall was given over to his collection of old computer parts. “They’re artifacts, like dinosaur bones,’’ he said.

Mr. Olsen’s wife — the former Eeva-Liisa Aulikki Valve, whom he married in 1950 — died in 2009. Gordon

College could provide no information on their children.

A memorial service will be held at 2 p.m. May 14 at Gordon College.

Marquard can be reached at bmarquard@globe.com; Bray at bray@globe.com.

Computer pioneer Ken Olsen dies at age 84

(AP) – 1 hour ago

Kenneth Olsen, a computer industry pioneer and co-founder of Digital Equipment Corp., has died. He was 84.

His death Sunday was announced by Gordon College in Wenham, Mass., where he was a trustee and benefactor. The college did not release a cause of death.

DEC, which Olsen launched in 1957, is considered an icon in technology circles today. The company attracted top engineers and helped usher in a technology revolution that changed the way people interact with computers.

In the 1960s and 1970s, Digital played a central role in creating the market for "minicomputers," powerful, refrigerator-sized machines that appealed to scientists, engineers and other number crunchers who did not need the bigger, multimillion-dollar mainframes used by big corporations. At its peak in the 1980s, DEC was the second-largest computer maker behind International Business Machines Corp.

"In the heady days of Bill Gates and Steve Jobs, it's too easy to forget that it was Ken Olsen's vision of interactivity that took computing away from the centralized mainframe and into the hands of the people," said Gordon Bell, who joined DEC in 1960 and headed the company's engineering operations for more than 20 years.

Ultimately, DEC lost its way in the Internet-era transformations of the technology industry, which shrunk computers down to pocket-sized gadgets that people carry wherever they go. And Olsen is still remembered for his 1977 prediction that "there is no reason for any individual to have a computer in their home." He later insisted the quote was taken out of context and that he simply meant he could not envision a day when computers would run people's lives.

Born in Bridgeport, Conn., Olsen grew up in the neighboring town of Stratford. His father designed machine tools and Olsen and his brothers spent hours tinkering with gadgets in the family basement. After being drafted during World War II, Olsen attended the Navy's electronics school, where he learned how to maintain radars, sonars and navigation systems. He went on to earn undergraduate and masters degrees in engineering from the Massachusetts Institute of Technology.

At MIT, Olsen worked in the university's Lincoln Laboratory, a federally funded research center created in 1951 to develop technology to improve the nation's air defense system. That technology, powered by MIT's advanced Whirlwind computers, grew into the Air Force's Semi-Automatic Ground Environment defense system, which was used to track and intercept enemy aircraft. One of Olsen's roles at Lincoln Laboratory was to serve as a liaison with IBM, a major contractor on the project. Olsen also worked on Lincoln Lab's TX-2 computer, which helped break new ground in computer-aided drafting.

In 1957, Olsen teamed with MIT colleague Harlan Anderson to start Digital Equipment Corp. with $70,000 from American Research and Development, an early venture capital firm. The company was headquartered in an old wool mill in Maynard, Mass.

DEC named its first computer the PDP-1, for Programmed Data Processor. But it was the PDP-8, which was introduced in 1965 and became a building block for computer systems made by other companies, that really established minicomputers as a major new industry.

The PDP-11 — and later DEC's Virtual Address eXtension, or VAX, series — offered a serious alternative to IBM's central mainframe approach. By the mid-1980s, many other companies had tried to enter the business. Digital was also a pioneer in the use of networking technology to link its computers together and enable DEC engineers around the world to communicate electronically almost instantly.

DEC's innovative machines helped bring computers out from glass-enclosed rooms inside big corporations, where they were operated by men in white lab coats, and made them accessible to small and medium-sized operations and even individual users.

"The computers we built were of a cost and size that they brought computing down a level," said Bell, now a principal researcher in Microsoft Corp.'s Silicon Valley Research Group.

DEC computers also trained and influenced many key players in the technology industry. Microsoft co-founders Bill Gates and Paul Allen used the PDP-10 to create the first version of the BASIC programming language for a personal computer. And Dave Cutler, who developed several key operating systems for DEC, went on to develop the Windows NT and Azure operating systems for Microsoft.

For many years, the company's sophisticated technology drove rapid corporate growth and inspired deep loyalty. That growth came even as Olsen discouraged his salesmen from selling products that customers didn't need and shied away from traditional advertising, convinced that

good products would sell themselves.

In 1986, Fortune Magazine called Olsen "America's most successful entrepreneur." By the late 1980s, DEC had more than 120,000 employees worldwide. Sales peaked at $14 billion in 1992.

According to Edgar Schein, an emeritus professor at the MIT Sloan School of Management and author of "DEC is Dead, Long Live DEC," Olsen had a distinctive management philosophy. His corporate culture valued creativity, ingenuity and open communication. And while he had a legendary temper and demanded top-notch work, Olsen empowered his employees with enormous freedom and responsibility.

"Ken Olsen built a company that encouraged innovation and rewarded people with good ideas," said Win Hindle, a former DEC senior vice president who spent 32 years at the company.

Olsen was also fiercely loyal to his employees and he abhorred the prospect of layoffs.

Dan Tymann, executive vice president of Gordon College in Wenham, Mass., where Olsen was a trustee, said Olsen's management style reflected a devout Christian faith. Olsen constantly implored his employees to "do the right thing," Tymann said.

Digital's fortunes had begun to decline by the early 1990s. The company was late to recognize the growing popularity of smaller personal computers and desktop workstations for business use. DEC also resisted the market's shift away from proprietary technology to open systems, including PCs powered by Intel microprocessors and generic servers running UNIX software.

"Olsen continued to believe in innovation while the market became more of a commodity market," Schein said. "People wanted simpler, cheaper desktop computers, while DEC continued to produce sophisticated computers for the technical market."

Even as DEC tried to catch up with new products, including a line of personal computers, it never regained its footing. The company posted its first quarterly loss in 1990. Faced with struggling product lines, Olsen had no choice but to start cutting Digital's work force through buyouts, early retirements and eventually layoffs.

In 1992, Olsen left the company at the request of the board. Robert Palmer, a DEC vice president, took over and set about trying to turn things around. But the heyday of the minicomputer — and Digital Equipment Corp. — was over. In 1998, Compaq Computer Corp. bought what was left of DEC for $9.6 billion. Four years later, Compaq and the remnants of DEC were acquired by Hewlett-Packard Co.

A memorial service at Gordon College is set for May 14.

Related articles

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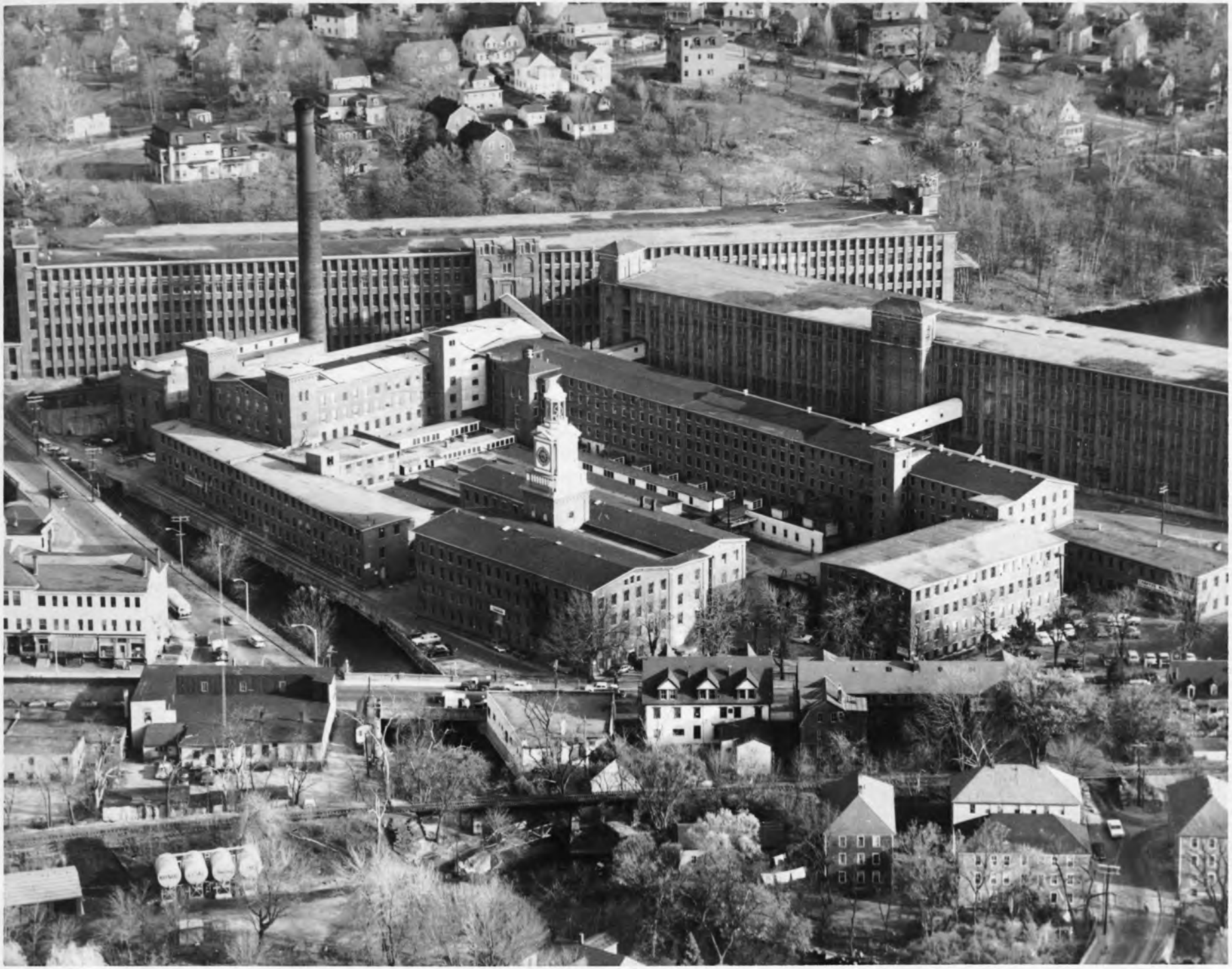


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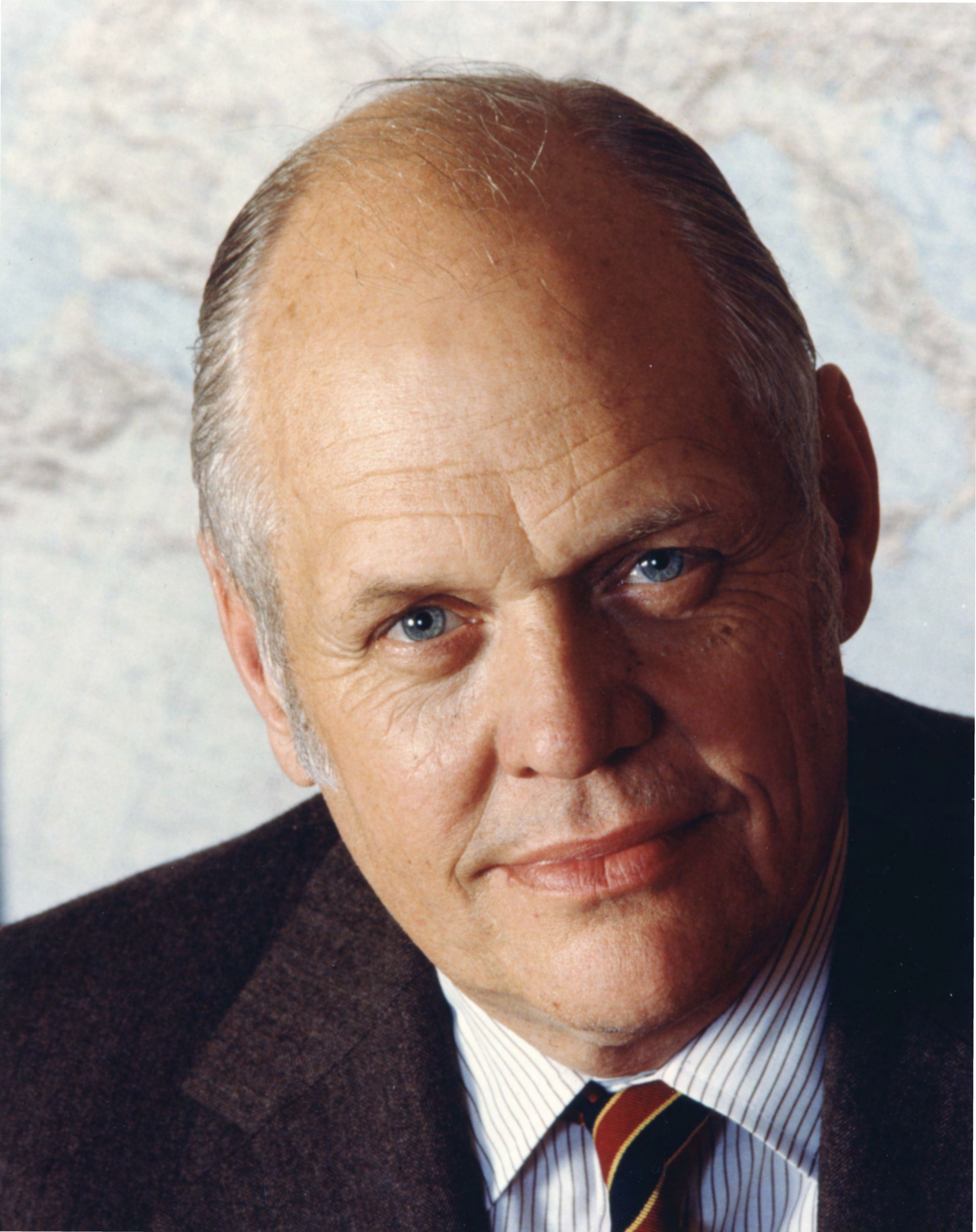


"Marketing or Engineering?"

Digital This Week Nov. 1980

Made by Digital?

Ken Olsen presents Vice President Gordon Bell, Engineering, with a silver bowl to commemorate his 20 years with Digital at the Engineering Awards Night held on Nov. 10. Digital honored its 10, 15 and 20 year employees, totaling about 500 this year, at seven award banquets held during the last two weeks.


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INTEROFFICE MEMORANDUM

Gordon Bell
MAY 23 1977

TO: Gordon Bell

DATE: May 19, 1977
FROM: Lou Gobeille
DEPT: Technical Documentation
EXT: 7995
LOC/MAIL STOP: ML3-6/E94

SUBJ: STRATTON MOUNTAIN SPEECH/NEW ENGINEER ORIENTATION MANUAL

Allan Kent requested that I condense the transcript of the speech Ken Olsen gave on the evening of 29 September 1976 for possible inclusion into the New Engineer Orientation Manual. I would appreciate your comments and approval of the attached draft copy. I have forwarded a copy of the draft to Ken and requested his comments and approval also.

Sometimes we don't fully appreciate the importance of keeping our mouth shut because any one thing doesn't look all that significant. But all together, things are really important. Any time we, as a company are so open and talk about or write about company matters we invest heavily in communications. Don't communicate with neighbors in your community about company matters, there is just too much information about what we do at DEC that reaches people outside the corporation.

Everything is a compromise and we ought to consider every decision we make as a meaningful compromise. The whole art of engineering is compromise therefore engineers, of all people should be best at compromising. However, they have the worst time in making compromises. You can't build a bridge, or an airplane, or a computer that's absolutely safe in every alternative. It would take forever, cost an infinite amount of money and there wouldn't be enough weight left for cars on the bridge, you couldn't get off the ground in the airplane and you couldn't meet your schedule.

There is no safety. We're professionals, we can't get away with saying "I will go all the way, one way and be safe". We must find the best compromise and then live with the ensuing criticisms. We just learn by our mistakes and do better. That's what we're paid for in our profession. There is a list of things we must compromise in and identifying them, I think will help us face the issue.

The first area of compromise is in new technology for example LSI. The only time we claim that we've ever been ahead of technology is the day we opened our doors and we've been behind ever since. There are a number of reasons for this. When we started, we had a handful of technology. After that we had to live with our previous product and with our customers who dictated what they wanted. In general, they didn't care about technology. They wanted the products to continue, they had

problems to solve and that is what they were interested in. Compromises come because in the long run they use technology that gives the best product, the best solution to problems, the lowest price and the best reliability. We always have to face that.

I was rather disturbed with a few of our people who said "The problem with LSI is that's the company policy now, and it is going to take us longer, cost a fortune and the product may not be viable afterward because it's too late. But we got to LSI because that's the party line now." We got here so far because we weren't stupid like that. Let's not start now. We're investing heavily in it, we've encouraged it, but we don't LSI anything for it's own sake.

Ten years ago, maybe it was 3, maybe it was 13, the world was promising great things in LSI, or at that time in integrated circuits. The Professors at MIT were promising what we can just do to-day and the world hated us because we said it wasn't ready yet. We were the last ones to use integrated circuits, and then we were 6 months early. The argument that showed we were right said that we paid 60 cents per unit while Computer Control in Framingham paid 4 dollars per unit because they started a year earlier than we did and their product was therefore that much more expensive. The reason we were 6 months late was that we didn't learn how to make them until 6 months after we started. The old '8L had just one integrated circuit that was in trouble. Boy, was that a chore! Even before that, when we were saying it wasn't ready yet, and all reasoning said it wasn't, it was to some people an emotional thing---a religious issue almost. Financial Analysts would get hold of us and find out we weren't using integrated circuits; they would write the worst reports on us. We were doing no solid-state in house. There was no hope for the company, it was dead. One person called me up and asked, "Are you using positive logic?", and I replied "Negative". It took

great courage to go to annual meetings and talk to analysts and say, "Not yet", but we were right. I can go through a whole history of things in which we often looked late.

Oh, five years ago now or so, Grant Saviers was all hot on magnetic bubbles. You couldn't lose. You know, all the press agents were there around the corner. You had to get on the bandwagon; you had to be a leader or you'd lose out, even Bell said it was just coming. We were reluctant to offend Grant because he was so enthusiastic, but we said no. Well, five years later it doesn't look like we lost all that much. Waiting until we're sure has been a good policy. On the other hand, you can't survive by saying no to all new technology.

The second area of compromise is merely red tape which includes scheduling and budgeting. The Engineering Departments terrify me because I think we're training hundreds of people to be budgeters and schedulers and after awhile they all forget how to be engineers. Budgets and schedules are tools; they are not used instead of engineering. I asked one fellow what was going on in the technological field in which he has become an expert. He replied "Oh, this last year I have just been making up budgets; they've all been turned down. I haven't bothered at all". Then we wonder why people who get to be 40 can't get jobs. You know it terrifies me. I used to chair the Engineering Committee. Something would come up and we had so much red tape we had to simplify it, so the Engineering Committee took over. Now, engineers have a problem. They fall into red tape and it's like the Senate doing tax reform. You know, the Senate and Congress just passed a tax reform---they had 40,000 pages filled with things. When the Senate does it, it's called incentives. After it's done and they go ranting and raving on Television, they call it loopholes and they're going to cut them all out. They added 15,000 pages of new loopholes and complications. Engineers are like that when it comes to applying red tape. They say letting the Senate do tax reform

is like leaving an unguarded beer truck in a high school parking lot. Asking Engineers to simplify red tape I think is the same thing. Red tape, scheduling and budgeting are tools. We've got to use them but that's all they are. We're engineers and we're only useful as long as we're doing engineering.

A third area of compromise is safety. There are many things that fail for which there is no excuse. We just really work to cover all the alternatives, projects shouldn't fail. When the television studios were getting ready for the first Carter/Ford debate, I was watching them and I was suspicious. I thought, "Those young technicians only work with transistors and don't know about the unreliability of electronics. They only have one system. There is so much invested in this thing---100 million people are going to listen to it. I bet they've never run into enough trouble in their young lives to have back-up systems". I don't know what failed but I suspect they just had one microphone, one channel, and one wire out. You see, they should have had four independent systems so that nothing would go wrong. At the recent company picnic there were 10, 30, 40,000 people. You shouldn't take the word of some clerk who says the roads can take it. In some areas there is no excuse for failure, the compromise comes in because you can't make everything absolutely safe.

In Engineering there are no excuses. It has to work. I sat at IBM for a year which was the worst year of my life because I didn't have much to do, but I learned a lot there. I was representing MIT and the Air Force. I had to make sure the products were done right. I could nail them because they didn't have technical analyses on the steel racks, but I couldn't tell them to start at the joints because that wasn't in the reqs. I decided that all the people there were really making a list of reasons to show that if any failures occurred it wasn't their fault. We can't do that. We have to get the job done, make sure it succeeds

and realize there is always some chance. We musn't make a list of reasons to show that if something goes wrong it wasn't our fault. When we schedule projects, you know the normal tendency of an engineer is to schedule the test point two years away; postpone the day of failure for two years and that's just not healthy. I have often thought I wouldn't hire my son at Digital. I think if I did I would have him go into Special Systems because they succeed or fail every month and learn from it. We should make all our mistakes easy ones, our failures small and have them come soon, so we can learn.

The fourth area of compromise that I worry about in our modern engineering is the time that people aren't spending on budgeting, scheduling and other red tape, they spend preparing presentations for marketeers. Now this one I can't explain at all but I'll tell you how it looks to an outsider. A group of engineers study something, they think about it for months and they look at it from every angle. They know as much as can be known. They know exactly which way to go. But, either because they are cowardly and want someone else to take the responsibility for their decision, or for some mysterious reason I can't explain, they make massive presentations to marketing; they lay the question before them. Now the marketeers that come in have never thought about the subject before, they don't even know what the initials mean. When engineers ask them for a point of view they get back from 100 people 100 points of view that become 1,000 points of view before the meeting is over. Marketeers have changed their mind a week later at the next meeting. How do we make decisions in this outfit? Well, engineers already know what is right. They are asking people who never thought of the subject and it seems to me there is a compromise here unless there is something I missed completely. There is a magic word here called "buy-in". Heaven only knows what it means. Because engineers have a project they don't want to do engineering on, they'll work two years budgeting

and scheduling, they won't do any work, won't read a magazine, won't look at a book, nor a catalogue and won't draw up our diagrams because they won't do any real work until they have this buy-in from marketeers. I can't explain the logic behind this either because by the time the project is done, those marketeers have gone somewhere else. Even if they are still here when the project comes out, they've forgotten what they said. There is no such thing as "buy-in". You can't accomplish what you want if you want marketeers to buy-in. If you want their point of view, lay out what you want--what you know is right. Say this is what we are going to do---speak up. If they have any thoughts on the matter whatsoever they'll speak up. If they don't they haven't thought about it anyway. So there is no point in getting together in a big room.

Another area comes in discipline. We follow sort of the New England tradition of revolutionary soldiers. Rebelers is often what we look like and behave like. We think we won the Revolution because those crazy British soldiers marched in straight rows, wearing red uniforms and when they finally got around to shooting the guns, they fired together and never aimed. The smart Americans who stayed behind the trees and stone walls did shoot it out. The real story is that whenever the British started shooting back, the Americans just ran. They weren't organized or disciplined at all. The whole fight that we're so proud of in Concord was one big mistake. The Americans were so undisciplined and unorganized they just gotthe whole thing started by mistake. They really didn't win until they hired some European officers who taught the Americans how to march in straight rows, shoot on command, and not run when the other side shot back. When they finally got discipline, they won the war. You can take all these great stories on discipline with a grain of salt. Complete discipline would be too much of course. It's a compromise. Gordon Bell has a problem in this area, he is very well organized and very disciplined. He works hard. When he goes on vaca-

tion he comes back and says "Ken, I relaxed. Look at the program I wrote." Once in a while he has a flirting experience with freedom. His secretary has him scheduled. He's away somewhere where he can truly be creative without any of the burden of schedule. It is so great to be so productive. You must remember he is doing it at a time of great discipline and that's when it's productive. No discipline whatsoever and there's never any production at all. We have to have discipline in our organization, our lives, our way of doing things. Compromise comes in because too much obviously by definition is too much.

Another area of compromise is in management. Managers always have to compromise. They can go to extremes. One extreme is to do it all themselves and we have a few like that. We can't get them to do anything right because the projects have to stay small so they can do everything themselves. It frustrates the men working for them. It frustrates the boss. Nothing happens until he gets around to it. He's not manager at all. The other kind of manager who maybe is even worse, abandons everything. In between there is a compromise. Being a manager is always playing that compromise. He has to realize it and always face it. There are all kinds of tricks you can use to help. One way is to have everything scheduled and have reports made that people need in order to do their job. When something falls apart you know it and then you can visit the people who are in trouble. It turns out that we have most of the company reporting. There are two areas we don't get reports from. One is the administrative area, except for payroll. You know that every Thursday, they make that payroll. That's because in effect they get a report. They'd get slaughtered if they didn't make it. The second area is personnel---they have so many projects. But one week is the same as any other week, and <u>no</u> reports. Engineering sometimes takes forever, but it always comes out. Those things we watch come out, and those we don't watch never come out. It's one of the tricks.

The other trick is when you're a manager, to threaten the people that you may do better than they. I had lunch with the editor of one of the big newspapers in Boston and had been critical of him. As we were walking out he asked, "Do you ever have trouble motivating these 30-35 year old people?" I said, "Our trouble is we can't get them to go home." My frustration with that newspaper is that the reporters don't know what they are doing. They report freely but don't know what they are writing about. I figured what the editor should do. If he would say "Let it be known that every month I am going to become an expert on a new subject. It might be schools in Boston, or the State Finances, or Welfare, or busing in Boston." But not tell anybody what those things were, it would change all those reporters attitudes. The prospect that the editor knows more than they do would just change the whole organization. I got mad at somebody this year. He wanted to make something. I said, "Okay, if that's the way you want to do it. Remember, I'm going to go in and do it over afterwards." As I left the meeting he came chasing after me. He said, "I catch on. But you were right!" It's good for the boss.

We used to work for J. Forrester, he did tremendous kinds of things with computers. Looking at his pictures on our walls now, we realize that he was so young. We would never get any responsibility with that young look at that age. At that time, radar was still kind of fascinating. The idea of getting a megawatt out of a 10 watt tube was just so fascinating. We called his style pulse management. He would come in with one pulse; he would come in on a Saturday and concentrate on the stock room. But he really knew it; he laid out the whole thing. Pulse management sure can keep people on their toes because they can't ever tell when you're going to come down and pulse them and know more than they do. They had better be awake. Keeps a whole outfit sharp!

The other area in working out this compromise is to delegate, of course you can't abandon it either or nothing happens. One technique is

to read a little about warfare. Sometimes you can even get it from television. Someone is defending a position. If you're an officer and you have ten foxholes or ten machine guns out there, your defending that position. Every hour you go by and check every single machine gun, every single mortar, every single position. You make sure you're men are not dead, they're not sleeping, they're not sick and they haven't run away. You make sure they're ready every hour. There is no such thing as loosing the position and saying "Well, I sent them out there; I checked yesterday." When World War II started, the French had a command post set up. They had a castle and all communications into that castle where the command was, were by horse. Once a day, the messenger would carry in all the messages from the front on horseback. In a matter of 2 or 3 days the Germans were all around them. The Germans didn't run their army that way. They had everything under control, they were organized in such a way that they knew everything that was going on. When you're a manager, you have to manage so that you know everything that is going on. There is no such thing as, "I trusted so and so and he let me down." Rommel was one of the best generals of the war, maybe even before he was general. He was right there with his troops. He probably didn't shoot a gun; he didn't take part in anything, but he knew every single part of his army and he thought about it all the time. He really knew what was going on; he was in command. He ran his army and everybody else ran in front of him because he really was in command. There's another part of that story of Rommel which a few of you should think about also. He worked so hard at it, he got sick. Germany lost the war in North Africa while Rommel was in Germany recovering from his illness. So you see you can't do so much of it you get sick. Managing is something you manage, you can't really keep up on everything. Not all the time, there are 52 weeks in a year, each week, you pick up on something.

What happens to middle age people? In general, they want to go off and do management. Engineers want to retire from engineering. I think maybe our society has forced us into doing that and engineers ought to fight it. It's O. K. to be a manager; we're depending on it. But we should, I think, never become managers because we want to retire and get an easy job. There is no easy job. You ought to fight it and always take the hard jobs. Always work hard at it and when you become 40 or 50 you'll be in demand. During the last recession, about four years ago, a lot of people in Massachusetts who were 45 and 50 were looking for jobs. They thought they couldn't find work because they were that old. I interviewed a number of them and consistently they said that they used to be engineers, they used to be draftsmen, or they used to be machinists. But they got promoted into some administrative work, got very well paid and now they couldn't get a job. The secret of it, I think, is always be something. Don't be a nothing. Be in demand. The interesting thing is that our society wants us to be promoted into a do nothing administrative job. Be someone who's been something for 45 years.

The easiest case I think is of a draftsman and machinist who got a job at 20. At 65 he had 45 years of experience. No matter what he did we wouldn't let him out if he came here looking for a job. Can you imagine a machinist with 45 years of experience? We wouldn't let him go. But if someone would say, "At 35 I was such a good machinist they pushed me into the office..." This hit me hard, because I had a friend quite a bit older than I was. He was an excellent machinist. I believe a pretty skilled one. General Electric promoted him into an office job. They had a cutback and at 55 they had to let him go. They retired him early, generously, they did everything a company could do. He died within a year. He didn't have a job. He should never have left being a machinist because going to a job with nothing to it was really too dangerous. It wasn't satisfying. We've got to do the hard jobs. I know most of you

are young; we're all young. Work for the day when you are 45, 55, and 65 so that you'll be in demand. You know that we worry about old people. All society doesn't love old people. They are selfish; they are contrary; they don't love anybody; they can't get along with anybody; they do everything for themselves; they don't save a penny. When they get to be 65 no one can stand them because they are so irritable. And then we say isn't it a terrible thing, society doesn't take care of them. I think we'd better work on our personalitites so that our kids and people will want us when we are 65 and 70. I go canoeing with someone who this year is 67 or 68. We started about 12 years ago.....we were sitting by the fire, and the subject came up on how old he was. I said, "55! If I knew you were that old I wouldn't have taken you!" Well at 67 he just won't admit to any weakness. He is such good company. He'll carry his share. He'll carry a canoe or a pack. This year we went down the St. John River. It was around Labor Day and it was cold. There was one quarter inch of frost on our paddles in the morning. He didn't complain at all. It didn't dawn on me until that night that he had put on two pairs of woolen socks before he got into his down sleeping bag. But he didn't complain. He's good company. He works at being young. If you look around, who would you like to be like when you get to be 55 or 60? You'll find people who have jobs which challenge intellectually at which they fail or succeed. They are teachers, preachers, professors or people who have to produce every day. We ought to learn to be GOOD.

MJ read & ret. Copy to Ed Schein & ret. or call, to send.

digital

INTEROFFICE MEMORANDUM

TO: Stratton Mountain Attendees

DATE: January 17, 1977
FROM: Dennis Buckley DJB
DEPT: Micro Products
EXT: 5855
LOC/MAIL STOP: ML1-2/E61

Gordon Bell
FEB 0 5 1977

SUBJ: KEN OLSEN'S STRATTON MOUNTAIN SPEECH (DJB-69)

Attached is a transcript of the speech Ken gave on the evening of 29 September 1976 at the Micro Products Development Engineering Meeting at Stratton Mountain, Vermont. The speech was transcribed from the video tapes of the meeting.

I have found this good reading for both new and old employees.

DB/cmm
Attachment

MJ please get me another copy.

Alan Kent

~~&~~ This should be summarized / boiled down to say 3-6 pages.

§

Welcome to Gale's Corner - I don't know if we're here to learn something or just appreciate all that Gale has done this last year but in either case it's educational and worthwhile.

I'm afraid of a few things. In their need to tell you everything, I'm afraid they have put it all down neatly in one or two little booklets. Show great respect for them. I don't want, at the Annual Meeting, to face financial analysts who know more about what's in those books than I do and try to explain them, and I don't want Data General to know exactly what we're doing. Sometimes we don't fully appreciate the importance of keeping your mouth shut because any one thing doesn't look all that significant. But all together, they really are important. So show great respect for the books. As a matter of fact, any time we, as a company, are so open and do this sort of thing, we invest heavily in communicating. Don't communicate with your neighbors though. There is just too much information about what we do that goes outside.

Lorrin asked me to come tonight and make the introductions, and I for this last summer have been worried about engineering, so I said, "sure, I'll come. I won't talk about LSI, but I'll tell you what I worry about in engineering" and what could he do but let me. Then in a note he sent to me he said, "Don't say anything about LSI, we'll cover that." But there are some advantages about being first, so I'll cover that as my first subject. Depending upon what's bothering me, I'll bring up different issues, and just to make sure we cover everything I've asked the O^2D that's here - Gordon, Dick, Bob, Henry - to come up after I'm finished, to sit here and to each make some comments. They can argue with

what I've said, bring up things I've forgotten, bring up their own ideas, and then after that, we'll open up for a free-for-all discussion.

My point tonight is that everything is a compromise, and we ought to consider everything as compromising. Engineers should, of all people, be best at compromising because engineering really is compromising. You can't make a bridge, or an airplane, or a computer that's absolutely safe for every alternative. It would take forever, cost an infinite amount of money, and there wouldn't be any weight left for the cars on the bridge or you couldn't get off the ground in the airplane--and we always have schedules. The whole art of engineering is compromise. However, engineers of all people have their worst time making compromises, so I want to just go through a list of all the things we have to compromise in, and just in identifying them, I think may help us to face the issue. There is no safety. We're professionals--we can't get away with saying, "I will go all the way one way and be safe." There is no safety. We have to go find the best compromise, and then live with the criticisms afterwards. We just learn from our mistakes and do better. That's what we're paid for in that profession we chose.

The first area of compromise is in new technology - for example LSI. The only time in our history we say this, it's not completely true. The only time we claim that we've ever been ahead technologically, is the day we opened our doors, and ever since then we have been behind. And there are a number of reasons for

it. When we started, we had a handful of technology. After that we had to live with our previous product, live with our customers, and our customers dictated what they wanted. They didn't care about new technology. They wanted the products to continue and they had problems to solve, and that is what they were interested in. In general, they didn't care about technology. The compromise comes because in the long run they do use the technology that gives the best product, the best solution to answers, lowest price, and the best reliability. We always have to face that.

I was rather disturbed with a few of our people--they aren't here tonight. Lorrin asked me how many people I recognized, and I said "a good number". Somebody else said, "a small number of them." Lorrin said, "I recognize everybody." I said, "That's because he only picked the people he recognized." The thing that bothered me with these people was they said the problem with LSI is that's the company policy now, and it is going to take us longer, cost a fortune, and the product may not be viable afterward because it's so late. But we got to LSI because that's the party line now. We got here so far because we weren't stupid like that. Let's not start now. We're investing heavily in it, we've encouraged it, we encourage a meeting like this, but we don't LSI anything for it's own sake.

Ten years ago, maybe it was 3, maybe it was 13, the world was promising great things in LSI, or at first, integrated circuits at that time. The Profs. at MIT were promising what we can just do today, and the world hated us because we said it's not ready yet. We were the last ones to use integrated circuits, and then we were 6 months too early. The argument that showed we were right said that we paid 60 cents per unit while Computer Control

in Framingham paid $4.00 per unit because they started a year earlier than we did, and their product was therefore that much more expensive. The reason we were 6 months too late was that we didn't learn how to make them until six months after we started. The old 8L had just one integrated circuit that was in trouble. Boy, that sure was a chore! But before that, when we were saying it's not ready yet, and all reasoning said it wasn't, it was to some people an emotional--a religious issue almost. Financial Analysts would get hold of us and find out we weren't using integrated circuits. They would write the worst reports on us. There was no hope for the company. We were doing no solid state in-house. The company was dead. One person called me up and said, "Are you using positive logic?", and I said, "Negative." It took great courage to go to annual meetings and talk to analysts and say, "Not yet," but we were right. I go through a whole history of things in which we often looked late.

Oh, five years ago now or so, Grant Saviers was all hot on bubbles. You couldn't loose. (It's not a girl. I have to explain this to some of these people--some of the executives.) You know all the press, they were there around the corner. You had to get on the bandwagon; you had to be a leader or you'd loose out, and even Bell, when they wanted to sell his patents on this said it was just coming, and we were so reluctant to offend Grant because he was so enthusiastic, but we said no. Well, 5 years later it doesn't look like we lost all that much. Waiting until we're sure has been a good answer. On the other hand, you can't survive saying no to all technology. This late at night I loose the train of thought periodically, but you're probably tired also. I still

loose my voice once in awhile. This summer I lost it altogether, and at that time I sounded like the Cookie Monster or Mayor Daley in Chicago.

The second area of compromise is merely a red tape which includes scheduling and budgeting. The Engineering departments terrify me because I think we're training hundreds of people to be budgeters and schedulers and after awhile they all forget how to be engineers. Budgets and schedules are tools; they are not used instead of engineerng. I talked to one fellow who I said what is going on in this technology which he has become the expert in? He said, "Oh, this last year I have just been making up budgets; they've all been turned down. I haven't bothered at all." Then we wonder why people, when they get to be 40, can't get jobs. You know, it terrifies me. Now, engineers have a problem. They fall into red tape; it's like the Senate doing tax reform. I used to chair the Engineering Committee. Something would come up, and we just had so much red tape we had to simplify it, so the Engineering Committee took over. You know, they had tax reform--the Senate Congress just passed--they had 40,000 pages of this thing filled with things. When the Senate does it, it's called incentives. After it's done and they go ranting and raving on TV, they call it loopholes, and they're going to cut them all out. They added 15,000 pages of new loopholes and complications. Engineers are like that when it comes to applying red tape. They say letting the Senate do tax reform is like leaving an unguarded beer truck in a high school. Asking engineers to simplify red tape, I think, is the same thing. Everything has to be filled with red tape. We're engineers; we're only useful as long as we're doing engineering. Red tape, scheduling,

budgets, are tools. We got to use them but that's all they are, and we got to make sure we're doing engineering.

The other compromise is in the area of safety. There are many things that fail for which there is no excuse.

We just really work to cover all the alternatives, projects shouldn't fail. When they were getting ready for the great debate last week, I was watching them, and I just was suspicious. I thought those young technicians only work with transistors and don't know about the unreliability of electronics. I just watched them and thought they only had one system. There is so much invested in this thing--100 million people are going to listen to it. I bet they've never run into enough trouble in their young lives to have back-up systems. Now I was just guessing that and talking to myself. I don't know what failed, but I suspect they just had one microphone, one channel, one wire out--whoops--and one glass of water. They should have had four glasses of water. I better drink the rest of it; I might loose it. You see, they should have had four independent systems so that nothing went wrong. In the company picnic a week ago, you have 10, 30, 40,000 people, or whatever it is. You just shouldn't take the word of some clerk down there that says the roads can take it. Some areas there is no excuse for failure. The compromise comes in because you can't make everything absolutely safe. It would take forever. If we made the premise absolutely safe, you could never have it.

In engineering there are no excuses. It has to work. I sat at IBM for a year, which was the worst year of my life. I learned a lot there, but I didn't have much to do. That's why it was the worst year of my life. I was representing MIT and the Air Force. Sitting there at IBM, I had to make sure the products

were done right. I could nail them because they didn't have technical analyses on the steel racks, but I couldn't tell them to start in the joints because that wasn't in the reqs. But while I was sitting there being critical, I decided all those people there were really making a list of reasons to show that any failures weren't their fault if it ever failed. We can't do that. We have to get the job done, make sure it succeeds, and realize there is always some chance, and not make the list of reasons to show that it was the clerk down at the picnic place that said something, and they were wrong, and it wasn't our fault. When we run into trouble, learn from it. We should also make all our mistakes easy ones. Make mistakes early. When we schedule projects, you know, the normal tendency of an engineer is to schedule the test point two years away. I have often thought I wouldn't hire my son for Digital, but I often wonder if I would hire him here. I think if I did, I would have him go into Special Systems because they succeed or fail every month, and they learn. Engineering always has a tendency to postpone the day of failure for two years and that's just not healthy. We should make all our failures small and have them come soon, so we can learn.

Another area of compromise that I worry about in our modern engineering is the time that people aren't spending on budgeting, scheduling and other red tape, they spend preparing presentations for marketeers. Now this one I can't explain at all. I can't figure it out, but I'll tell you how it looks to an outsider. A group of engineers study something, they think about it for months, and they look at it from every angle. They know as much as can be known. They know exactly which way they should go. But, either because they are cowardly and want to have someone else to take the responsibility for their decision, or for some mysterious reason I can't explain, they make massive presentations to a big marketing group. They get a group like this and lay the question before them. Now the marketeers that come in have never

thought about the subject before, they don't even know what the initials mean. When engineers ask them for a point of view they get back from 100 people 100 points of view. The engineers think that if they keep talking, a consensus will come out. Of course, that 100 becomes 1,000 points of view before the meeting is over. They come back next week, the marketeers have even changed again. How can we make decisions in this outfit? Well, they already know what is right. They are asking people who never thought of the subject, and it seems to me there is a compromise here unless there is something I missed completely. Now there is a word that's magic here called "buy-in." Heaven only knows what that means. Because engineers have a project they don't want to do the engineering on, they'll work two years budgeting, and scheduling. They won't do any work, won't read a magazine, won't look at a book, won't look at a catalogue, and won't draw up our diagrams because they don't do any real work until they have this buy-in from marketeers. The logic behind this I can't explain either because by the time the project is done those marketeers have gone somewhere else. Even if the same marketeers who were brought in are there when the project comes out, they've forgotten what they said. There is no such thing as "buy-in." But I can't explain all that has come out of this modern engineering. I think about it carefully, and see if there isn't some compromise, because to an outsider, it seems just a bad waste of time. You can't accomplish what you want if you want them to buy-in. If you want their point of view, layout what you want--what you know is right. Say this is what we are going to do--speak up! If they have any thoughts on the matter whatsoever they'll speak up. If they don't, they haven't thought about it anyway. So there is no point in getting together in a big room.

The other area comes in discipline. We follow sort of the New England tradition of revolutionary soldiers. Rebelers is often what we look like and behave like. You see we have read only certain of the stories about the revolution. We didn't read them all. We think we won the revolution because those crazy British soldiers marched in straight rows, wearing red uniforms, and when they finally got around to shooting the guns, they shot them together and never aimed. The smart Americans, who stayed behind the trees and the stone walls, did shoot it out. The real story is that whenever the British started shooting back, the Americans just ran. They weren't organized or disciplined at all. That whole fight that we're all so proud about here in Concord was one big mistake. The Americans were so undisciplined and unorganized they just got the whole thing started by mistake. They really didn't win until they hired some European officers who taught the Americans to march in straight rows, shoot on command, and not run when the other side shot back. When they finally got discipline, they won the war.

In all these great stories on discipline, you can take them with a grain of salt. It would be too much, of course. It's a compromise. You have to watch out for Gordon Bell. Here's Gordon's problem in this area. Gordon is very well organized and very disciplined. He works too hard. Periodically, I get together with his wife and make sure he goes on vacation, but not very successfully either. He comes back with a program. He says, "Ken, I relaxed. Look at the program I wrote." He's organized and disciplined. Every once in awhile, he has a flirting experience with freedom. His secretary has him scheduled. He's away somewhere where he can truly be creative without any of the burden of schedule. It is so great, to be so productive. He thinks the secret of productivity is no discipline and freedom. You have to remember he is doing it from the time of great discipline, and that's when it's productive. No discipline whatsoever, and there's never production at all.

We, as a society, went through a time when we thought discipline was bad and limited creativity. Now, the last thing you can sell is one of these schools where we encourage creativity with no discipline. We have to have discipline. In our organization, our lives, our way of doing it, the compromise comes in because too much obviously is by definition too much.

The other area of compromise is in management. About one-half of you are managers. Managers always have a compromise. They can go to extremes. One extreme is to do it all themselves, and we have a few like that. We can't get them to do anything right, because the projects always have to stay small so they can do everything themselves. It frustrates the men working for them. It frustrates the boss. Nothing happens until he gets around to it. He's not a manager at all. The other kind of manager who maybe is even worse, because you have no handle on it, abandons everything. He heard about these terrible people who can't let go, so they let go of everything. In between there is a compromise. Being a manager is always playing that compromise. He has to realize it and always face it. There are all kinds of tricks you can use to help. One way is to have everything scheduled and have reports made. Reports can be tedious. Reports only should be what people need in order to do their job. Just writing reports does wonders for keeping everybody going. When something falls apart, you know it, and then you can visit the people who are in trouble. It's just a good way of managing. It turns out that most of the company we have reporting. Scheduling whatever they're doing and reporting. Two areas we keep getting into trouble. This didn't dawn on me until last week. We don't get reports from them. One is the administrative area, the finance administrative area, except for payroll. You know that every Thursday they make that payroll. That's because they get a report. It's in effect a report. They get slaughtered if they didn't make it. So they

haven't missed it yet, I don't think. And personnel--they have so many projects. But one week is the same as any other week, and no reports. Engineering sometimes takes forever. Oh, I get frustrated. But it always comes out. Somebody said about engineering, "You know these reports and these schedule reviews we have, they are such a waste. They just snow us. They just don't seem worthwhile." You know those things we watch come out, and those things we don't watch, never come out. It's one of the tricks.

The other trick is to, when you're a manager, threaten the people that you may do better than they do. I had lunch with the editor of one of the big papers in Boston, and had been so critical of him. As we were walking out, the editor said, "Do you ever have trouble motivating these 30-35 year old people?" I said, "Our trouble is we can't get them to go home." I figured out what he should do. I think it's a technique in management which we use at times, and we ought to use more. My frustration with that newspaper is that the reporters don't know what they are doing. They report freely and they don't know what they are talking about. But if the editor said, "Let it be known every month I am going to become expert on a new subject. Might be schools in Boston, or the state finances, or welfare, or busing in Boston." But not tell anybody what those things were, it would change all those reporters attitudes, because right now they know nothing. But nobody knows any more. The prospect that may be the editor knows more than they do would just change that whole organization. I got mad at somebody this year. Don't laugh! I'm thinking of only one case. He wanted to make something. I said, "Okay, if that's the way you want to do it. Remember I'm going to go in and do it over afterwards." As I left the meeting he came chasing after me. He said, "I catch on. But you were right! You were right!" It's good for the boss.

We used to work for J. Forrester and being young kids, at the time, he did tremendous kinds of things with computers. At the time, looking at his pictures on our walls now, he was so young. We would never get any responsibility with that young look at that age. But we accused him of pulse management. At that time radar was still kind of fascinating. The idea of getting a megawatt out of a 10 watt tube was just so fascinating. We called his style pulse management. He would come in with one pulse. He would come in on a Saturday, concentrate on the stock room. But he really knew it. He layed out the whole thing. Pulse management is not a bad way. It sure can keep people on their toes because they can't ever tell when you're going to come down and pulse them and know more than they do. They better be awake. Keeps a whole outfit sharp!

The other area in working out this compromise, the reason you have to delegate is, of course, you can't do it all yourself. But you can't abandon it or nothing happens. One technique is to read a little bit about warfare. Sometimes you can even get it from television. Someone is defending a position. If you're an officer defending a position, and you have ten foxholes or ten machine guns out there, your defending it, and every hour you go by, you check every single machine gun, every single mortor, every single position. You make sure they're not dead, they're not sleeping, and they're not sick, and they didn't run away. Every position you check, every hour, and make sure they are ready. There is no such thing as loosing the position and saying, "Well, I sent them out there; I checked yesterday." Every position, every hour. When WW II started, the French had a command post set up so they could fight WW II. They had a castle, and all the communications into that castle where the command was were by horse. The messenger would carry in all the messages from the front by horse once a day. In a matter of 2 or 3 days,

the Germans were all around them. The Germans didn't run their army that way. They had everything in control, knew everything that was going on, and they organized in a way so they knew everything that was going on. When you are a manager, you have to manage so that you know everything that is going on. There is no such thing as, "I trusted so and so, and he let me down." You know what's going on. Rommel was one of the best generals of the war, maybe even before he was a general. He was right there with his troops. He probably didn't shoot a gun. He didn't take part in anything, but he really knew what was going on. He knew every single part of his army, and he thought about it all the time. He was in command. He ran that and everybody else ran in front of him because he really had command. There's another part of that story of Rommel, which, a few of you should think about also. He worked so hard at it, he got sick. While he was in Germany recovering, that's when they lost the war in North Africa. So you can't do so much of it you get sick. But managing is something you manage. While you're managing there is no time to get up on technology. Because in managing, you can't really keep up on everything. Not all the time. One thing at a time, fifty-two weeks of the year, each week, you can pick up on something.

The last area I want to make some comments on is our personal goals as engineers. Ed Shine is our consultant from MIT. He's an industrial psychologist, before they got these high-faluten names. But Ed's good! We've hired him to interview much of our engineering department just to get a feeling of what's going on and see what direction we ought to go in. So he talks to you. Two things tell him something because he's learning from us. He's probably going to write a book about it too, anyway. But he won't use your name. While he's there you know you get some help from him. It's free. I don't know what Ed does, but everything works out well after he's around. You see, we are superstitious. When things work, there is no point in fooling around with it.

We like lucky people. For some engineers, everything works out well, and it's important to identify that even if they don't look right ; they didn't go to the right school, they don't do it right, but they are always lucky. Other people talk right, talk so well, go to the right school, but nothing works out. We want to identify the lucky people . In Ed Shine's area, we like him because everything works out well after Ed's been around, which isn't strictly superstition, but it can't always be true. Ed's worry perhaps, as he gets toward middle age, is middle age people and what happens to them. He's written some papers on it. In general, people want to go off and do management. They want to retire from engineering. Ed, being a soft scientist, I think, concludes that that's the way engineers have to be. I think maybe our society has forced people into doing that, and engineers ought to fight it. It's okay to be a manager. We're depending on it. But we should, I think, never become managers because we want to retire and get an easy job. Because there's no easy jobs. You ought to fight it and always take the hard jobs. Always work hard at it and come 40 or 50 we'll be in demand. During the last recession, about four years ago, a lot of people in Mass. were looking for jobs who were 45 and 50. They thought it was because they were that old. I interviewed a number of them and consistently they said they used to be engineers, they used to be a draftsman, or they used to be a machinist; but they got promoted into some administrative thing, got very well paid, and now they couldn't say what they were. But they knew they were very well paid, and they couldn't get a job. The secret of it, I think, is always be something. Don't be a nothing. Be in demand. The interesting thing is that our society wants us to be promoted into a do nothing administrative job. Be someone who's been something for 45 years.

The easiest case, I think, is of a draftsman and machinist who got a job at 20. At 65 he has 45 years of experience. No matter what he did, we wouldn't let him out the door if he came looking for a job. Can you imagine a machinist with 45 years of experience? We wouldn't let him go. But, if someone would say, "At 35 I was such a good machinist they pushed me into the office..." This hit me hard, because I had a friend, quite a bit older than I was. He was an excellent machinist. I believe a pretty skilled one. General Electric promoted him into an office job. They had a cutback and at 55 they had to let him go. They retired him early, generously, everything a company could do. He died within a year. He didn't have a job. He should have never left being a machinist because going to a job with nothing to it was really too dangerous. It wasn't satisfying. We got to do the hard jobs. I know most of you are young; we're all young. Most of you are very young. Work for the day when you are 45, 55 and 65 so that you'll be in demand. You know that we worry about old people. All society doesn't love old people. They are selfish; they are contrary; they don't love anybody; they can't get along with anybody; they do everything for themselves; they don't save a penny. When they get to be 65 no one can stand them because they are so irritable, and then we say isn't it a terrible thing society doesn't take careof them. I think we'd better work on our personalities so that our kids and people will want us around when we're 65 and 70. I go canoeing with someone who this year was 67 or 68. We started about 12 years ago, I think--he was 55. We were sitting there by a fire, and it came up how old he was. I said, "55! If I knew you were that old I wouldn't have taken you!" Well, at 67 he just won't admit to any weakness. He is such good company. He'll carry his share. He'll carry a canoe or a pack. This year we went down the St. John River. It was Labor Day approximately, and it was cold. There was 1/4" of frost on our paddles in the morning. He didn't complain at all. It didn't dawn on me until that

night that he put on two pair of wool socks before he got into his down sleeping bag. But he didn't complain. He's good company. He works at being young. If you look around, who would you like to be like when you get to be 55 or 60? You'll find people who have jobs which challenged; at which they failed or succeed. Where they are challenged intellectually . They are teachers, preachers, professors, or people who have to produce every day. We ought to do that. We ought to learn to be good. Maybe I ought to stop there. Henry looks like he has something to say; so rather than continue on, I'll invite the fellows up. They each can say something for one-half hour or one-half minute, and then we'll open up a free-for-all.

File Ken's Dick

Copy to Ken

Note

E 52-584
Massachusetts Institute of Technology
Alfred P. Sloan School of Management
50 Memorial Drive
Cambridge, Massachusetts, 02139

Edgar H. Schein
Chairman, Organization Studies Group

Looks great to me a good Summary of what I feel about Ken's wishes. It is not a complete set to succeed but it is also clear that one must meet the intent to succeed in the environment. You should circulate to the rest of us. Dick

SEP 00 1976

August 26, 1976

Mr. Gordon Bell
Mr. Dick Clayton
Page Farm Rd.
Lincoln, MA 01773

Dear Gordon and Dick,

I don't really have anything profound to say in this memo but some things became very clear to me about Ken's management style and they may be helpful to put down in an explicit way.

Ken's principles of management are;

1) Stay involved with your project (or your immediate subordinates) at all times; meet with them regularly, keep control by knowing what is going on, stay on top of that for which you are accountable. But above all else, stay involved enough to really know what is going on. Ignorance or neglect is sin, punishable by excommunication.

2) Always retain and maintain the initiative; keep going forward doing what you think is right until someone stops you or tells you that what you are doing is stupid or harmful. Under no circumstances become passive or ask others what you should be doing, especially if the others are not as likely to know as you.

3) Be open and above board at all times so that if you are doing something dumb or harmful, others can spot it and tell you about it. Under no circumstances build a wall around yourself because then you become isolated and run the risk of doing something dumb. Once people tell you things, listen to them.

4) A product without a market is better than a market without a product!

5) Plan ahead and sell your plan through a budget. Once the budget is approved live within it. If you cannot live within it, propose a change in the budget. If things go wrong or are not anticipated, decide what you need and go to the "boss" and ask for it. Don't hide problems, don't play political games, don't get scared of unanticipated events. Figure out what is needed to compensate for them and go sell the new plan.

6) Don't lose touch with the people below you in the organization. Open up channels of communication downward and upward, and listen.

7) Don't propose a new solution (new product line, new projects, new group, etc.) until you figure out what went wrong with the old one.

The implication of all this for OOD is fairly clear. Keep the initiative, don't let marketing (whatever is marketing) become an inhibiting force; you be the integrators if there is conflict, but let everyone know what you are doing so that you can get feedback; don't ask questions about things that they don't know any more about than you, and maybe don't ask questions period. Make your own decisions, be open about them, and get feedback.

This does not solve the marketing/sales problems, but that is not your problem. Others will have to worry about how to market and sell the low end products, if I hear Ken right. But the fact that there is a problem there is no excuse to slow up on good product development, and no excuse for undermanaging engineering projects (in terms of the above "principles.")

Sincerely,

Ed (msk)

P.S. Do you have any objections to sharing this memo with Ken? I would like to show it to him to check out how accurately I am hearing him.

EHS:MSK

Note Ken Dick's ✓ comment To: OOD copy for me. Gordon Brauer Thompson

Probably easy to restate to get as a policy to be appended to corporate goals... Or engineering Operations (OOD Handbook update).

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Edgar H. Schein
Chairman, Organization Studies Group

To Gordon: I agree with Ken & Ed but again. This is a quite fundamental issue and in no small way at odds with some instincts and training of both Bob & Larry. It is an issue of degree. like anything else it is a balance issue. The issue is one of visibility to the data for three several levels down and the amount of formal this sort of policy encourages. Dick

SEP 08 1976

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5) Plan ahead and sell your plan through a budget. Once the budget is approved live within it. If you cannot live within it, propose a change in the budget. If things go wrong or are not anticipated, decide what you need and go to the "boss" and ask for it. Don't hide problems, don't play political games, don't get scared of unanticipated events. Figure out what is needed to compensate for them and go sell the new plan.

6) Don't lose touch with the people below you in the organization. Open up channels of communication downward and upward, and <u>listen</u>.

7) Don't propose a new solution (new product line, new projects, new group, etc.) until you figure out what went wrong with the old one.

BJ

ATTACHED: MEMO;18 MEMO;145

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digital Interoffice Memo

TO: SYSTEMS TASK FORCE:

DATE: WED 6 JUN 1984 10:29 AM EDT
FROM: GEORGE CHAMBERLAIN
DEPT: ENGINEERING FINANCE
EXT: 223-5305
LOC/MAIL STOP: ML02-2/U48 (ENG. FI->

NANCE)

MESSAGE ID: 5238789141

SUBJECT: A CORPORATE EMERGENCY

For your info.

ATTACHED: MEMO;145

---

digital Interoffice Memo

TO: see "TO" DISTRIBUTION

DATE: MON 4 JUN 1984 3:56 PM EDT
FROM: KEN OLSEN
DEPT: ADMINISTRATION
EXT: 223-2301
LOC/MAIL STOP: ML10-2/A50

MESSAGE ID: 5238585527

SUBJECT: A CORPORATE EMERGENCY

When a pilot says he is in trouble and needs some help, he is asked, would he like to "declare an emergency." He is often reluctant to do this; he will try to get by without that formal act.

When he declares an emergency, all resources are available to help him, everything in the neighborhood comes to a halt, and the highest priority in that area is to get him safely to the ground.

This is expensive, and after it is done there is a formal, legal inquiry into how it all happened. This, of course, makes people reluctant to "declare an emergency."

I am about to declare an emergency at Digital in the world of small computers. There are a number of reasons why we did a terrible job in the personal computers and why we do poorly in the small business. We have discussed some of them, but they are relatively unimportant. We built too much quality into the

product, we announced them before they were done, we took orders before the products were completed, and we spent more money on advertising than we did on servicing the customer.

These problems are survivable and we have already proved this. We have a good product and the customers love them, but we are missing two things that we set about to do as initial goals and the stated goals all along the program. Management feels its job is budgets and finance, and that, miraculously, technical goals should be taken care of by someone else and management will not take part in these goals.

Corporate management spends a lot of time squeezing budgets so that on paper we make a profit, and Engineering management spends a lot of time squeezing budgets so that they can get all the projects they initiated done, even though none of those projects solve the basic Corporate needs.

We are missing two basic things that we have said many times in the several years we are going to accomplish.

We still have no plan, no techniques, and no ambition to be able to tell a small customer how he can integrate his small computers into a system for running a business, his agency, his brokerage company, his small hospital, or his store.

We still have no plan to make a system which is so simple that anyone can understand it, anyone can sell it, anyone can install it. We do not need another wheel-around computer that has more options, more freedom, more complexity than we have ever had before in any of the computers we have ever built.

Our plans are still to insist that the customer figure out if he wants to have serial or parallel communications, synchronous or asynchronous lines, buffered or unbuffered lines, RS232, RS423, RS422, RS449, or 20 ma. loops. Then, to top it off, the customer has to decide which combination of the above he wants in funny sounding modules.

We do not know the difference between distributed processing and time sharing, but we expect the customer to figure it out and order all the parts he needs to do what he wants to do. Of course, we won't have the software to help him, but we will have a vast number of pieces which our salesmen, of course, cannot figure out how the customer should use, but with all of that stuff, the customer surely should be able to figure out something.

I am about to declare an emergency.

Most of our small business marketing groups came from the OEM world, which insists on all this freedom. To them, systemness means they have never forgotton anything the customer may possibly want in some weird set of conditions or in some state of ignorance. I do not think they could sell a product which was so simple that anybody could install it and use it.

I am about to declare an emergency which will set about to develop a naive, limited, simple minded J-11 Q-BUS smart server that would integrate distributed small processors in an organization. The same box would be a disk server when ETHERNET

is necessary.

I am about ready to contract outside, a small business plan that would have naive, simple minded, limited set of computers and hardware that would allow a small number of configurations that anyone could understand, and software which is naive and efficient, but readily understood by everybody and that are hooked together with our new RS423 serial lines that are so easy to use anyone can do it, but then not allow in this system, people to use any other system for interconnect. If people want a special system, they can go somewhere else or buy it through an OEM, or through special systems.

I want to be able to say that with our system we can integrate anybody's PC, but only in a very simple minded way.

Gordon insisted on dropping the Q-BUS for small computers, because installation was so expensive as compared to a personal computer. Part of this was illusion, because our marketers then offered all the software that was standard within the industry and never got around to integrating into a system necessary to run a business. I thought it was clear for years that we made a mistake, and that we should have, and that we should solve the office, the business, the organizational problem, but do it with a traditional computer system, but limit them severely, but not as much as we have when we limit ourselves to off-the-shelf, bubble-pack software. However, we are in worse shape today than when we started, because we have learned a lot more complexity in our Q-BUS machines. We have made it more complicated for people to use them, and we made the machines even more expensive than they used to be because we know more options and freedoms to build into them. In the personal computer area, we are still trying harder and harder to get more standard software off-the-shelf, but still not trying to accomplish what the customer wants, and not fully realizing what we are missing.

KHO:blk
KO3:S10.34
DICTATED BUT NOT READ

"TO" DISTRIBUTION:

GEORGE CHAMBERLAIN	PETER F CONKLIN	BOB DALEY
DON GAUBATZ	DOM LACAVA	OLLIE STONE

STRATEGY COMMITTEE:

7-JUN-84 17:57:31 S 06952 BURT
BURT MESSAGE ID: 5238891961

11-JUN-84 16:27:45 S 03640 OGEM
OGEM MESSAGE ID: 5239286842
11-JUN-84 17:35:30 S 04841 CFSO

Tue 12-Jun-1984 12:34 EDT - Merrimack, N.H.

+----------------+
| D i g i t a l |
+----------------+

I n t e r o f f i c e
M e m o r a n d u m

To: Sam Fuller

Date: 2-July-1984
From: Hank Levy
Dept: Corporate Research
Phone: 206-543-9204

Subj: The REAL emergency at Digital

Ken Olsen's recent memo on the "emergency" at DEC has spawned a lot of discussion. Although the memo cites real problems, I feel that it misses the global issues. We don't have an emergency but a disaster; the plane went down a long time ago. The disaster is corporate-wide and runs from top to bottom. Unfortunately, DEC management is still looking for the plane while our customers have already booked on a competitor's flight!

I have been at DEC now for 10 years this month, and have seen the company transformed in many ways. Despite what we tell ourselves or read in the trade press, we have gone from a small friendly company to a large unfriendly one. The company is not responsive to its employees or its customers. I sense a tremendous frustration from our engineers. Many excellent people have already left -- many are just waiting for the right opportunity. I can't hope to define all of the company's problems, nor can I suggest remedies. However, it is crucial that we be honest about our problems and the weaknesses that we have. Following are, from my biased engineer's point of view, some of the major problems.

1. The company suffers from a lack of leadership. Digital needs a leader to establish our corporate goals and determine our strategies. For the last several years, it's been unclear what business we are in, who we're competing with, and what our model of the future is. People in the company have lost confidence in upper management. Digital was formed by people who had a vision of the future. Now we see managers with only a vision of the past.

2. We have an incredible ignorance about our own business and marketplace. The computer industry has been revolutionized over the past 5 years. I'm constantly amazed at the number of managers and engineers alike who have no idea what is CURRENTLY available from our competitors. We're still designing products for the 70s while everyone else is well into the 80s. If you haven't taken a good look outside of Digital for even 2 or 3 years, then you don't know what's going on.

3. We have a protectionist attitude towards our products. We're so afraid that someone else will make money on our computers; we would rather turn down a million dollars than let

someone else make a nickel. We didn't allow people to easily add hardware and software to our PCs, so they have difficulty competing. We didn't allow another company to build a PDP-11 microprocessor (or VAX for that matter) early in the game, so now the Motorola 68000 and Intel 8086 are the industry standard 16-bit machines.

4. We have a misplaced sense of our position in the computer industry. People think that we have some super power: that if we decide not to make a product, nobody else will. Ken argued that mangers don't want computers on their desk -- now an IBM desktop computer is a status symbol. Recently, those who prefer VMS to Unix argued that we shouldn't support Unix because it would legitimize the "little guys". Now IBM is aggressively attacking our university market with Unix on 4300s, AT&T is supporting Unix as the basis of its new market thrust, and we're the little guys running to catch up. The point is, nobody cares whether we like personal computers, Unix, mice, or high-resolution displays; these things are requirements for competing in today's marketplace.

5. We're afraid to change with the times. Our failure to build a workstation is a NATIONAL EMBARRASSMENT. Our lack of a product in this space is no less a threat to DEC than our lack of a 32-bit computer was in 1975, but nobody seems to care. We have lost the confidence of much of our high technology customer base, including universities. The success of the VAX-11/780 has crippled us into thinking that all computers must look like a 780. We could have made hundreds of millions selling systems based on the Motorola 68000, but we couldn't see the writing on the wall because of our bias for the VAX and VMS. Note that IBM's failure to see a new market spawned a new industry -- minicomputers; our failure to see a new market has spawned the workstation industry.

6. We have an organization whose goal seems to be prohibiting the marketing and manufacturing of new products. Everywhere you turn in Digital people are telling you why you can't manufacture in less than 2 years, why you can't go into new markets, and why what you're doing doesn't make sense. I had a product manager for workstations tell me over dinner that he didn't believe in local area networks or single-user computers. How could he possibly help us get into the workstation business?

What do we do? First, recognize that the industry has changed. Digital no longer has a monopoly on the construction of computers. Any two guys in their basement can build a system as fast or faster than a VAX-11/750, and can get venture backing to market it. Therefore, Digital must compete as never before in quality, cost/performance, and time to market. Software has changed also, and along with it customer's expectations for software. We can't outproduce the myriads of software applications companies. Therefore, we must make it easy (and interesting) for them to produce software for our systems.

I think that we're in a vicious cycle: DEC is not making interesting products and so it is unable to hire top technical people: because we can't hire top technical people, we're unable to build interesting products. I think that DEC needs a major change in attitude. This change must be initiated from the top. There must be a commitment to COMPETE in the marketplace. We cannot sit on our VAXes and think that we'll be OK because we're DEC. Nobody is guaranteeing that DEC will survive without competitive products.

I think that lots of DEC's engineers would love to hear Ken make a statement like:

> Digital has always been a leader in the construction of computer systems for sophisticated technical users. We have made systems that were used and highly respected by those customers. During the last several years, our position in this marketplace has slipped. As of now, we are making a major commitment to renew our leadership in the technical computer industry. We will not be prejudiced by past successes or failures. We will once again be cost/performance leaders, and we will use whatever technologies we need to take us to the future.

The DEC I joined in 1974 was a highly-respected manufacturer of technical products. Our products were used for research in industry and universities. New ideas were tested on our equipment. People developed new systems, such as Unix and Tenex, on our equipment. An entire generation of engineers, scientists, and programmers was educated on our computers. Now those days are gone. The next generation is being educated on Suns, Apollos, and yes, IBMs. I think we need to return to our roots -- to making computers that technical people like to use. I think that I speak for many engineers when I say that I don't want to work for Burroughs, CDC, Honeywell, or NCR. Many of our people have left already. Is it too late to change?

DIGITAL EQUIPMENT CORPORATION

MAYNARD, MASSACHUSETTS 01754

KENNETH H. OLSEN
PRESIDENT

6 March 1984

Mr. C. Gordon Bell
Chief Technical Officer
Encore Computer Corporation
15 Walnut Street
Wellesley, Massachusetts 02181

Dear Gordon:

Sometime ago, you suggested that when the Museum went to Boston, we should start a small, not terribly aggressive or active, Museum to save and show things from Digital's history.

I think I agree with you, and I am toying with the idea of hiring someone to identify all the parts that we should try to get hold of, and to figure out a program to perhaps show off groups of them in the lobbies of our facilities.

If you have any suggestions about what equipment we should try to get hold of, please let me know.

With best wishes.

Sincerely yours,

KHO/aj

Mr. Kenneth Olsen, President
Digital Equipment Corporation
146 Main Street
Maynard, Massachusetts 01754

Dear Ken,

I was delighted to receive your letter about establishing a collection of Digital's ~~major historic machines~~ artifacts. ~~was super to receive~~. Gwen and I have been concerned that no one at DEC is concerned about this role. Many people who care ~~about the machines~~ call and she is trying to ensure that the artifacts are saved somehow, but there needs to be a single focus.

We'd like to suggest a way to get started: Geri Rogers is Digital's employee assigned to the Museum. She was reluctant to move to Boston and Ron Smart was reluctant not to have someone to really watch over Digital's interests. Starting in April, Geri will work in the Mill (Ron's area in Bldg. 10) two days a week and at the Museum three days. She would be and excellent starting point for this effort. Because no one was in this role, The Computer Museum now holds both Digital's and its own artifacts in the New Hampshire warehouse. Some of the machines that should be Digital's for display include: a prototype desktop PDP-1, Fred Hertrick's cherrywood prototype of the RL01, the 100,000th LA-36, the first computer (PDP-4) used for module testing, which created the computer testing industry including Genrad, Teradyne, the LINC-8, and a variety of consoles of 6's, 10's, and a long list of other things. When things are of industry wide significance we make sure there are duplicates in the Museum.

for example, DEC's role in [illegible] Computer and [illegible] the VAX

A central coordinator (Geri) would build a simple database on a Word Processor to register the contents and location of the artifacts. Most things are at the main warehouse in New Hampshire, but with the proper care and feeding a truely distributed warehouse/museum would develop where the people involved care for their own. The central site would record what's around. For example, Bob Glorioso is looking after the Venus story to form a mini-museum. This is vital in order to learn and to avoid repeating history. Nautilus really came out of all the Venus experience. Similarly, the Hudson folks really understand and Jeff is an excellent student/teacher who excels by understanding the process. Also enclosed is a memo I wrote to one of our directors (Andy) to describe why the Museum was an investment in the future, not the past.

history

Our book, Computer Engineering was put together to identify the major projects throughout DEC's history and it really ~~is~~ should be the best guide for the selection of items. Maybe John McNamara would also help on a volunteer, advisory basis. In addition, I put together three posters: the one of the tree, then one of consoles and one of terminals. The console one I had always thought might be built. I hope these trees eventually get updated with the next round of PC's and VAXen. Also a tree of secondary memories are needed because this story is very dramatic. Similarly, I'd like to see the Hudson folks put together a story of the chip at Digital because in only 10 years, Digital has

from the Mills

become one of the top 10 companies in chips (even though chips aren't available as products and people are forced to buy ~~inferior~~ processors from National, Motorola and Intel)!

Just as a final thought, you might do pro-active historical things: get a number of the first system module building blocks and have appropriate captions printed so that they could be distributed to sites that want a display -- so every place could have one of the first products. Make an IVIS videodisk and use DEC's own product to record it's product history. Also include several short sections of film -- one of Alan Kotok explaining and playing spacewar on the PDP-1 and a few others so that people in the future can get the "feel" of the action. The videodisk promises to be one of the best ways to preserve hardware and software. A disk would also show tours through various factories: PC Boards, I/Cs, testing, FAT, disk assembly, CRT assembly in Taiwan, LA100's in Phoenix and LA50's being built in Japan, PC's, etc. The Museum has over 200 films and they are probably the most valuable asset because one can really see what it was like then.

I applaud your effort. The key thing is to get someone to take it on in a low-key, high quality fashion. History is the only thing in computing that can be done by quality instead of by schedule. I would be happy to work with them on particular details and the right priority for acquisitions. The Computer Museum also would like to have the various disks for general viewing too. It really would be nice if all the audience could take a walk through the Hudson facility and see what a class 1 clean room looked like.

As a seperate issue, I met Jerry Weisner the other day and he was completely unaware of the Hudson facility or the level of work there. He also is using a Radio Shack system and could do a lot better with a DECmate.

DIGITAL

INTEROFFICE MEMORANDUM

TO: Gordon Bell
OOD

CC: Operations Committee

DATE: 17 October 1978
FROM: Ken Olsen
DEPT: Administration
EXT: 2300
LOC/MAIL STOP: ML 12-1/A50

SUBJ: Modern Engineering or How We do Engineering Faster and More Efficiently Than Small Companies.

When we enlarged Central Engineering our motivation was two-fold. First of all, product lines were too close to changing customer whims to give stable direction necessary for one, two or three year projects and secondly, with engineering spread around so broadly, we couldn't take advantage of the size and assets of the corporation. It is probably time now that we review the results of centralizing engineering. I would like to see OOD come to the February State of Affairs Meeting and tell the senior people of the Corporation the problems and the results of centralized engineering, and after this practice session, it should then be presented in more detail to the next Spring Stratton Mountain Meeting.

We should concentrate on the things we do to make decision making quick and easy and develop efficiency which can come from size and capital.

I would suggest that we have the presentation made by the Managers one level below the OOD.

First, I think we should present todays environment. We now have well defined goals for reliability and we have two goals to make the cost of our manufacturing compete with the Japanese. We have noise and safety goals which sound confusing, but in a session like this we can organize them so everyone understands what set of goals we work towards.

As we go into a time when there is a shortage of engineers, we should explain how we motivate our engineers, and how we build teams that have pride and efficiency and the feeling that they take part in goal setting.

I think we should squeeze all this into a one day session for the State of Affairs Meeting for the Corporate people, but should expand it to two or three days for the Engineering Managers at Stratton Mountain.

It probably will be good for us to generate a document that will be a guide to tell our engineers how decisions are made. We should make it clear who can propose, who makes the decisions, and who proposes and passes on changes to decisions.

We should explain how budgeting is done, how we weigh the difference between expense money, capital money, people and space, and we should give direction as to how much safety factor people should include in their budgets.

The outside world sometimes seems to think that engineering measures their output by numbers of people rather than results. It seems obvious that the output of an individual can vary by some large factor, and getting these factors of improvement from individuals should be the main measure of success, not how many people we can fit into a budget. It would be good to present to the people how we do and how we should measure and reward output.

I was surprised at the reaction at the last Operations Committee Woods Meeting where it was claimed that there was a corporate policy that you cannot make a model unless you first make a marketing plan. It will be good for everyone including engineering management, to write down a policy which explains when you build models and when you have to make marketing plans first and how far you go in design before you get certain levels of approval and how much freedom one has or could claim to make variations in this policy.

sm

Blank, George F. + 10?

JUL 31 1979

I need help here. You got anything that can be used easily, right now? F/U 8/10

+---------------+
: d i g i t a l :
+---------------+

INTEROFFICE MEMO

TO: Gordon Bell

cc: Larry Portner
Dick Clayton
Ed Schwartz
Dick Berube

Date: 30 July 1979
From: Ken Olsen
Dept: Administration
MS: ML10-2/A50 Ext: 2300

delayed to 11/26/79

SUBJ: Board of Directors Meeting

I think it is a good idea for Dick Clayton to prepare his small computer strategy for presentation to the Board of Directors. We won't have a meeting until our October meeting which is combined with our Annual Meeting, and by that time, people are usually too tired to have a long presentation.

We could have a special meeting in September, or we could wait until the November one, depending on what you would like to do.

Please let me know and we will schedule it at the Board of Directors meeting of your choice.

I would like to also see a technical presentation, probably at the same time, which gives our sales pitch on Networking. Networking, too often means a lot of technical jargon. We love to go into detail of all the different approaches and all the things we can go. Most people I have contact with, have a very simple question. They would like to know, can we hook up directly to the IBM computers they have with very little trouble?

We normally give the impression that we can do anything, but that everything is special and we have never done it before. In order to sell to large organizations, almost all of whom have IBM computers, we have to have a sales pitch which says, "with the equipment we have to offer you can, without any extra technical help, tie directly to the IBM computers". We should get over leaving the impression that it is extremely difficult, but because of our great confidence, we can do anything even though it is very difficult.

George P. For the Annual Meeting in October, I will need a very short, very simple statement as to what we are doing with Networking. I think it should be in the same terms that I would explain it to a company president who doesn't know a baud rate from an interface. He just wants to know, can we make our computers talk to his computers without a great technical challenge.

?

You may want to get this into our Annual Report, and you may want to also make sure we have our small computer strategy very clear in the Annual Report. We may use one page, and be sure that we have the family of computers presented in such a way that it is clear to everyone that we cover everything thoroughly, beautifully, and effectively.

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* d i g i t a l *
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TO: GORDON BELL
DICK CLAYTON
JACK SHIELDS
JACK SMITH

DATE: TUE 18 NOV 1980 8:38 AM EST
FROM: KEN OLSEN
DEPT: ADMINISTRATION
EXT: 223-2301
LOC/MAIL STOP: ML10-2/A50

SUBJECT: 11/23 AND RX02 FLOPPIES

I had an 11/23, a pair of RX02 floppies and a letter quality printer delivered to my home. I'm terribly embarrassed by these. I've never seen such poor mechanical design and such poor system thinking.

Will you send a note to me saying:

1. Who designed these units?

2. Who packaged them?

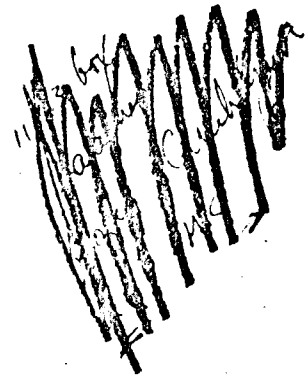
3. Who approved them for Manufacturing?

4. Who approved them for Field Service?

I think it's time we identify who does poor design and make sure they don't do design for us again. For years we've been doing poor design, keep doing it, and I think we're embarrassed to find out who does the poor design and, therefore, we never stop it.

I'd like to know who looks over the whole system to say that it is a product we'd be proud of.

The LQP came in a box which must be five feet tall and so big it won't go through most of the doors in my house. Two people have a terrible time carrying the empty box without the table and printer in it. Inside there's a printer which is just the size of an IBM typewriter and probably lighter in weight. We probably had good reasons originally to put the printer on a table and then the box so it wouldn't get damaged, but no one stopped to think of how much space we wasted, how much warehouse space we wasted, how hard it is to ship, and the overall cost.



The 11/23 is a micro-processor on four dual boards which takes very little space but they're put in a huge steel box which is very heavy, very hard to carry, and quite vulnerable in shipping. I don't know why we bother making large scale integrated circuits when we put them in boxes like this. All our work in integrated circuits is a waste and our packaging is so dumb. We even do things like not taking advantage of the metal covers for shielding because we don't ground the covers.

The dual floppies are put in a huge metal box which the automobile industry would be embarrassed to ever ship. It's "fit and trim" is terrible. No way can you make the trim look good. The floppies take up approximately a third of the volume of this box and the rest is empty air or poor design. We went to new small floppies because this box is so big. Anybody in their right mind would have made a box to fit the floppies rather than make small floppies. We could put small floppies in the same big box and gain nothing.

This equipment is filled with loose screws, each of which has a separate washer and a separate lock washer. I am not completely unhandy in taking things apart and putting them together, but I have a terrible time with all these loose screws and washers. I've lost one washer inside the equipment which I'm afraid might cause trouble later on when we turn it on. Many, many years ago people learn not to put things together this way.

Gordon Bell says the Japanese are coming because of their financing and better manufacturing. They're going to kill us by better design. This is absolutely atrocious and I want to know who did it and who approved it.

KH/em
13.10

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* d i g i t a l *
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TO: see "TO" DISTRIBUTION

cc: KEN OLSEN
EDWARD A. SCHWARTZ

DATE: FRI 9 JAN 1981
FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE BOD PRESENTATION

The BOD agenda is full this time. Ken still hopes to present this at some later time (e.g. March). He may call on you later (on short notice) for the poop.

Alternatively, starting in April, I believe your individual monthly presentations to the BOD should cover this to start with in order to give a context for any numbers.

Reference attached message.

Dec 11 EMS from Gordon Bell:

"According to your (KO) request, the appropriate development groups should feed you the products, their cost and their performance (that's what a lot of customers buy) for the last couple of years and then the next 3 years. Is that what you mean?

The group should include:
. all 10/20's Bill McBride
. the 780, 750, and 730 Bill Demmer
. the current 11's and the newly introduced ones (23,24,44)
Herb Shanzer
. the 78 and 278
. all the terminals Bill Picott
. the current mass stores (RL, RK, RM, RP) and the
new R80, 81, Aztec, Pinon Grant Saviers

As a way to simplify what you give them, you might consider leaving out the terminals VT/LA, and giving them the systems that are packaged together with disks, thereby leaving out the individual disks."

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* d i g i t a l *
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TO: *GORDON BELL
EST
EDWARD A. SCHWARTZ
cc: see "CC" DISTRIBUTION

DATE: TUE 9 DEC 1980 4:31 PM

FROM: KEN OLSEN
DEPT: ADMINISTRATION
EXT: 223-2301
LOC/MAIL STOP: ML10-2/A50

SUBJECT: BOD PRESENTATION

I'd personally like to make a presentation to the Board of Directors early in February giving them an overview of our complete line of products. Will you have each of your engineering groups prepare for me a list of the products we are now selling and those that we will introduce in the next three years showing in just numbers what the characteristics of the various units are. I'd like to give an overview of what we're selling, and what the differences are, and why we have so many units.

I'd like to know the actual cost of the LSI chips in the central processor, the cost of the central processor complete with power supply but without packaging, and finally, the cost of packaging, shipping and testing. I'd like to explain how much of the cost is in the high technology part of the computer.

KHO/er
KHO:S1:31

"CC" DISTRIBUTION:

BILL DEMMER ULF FAGERQUIST SI LYLE
GRANT SAVIERS

"TO" DISTRIBUTION:

BILL DEMMER ULF FAGERQUIST SI LYLE
GRANT SAVIERS

****
* d i g i t a l *
****

TO: KEN OLSEN

cc: see "CC" DISTRIBUTION

DATE: THU 11 DEC 1980 8:45 PM EST
FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: RE: BOD PRESENTATION

I'm glad you are giving this presentation to the BOD. The groups will certainly give you all the poop. According to your request, the appropriate development groups should feed you the products, their cost and their performance (that's what a lot of customers buy) for the last couple of years and then the next 3 years. Is that what you mean?

Let's go for the February date. Also the research group is planning to present then too.

Unless, I hear different, the groups should send you the data say by December 19 so that there can be an iteration.

The group should include:

- all 10/20's
- the 780, 750, and 730
- the current 11's and the newly introduced ones (23, 24, 44)
  the 78 and 278
- all the terminals
- the current mass stores (RL, RK, RM, RP) and the new R80,81
  Aztec, Pinon

As a way to simplify what you give them, you might consider leaving out the terminals VT/LA, and giving them the systems that are packaged together with disks, thereby leaving out the individual disks.

Please redirect if appropriate. Otherwise we should send you the data.

"CC" DISTRIBUTION:

BILL DEMMER
*GRANT SAVIERS
ULF FAGERQUIST
EDWARD A. SCHWARTZ
SI LYLE

****
* d i g i t a l *
****

TO: GORDON BELL
EDWARD A. SCHWARTZ
cc: see "CC" DISTRIBUTION

DATE: TUE 9 DEC 1980 4:31 PM EST
FROM: KEN OLSEN
DEPT: ADMINISTRATION
EXT: 223-2301
LOC/MAIL STOP: ML10-2/A50

SUBJECT: BOD PRESENTATION

I'd personally like to make a presentation to the Board of Directors early in February giving them an overview of our complete line of products. Will you have each of your engineering groups prepare for me a list of the products we are now selling and those that we will introduce in the next three years showing in just numbers what the characteristics of the various units are. I'd like to give an overview of what we're selling, and what the differences are, and why we have so many units.

I'd like to know the actual cost of the LSI chips in the central processor, the cost of the central processor complete with power supply but without packaging, and finally, the cost of packaging, shipping and testing. I'd like to explain how much of the cost is in the high technology part of the computer.

KHO/er
KHO:S1:31

"CC" DISTRIBUTION:

BILL DEMMER
*GRANT SAVIERS
ULF FAGERQUIST
SI LYLE

Cancel it. Message was to do it overview
- 10/20
- VAX

****
* d i g i t a l *
****

TO: *GORDON BELL
JACK SMITH
cc: WIN HINDLE
EDWARD A. SCHWARTZ

DATE: MON 5 JAN 1981 1:18 PM EST
FROM: KEN OLSEN
DEPT: ADMINISTRATION
EXT: 223-2301
LOC/MAIL STOP: ML10-2/A50

SUBJECT: PRESENTATIONS AT 1981 BOARD MEETINGS

I'd like to make a major presentation at each Board meeting in 1981 by one man from Manufacturing and one man from Engineering telling how they are optimizing the inventory, the ease of manufacturing and the reliability of their products. I'd like to lay out the schedule for the whole year, and give it to the Board during our February meeting. I would suggest that the first group be CRT terminals, and the next presentation be made by the 32-bit group, then the printing terminals group, then the 16-bit systems group.

I'd like to let the Board know that we appreciate the fact that inventory is largely the result of how things are designed for manufacturing, and how the manufacturing planning is accomplished. I think it would be healthy for our people and good for the Board to have our thinking presented to them.

KHO/er
KO:S1.72

John Meyer

Let's submit suggestion GORDON BELL

Office of the President

Rensselaer Polytechnic Institute Troy, New York 12181

DEC 18 1980

12-35

Fld 1/5

December 12, 1980

DEC 17 1980

Mr. Kenneth H. Olsen
President
Digital Equipment
146 Main Street
Maynard, Ma. 01754

Dear Mr. Olsen:

As an employer of many Rensselaer graduates, your company is invited to submit nominations for Rensselaer's premier award, the Davies Medal for Engineering Achievement.

The Davies award consists of a medal, certificate, and prize of $1,000, and is presented annually to recognize distinguished engineering achievement of holders of earned degrees from RPI who are under 50 years of age. I encourage you to take advantage of this special opportunity to honor a deserving associate.

Nominations are currently being sought from among the leaders in industry and the field of engineering. Enclosed is a brochure outlining the criteria for the award and a nomination form. Nominations are requested on or before January 15, 1981. The successful candidate will be notified of his or her selection by the Selection Committee during February and the award will be presented on campus on April 9, 1981.

Should you desire additional nomination forms or need any further information, please contact our Alumni Programs Office at (518) 270-6205.

We look forward to hearing from you within the next few weeks and, in the meantime, send all good wishes.

Sincerely,

Jack W Powers

George M. Low
President

Enclosure

Signed for George Low in his absence

Circulate 9/3/80
1 Clayton, 2 Rodgers,

WESTERN DIGITAL
CORPORATION

3 Murphy, 4 Taylor, 5 Tech

7-65

CHARLES W. MISSLER, Chairman of the Board,
President and Chief Executive Officer

3128 RED HILL AVENUE, BOX 2180
NEWPORT BEACH, CALIFORNIA 92663
(714) 557-3550 TWX 910-595-1139

May 28, 1980

Fyi

6 G. Bell

Mr. Kenneth Olsen
President
Digital Equipment Corporation
146 Main Street
Maynard, MA 01754

Dear Ken:

I continue to get very favorable feedback from both your people and my own concerning the continuing improvement in the relationship between our firms. You are clearly our most important customer and I believe we are proving to be both diligent and responsive.

I must confess, however, that I was disappointed and disturbed by the recent announcement of your network venture with Intel and Xerox. While these partners are obviously both substantial and competent, it happens that this is an area in which we have already established a significant proprietary interest. It's possible that in our zeal to focus on our immediate production commitments, we may have been excessively conservative in keeping your people adequately informed on our new product commitments.

Of particular note is the network summary which attempts to relate our various product offerings in the packet switching and local network areas. I have taken the liberty of including a few materials for review by your staff. We will, of course, take whatever steps you feel appropriate to better keep your

people abreast of our products, on as intimate a basis as you are comfortable with.

This is no relationship which is more important to us and I would be grateful for any opportunity that we may have overlooked to be responsive to your needs.

You sincere and devoted friend,

CHARLES W. MISSLER

CWM:gls

Enclosures

****
* d i g i t a l *
****

TO: BILL PICOTT

DATE: FRI 25 APR 1980
FROM: GORDON BELL
DEPT: OOD
EXT: 223-2236
LOC/MAIL STOP: ML12-1/A51

SUBJECT: YOURS

ATTACHED: MEMO;50

****
* d i s i t a l *
****

TO: STAN OLSEN

cc: GORDON BELL

DATE: FRI 25 APR 1980 9:26 AM EST
FROM: KEN OLSEN
DEPT: ADMINISTRATION
EXT: 223-2301
LOC/MAIL STOP: ML10-2/A50

SUBJECT: CRT TERMINAL FEATURES

Here is a list of the CRT terminal features that the Europeans are interested in. This is almost the same list as the one I brought back a year and one-half ago. Will you let me know what your thoughts are in adding these features to the VT100.

It seems that most countries are interested in a yellow, amber or brown color. Our customers are spraying the face of the tube with a yellow color now, but this tends to defuse the characters and we lose the advantage of the sharpness that we enjoy today. I think that it would be a good idea to find out what phosphors are readily available, and we could offer one or two optional colors, or maybe even standardize on one of the colors for the whole world, including this country.

The people in Europe seem to want the intensity control on the side of the box.

Germany, Sweden and the others want to have the CRT tiltable. I am sure that much of this is psychological, but these standards are being propagated by the government. Although they are not law, they do become negotiating points with the unions, and therefore, they may end up being as good as law.

Having the power switch in the back always seemed to me to be the right place, but someone should look into the possibility of having a power switch on the side of the CRT or having it as part of the keyboard. If it is put on as part of the keyboard, it has to be done rather cleverly so that turning it off and on is done with the same number of wires that now drive the keyboard.

It is, or is about to be, a standard for word processing to have a whole page on the CRT. I am not sure that I believe this one because the text gets to be very small unless a much larger CRT is used. A year and one-half ago we thought about putting a much larger CRT in the same cabinet as the VT100, but rotate it 90 degrees and sticking out the top of the VT100.

O²D

Fyi g

APR 1 1980

DIGITAL INTEROFFICE MEMORANDUM

TO: Ken Olsen
cc: Operations Committee

DATE: 3/31/80 Mon 12:11:19
FROM: Win Hindle
DEPT: Corporate Operations
EXT: 223-2338
LOC: ML10-2/A53

SUBJ: List of Issues Needing Resolution

1. When will we have a system to schedule customer orders promptly (especially in the OEM business)?

2. Should we enter the small business market with our direct salesforce?

3. What should our strategy be to capture a significant portion of the office market?

4. How rapidly we can grow and still run a quality company (i.e., how strong is our management, how capable are our management information systems)?

5. Should we change the international reporting structure? Should major countries have profit and loss responsibility?

6. How much growth should we have in Massachusetts?

7. Do our current pay practices allow us to retain our good people and attract new people (i.e., do we have to start paying people above the market average)?

8. Should we accept more government controls (i.e., SCA) in order to gain a larger share of government business?

9. How do we raise the awareness of all managers to the urgency of increasing productivity in an inflation economy?

10. How can we gain predictability in bringing new products into production?

11. How can we increase the accuracy of product line ship forecasts?

WRH/bwf

To: O²D, Mfg. staff, ~~Estes, Poffenbarger, Smith~~, Gordon Bell

The way the company operates is that Eng/Mfg makes these decisions in a very, very informal, ad hoc, implicit way with absolutely No review of thinking & policy at either of our staffs. ~~Right~~ Our policies in Mass Store / Semiconductors look highly suspect.

FEB 23 1980

+---------------+
: d i g i t a l :
+---------------+

INTEROFFICE MEMO

TO: OPERATIONS COMMITTEE
Henry Crouse

Date: 28 FEB 80
From: Ken Olsen
Dept: Administration
MS: ML10-2/A50 Ext: 2301

SUBJ: VERTICAL INTEGRATION AND THE MANUFACTURE OF SEMICONDUCTORS

How could ~~Should~~ we address this?

Joe Bower of Harvard Business School sent me an unpublished paper on business strategy. Enclosed is a few paragraphs from this study which, I think, bears on the question of how much we should vertically integrate.

Gordon (P/U 3/21)

> (4) Vertical integration is not necessary to exploit cost leadership in mature markets, as suggested by a number of empirical and economic studies. In fact, all of the low-cost producers in the industries under study were less vertically integrated into upstream and downstream activities than at least one other major competitor in their industry. Instead of emphasizing vertical integration as a policy, all looked for selective integration into high value added, proprietary componentry, following the type of integration policy first delineated by General Motors in the 1920s of "not investing in general industries of which a comparatively small part of the product is consumed in the manufacture of cars."

Instead of fully integrating, all of the low-cost leaders invested to have the most efficient process technology at least one stage of the vertical chain; for example, Ford in truck assembly, Inland in order entry/distribution. The result in all cases is focus and very low costs within a partially integrated operation. As one of Ford's major competitors observed:

> Ford is the least integrated of any of the high volume heavy duty truck manufacturers in the world, yet it is still the low-cost producer and gains one of the highest ROIs in the industry. In retrospect, their strategy was brilliant; they let the rest of us learn to manufacture componentry while they learned to manufacture profits.

JUL 31

I need help here. You got anything that can be used easily, right now? F/U 8/10

+---------------+
: d i g i t a l :
+---------------+

INTEROFFICE MEMO

TO: Gordon Bell

Date: 30 July 1979
From: Ken Olsen
Dept: Administration
MS: ML10-2/A50 Ext: 2300

cc: Larry Portner
Dick Clayton
Ed Schwartz
Dick Berube

SUBJ: Board of Directors Meeting

I think it is a good idea for Dick Clayton to prepare his small computer strategy for presentation to the Board of Directors. We won't have a meeting until our October meeting which is combined with our Annual Meeting, and by that time, people are usually too tired to have a long presentation.

We could have a special meeting in September, or we could wait until the November one, depending on what you would like to do.

Please let me know and we will schedule it at the Board of Directors meeting of your choice.

I would like to also see a technical presentation, probably at the same time, which gives our sales pitch on Networking. Networking, too often means a lot of technical jargon. We love to go into detail of all the different approaches and all the things we can go. Most people I have contact with, have a very simple question. They would like to know, can we hook up directly to the IBM computers they have with very little trouble?

We normally give the impression that we can do anything, but that everything is special and we have never done it before. In order to sell to large organizations, almost all of whom have IBM computers, we have to have a sales pitch which says, "with the equipment we have to offer you can, without any extra technical help, tie directly to the IBM computers". We should get over leaving the impression that it is extremely difficult, but because of our great confidence, we can do anything even though it is very difficult.

For the Annual Meeting in October, I will need a very short, very simple statement as to what we are doing with Networking. I think it should be in the same terms that I would explain it to a company president who doesn't know a baud rate from an interface. He just wants to know, can we make our computers talk to his computers without a great technical challenge.

You may want to get this into our Annual Report, and you may want to also make sure we have our small computer strategy very clear in the Annual Report. We may use one page, and be sure that we have the family of computers presented in such a way that it is clear to everyone that we cover everything thoroughly, beautifully, and effectively.

Larry I like this. Let's do it.
cc: Paul Bauer Gordon

+---------------+
: d i g i t a l :
+---------------+

I N T E R O F F I C E M E M O

TO: Gordon Bell

Date: 26 October 1979
From: Ken Olsen
Dept: Administration
MS: ML10-2/A50 Ext: 2301

I made an arbitrary rule several years ago that on new buildings we could not add vents, tanks, fans and chimneys to the outside. Everytime someone had a chance to add junk on the outside of a building, they went ahead and did it.

I notice that we are doing this to the Mill, and we are quickly losing all of the appearance of a beautiful old building. Should we introduce this rule for the Mill?

/aj

To:

Copy ~~this page to~~ Dick, ~~first~~. Andy Si

+---------------+
: d i g i t a l :
+---------------+

INTEROFFICE MEMO

TO: Gordon Bell

cc: Dick Clayton
Larry Portner

Date: 1 OCT ~~79~~
From: Ken Olsen
Dept: Administration
MS: ML10-2/A50 Ext: 2300

SUBJ: YOUR NOTE ON IBM'S ENTRY INTO THE COLOR GRAPHICS TERMINAL BUSINESS

I would like to know what your goal is.

1. Would you like to have eighty percent out of all the simple alphanumeric terminal business, because we do the very best and are striving to be way, way ahead of everyone else?

2. Or, would you rather concentrate our effort on getting eighty percent of the color graphics terminal business?

3. Or, would you rather get five percent of everything because we spread all our developement and investment over eveything?

No

/dag

Let's look at parallel with B/W + Color TV.

Somehow, the leader ends up with both.

10/4 98

From a user cost/performance viewpoint we've seen:

- Relatively constant cost improving performance with
  - more lines
  - upper + lower case
  - more characters/line

  } Note VT50 was a bust, we had to have the VT52... also the VT100 at about this price is a winner.

- I expect nearly simultaneous evolution to: a full page of b/w; + color graphics — all at the $1K–$2K price level

Versus $500 VT100 capability.

The Most expensive part of a terminal is the User... anything we can add to help him, really wins big.

OCT 8 1979

+---------------+
: d i g i t a l :
+---------------+

INTEROFFICE MEMO

TO: Gordon Bell ← cc

cc: Dick Clayton
Larry Portner

Date: 1 OCT 79 ← TO
From: Ken Olsen
Dept: Administration
MS: ML10-2/A50 Ext: 2300

SUBJ: YOUR NOTE ON IBM'S ENTRY INTO THE COLOR GRAPHICS TERMINAL BUSINESS

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2. Or, would you rather concentrate our effort on getting eighty percent of the color graphics terminal business?

3. Or, would you rather get five percent of everything because we spread all our developement and investment over eveything?

/dag

1) We want the volume business

2) But when color & Graphics are the items it takes to WIN in the volume market we want the Best engineered product (from production viewpoint)

Keep pushing us!

Dick C.

SEP 26 1979

Ken We'll tell you from
cc: Bruce, Chalmers, Campbell, Stan
the market

SEP 19 1979

****
* digital *
****

INTEROFFICE MEMO

doesn't Need or Want

TO:

Gordon Bell
Alyce Branum
Roger Cady
Dick Clayton
Dave Cotton
Ann Courtright
Jerry Cox
Len Halio
Paul Kampas
Ed Lazar
Stan Pearson
Dave Reed
Charle Rupp
Ava Schutzman
Bill Seaver
Ted Webber
Art Williams

DATE: 9/18/79
FROM: Richard H Case RHC
IBM Competitive Analyst
DEPT: Commercial Sys. Mktg.
EXT: 264-7307
LOC/MAIL STOP: MK1-2/N38

COLOR or graphics.

SUBJECT: IMMINENT IBM TERMINAL ANNOUNCEMENTS

The following new terminal products may be announced by IBM in the near future:

LOW PRICED ASCII CRT

- Code named TOPAZ
- Asynchronous or Synchronous CRT
- ASCII code, teletype compatible
- Has a M8500 microprocessor in it
- Price: about $1200 in ASCII only
- May have future options for BSC and SDLC 3270 mode
- Purchased via an 800 number, not sales force
- No details on features

COLOR CRT

- Code named WIZARD
- Color 3277
- Synchronous BSC or SDLC CRT
- Could be called the 3279
- Limited "business" Graphics
- No pricing information yet (should be > $4000)
- IBM is OEMing Japanese color Tubes

→ Gordon:

Which segment of The Terminal Business do you want
(1) 80% of The data entry, alpha numeric only or
(2) 80% of The color - graphics
(3) 45% of all because we try to do all

Jim

Stan, Art, Jon

Can we get Ken a one modem, preferably built in, link to both a VT and LA?

JUL 31 1979

+---------------+
: d i g i t a l :
+---------------+

INTEROFFICE MEMO

F/U 8/10 gbell

TO: Gordon Bell
Art Williams
Dick Clayton

Date: 30 July 1979
From: Ken Olsen
Dept: Administration
MS: ML10-2/A50 Ext: 2300

SUBJ: Portable Printing Terminals

You misunderstood my request to call the LA34 a portable printer.

You feel a portable terminal should be able to be carried like a briefcase on an airplane and set up in a hotel room, and in order to compete with the TI unit, it has to be equally portable.

In my travels, it seemed to me that most of the TI terminals are being used in one place in the office and are never moved except by the cleaning lady. The big advantage these units have over other units is that they are plugged in like a portable radio and it takes no more installation than that, and they can be lifted by the cleaning lady.

I think the LA34 would do a much better job for most applications if we decided to make it easy to use.

Being very technical people, we act like stereo enthusiasts. To these people stereo doesn't sound right and it's easy to use. It has to have a rats nest of wires and an expert to hook it up and along with hooking it up goes a lot of jargon about baud rates, etc. Users of portable units like to set it down in the middle of a room somewhere in their lab or office, or maybe in their living room, and leave it there until they want to hook it up. At which time, they just plug it into the phone line or drop the telephone in the receiver. They can use the terminal with no technical information and they do not have the mess of modems and a mass of wires to worry about.

The LA34 is compact and light weight and I think meets all these chracteristics except that it maintains the technical challenge that you guys want to keep built into this system.

If we made the LA34 easy to use, I am sure it would take care of 90% of the jobs that the TI unit is now used for. In order to do this we do not need a case to carry the thing around in because this 90%, I believe, are not moved any more than an IBM typewriter is moved.

JUL 3 1 1979

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: d i g i t a l :
+----------------+

INTEROFFICE MEMO

TO: Gordon Bell

Date: 30 July 1979
From: Ken Olsen
Dept: Administration
MS: ML10-2/A50 Ext: 2300

SUBJ: VT100

I like our VT100 which I took home. It works well and it fits in well in the living room, the greenhouse, the basement and in my study, and it is a beautiful terminal. However, there are a few comments I would like to make on it.

When I took it home, apparently our experts assumed that every company president knows he should have a modem with it and I, of course, forgot to get one. We had the great idea of using the modem that is in the printing terminal, but alas it uses differenty polarity. So, we had to do some midnight requisitioning to convert the signal so that we could use it both for the printing terminal and for the VT100. It is kind of nice to have both of them hooked up to the phone line at the same time.

The next observation is that although the unit is compact and not very deep so that it can fit in a small area, the cable connector sticking out the back adds at least 3 inches to the depth of the machine. All the connectors including the power, the keyboard and the standard interface connector should all be recessed so that the cables do not make the machine any deeper.

KHO/aj

Larry Scott file Gordon Bell

JUN 28 1979

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: d i g i t a l :
+---------------+

INTEROFFICE MEMO

TO: OPERATIONS COMMITTEE

Date: 18 JUNE 79
From: Ken Olsen
Dept: Administration
MS: ML10-2/A50 Ext: 2300

SUBJ: JULY WOODS

At our July Woods, I would like to see us take one day to thoroughly go over the question of how we decide on engineering projects and try very hard to eliminate the frustration that is felt so strongly by the product lines. On the second day of the Woods Meeting, I would like to make another pass at the subject we tried at the June Woods.

As we started our June meeting, we made a list of problems and frustrations that are felt by the product lines but the solutions brought up were not tied to the problems. Let's, in our preparation for this next meeting, each one of us list the problems that we see and write down suggestions that would alleviate these problems. Then, maybe we will have a more useful meeting in July.

We as a corporation are organized by product lines, our budgets are the sum of the product lines; in theory, we give some of the product lines autonomy and we, in theory, do not fool around with their budgets. We let them do the marketing, the planning, the strategy and eliminate as many taxes as possible on the product lines. If we want to change the way that the company is organized, towards a more conventional way, we should have carefully thought out proposals, maybe with experts in organization from one of the business schools to help us, and then consider if we want to do it. I do not want simply to drop our present organization and change toward a traditional form without any planning.

One time, in the early history of the company when we had problems not unlike these, I asked for suggestions to solve the problems. Our then one Vice President suggested that the answer was to make him President. When I asked how this had any bearing on the problems, there was no clear answer. I never figured out whether he was so involved in his own problems he could only think of being President or if he had the belief that if he were boss, obviously, all problems would go away.

Another time we had somewhat similar problems, and I suggested that the Operations Committee list the problems and unanimously agree on a solution, and I would go along with this. They proposed Pete Kaufman be made president, which would solve all the problems and they would be happy forever. Getting a new president might be a good idea, but we still have to solve the problems. I think wisdom says we should figure out how we

solve the problems and then as a separate issue decide who we should make as president, or as president of a part of the company.

I do not think that we should have simple solutions with no explanations of what the problems are and how we solve them.

Some of the frustrations that I remember are as follows:

1. Product lines ordered the wrong parts and other product lines got the parts that they ordered
2. Deliveries are not reliable
3. Profit was suddenly raised to 18% and insisted upon before prices were raised.
4. NOR cut from 2.4 to 2.3
5. Change in some plans such as the insurance group just before the fiscal year started
6. Too much taxes for corporate activities
7. Organization changes
8. Engineering strategy changes
9. Difficulty in influencing engineering decisions
10. Difficulties in influencing Europe
11. Too many bosses
12. Too many bosses
13. Too many bosses
14. Too many bosses

dag

Larry This looks good. Who can help put it together? Thx

Gordon [6/20 mtg]

+---------------+
: d i g i t a l :
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INTEROFFICE MEMO

TO: Gordon Bell
Andy Knowles
Jack Smith
Bill Thompson

cc: Bill Long

Date: 18 JUNE 79
From: Ken Olsen
Dept: Administration
MS: ML10-2/A50 Ext: 2300

During the July Woods meeting, we proposed talking about how we will formalize engineering decisions to relieve the frustration the product lines feel so strongly today. As part of the preparation for this, I would like to make you four a committee to tell us about alternatives we have for pricing our products that would include all the costs and would take into account the quantity produced.

This is important because I think many of the requests for engineering would disappear when the price to be charged is considered when the proposal for engineering is brought up. I would suggest that even when a product line invests their money in an engineering project, the corporation should insist that that engineering investment be returned in the price of the product, even though some product lines feel that if they invest it now they can give that part away free in the future.

It seems to me that we should also have products engineered and financed by the product line approved by the corporation.

I think we should have a cash flow proposed at the beginning of each project, so that in making the decision we can see whether or not that project, in final accounting, ever returns cash to the corporation or when it comes to picking between projects we see which ones return cash soonest and in biggest quantities.

When pricing is simply a function of manufacturing cost and does not take into account all the capital and other expenses, it is quite clear that many projects will have a net cash loss at the end of their life.

It seems to me that we planned to invest capital or increase our assets every year whether or not we grow. I think we have to do this because we want to do many projects for which we will not have a cash return.

dag

Larry Can you do this? F/U 5/18

Ken: I believe this is the domain of Product lines.
The situations I know of have RCV 04 1979
all been a combination of—
a salesperson <--> P/L, although we can,—

+---------------+
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INTEROFFICE MEMO

TO: Gordon Bell
Larry Portner

Date: 3 MAY 79
From: Ken Olsen
Dept: Administration
MS: ML10-2/A50 Ext: 2300

⟹ why not put this in Andy's province?

The Board of Directors has developed a new interest in our customers because, as they have had to consider possible conflicts as Directors of other companies, they have asked questions about their relationship with Digital and have discovered that many of them are unhappy. We will now report regularly to them on the nature of our relationship with customers. One of the items we will present at each meeting is a list of all software and hardware committments that we have made to customers and OEM's that are more than four weeks late.

Will you prepare the list for the next meeting in the middle of June.

dag

MAR 19 1979

+---------------+
: d i g i t a l :
+---------------+

INTEROFFICE MEMO

TO: Gordon Bell
John Leng
Julius Marcus
Stan Olsen
CC: Andy Knowles

Date: 19 MAR 79
From: Ken Olsen
Dept: Administration
MS: ML10-2/A50 Ext: 2300

Will you make a list of all your people who are doing marketing, product line managing, or group product line managing and those who are doing product managing, and with each name list the degrees, courses, seminars and self-teaching that people have completed in marketing.

Would you also list the training the person has done since he has started marketing or product managing at Digital.

Andy will collect these but they will not be summarized or distributed to the Operations Committee; they will be for Andy's and my use.

dag

Gordon Bell

MAR 19 1979

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: d i g i t a l :
+---------------+

I N T E R O F F I C E M E M O

TO: OPERATIONS COMMITTEE

Date: 19 MAR 79
From: Ken Olsen
Dept: Administration
MS: ML10-2/A50 Ext: 2300

It was decided during the March Woods Meeting that every member of the Operations Committee would write a definition or job description of Marketing and the same for Product Managership. These could be either in prose or a list of steps or pieces that make up the job of marketing and product managing.

Andy will collect and summarize these for the Operations Committee.

dag

Dech Ken's got a Point
What can we do re image?
F/U 3/2

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I N T E R O F F I C E M E M O

FEB 19 1979

TO: Gordon Bell
Stan Olsen
CC: Bill Chalmers
Andy Knowles
Art Williams

Date: 16 FEB 79
From: Ken Olsen 2-219
Dept: Administration
MS: ML10-2/A50 Ext: 2300

SUBJ: NO NAME FOR LA 34

I propose that we change the label on the LA 34 and call it the portable DEC Writer.

For all the applications in which I have seen the TI portable printer, our machine would do so much better. I think we owe it to society to tell them about the features we have and how compact and lightweight our unit is so that they would not have to suffer with all the inconvenience and limitations of the TI Unit.

If in our ads we call it the portable DEC Writer, and if we push its size and weight and ask people to compare all the features we have with those of any other portable writer, I think we should able to enlighten many people who don't know any better at the present time.

We may want to mold a plastic case to put around it so that it can be taken home, but I am not sure that it is necessary. Most portable units are portable in that they are taken from desk to desk once in a while within an office and only a very small number are taken home like a suitcase.

dag

What about carrying case?
Let's look at it.

Phil Tarpy
cc: DOD

Good idea. How do we carry it?
F/U 3/2

+---------------+
: d i g i t a l :
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INTEROFFICE MEMO

FEB 19 1979

TO: Gordon Bell

Date: 16 FEB 79
From: Ken Olsen 2-220
Dept: Administration
MS: ML10-2/A50 Ext: 2300

SUBJ: STRATTON MOUNTAIN MEETING

At your 1979 Stratton Mountain Engineering Conference, I would like to see you stress as a conference theme, "Elegant Engineering."

I think that it would be a good idea to teach people how to engineer products which are elegant, inexpensive, simple to build, easy to inventory and very very easy to maintain.

If we sell everyone on the idea that elegant engineering is a primary goal at Digital and we appreciate elegant engineering, I think that we could change the attitude of many of our people. Those things which have been elegantly engineered sell like hot cakes and those which are not are always getting us into trouble.

We should try to develop a simple way of getting ideas across and simple ways of getting people to check on elegance. Part of the elegance is to introduce as few new parts, brackets, cables, fasteners, etc. with each new design. I think that we should be motivated to use as many things that are already in inventory rather than to start from scratch.

Then there should be some simple way of optimizing inventories. We have some very poor examples of products with a large number of options which we keep in inventory. A little more elegant engineering would have allowed us to keep one major part in inventory and with slight additions or maybe even switch changes or jumper changing, change the units to various options.

We sometimes think that elegant design means mechanical things. Of course we know better and elegant design is perhaps even more important in software design and in architecture. We should have a speaker who will give examples and be helpful in these areas also.

dag

JAN 12 1979

Please get with Jack or his delegate. JAN 12 1979 Let me know Jack → I should read I only if Ken's this. Gordon

F/V 1/19

cc

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| digital |
+----------+

INTEROFFICE MEMO

TO: Gordon Bell
Jack Smith

Date: 11 JAN 79
From: Ken Olsen
Dept: Administration
MS: ML10-2/A50 Ext: 2300

Command.

Should we talk about this or just do it?

We decided some time ago that there should be one group at each facility responsible for that facility. I think we should make an exception here at the Mill because engineering and manufacturing are both major tenants and are always competing for space, parking and janitors which produces conflict.

The Mill is unusually big and this rule doesn't have to apply here. I suggest that we draw a line around manufacturing and engineering and that they each have their own facilities planning, their own facilities crew, their own janitors, have rights to their own parking and space, and that when differences come up a higher group, not the larger of the two groups, make the decision.

dag

COMPANY CONFIDENTIAL

+--------------------+ #1650
d i g i t a l INTEROFFICE MEMO
+--------------------+

To: Gordon Bell
Jack Smith

1/18/79 Thu 10:19:23
From: Bob Puffer
Dept.: Eng. Oper.
Ext.: 3-2863
MS: ML12-2/E38

SUBJ: Ken Olsen Memo of 1/11
(Mill Facilities)

I believe the origin of Ken's recent memo to be in conversations which he and Pete Koch have had concerning housekeeping and other matters pertaining to the Board Shop. As you may or may not know, we have recently had a serious employee relations problem with second-shift employees in the Board Shop as a result of closing a "courtyard" which had previously been reserved for parking by them.

Pete Koch, Paul Bauer, and I have been working on this issue since it arose, and I must agree that the resolution has been far less speedy than I would have liked. We made a number of mistakes in communicating the decision to close this parking area, and Plant Engineering management inappropriately conveyed the impression to second-shift employees that their concerns were of little importance.

The fact of the matter is that there have been some serious problems in the area of the Board Shop with second-shift parking. I, personally, on two occasions witnessed near fist fights in the alleyway adjacent to the Assabet River as second-shift employees arrived for work and hunted for available parking. One afternoon at three o'clock this entire access to the Mill was completely obstructed to all vehicular traffic and posed a serious safety threat to the entire facility. The courtyard in question is designated on the 1974 parking map, which was approved by the town of Maynard, as a fire lane. The Fire Chief has expressed concern that he must have access through this area and adjacent alley since it's the only means of outside access to the flammable storage areas in the Paint Room.

During the last 12 months of severe parking shortage at the Mill, coupled with the retirement of the Mill Safety Manager, we admittedly were lax in enforcing many parking regulations and in not taking adequate safety measures in the storage and handling of flammable and toxic PC waste materials. For example, we have been working with Joe Bentley in an effort to identify the contents of a number of 55-gallon drums of toxic material which are not labeled and which are of considerable concern to the Fire Chief and our own Facilities people, especially in view of the fact that two accidents have occurred in handling this

material during the last several months. One of these involved a contractor, the other involved an employee who was pumping material from one tank to another which resulted in an explosion serious enough to have caused loss of life except for some old-fashioned luck.

In an effort to help alleviate the second-shift parking problem, space has been reserved in the Walnut Street lot next to John Tobin's shack, and additional space has been made available for second-shift use alongside Building 1 in the Mill Yard. We have also offered to run a shuttle service to transport second-shift employees to their vehicles at the beginning and end of their shift, were they to park in lower Thompson Street lot where there is plenty of room. We have also volunteered to have a guard on the lower Thompson St. door during those hours when employees would need to go through to their cars so they would not have to walk outside at night. Neither of these suggestions has met with enthusiasm, however, since these employees would like to have their cars as close to their place of work as physically possible, and because some of the older women do not feel they should have to walk the distances involved.

In order to gain access to these employee vehicles parked in the "courtyard" area, three fire doors have been broken repeatedly by second-shift employees, and in one case the $150 locking mechanism was observed on the bottom of the Assabet River. In addition, the Facilities people have been cleaning up broken beer bottles as a result of these same employees eating dinner in their cars and discarding the bottles inappropriately. It's understandable in view of these circumstances that a certain amount of antagonism exists between these employees and the Facilities group. In recognition of these problems, Pete Koch has committed to improved second-shift supervision, and, in fact, there has been a recent marked change in the cooperation Security has received in removing inappropriately parked vehicles.

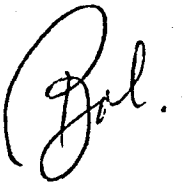
We are planning to request that the Fire Chief approve a limited amount of parking in the area in question, and feel that he should be involved since the original plan designating this area as a fire lane was approved by him. We intend to have Joe Bentley meet with him directly so that Joe can hear his concerns first-hand.

I must say I am also concerned about the motivation of these people who are complaining about the parking situation. We have observed that during their evening dinner break, many of them move their cars from the designated reserved Walnut Street area and drive around to the Building 21 entrance and re-park within the Mill Yard. Even though they park closer to their work at Walnut St. than the vast majority of first-shift employees (including myself), they feel compelled to save two minutes at the end of their working day by not walking the extra 100 yards across Walnut Street.

With all of this as background, I am not against Ken's proposal to split things up, because I can assure you that Paul Bauer, the Security people, and I don't enjoy being in the middle of

such hassles. On the other hand, although Facilities Planning and janitorial services could clearly be done on a local basis, it gets more difficult to see how to provide security, receptionist, telephone, dispensary, mail, snowplowing, safety, etc., etc., on a floor-by-floor basis within the Mill. Parking problems are going to continue to exist at the Mill no matter how we parcel it up, and I would hate to have "segregated" parking facilities. We are no longer competing for space because there is a surplus of square footage in the Mill for the number of cars and people we can have here, and our problem is in insuring the population cap rather than finding more space. The janitor problem has been alleviated by adding enough janitors by bringing janitorial service per square foot up to the level of other Digital facilities. The bottom line is that I believe it makes business sense to continue to manage this facility centrally, although I don't envy the person with that responsibility and would be happy to have volunteers step forward if they are dissatisfied with the current arrangement.

rml
Att.



OOD another mtg. + ltr

OC Woods

2/12 & 13
3/14 & 15

K.O. file

GBell

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INTEROFFICE MEMO

TO: OPERATIONS COMMITTEE 1-131

Date: 10 JAN 79
From: Ken Olsen
Dept: Administration
MS: ML10-2/A50 Ext: 2300

SUBJ: FEBRUARY AND MARCH WOODS MEETINGS

There are a number of things that I would like to cover at the February and March Woods Meetings. I would like to have you start thinking about them because we have to make a decision soon as to where we will have the Meetings. Most of the items involve people other than the Operations Committee and, therefore, the meetings should not be very far away.

Two items already on the list are Jack Smith's plans for manufacturing which he would like a whole morning for and Ed Schein's review of what he found interviewing the Operations Committee.

I would like to see us spend two or three hours with some of the people who do our advertising as compared to the managers and with one or two people from each of our advertising agencies to casually discuss their advertising philosophies and the Operations Committee's philosophy. I have a feeling that people try very hard to follow the philosophy of the Operations Committee but they do not always understand it and a few hours of discussion might be very helpful.

Sometime, I would like to wrap up in a consise way our final commercial product line strategy.

I would like to spend a half day discussing, from a group point of view, how we manage engineering groups and another half day on how we manage product line groups. I would like to know what freedom, what protection, what chance for innovation, what frustrations and what help they need. We normally see only the point of view of the top managers and I would like to spend this time discussing it from the point of view of the group that actually does the work. This means we should have the group managers and also the direct line managers in for these discussions.

Also, I would like to discuss our pricing philosophy. Our marketing types feel the big problem is that our manufacturing costs more than some of the cheap outfits or some of the things that we can get overseas. It might be that we should charge more and spend more on overhead and add to the cost in order to have a reliable supply and a reliable product. I think that it is wrong to allow the pricing philosophy to be the result of hassles at the lower levels. Instead, we should decide what kind of products we want and then be willing to pay the price. We can not insist on two sources for every critical component, have inven-

tory so that we are never out of supply, have all the overhead to make sure that everything runs smoothly, have a reliable product and then wonder why we can not compete on price. So, I would like to see us discuss for a half day what our pricing philosophy is and where we want to sit in the market.

I would also like to spend a half day discussing the responsibilities of our first-line managers. During Christmas vacation it seemed that half of our employees in Maynard were not working. If they were all on vacation that's fine, but I have a suspicion that when the engineers were away the technicians didn't come to work either, and when the bosses were away the clerks didn't come to work. No first-line manager can enforce these rules if it is commonly done throughout the whole corporation. I would like to spend a half day discussing the responsibilities of first-line managers, how do we teach them, and how do we make sure they fulfill their responsibilities.

dag

digital

Ken / Dick Beane / Ron Gould MAR 2 1979

INTEROFFICE MEMORANDUM

TO: Gordon Bell

Should we show this System in "our museum" ... if we ever get one? Gordon

DATE: 22 FEB 79
FROM: Ralph Coffman Ralph
DEPT: Corporate Library
EXT: 6465
LOC/MAIL STOP: ML4-3/A20

FEB 23 2-280

SUBJ: MUSEUM PROJECT

With regard to your interest in a museum project, the attached may be another way it could be approached. The article appeared in EDU TWENTY-THREE (The Education Magazine of DEC.)

Gordon

vak
Attachment

A COMPUTER FOR THE KIDS

The Children's Museum of Boston has received a major new addition to its computer facility: a PDP-11/70 timesharing computer system from Digital Equipment Corporation.

The new system will be installed at Museum Wharf, the new downtown home of the Children's Museum which will open in July, 1979.

The PDP-11/70 will join the museum's existing PDP-11/40 system to provide a high-reliability networked computing facility. The dual system will be used as the foundation for a major new Computers exhibit at the museum and as the host facility for a network of LSI-11 microcomputers that will monitor and control security, climate control, and energy management systems for both the Children's Museum and the Museum of Transportation.

Combined with the PDP-11/40, the PDP-11/70 represents the largest single gift ever received by the Children's Museum, whose director, Michael Spock, describes the system as "a cornerstone of our new headquarters."

Bill Mayhew, director of the museum's computer center, notes that "the installation of the PDP-11/70 and our new exhibit are [illegible] possible because of our close working relationship with Digital [illegible] eight years. We're extremely grateful for their magnificent support."

The new Computers exhibit [illegible] 1300 square feet on the second floor of Museum Wharf. It will feature [illegible] interactive video terminals, [illegible] self-instructional programs, [illegible] access data bases (or "video bulletin boards"), and a number of off-[illegible] activities. The museum still [illegible] about $100,000 to completely equip and install the exhibit and to support staff time to develop the interactive software and displays.

The museum's Computers exhibit is carefully designed to make computers [illegible] as well as educational for kids. The [illegible] is decidedly unlike the classic computer room: terminals are set on [illegible] tables, just the right height for an inquisitive [illegible] year old. The exhibit is also tremendously popular with parents who linger behind while their kids run off to see themselves [illegible] TV or visit the Japanese [illegible] around each of the six terminals in the museum's current Jamaica Plain [illegible].

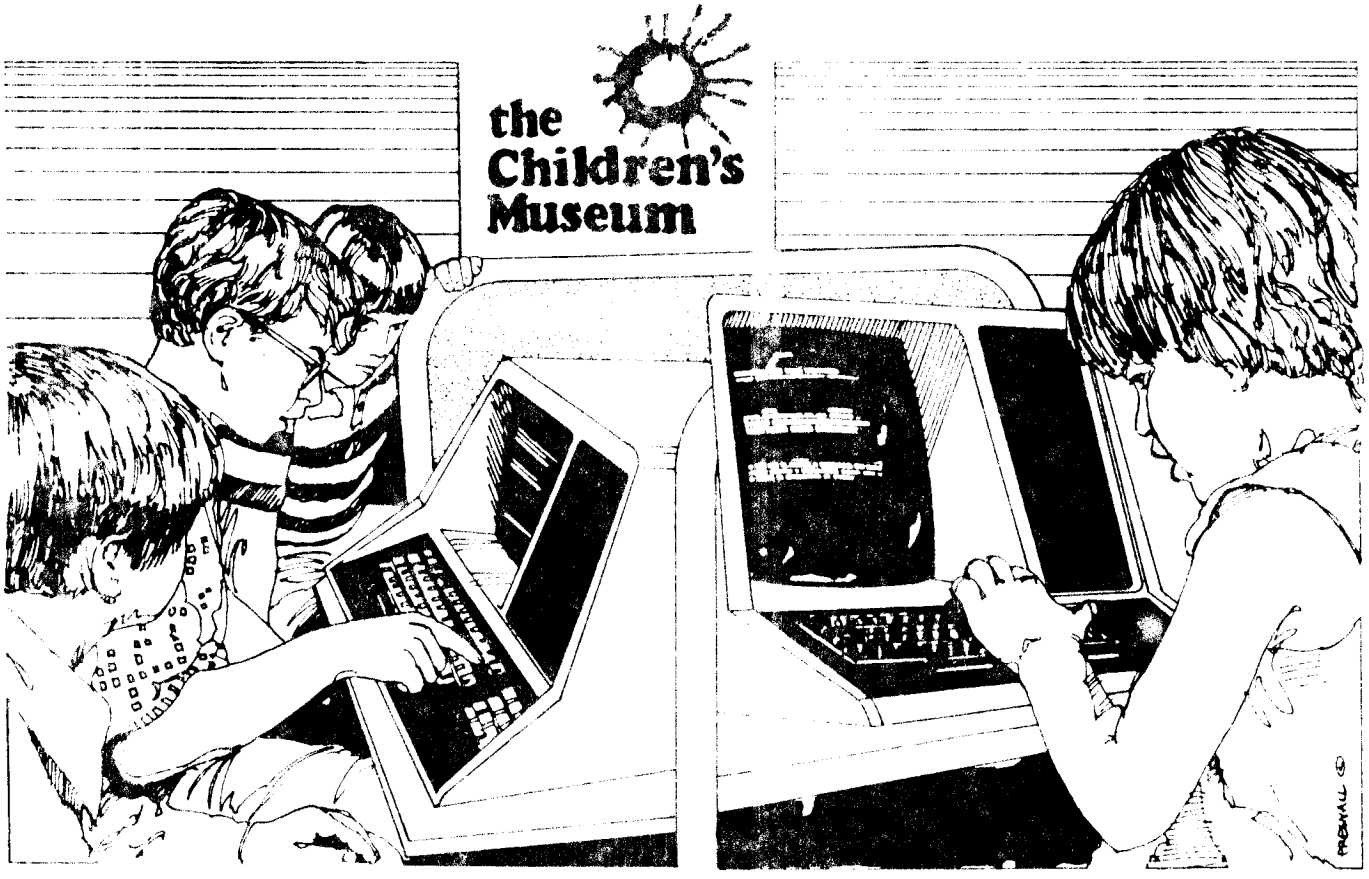
The PDP-11/70 system will multiply the museum's computer capacity by a factor of 5. Part of the capacity will be used by other cultural and educational organizations in greater Boston that will make use of specialized software developed by the Children's Museum staff.

The Children's Museum supports the most extensive assortment of computer-based activities in any American museum, ranging from analyzing information about the museum's visiting public (an [illegible] PDP-11 provides on-line ticketing and admissions reporting at the museum entrance) to providing up-to-date reports on the museum's financial status.

The museum has also developed a very fast database management system that will be at the heart of an interactive cataloguing of the museum's collection of cultural artifacts. The cataloguing system can handle very large data bases with no degradation in response time and can evaluate English-like queries in 1/30 second. Designed for use by people with no computer background, the system employs a straightforward command syntax which will enable it to be used by teachers to evaluate collection artifacts that may be useful in school programs. The package is being licensed for use by other museums nationwide.

Extensive software research and development work is undertaken by the museum staff to accommodate the growing demand for new services. The museum uses Digital's RSX-11M operating system and, in some application areas, the UNIX* timesharing system. Software developed by the Children's Museum is in use at over 50 universities and museums worldwide.

*UNIX is a trademark of Bell Laboratories.



John Mayer / Bob Puffer cc: OCD + us

Please get these collected from your personnel people + copy me. Gordon

+---------------+
: d i g i t a l :
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INTEROFFICE MEMO

TO: Gordon Bell
John Leng
Julius Marcus
Stan Olsen
CC: Andy Knowles

Date: 19 MAR 79
From: Ken Olsen
Dept: Administration
MS: ML10-2/A50 Ext: 2300

Will you make a list of all your people who are doing marketing, product line managing, or group product line managing and those who are doing product managing, and with each name list the degrees, courses, seminars and self-teaching that people have completed in marketing.

Would you also list the training the person has done since he has started marketing or product managing at Digital.

Andy will collect these but they will not be summarized or distributed to the Operations Committee; they will be for Andy's and my use.

dag

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INTEROFFICE MEMO

TO: OPERATIONS COMMITTEE

Date: 19 MAR 79
From: Ken Olsen
Dept: Administration
MS: ML10-2/A50 Ext: 2300

It was decided during the March Woods Meeting that every member of the Operations Committee would write a definition or job description of Marketing and the same for Product Managership. These could be either in prose or a list of steps or pieces that make up the job of marketing and product managing.

Andy will collect and summarize these for the Operations Committee.

dag

Gordon Bell

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: d i g i t a l :
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INTEROFFICE MEMO

TO: Andy Knowles
Larry Portner
Bill Thompson

Date: 2 JULY 79
From: Ken Olsen
Dept: Administration
MS: ML10-2/A50 Ext: 2300

cc: Operations Committee

SUBJ: ENGINEERING ALLOCATION COMMITTEE

I understand that you are the committee which will propose to the Operations Committee how we allocate engineering and how we answer the requests of the product lines for engineering.

I would like to request that you present to the Operations Committee a list of alternative ways, not the way that you think is the best or the most obvious answer. I have two reasons for this. First, it helps you to be a little more objective during your preparation and secondly it gives the Operations Committee a chance to take part in the decision.

Also, I would like to have you propose how we can change our pricing to include the total cost of the product. Right now we multiply the manufacturing cost by some magic number and get a price, which means that our high production items are way over priced and we are probably losing money on our low production items.

Our present way of pricing means that if a product line can talk or sell engineering into starting a project that would be of help to that product line even though the quantity is small, they end up with a great bargain. The only cost to them is a manufacturing cost and that is charged against them only when they sell the product.

When we price or go into the total cost, the decisions of engineering will be much easier. In fact, I think that we will see a lot fewer proposals.

For example, when the product manager in charge of small disks proposes one more disk for a particular product line, he realizes that part of the proposal will have to include all costs including tooling, field service writeoffs, manuals, training, interest on the investment, etc., divided by the number of units sold and added to the manufacturing cost to figure out the price for the job. If this is done, I think that you will see a lot fewer software and hardware projects proposed, because some of them will be sold in such small quantities that the price would make them undesirable to the product line.

I wouldn't be surprised if when we institute this and people understand

it, that all the questions about which engineering projects we invest in just disappear, because wisdom will automatically control the number of projects we go into.

Of course, another significant result will be that our high production items become much less expensive and will then be able to compete with other high production organizations. When we can not compete with today's naive way of pricing, people blame it on manufacturing, when I am sure that it is not manufacturing, but the fact that we average all costs over high production items and low production items.

dag

THE EVILS OF AVERAGE COSTING

Average costing leads to the loss of market share. Given the normal accounting procedures of any business, some costs are assigned directly to particular products sold to specific customers. All others are averaged, that is, divided among all products and customers. This leads to a misstatement of real costs and a potential competitive threat.

Costs are a function of market share. The leading competitor in any business should have the lowest costs. This low cost position allows the leader to make the most profit, charge the lowest prices, or add the most value to his product. He may do all three. In any case, there seems little reason to expect a low share competitor to be able to compete effectively, let alone to gain share on the market leader.

In business after business, however, new entrants gain share on the leader and displace him. In some cases, this is because the return expectations of the leader are so high that a price umbrella is held over the competition. A competitor with a lower return expectation can enter the business and grow to a leadership position. In other cases, the new entrant practices an aggressive financial policy relative to the leader. With greater use of debt and higher retention, the new entrant, despite lower initial returns, can add capacity at a greater rate than the leader.

In many cases, however, the displacement of the leader is the result of average costing. Although costs are averaged across the entire business, overhead and other costs often differ greatly from one product to another. A "focused factory" can produce high volume products much more cheaply than a plant designed for flexibility. As a result, broad product lines tend to raise the manufacturing cost of all products. Cost averaging ignores this and therefore overstates the real and potential cost of the high volume products to a much greater extent than the cost of the low volume products.

The broader the product line and the larger the number and variety of the customers, the greater the use of overhead cost averaging. Since the leader typically has the largest product line and biggest customer base, he tends to do the most cost averaging.

The costs to serve different sets of customers are also averaged. Usually all sales and marketing expenses are averaged across products in such a way that they are averaged across sets of customers as well. Yet different groups of customers have different needs. Large buyers tend to be sophisticated users of the products. They therefore place greater emphasis on price and delivery than on education, service, and support. The result is that it costs less to serve the larger customers than the smaller. This is intuitively obvious. However, costs are rarely classified by customer group; the real differences in cost of service are hidden by cost averaging.

Average costing leads to average pricing. Average pricing means that some customers are being

In many cases, however, the displacement of the leader is the result of average costing. Although costs are averaged across the entire business, overhead and other costs often differ greatly from one product to another. A "focused factory" can produce high volume products much more cheaply than a plant designed for flexibility. As a result, broad product lines tend to raise the manufacturing cost of all products. Cost averaging ignores this and therefore overstates the real and potential cost of the high volume products to a much greater extent than the cost of the low volume products.

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Average costing leads to average pricing. Average pricing means that some customers are being overcharged while others are being subsidized. This is particularly true if the overcharged customers concentrate their purchases on higher volume products. The problem is compounded when the leader institutes across-the-board price increases in times of inflation. Across-the-board increases, by their very nature, ignore the changes in product and customer mix which occur as markets mature.

The new entrant in the business is forced to focus because of his basic cost disadvantage. If he hopes to be successful, he focuses on those sectors of the market which are being overcharged. He will probably charge less than the leader to penetrate the market. It is only in these sectors that he can deliver product profitably because of the average pricing umbrella. It may be a strategy born of necessity rather than insight, but it still works.

The overcharged customers tend to be the largest and most price-sensitive sector of the market. The leader abandons them to the new entrant because his average costing reports them as less profitable accounts at the lower price levels. These customers also tend to be the fastest growing sector of the business. The new entrant not only establishes a base load business upon which to improve his relative cost position; he also grows faster than the leader.

Continued averaging by the leader produces a new set of customers who are being overcharged. The new entrant grows rapidly, improves his costs, and expands into these sectors as well. Eventually, the original leader is displaced. Despite a basic cost advantage to start with, average costing and average pricing lead to a loss in share.

****
* d i s i t a l *
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TO: OPERATIONS COMMITTEE:
OPERATIONS COMMITTEE: @CLEM

DATE: THU 6 MAR 1980 2:09 PM EST
FROM: KEN OLSEN
DEPT: ADMINISTRATION
EXT: 223-2301
LOC/MAIL STOP: ML10-2 A50

SUBJECT: BOONDOGGLE

+----------+
: d i s i t a l :
+----------+

I N T E R O F F I C E M E M O

TO: Operations Committee

Date: 6 March 1980
From: Ken Olsen
Dept: Administration
MS: ML10-2/A50 Ext: 2301

SUBJ: BOONDOGGLE

I am again hearing complaints that at the peak tourist season our foreign subsidiaries get overwhelmed with visitors from the US who have to be entertained, to the detriment of the local operation. Because the local offices can see no business reasons for these trips or for the timing of these trips, and because of the obvious costs to the corporation, the time of the people making the trips and the time of the people entertaining those making the trips, the management in Maynard is loosing the respect of parts of the company.

I am sure that the situation is not as bad as it appears, but I think we ought to look into it. Everyone who takes a trip works for someone on the Operations Committee. Sometimes our managers think that watching these things is the responsibility of the Office of the President or Personnel, but I think it is the responsibility of the group vice president. I would like each of you to make a list of those people who are going to Japan this Cherry Blossom season and those going to Ireland or Scotland during the coming tourist season, with a few words describing the reason for the trip.

Will you send these lists to Bill Long to be summarized, and then discussed. We will then have Bill send the lists to each of the countries so they realize that these trips are important, the Operations Committee does want them to be taken, and these people are worth the time it takes to entertain them.

I think one hundered people went to Japan last year, most of them during the Cherry Blossom season with their wives. I think for good business reasons and to avoid outside criticism, we should have some justification on record for these trips.

DEC 17 1980

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INTEROFFICE MEMO

TO: Gordon Bell

CC: Peter Boers
Don Metzger
Dave Brown
Tom Campbell

Date: 17 December 80
From: Ken Olsen
Dept: Administration
MS: ML10-2/A50 Ext: 2301

SUBJ: FCC TESTING

I like the idea of having a simplified, standardized building that we can produce anywhere for FCC testing. We may want a more elaborate system to do fine testing when we are close to limits to prove that we can just pass the limits. However, for the bulk of our testing, we want readily available facilities that can be used while units are being fixed and adjusted to pass.

Here's a drawing of a unit which I think is as simple as anything we've come across. I think it is an important requirement that the antenna be enclosed in the air bag. The fins are fragile, awkward and have to be adjusted readily, and one must be able to see them to make sure they are in the correct position. This limits the length of the range. I, therefore, propose that we standardize on a ten meter range. This makes the distance of the antenna long compared with the length of the equipment we might have and yet, short enough to include the antenna and a workshop all in the same balloon.

The antenna would then be thirty-three feet from the test table, and this would allow just thirty-three feet behind the test table, a workshop and office area, and a place for the testing equipment.

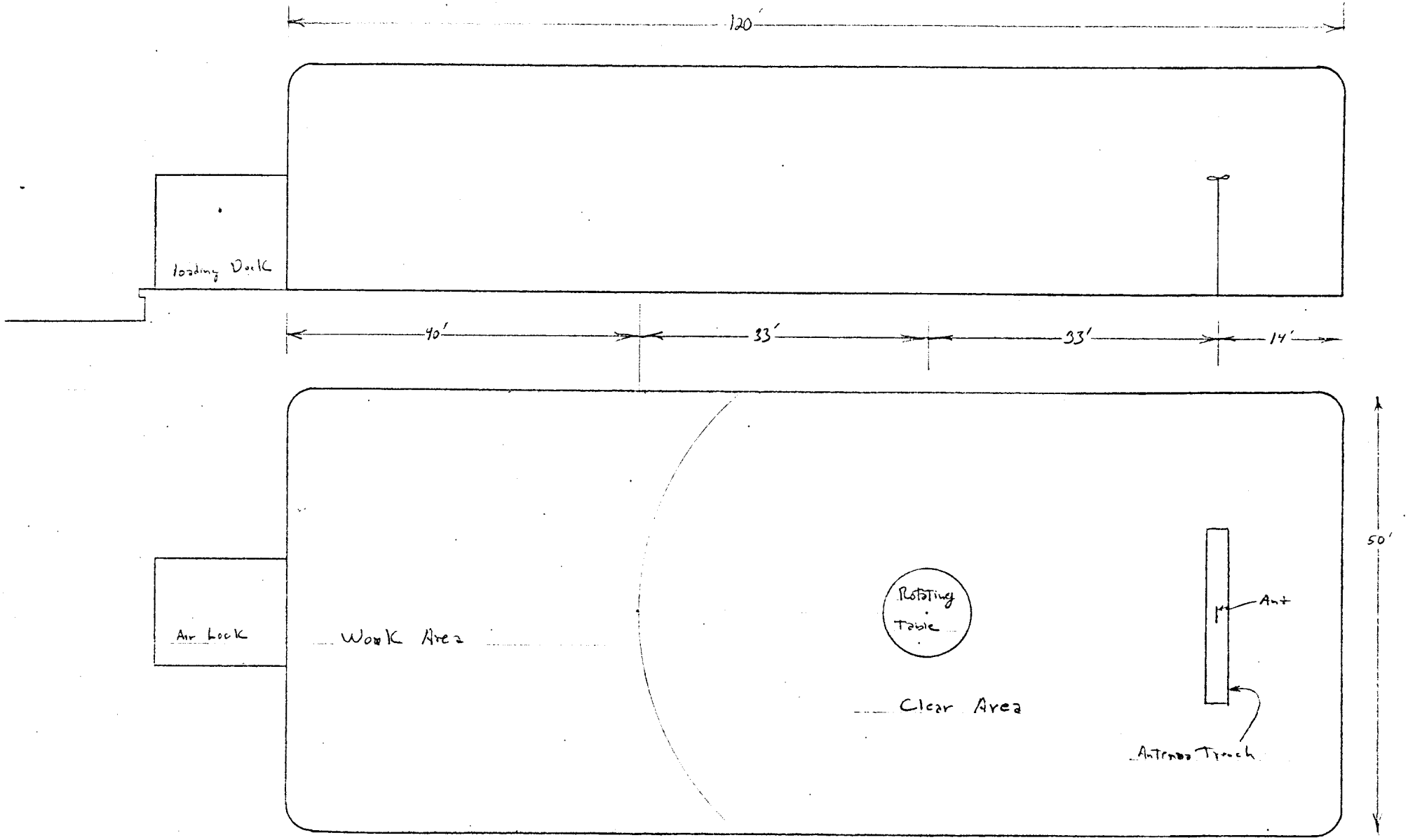
This means that if there is fourteen feet from the end of the balloon to the antenna, and if there is thirty-three feet from the antenna to the table, and thirty-three feet from the table to the work area, and forty feet of work area, the ballon should then be one hundred twenty feet long. The width could be anywhere from forty to sixty feet.

Probably the easiest way to make the floor is just to pour a concrete slab. We should be careful to be sure the reinforcing rods are connected together so there is a fairly good ground plane between the table and the antenna. There should be a trench formed in the slab, in the antenna area so that we can change, adjust and do various things with the antenna. I think the table should be about ten feet in diameter, and should be power-driven, then when we cast the floor, we should leave an opening big enough for the table.

We should also leave room in the slab for a number of pieces of plastic pipe to carry wires and cables.

I think we probably would want to have an outside fiberglass outhouse, like they use at a construction site, and bottled water for drinking and no plumbing at all.

KHO/er
KO1:S1.41



Standard 10 meter Test Room

Dec 16, 1980 KHO

FEB 4 1981

F

JOHN C. MEYER

OCT 1 1980

PLEASE CIRCULATE.

TO: OOD

FR: GORDON BELL

~~LARRY PORTNER, ML12-1/T32~~

~~SI LYLE, ML12-1/T39~~

~~JOHN MEYER, ML12-1/A11~~

~~DICK CLAYTON, ML12-2/E71~~

~~JOHN HOLMAN, ML12-2/T38~~

~~MITCHELL KUR, ML12-2/A16~~

~~BILL JOHNSON, MLT2-3/A62~~

~~SAM FULLER, ML3-5/H33~~

~~GRANT SAVIERS, ML3-6/E94~~

~~JIM GUDMORE, ML~~

~~WILL THOMPSON, ML1-5/E29~~

~~ULF FAGERQUIST, MR1-2/E78~~

~~BILL DEMMER, TW/D19~~

RECEIVED

10/7/80

SAM FULLER

RECEIVED

OCT 23 1980

GRANT SAVIERS

PLEASE RETURN TO GORDON BELL, ML12-1/A51

~~Want this~~

Copy

DIGITAL Circ. 02D INTEROFFICE MEMORANDUM

C. Gordon

TO: Operations Committee

DATE: April 5, 1977
FROM: Ken Olsen
DEPT: Administration
EXT: 2301
LOC/MAIL STOP: ML12-1/A50

APR 7 1980

SUBJ: NEW RULES FOR GROWTH (FOR WOODS DISCUSSION)

We should also apply to Products!

From now on, Product lines will, to a first approximation, be self-financing. We will develop a new definition of Return On Resources which is more meaningful and which will still be very simple, and for each R.O.R. there will be a certain growth level. We will probably average last year's actual return with next year's promised return to get next years allowed growth. We might average last years actual with the next two years promised to get tentative budgets for two years ahead, but budgeting will become so simple that we can change the budget two years away as the next year develops.

New product lines will not be expected to be self-financing, but we will pick a period of time such as three years after which they have to be self-financing.

If the company does well, we will have the chance to raise more money for additional growth. Those product lines that are doing so well that the company can raise these additional funds may request use of those funds for additional growth.

I think we can improve R.O.R. calculations by simply adding a factor for high production inventory and capital costs. If, by some simple formula, we assign a certain amount of capital dependent on what people receive, we might have a simple calculation. We can have materials in three categories: those which we buy outside and never see, those we buy outside and work on in inventory, and those which we manufacture ourselves. If there is a rate for each of these categories, we might simply calculate an additional inventory cost and make the calculation simple.

/jt

7 April 1980

[redacted]

From: Ken Olsen

For your reference

COMPANY CONFIDENTIAL

[redacted]

OPERATIONS COMMITTEE
Minutes of [redacted]

Attendees: Ken Olsen, Pete Kaufmann, Andy Knowles, Stan Olsen, Gordon Bell
Win Hindle

Rotating Members: George Chamberlain, Jack Shields

Guests: Bob Lander, Ed Schwartz, Ed Finn

The minutes of the March 21, 1977 meeting were accepted as written.

KEN'S CURRENT TOPICS

Ken started the meeting by reporting on several key decisions and issues:

1. We have established a new rule stating that all purchases of land and buildings will have to have the Board of Directors approval. The board will be asking how individual approvals impact the corporation's Capital Plan.

   Pete inquired as to whether he could batch requests for approval. The answer was Yes, but all changes would require reapproval.

2. Ken is searching for a method by which we can measure all product lines on whether they are self-financing. This means we are ready to go further than our current ROR measurement. This is an important change which is necessary to help them understand the significance of our cash needs. No established product line will automatically be allowed to grow any faster than they may self-finance. We will establish rules so that new product lines which can not be self-financing will be allowed a reasonable grace period.

   If we do well and are able to raise money, then we will give additional resources to the successful product lines. We will work out the details of this process in the April Woods.

3. The Budget Process has got to be simplified. We are currently spending an enormous amount of time in the details so that no one is willing to change their plans. This is utter nonsense.

4. We will attempt to define the job of the Marketing Vice President in the April Woods. Ken sees this as a key change in the corporation.

5. We are still not satisfied that the Order Processing problem has been resolved. Win feels that we are doing better but have a long way to go.

CAPITAL PLANS

Ken expressed concern over the process. Bill Thompson reviewed the changes to the planning process.

George Chamberlain reviewed the changes in the Capital Plan--our use of capital is creeping up. His major concern is inventory. We do not seem to have a handle on this.

Pete Kaufmann felt he was in good shape--he has twelve weeks and expects to maintain it. George continued to push for an inventory guru. Ken felt the ROA approach will solve this problem.

UNSCHEDULED ITEM

Ken has asked the Travel Department to list all employees traveling to far off places and why. This will be supplied monthly along with the pink sheet.

ROA

Al started the discussion by reviewing the process--It is a start--It must be tested.

Bill Thompson reviewed data and the approaches used for allocation.

We will do June as usual, but use the ROA model. FY78 will be constrained by the manufacturing allocation and FY79 by the NOR constraints.

Any product line wishing to propose more NOR will do so on an ROA basis. The high ROA PL will be allowed to grow.

Ken is disposed to give any FY78 increment to one or two PL's to control expenses.

Ken poked at what is an efficient level of manufacturing to operate in FY78.

Stan agrees to ROA but is worried that we don't understand the impact of how to calculate. Also worried that self-financing of Field Service will allow them to grow too fast.

One set of plans is necessary--Bill will integrate. Capital plans are essential to this process.

Gordon would like an outside push by products. Bill agreed to help.

SPACE

.Nagog Square was approved with little discussion.

.Bob Puffer reviewed the Tewksbury facility proposal. It will be for 250 people primarily in the mid-range 11.

digital

INTEROFFICE MEMORANDUM

5

TO: Operations Committee

DATE: 12 MAY 1977
FROM: A. M. Bertocchi
DEPT: Finance
EXT: 5311
LOC/MAIL STOP: PK 3/A56

SUBJ: PRODUCT LINE SELF FINANCING MODEL

The Product Line Self Financing Model we discussed in the March Woods has been developed. It is not, as discussed in the Woods, precise; however, it is a reasonable reflection of the Product Line generated cash and Product Line asset levels within a tolerance of + or - 10%.

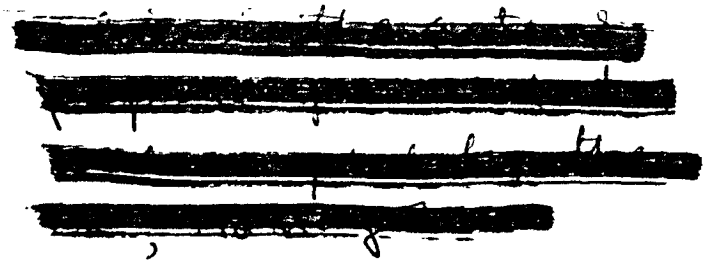
A preliminary explosion of ROA Data as developed from available budget information indicates that on a corporate basis and for the hardware product lines, meaningful statistical comparisons and reasonable conclusions can be drawn. We were unable to generate asset allocation for non FA&T Product Lines at this pass because of a timing problem. Therefore, these product lines (CSS, TPL, TRNG, F/S, SP, SWS) were treated as a group in this analysis.

The attached exhibits were generated from the March Pass. (9 months actual plus Q4 budget). A complete set of Product Line statements is available.

We will acquaint the product lines with the use and understanding of the self financing data. This will enable us to use this data for purposes of establishing and/or confirming budget levels by Product Line.

I will explain the process and the methodology at the Operations Committee meeting.

/mo
att.



PRODUCT LINE ROA RANKING

	FY 76		FY 77		FY 78	
Rank	PL	ROA %	PL	ROA %	PL	ROA %
1.	SWS	57.2	SWS	*	SWS	*
2.	SPR	55.5	SPR	*	SPR	*
3.	TPL	35.0	LOG	43.8	LOG	42.1
4.	F/S	34.7	F/S	*	F/S	*
5.	TRN	31.2	TRN	*	TRN	*
6.	LOG	28.0	TPL	*	TPL	33.6
7.	TEL	22.8	TEL	22.3	TEL	17.8
8.	EPG	14.8	DDP	15.1	TYP	17.5
9.	OEM	14.6	TER	14.0	EPG	16.7
10.	ECP	13.4	LDP	13.8	DDP	16.6
11.	LDP	12.4	OEM	12.8	LDP	15.7
12.	CSS	11.4	CSS	*	CSS	*
13.	DDP	10.4	TYP	12.0	BUS	15.4
14.	15's	9.9	BUS	11.9	IPG	15.3
15.	10's	9.5	EPG	11.2	OEM	13.0
16.	TYP	9.4	ECP	9.6	TER	11.2
17.	TER	9.3	IPG	7.5	MIC	7.8
18.	BUS	7.7	10's	6.8	ECP	6.4
19.	IPG	2.6	15's	6.7	15's	*
20.	MIC	NEG	MIC	1.2	10's	5.9
21.	WP	NEG	WP	Neg	WP	Neg

* The CSS, TPL, TRN, SWS, SPR, and F/S Group has an ROA of 29.3% and 31.9% for FY77 and FY78, respectively.

11 May 1977

TOTAL PRODUCT LI

DIGITAL EQUIPMENT COR. ATION

ROA CALCULATION

05/11/77

07:35:55

Exhibit 2

P/L CONSOLIDATED LCG	MICRO TYPE	TERM TPL	LOGIC DDP	PDP-8 TELCO	OEM WRD PRO	LDP BUS	IND SPARES	EPG TRN	GSS ECP PDBIS F/S SMS
	BUD 77 Q1	BUD 77 Q2	BUD 77 Q3	BUD 77 Q4	BUD 78 Q1	BUD 78 Q2	BUD 78 Q3	BUD 78 Q4	
NOR	204883	237380	283633	327106	309799	352790	401873	457559	
ASSETS USED									
P/L INVENTORY	116199	131436	137616	146005	157670	171657	190274	195310	
P/L ACCOUNTS REC	196311	216762	251052	278199	278643	317385	351146	379822	
HIGH VOLUMN ASSETS	206776	248784	258224	286359	322129	346048	369672	384629	
FA&T FIXED ASSETS	27762	27029	31026	41339	41079	46044	55976	63733	
COPR. ASSETS	78399	99170	105982	116598	122417	134170	143826	162703	
TOTAL ASSETS	625443	723179	783899	868499	921935	1015305	1110891	1186196	
CASH GENERATED									
P/L CONTRIBUTION	45163	55676	72385	90626	73268	88519	108998	131717	
LESS SHARED EXP	13123	13841	17313	20158	17422	20127	23419	26631	
LESS PL 10 ALLOC	3742	5436	8580	7122	7537	9482	9289	10158	
PBT	28298	36399	46492	63346	48309	58910	76290	94928	
LESS TAXES	10896	14015	17900	24390	19323	23565	30515	37973	
TOT CASH GENERATED	17402	22385	28591	38960	28985	35344	45775	56956	
ANALYSIS									
ASSETS									
INC/DCR IN ASSETS	69243	97736	60720	84600	53436	93370	95586	75305	
CUM. ASSETS(INC/DCR)	69243	166979	227699	312299	365735	459105	554691	629996	
CASH									
CASH SURPLUS(DEF)	-51841	-75351	-32129	-45640	-24451	-58026	-49811	-18349	
CUMULIVE CASH(DEF)	-51841	-127192	-159321	-204961	-229412	-287438	-337249	-355598	
CUMULIVE TOT CASH	17402	39787	68378	107338	136323	171667	217442	274398	
RATIO									
PAT%	8.5	9.4	10.1	11.9	9.4	10.0	11.4	12.4	
4QTR AVE ROA%	0.0	0.0	0.0	14.3	14.4	14.7	15.2	15.8	

Exhibit 2A

Description of Product Line ROA Calculation Statement and Allocation of Non Direct Product Line Assets

NOR

Taken from OLBS/Fixed $

Product Line Inventory

Taken from OLBS/Fixed $

Product Line Accounts Receivable

Taken from OLBS/Fixed $

High Volume Assets

A factor (Assets per dollar of Transfer Cost by product group) is determined for each quarter. Each of these factors is then multiplied by a Product Line's associated $ requested for the twelve (12) specific product groups in each quarter to determine the Total High Volume Assets associated with the Product Line. The asset levels are supplied by Joe Fargano's group, and include High Volume Net Fixed Assets and Net Inventory levels.

FA & T Fixed Assets

Projected Quarterly FA & T Net Fixed Assets are divided by the total Projected Quarterly Budgeted FA & T expenses to determine a quarterly factor. This factor is then multiplied by each Product Line's individual FA & T expense to determine their FA & T asset level.

Corporate Assets

Projected Quarterly Corporate Assets (Non Manufacturing, Inventory, and Product Line Receivables are divided by Corporate Product Line expense less Reserves for bad debt to determine a quarterly factor. This factor is then multiplied by each Product line quarterly expenses less Reserves for bad debt to determine the Product Line's rporate Asset level.

Product Line Contribution

From OLBS (8 Quarter Budget)

Shared Expense

From OLBS (9 Quarter Budget)

Product Line 10 Allocation - OLBS

$$\frac{\text{PL 10 CHG}}{\text{Corp. TC by QTR}} = f \qquad f \times \text{PL TC} = \text{Allocation}$$

Taxes

.385 in FY77 and .4 in FY78

Cash Surplus/(Deficit)

Cash generated in a quarter minus asset increase in a quarter.

Profit After Taxes %

Cash generated in NOR

4 Quarter Average ROA

$$\text{Rolling 4 Qtr.} = \text{Sum Prior 4 QTR's P.A.T.} \div \frac{\text{Prior 4 Qtr's Assets}}{4}$$

PRODUCT LINE NET CASH FLOW/ROA RANK

	FY 76			FY 77			FY 78		
	PL	Cash Sur/ (Deficit)$M	ROA Rank	PL	Cash Sur/ (Deficit)$M	ROA Rank	PL	Cash Sur/ (Deficit)$M	ROA Rank
1.				SWS	*	1	SWS	*	1
2.				SPR	*	2	SPR	*	2
3.				F/S	*	4	F/S	*	4
4.				TRN	*	5	TRN	*	5
5.				LOG	3135	3	TYP	2092	8
6.				EPG	(1459)	15	LOG	746	3
7.				TYP	(2050)	13	EPG	(830)	9
8.				MIC	(4492)	20	WP	(3069)	21
9.				LDP	(7230)	10	10's	(3070)	20
10				WP	(7871)	21	ECP	(3810)	18
11.				DDP	(9438)	8	IPG	(5460)	14
12.				ECP	(9496)	16	LDP	(6062)	11
13.				TEL	(9874)	7	BUS	(9434)	13
14.				IPG	(13127)	17	MIC	(11529)	17
15.				BUS	(13921)	14	TER	(14182)	16
16.				TER	(23566)	9	TEL	(25048)	7
17.				10's	(25467)	18	DDP	(27556)	10
18.				OEM	(80967)	11	OEM	(62715)	15
19.				CSS	*	12	CSS	*	12
20.				TPL	*	6	TPL	*	6
21.				15's	*	19	15's	*	19

* The CSS, TPL, TRN, SWS, SPR, and F/S Group has an ROA of 29.3% and 31.9% for FY77 and FY78 respectively.

11 May 1977

CASH FLOW AND ROA
As of Q4 FY77

	PL	Q4 Cash Flow	Q4 ROA	Q4 Rank	FY77 to Date Cash Surplus/ (Deficit)	Corporate Cash Award	Adjusted Cumulative Cash Surplus/ (Deficit)
1.	SWS	3905	*	1	*		
2.	SPR	1466	*	2	*		
3.	F/S	5437	*	4	*		
4.	TRN	455	*	5	*		
5.	LOG	532	43.8	3	3135		
6.	EPG	1188	11.2	15	(1459)		
7.	15's	185	6.7	19	(1841)		
8.	TYP	616	12.0	13	(2050)		
9.	MIL	132	1.2	20	(4492)		
10.	LDP	3587	13.8	10	(7230)		
11.	WP	(267)	Neg	21	(7871)		
12.	DDP	1681	15.1	8	(9438)		
13.	ECP	404	9.6	17	(9496)		
14.	TEL	2108	22.3	7	(9874)		
15.	IPG	1478	7.5	17	(13127)		
16.	BUS	3832	11.9	14	(13921)		
17.	TER	2224	14.0	9	(23566)		
18.	IOS	2464	6.8	18	(25467)		
19.	OEM	8968	12.8	11	*		
20.	CSS	1020	*	12	*		
21.	TPL	762	*	6	*		

* The CSS, TPL, TRN, SWS, SPR, and F/S Group has an ROA of 29.3% and 31.9% for FY77 and FY78, respectively.

11 May 1977

digital

Interoffice Memo

TO: Carl Angel
Horst Mehlfeldt
Paul Milbury
Harry Murphy
Rajan Nanda

DATE: 10 JUN 83
FROM: Ilene Jacobs
DEPT: Treasury
EXT: 288-6464
LOC/MAIL STOP: AKO1-3/B10

SUBJ: KHO REVIEW MEETING

Below are the notes that I took at the KHO meeting. I hope I can reflect the flavor of the occasion.

KEN OLSEN TALKING:

"Every time someone's given a job, they feel the obligation to change everything his boss did. That's what's going on right now throughout this company because so many people are in new jobs.

"We did a smart thing in building three personal computers, because we didn't know what we were doing. Once we wanted to put everything into one, but as it turned out the one that everyone wanted to build is not doing the best, i.e. the Pro. That's the same problem Ford has. When they decide on a big or small car, they could build just one, but instead they build one of each kind so they can't lose. We can't gamble on one man or one product or one group. That's not obvious any more, emotionally. We want to play all the horses, that's my strategy. But we can't play it the way the product managers have been playing it: that is, against each other to the detriment of the whole company. we also can't afford to do it. we spend too much time courting our oem's, promising them everything, which is even against our corporate policy. the only people that can't discount our products are our very own stores. That's the only group in the company that's honest. I want us to be able to sell all our very best products. This can be done both ways, both through the micro dealers and by ourselves. The question is how can we do everything. I believe it's easy.

"When we decided to make the VAX, we decimated the low-end engineering group. We did the same thing when we decided to make the CT. Currently we don't have much in the way of world-class engineers in the low-end group. The LCP5 which is our hottest product is really an 11 with a floppy and a Winchester disk. It's an old, old product and that's because the whole engineering organization in the low end is filled with tired engineers who've done nothing but create red tape. They wanted it that way so that they don't have to make anything new or strain themselves by doing any work. As you read magazines you notice that we're reported on less and less. Digital has less and less visibility as the premier engineering company. I want the non-technical managers to get out of here because they're tired and they

don't want to do any work. I want to hire world-class engineers to help create the new products for the future.

"This is what I really want to do. I want to break down the company into three pieces as if they were almost divisions: (1) Division A would be an OEM group, headed up by Ward MacKenzie in Marketing and Mike Dutton (?) in Engineering. They would operate as a team and set up an organization so that we can sell to OEM's without giving everything away. They would mainly sell VAX's and 11's. (2) The B group would be the end user group. In this group they don't like to give everything away. There will probably have to be a lot of groups (within B) because there are a lot of end users, but we must focus on this group and get for this group the world's best engineers so that we can meet the needs of the end user. (3) The C group is resellers. They would produce industrial standard hardware and software, package it and sell it to micro dealers. It would be headed up by Joel Schwartz in Marketing and Barry Folsom in Engineering.

"The rules of the game would be as follows: A could sell all their things and C things, but can't compete with the end users. The end users have the right to products as they see fit. (The OEM hardware business isn't a disciplined group and as a result of previous commitments we may have to live up to some of them.) The B group can sell all of A, B, or C products and the C group can compete with everybody but can only sell C products.

"Now I'd like to set this record straight on what the PC is. There is no real clean definition on the PC, but in my mind, the 10's and VAX's aren't all that different from the PC's. A mini computer is designed to grow to any size and do anything. This expansion costs something. All the PC does is cut away some of the things from the mini computer and put it on a job designed for one person. A PC is a single user piece of hardware unlike the mini that can have many users. PC's don't make good business machines because of the fact that they're designed for a single user. I predict that the mini's will be the most significant product because it can be designed to be a low cost as a PC but have the growth capability. That's what I want to build and sell. It would allow us to fight the competition.

"Back to my idea about the 3 divisions. I've been working on it for 6 months. I've been trying to get it out to everybody and listen to what they say when I tell them. But I don't want to write it down because I don't want it to go in the Boston Globe. That's the problem around here. Everybody wants to show how much they know and tell it to the Boston Globe.

"When we started working on the new Digital, we wanted to accomplish a lot, but we started to get tired and we stopped paying attention.

Things didn't happen that should have happened. The product line should lay out plans with staffing, expenses and profits just like they always have done. But instead, they stopped doing it. The product line must know what happens to profitability when they change prices. They are saying, 'You can't ask me to do that if I don't run everything, if I'm not in charge of everything'. That's crazy. They have to know what the profitability of their products are even if they're not in charge of running the tactical business. They suddenly realized that they thought they were being frozen out of planning. Once they learned that they did have responsibility for planning, morale has increased tremendously because they do have responsibility for strategizing, for planning and for marketing. The mood is really up in the product groups now.

"We've made some mistakes in the PC business. What we said is that we're planning to make "X" machines in the first 18 months and we've spent accordingly. But we were wrong. We tried to improve the product forever so it was too late. We pushed Manufacturing to produce two times what's required and we spent based on the plan instead of based on a realistic amount we could sell. We were particularly naive in announcing one year early and at a low price. We advertised 6 months before the product was in the stores and all we did was help IBM sell their machines. That cost us millions of dollars. I'm going to have a strict rule that there will be no more advertising products until they're in the stores, and support is all lined up and then we'll hit it hard."

SHEL ARONOFF then presented the Q4 and fiscal year forecast. While the numbers are really quite bad for Q4, next year appears to be significantly better. The major reason is that bookings had been flat for a year through Q1 of this year. Then in Q2 and Q3, it took off. Q4 looks like it's at the significantly higher level as well.

KEN then commented, "The hangup with you guys is that you present data like this but don't do anything about it. Senior management should not be expected to do all the work themselves. I want the finance department to do the work and to make the decisions. Don't expect senior management to make all these decisions. I believe we're wasting our money on advertising but no one challenges those decisions. You people in finance have to be able to challenge those decisions. Instead, all you do is cover it up. All our mistakes in engineering and advertising have been covered up. No one's learning by our mistakes because we won't even admit to them.

"Besides, there are two ways to do budgeting: the Massachusetts way which is to decide how much we're going to spend, spend it, and then finance it afterwards. There's also the New Hampshire way, which is to spend only what we take in, squeeze every penny to make the numbers

come out right. We used to do it the New Hampshire way, now we do it the Massachusetts way. We must to struggle to get back into doing it the way we used to. Only if the product lines understand their full costs and revenues are we going to get back to the way we did it before. Each product group must have to go through hell, travail and ordeal. That's the creativity. That's the struggle. And that's good for us."

BILL STEUL then commented, "The product lines used to have the responsibility for profit. You've taken it away. How do you expect them to struggle without the profits incentive."

KEN answered, "What's missing is a plan. They don't need to see the profit. What they need to see is a full plan. This year they lowered prices without seeing the impact on their plan. By the way, there's another positive message that I think all of us should be getting out, and that's that we've decided to get out of the Jupiter project. I see that as nothing but positive. We had to bring ourselves and the customers into the modern world. The cluster concept works, the PC's are changing the way computing is done, and we're smart to abandon the big, high-end Jupiter kinds of systems. By the way, I also believe that two-tier profits are the solution to our problems in motivating the product groups and the field."

BILL STEUL then presented the Q4 Pro and Rainbow forecasts and some thoughts on next years plan. For Q4 the plan is down $24 million, the software problems continue to be there on the Pro. Computerland is not moving our products. They say the reason is that we haven't done a good job getting software for our products. Also, that without the color and graphics capability that we're not competitive. Advertising certainly won't help fix these problems. Also, the order rate is behind plan. There's been a systems failure in OA; we've been processing all orders by hand. The information systems are unsatisfactory. We're going to have to slow down production in Q1. The high level of inventory at the end of Q4 is starting to be visible. We're going to have 12,000 Rainbows in inventory at the end of Q4. As far as the terminals business is concerned, it's losing focus. We're not managing the authorized terminal distributor channel. Bookings have been flat for three quarters because of the loss of focus and because of the delivery problems. LCG is still scrambling to get orders on the 10's and 20's, but we're probably going to have to set up a rental program to move some of these things. For the three products, Rainbow, Pro and DECmate II, we plan to ship between 42 and 46,000 units instead of the original 103,000. Rainbow is close, the Pro is way off and DECmate II is only half of budget. Against a revenue plan of $571 million, we're going to come in somewhere between $249M and $231M. Operating profit, instead of being zero, will be between a loss of $148M and a loss of $154M. That's a margin of somewhere between a

-59% and a -67%. Our real concern is that the build plan for next year is over 300,000 units, when we can only envision shipping 70,000 for the first half of next year."

KEN then cut into the conversation and said, "I propose that we're going to have to do some tough things to survive in the future. Don't anticipate that some of the things that have to be done I won't like and so you don't stand up and propose them. What would happen if some other company bought us? They would cut us back to a size that we could operate at profitably. Perhaps there are some products we have to get out of, or some markets we have to give up. If that's necessary, we have to do it. We can't operate with our cost structure the way it is."

Then KEN turned into a positive mood and said, "All these problems are starting to have some real good impact on the company. For successful, hard working people, there's no such thing as a recession. If we put our management energy into attacking the enemy, we'll win. We won't beat them by doing it the way we did it 10 years ago, but I see the end of the problems for us in sight as we finally start moving off of tired old engineers and we start hiring some world class engineers. The new Digital is still the way we ought to go. I still believe in it. We just abandoned the product groups too quickly; we demotivated them too much. But now that they're going to have a plan again, they'll make us win."

/ntr

TO: GORDON BELL
DICK CLAYTON
JACK SHIELDS
JACK SMITH

DATE: TUE 18 NOV 1980 8:38 AM EST
FROM: KEN OLSEN
DEPT: ADMINISTRATION
EXT: 223-2301
LOC/MAIL STOP: ML10-2/A50

SUBJECT: 11/23 AND RX02 FLOPPIES

I had an 11/23, a pair of RX02 floppies and a letter quality printer delivered to my home. I'm terribly embarrassed by these. I've never seen such poor mechanical design and such poor system thinking.

Will you send a note to me saying:

1. Who designed these units?

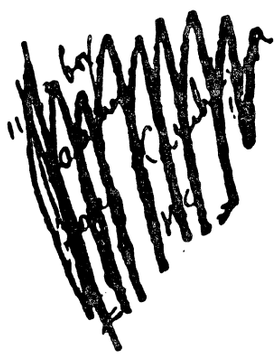
2. Who packaged them?

3. Who approved them for Manufacturing?

4. Who approved them for Field Service?

I think it's time we identify who does poor design and make sure they don't do design for us again. For years we've been doing poor design, keep doing it, and I think we're embarrassed to find out who does the poor design and, therefore, we never stop it.

I'd like to know who looks over the whole system to say that it is a product we'd be proud of.



The LQP came in a box which must be five feet tall and so big it won't go through most of the doors in my house. Two people have a terrible time carrying the empty box without the table and printer in it. Inside there's a printer which is just the size of an IBM typewriter and probably lighter in weight. We probably had good reasons originally to put the printer on a table and then the box so it wouldn't get damaged, but no one stopped to think of how much space we wasted, how much warehouse space we wasted, how hard it is to ship, and the overall cost.

The 11/23 is a micro-processor on four dual boards which takes very little space but they're put in a huge steel box which is very heavy, very hard to carry, and quite vulnerable in shipping. I don't know why we bother making large scale integrated circuits when we put them in boxes like this. All our work in integrated circuits is a waste and our packaging is so dumb. We even do things like not taking advantage of the metal covers for shielding because we don't ground the covers.

The dual floppies are put in a huge metal box which the automobile industry would be embarrassed to ever ship. It's "fit and trim" is terrible. No why can you make the trim look good. The floppies take up approximately a third of the volume of this box and the rest is empty air or poor design. We went to new small floppies because this box is so big. Anybody in their right mind would have made a box to fit the floppies rather than make small floppies. We could put small floppies in the same big box and gain nothing.

This equipment is filled with loose screws, each of which has a separate washer and a separate lock washer. I am not completely unhandy in taking things apart and putting them together, but I have a terrible time with all these loose screws and washers. I've lost one washer inside the equipment which I'm afraid might cause trouble later on when we turn it on. Many, many years ago people learned not to put things together this way.

Gordon Bell says the Japanese are coming because of their financing and better manufacturing. They're going to kill us by better design. This is absolutely atrocious and I want to know who did it and who approved it.

KHO/em
13.10