Oral History of Harlan Anderson

Interviewed by:
Gardner Hendrie

Recorded: May 15, 2006
Mountain View, California

CHM Reference number: X3590.2006

Gardner Hendrie: We have here with us Harlan Anderson, *who* was one of the *two cofounders* of Digital Equipment Corporation and he *has* gracefully agreed to do an oral history for the Computer History Museum, thank you very much Harlan. I should start out, shall I address you as Andy or Harlan.

Harlan Anderson: Please Andy.

Hendrie: Alright.

Anderson: That certainly what I was known as at Digital and my family and everybody except my two brothers because they were known as Andy also and it was too confusing for everybody to be Andy and I was the youngest.

Hendrie: I think where I'd like to start is a little bit about your family background, for instance where were you born, a little bit about your parents and maybe a little about where you fall in the birth order in your siblings.

Anderson: Okay, well I was born in Freeport, Illinois a little town *of* about 25,000 people in *the* North West corner of the state. Almost into Wisconsin and almost into Iowa and I was the youngest of 3 boys. I was born in 1929 and my older brothers were quite a bit older than I was. We weren't buddies in the sense of playing games together. They went off to World War II and I was still in Junior High School, so that was the age relationship. It was a farming community although we never lived on a farm. My father worked in a factory that made hearses and ambulances by converting Packard automobiles. It was very much a factory town when I grew up. I first met my bride to be [many years later] in junior high school. I kind of had my eye on her until we were juniors in college when we got married.

Hendrie: Andy tell me a little bit about your growing up period. What are your first earliest memories of what you thought you might want to do when you grew up?

Anderson: Well I skipped over the fireman, policeman routine and the first recollection of what I thought I wanted to do, came in high school. I had a very inspirational mathematics teacher. He made math interesting and I liked the subject matter. He went on to be principal and he became a life long friend. He just died a year ago. He was my model of what I would like to do when I grew up.. So I thought I would go off to college, but nobody in my family had ever done that before. There was no real economic support from the home to be able to do that, so I was thinking of going to the community college that was just starting in Freeport. Then my bride to be Lois Kahl was going off to Northwestern University and she said "Don't you think you ought to go away to college?" I thought about that for a while and worried about the economic support to do this and finally concluded that I could make it at the University of Illinois and I worked my way through the college totally. Fortunately the tuition was very low at the state supported university at the time It was $40 a semester and I had a scholarship that covered that. So all I really had to worry about was something to eat and a place to sleep and have money to buy some books. Those were my big expenditures. I would work during the summers when I went

to college. During the summer I worked at all kinds of jobs around Freeport, everything from a couple of days on a construction job, which I hated, to a couple of days, in a shoe store trying to con people into buying shoes that didn't fit, and I hated that also. But I finally found some things that were interesting and as I got into college a little further I ended up doing some things that really had something related to engineering. I said I wanted to be a math teacher but by the time I actually went to college I decided I wanted to be an engineer. I didn't choose a particular type of engineer. Physics was such a general subject, that I entered the University of Illinois in 1947 as a Physics Major in the College of Engineering.

Hendrie: Is that an unusual combination, would a physicist normally go to get a Bachelor of Science degree in the?

Anderson: Yes it is somewhat unusual. You were eligible after you had your bachelor's degree to start in as a PhD candidate if you wanted to. But something happened along the way that took me away from this idealistic thing of being either a math teacher or something else. It was computers. This was the infancy of the computer field. They were building one of the first ones at the University of Illinois for the Army. It was called the Ordinance Vacuum Tube computer It was supposed to help Field Commanders in the Army calculate the trajectory of shells they were launching. It was a monster computer. It was one of the first Von Neumann machines that was ever built.

Hendrie: Now what was the name of this, was this ORDVAC?

Anderson: This was ORDVAC, I'll explain that name in a minute, it stood for Ordinance Vacuum Tube Computer and it was built under a contract that the College of Engineering had with the Army. There were 3 principal professors who were working on this. One was a fellow named Ralph Meager, another was Jack Nash and another was David Wheeler. These fellows were teaching programming classes to undergraduate students in the Math Department, and I like to say they did that by day and at night time they were building the computer. Well the students never had access to that computer because it didn't work most of the time. It was still under construction. Nevertheless we students had to write programs for the Ordvac and we did that. These were mainly numerical analysis and series calculations, because that was the main anticipated use of computers. The professor had to take those programs home at night and pretend like he was the computer to see whether they would work. Well they shipped that computer to Aberdeen Proving Grounds of the Army. These smart fellows were Professors and I was a lowly undergraduate student. Every time they bought a part for the ORDVAC they bought another duplicate part and put it in a closet beside the ORDVAC. When they shipped the ORDVAC, they opened the closet and put those parts together and called it the ILLIAC. That was the first computer at the University of Illinois and was essentially identical to the ORDVAC.

Hendrie: And so that was what was later would be referred to as to the ILLIAC1?

Anderson: They just called it the ILLIAC.

Hendrie: Of course because there wasn't a II.

Anderson: They weren't sure they needed a II or a III or IV. As a student I still didn't have access to the ILLIAC because it didn't work until after I had left Illinois, which was the spring of 1952. So that was kind of my computer career at Illinois.

Hendrie: What did you do for summer jobs during this time? You were going to mention that a couple of them dovetailed a little bit with your actual interests?

Anderson: Well they were lowly jobs from engineering companies. One of them was with the Microswitch Corporation, which ended up being a major supplier of computer keyboards many years later. That was a home town company in Freeport and I worked in the laboratory, testing switches for how long they could last, how many times you could open and close these tiny little switches. That was one job that was probably the most interesting of my summer jobs. The next less interesting job was with the Fairbanks Morris Company that made industrial electric motors. It seemed like every one of their customers wanted to have a special shaft on their motors. These were custom made motors. My job was to do the mechanical drawing with pencil and paper of a shaft that was slightly different from the last one they manufactured. It was an engineering job kind of, but it was pretty boring. However, I earned enough money in each one of those jobs to pay for my room during the college year and that was my goal. The least interesting of all of these jobs was when I worked in the Kraft Foods cheese factory. This was a processing factory that manufactured cheese which basically meant you boiled cheddars of cheese. My job had nothing to do with making the cheese, I was on what they called the heavy weight gang, I was probably the lightest weight person on the heavy weight gang and our job was to unload truck loads of cheese that had come from small cheese factories in Wisconsin. There would be four or five of these cheddars, each one weighing about 50 pounds. They'd be stacked one on top of the other and we had to wheel them around on two wheel trucks in a cold room storage facility. This would allow them to age properly. Each stack probably weighed 200 pounds. And here I was wheeling these things around in a factory that ran three shifts, 24 hours a day. My shift began work at 5 in the morning and we finished at 1pm. We had our lunch break at 9.30 in the morning. That was by far the least interesting job and it was a time period when I was courting Lois for marriage. It was really hard on night time courting. That was the least interesting of the jobs that I had.

Back at college during the first few years I worked in a cafeteria line at mealtime and I was entitled to get free meals in exchange for that. That took care of the second major part of my college expenditures. I saved enough money to buy the books which were relatively cheap then. So that was my work involvement at Illinois during my first year. In later years, I had some more interesting jobs there than working just in a cafeteria. I lived in the Newman Hall, which is the Catholic Student Organization on campus and there is a Newman Club in most university towns. I was not Catholic but they had the best dormitory location on the entire campus. It was straight across from the library and they were trying to recruit me to become a Catholic which I did not do. But it was a wonderful place to live because of the location, and they had rooms for about 400 young men to live there. It was a big place. And I got rather close to the priest that ran the place and ended up working nights in their soda fountain. They also had a dining hall which is where I ate. I worked in their soda fountain making chocolate ice cream sodas and

sundaes and then I advanced within the Newman hierarchy. I had had a dance band in high school so I ended up leading the Newman Dance Band maybe because I had the music. You have to take advantage of all the things you have. I had the music and they needed music and I had led a dance band so I did that.

Hendrie: Now when did you get interested in music and do you play an instrument or your parents?

Anderson: I was never a good musician but I had this dance band in high school and I did play the piano as a young child, not particularly well but…

Hendrie: Your parents had given you piano lessons?

Anderson: They had given me piano lessons. My mother played the piano and the family would sing along with her old songs. So they did give me piano lessons and then when I got to high school, there really wasn't a place for a piano in the high school band so I took up the drums and played the timpani, I was a percussionist in high school with both the high school band and the high school orchestra and then I became drum major of the high school band. It was my first limited opportunity at leadership. The leadership role of the drum major isn't really what it seems to be.

Hendrie: But somehow, did you get appointed or elected to that or how did you get that job?

Anderson: I guess it was not an elected job. I guess the music director of the schools did it. I don't know whether it was one of those short straw stories where the guy with the shortest straw gets the job or what but anyway it was fun and it had a special uniform of course as drum major. All you did was blow the whistle twice and the band started playing so it really wasn't a big musical job but it was fun. So I tried to carry over some of those activities from high school in college, and I found I really didn't have enough time for many outside activities. In high school I had taken part in the debating club which was a speaking kind of thing. I enjoyed that and there was competition between different high schools and that was fun. I tried to get involved with the debating society at the university but I was just too busy with studies and all the work I didn't really do that. But I did get involved with the band at the University of Illinois. They had three bands. They had the marching band which is the one you saw at football games. It was a very precision oriented kind of band thing and it was big. It had 175 members in the band and it was not like the football bands we saw when we came to the East Coast where it was kind of a drunken brawl. This was a very serious band and they also had the second regimental band, which if you joined that or the first regimental band, you could then be excused from the ROTC requirement that the university had. Every male student had to take ROTC, but if you were in one of the military bands, you got excused from it. I did that and I enjoyed that. I did that throughout my college days.

There was one more interesting job than slinging hash in a cafeteria line or making sodas. In my junior and senior year I was working as a lab assistant in the College of Engineering I was an

assistant to a professor who was testing materials for their long term strength. By long term they meant like 5 years and 10 years. They would stress a piece of laminated plastic and see at what point it broke and how much it extended when these heavy weights were put on. That phenomenon is called creep and my job was to measure the creep of these plastics, it was a pretty boring job but it became more interesting because they let me get involved in the theoretical and the mathematical end of it. As an undergraduate I gave some lectures to the department on the mathematics of the stuff, so that was rather fun. I graduated and had a bachelor's degree by now.

Hendrie: Now what did you major, by the time you left.

Anderson: It was still physics.

Hendrie: It was still physics in the Engineering Department?

Anderson: Yes, they didn't have any computer science department.

Hendrie: Now did you have any involvement other than in your math classes in computers up through that point?

Anderson: None because there wasn't any computer science department and under graduates didn't get to touch computers. So the closest thing you could do was to take these classes and I took three of them. David Wheeler, the professor I mentioned, was from Cambridge University and had just received his Ph.D. at Illinois and apparently was teaching and staying on for post graduate work. He clearly wanted to see the completion of the ORDVAC and the ILLIAC computers because he was part of the team. So later he went back to Cambridge, England and remained there. He is still alive and I had a reunion with him a few years ago after 50 years. The purpose for the reunion from my standpoint was to thank him for telling me about computers because it changed my life.

Getting back to Illinois for a moment, after I got my bachelor's degree, technically I was now faculty since I had a teaching assistantship. We were able to upgrade our housing considerably from what was available earlier because we were married between our junior and senior year. There was an extreme housing shortage. It was shortly after World War II, and there were lots of married GI's. Places for married couples to live were in very short supply. So when we got this upgrade from this terrible apartment we had the first year we were married, we got to live in faculty housing and it was a zero bedroom apartment It was a brand new building, much closer to the campus and it was wonderful, $65 a month.

But there was one other fringe benefit that came with being a faculty member because I had a teaching assistantship and Lois had a research assistantship in the Psychology Department. We had a little money coming in now. Not much but a little. But one of the benefits if you want to call it that was that we were eligible to be chaperones at social events. All the sororities on

campus or any female gathering had to have a faculty chaperone. Now I was only one or two years older than the average student in these sororities but I was eligible to be a chaperone at their sorority party and one of my young lady students asked whether we would be chaperones at a sorority party. What an unusual experience for somebody so young. So we went and we realized afterwards that they kept us in the living room of the sorority house the whole time. The young ladies took turns watching over us to make sure we didn't really know what was going on at the sorority party. But it was lots of fun and they didn't invite us back because I guess they thought we had become suspicious but we don't really know what went on at that party.

Hendrie: Now you wife had graduated from Northwestern?

Anderson: No she transferred to Illinois when we got married.

Hendrie: So she ended up going to the University of Illinois also?

Anderson: Her degree ended up being from the University of Illinois. I wish we had waited to get married because she was deeply involved in Northwestern. She loved it and it would have been nice for her to have had her degree from Northwestern. But we were madly in love and so we got married between our junior and senior year.

So now during my senior year (I believe it was in the spring of the year) I wasn't sure I was going to stay there for graduate school. So I was starting to look around for job possibilities and took some interviews with the traditional places that hired engineering students, Eastman Kodak, IBM and American Standard Plumbing. The plumbing company was interested in me because I had the strength of materials laboratory experience which related to some of the things they were doing in their engineering lab.

Hendrie: Now what year is this?

Anderson: This would be the spring of 1951. Well one of the possible job opportunities came from MIT, they were just starting a new laboratory called Lincoln Laboratory and its first location was going to be on the campus of MIT. Jay Forrester, who had invented the coincident current magnetic core memory, was heading up the computer part of this laboratory and had previously run the M.I.T. Digital Computer Laboratory, which became the computer division of the new Project Lincoln Laboratory. He was coming to Chicago on a Monday to deliver his famous paper on the coincident current magnetic core memory. It became the standard of the computer industry for many, many years and was the first reliable memory for computers. Well he came a day early for his Chicago meeting and came down to the University of Illinois in Urbana where I was in school and interviewed anybody who had taken any computer programming classes. At that time there were very few engineering students who had shown any interest in computers. I was one of the lucky ones and they made me an offer to come to work at Lincoln Lab in the spring of 1951. In the meantime I had decided that I was not going to go to work right away because I told him that I was going to stay at Illinois and get at least a master's degree. They very kindly said that alright, and they would keep the job offer open for another year. A year

later when I had a master's degree, they increased the starting salary. By this time I was ready to go, because I had decided that my career had been permanently side tracked from being a high school math teacher or being a PhD in Physics because I had been bitten by the computer bug. Computers were where I wanted to be. So we packed up in 1952 and moved to Massachusetts.

Hendrie: What kind of coursework did you do for your masters do you remember?

Anderson: There were some more computer programming courses plus some required physics courses to get a master's degree.

Hendrie: But you had been bitten by the computer bug you?

Anderson: During my senior year.

Hendrie: So you took all the computer courses you could?

Anderson: I took everything that was available in computer courses. There wasn't a lot but there were three courses. Now we were taking computer programming before computers worked. I like to say, well I didn't exactly take my first programming course from Babbage but it was close to it because it was Professor Wheeler from Cambridge University, <inaudible> I believe he is now a Fellow of the Computer History Museum and gave a lecture here recently.

Hendrie: Gave a wonderful lecture on the invention of sub routines which apparently he was.

Anderson: I watched that lecture a few weeks ago so I could see what happened.

Hendrie: How did you do, were you a pretty good student, did you get good grades when you?

Anderson: I got reasonable grades yes, I would say I got good grades, I was not a straight A student because the physics courses were getting tougher and tougher and all these brainy guys were clearly going to get their PhD's but no I was doing well, there was no problem with that.

Hendrie: I wonder what attracted you to Jay Forrester, what Jay Forrester saw that, you know, he said alright we'll wait, do you have any idea what their criteria was in terms of hiring people, other than that just any warm body that loved computers and could program?

Anderson: I can only guess because they didn't tell me. Lincoln Laboratory was in an infancy state at that time and it expanded over the next 3 years to be 2000 employees so they were on

a big expansion program and radar, communications, computers and programming were all the things that were going to be very important to their project at Lincoln Lab, which was the SAGE system. This would be the first time that computers had been hooked to multiple radar sites where you could have a composite picture and have a graphical display of this. They used X,Y coordinates as opposed to the original scanning mode where the beam rotated around on a circle which had been standard radar displays prior to that time. So to try to answer your question as best I can, I think they wanted all the warm bodies they could find who had an interest in computers. I'd like to give you a more powerful answer that they saw that I was going to make a career out of computers and etc, etc but…

Hendrie: Tell the truth, that's probably what was going on.

Anderson: I think that's what was going on and it was lucky for me.

Hendrie: So you get your masters degree and decide alright enough is enough of I'm not going out in Physics I have been bitten by the bug, I want to go and you accepted the Lincoln Lab offer. Is that correct?

Anderson: That's correct.

Hendrie: Now do you remember how much they paid you that first year, what was your starting salary?

Anderson: Well this is confidential information but because it's you Gardner, I'll answer that. The starting salary I was offered the first time was $360 a month and they raised that by the time I was ready to go to $405 a month. Now I had 5 job offers, three of them were in the Aerospace industry where they were doing some computer work which they couldn't talk about apparently. I assume it had to do with computers in military aircraft and all the other salaries were higher, I took the lowest paying salary because it was MIT and I foresaw an opportunity there. Maybe they didn't see that I was going to be a major contributor. I was a lowly computer engineer right out of college. They had divided the big picture project work load up into small pieces. My small piece which I started doing immediately when I got there was to design the control logic for a new computer and Ken Olsen was my first boss there. He was Chief Engineer of this new computer, which was called the Memory Test Computer. The sole purpose of this computer was to test the magnetic core memory that Jay Forrester had invented. They had previously tested it with pattern generators as best they could, but the real test was did it work properly with a computer. The computer that we designed had no memory except this new one to be tested, which we didn't know whether it was going to work or not. So we had 5 memory locations of changeable memory (we would call it RAM today) and I'm using that term because they were really flip flops and they could be altered by the program and then there were I believe a total of either 16 or 32 memory locations. Other than the 5 RAM locations, the balance of memory were manually set switches. It is similar to what we would call ROM today. In other words you could set the switches to be the initial memory content but they could not be changed while the program was running. Now the purpose of what I just described was that's how you got the program into the computer to test the new coincident current memory. You couldn't put

the program in the new memory because it was unknown whether it would work. So the problem was the test program had to be a very short program to test the memory. It couldn't be the traditional kind of tests because those programs are much too long.

So Wes Clark to the rescue. Wes Clark was one of the most creative people I have known. He wrote the program to test the memory and it could only fit into a very small part of this fixed memory I described a moment ago. He called it the inch worm and it worked in the following way. It was only maybe 10 or 12 memory locations and you could load it in through these switches that I described. The program would pick itself up and move to a new part of the memory and when it got to the new part it would pick itself up again and move to another part of the memory. If it kept moving itself through the memory and came out the far end, it meant the memory was working. It was called the inch worm, a very clever idea. That verified that the new memory was working. Shortly after that, they took the memory away from the Memory Test Computer because they wanted to use it in the Whirlwind computer system that was being used to test the concept of the SAGE system for the military application. The Whirlwind computer previously had had a storage tube memory which was very unreliable, very slow and quite unsatisfactory.

Hendrie: So the Memory Test Computer was built before and used the memory before that first core memory was ever installed in whirlwind?

Anderson: Before it was installed in any computer and particularly Whirlwind Now the Whirlwind feasibility system quite a prototype, it was truly only a feasibility thing. It was called the Cape Cod system and it had radars from all over New England that were connected into the building where the Whirlwind was via phone lines. They had many radar signals that were combined into one picture where the enemy aircraft were. They had real drones that flew into the system and they scrambled real fighter airplanes from ____Hansom Air Force Base and different places. It was a very exciting time. Now I played no direct part in that military test. As a young engineer my job was to help make this memory test computer to provide a reliably tested memory for the Whirlwind computer that was the heart of the system. The rest is history.

Hendrie: And do the control logic for it?

Anderson: Yes. Do the control logic. Now the control logic for it was made up of digital commercial vacuum tube circuits manufactured by the Burroughs Corporation. These were intended to be used as pattern generators, counters etc. and could be connected together with patch cords which were coaxial cables with BNC connectors. One flip flop was 3½ inches high and filled up a full 19 inch wide rack. As you know, the control logic for a computer is fairly involved even if it's a simple computer. Those of us who were hooking the Burroughs units together had fingers that were bleeding from connecting all of those BNC connectors. We finally wore gloves to keep from ruining our fingers. But we got it done in very quick order and it worked and the test was done. We did build another memory for that memory test computer after the original one was put on Whirlwind. M.T.C. was used for quite a while internally at Lincoln. It was nothing pretty because it was thrown together as fast as possible to test the core memory.

Hendrie: Now did I hear you correctly that a single bit of flip flop was 3 inches wide by.

Anderson: Three inches high.

Hendrie: And fitted into a 19 inch rack.

Anderson: And then we had the AND gates. You could get two of those in a 3 inch by 19 inch rack module unit. So this control thing was sizeable in its own right just because the equipment we were using was made of vacuum tubes and was so complicated big. Clumsy is probably the best word.

Hendrie: Who else worked on that with you?

Anderson: Well of course Ken Olsen was the Chief Engineer for it and Phil Bagley whom I've lost track of. I don't remember all the other people. Wes Clark was not technically part of the group but came to the rescue by figuring out how to write a program that would fit into such a small memory. I don't really remember the names of the folks that worked on that. It was a team of 8 as I recall.

Hendrie: And so that's how you originally met Ken?

Anderson: That's how I met Ken.

Hendrie: Very good, though how long did you work on this would you say?

Anderson: Well I probably worked on it a year or two and then went onto things that were really outside the pure hardware area. I was involved in Systems Integration with other military systems that were supposed to work with the SAGE system. Some of that was liaison and a variety of things. It involved a lot of travel to places where they were making various weapon systems. My job was to help facilitate the integration. But during this time period IBM was selected to build the production prototype of the military system. I played no direct role in selecting IBM as Ken did. There was a lot of flying back and forth to IBM's place where they were doing the work in Poughkeepsie and later in Kingston, New York. The Kingston factory for IBM was built for the purpose of building the SAGE computer system. The system was called the AN/FSQ-7. XD-1 was the prototype of it and that was build and installed at Lincoln Lab. The original location for Lincoln when it was started was on the campus of MIT. They didn't have enough of their own buildings available for such a large growing project, so they acquired buildings that they rented within a block of the campus. My first office was in the former Whitehorse Shoe Polish factory one block off Mass Avenue and one block from the heart of the campus.

Hendrie: Where were we? You—

Anderson: Well, I was talking about the SAGE System and that deserves a little bit of elaboration for anyone not familiar with it. The SAGE system was a real pioneer thing which for the first time had interactive computers with man and machine in a way that was never done before. Where a human being could see in real time a graphical picture of what was going on in a military situation and interact with it. It was a very successful system for the defense of North America. And that system went into production. It was installed throughout the United States and Canada, and the SAGE computer that's here at the Computer History Museum actually came from Canada. It was one of the last ones that was decommissioned and it was in use there for I would guess at least 25 years.

The other thing that I think is worth mentioning about MIT Lincoln Lab: It was a very collegial atmosphere and they did a lot of things in a very casual environment. Their budget was reviewed by the Defense Department in kind of a huge lump sum and you didn't have to go through lots of paper work to justify individual projects. They had tremendous freedom. MIT got that freedom because during World War II they had played such a role in developing radar that it was almost like they could do no wrong in the eyes of the Defense Department. I think MIT delivered on this new project, the SAGE system. So that's kind of it. Ken and I were getting bored at MIT and Lincoln Lab because the thing that we had started with had gone into production now and it was quite a different world.

Hendrie: Were you involved at all in any of the design work for the TX-0 or—

Anderson: I was not but that deserves some mention because it was an important part of what's coming later in our discussion here. It was the first transistorized computer. Ken Olsen played a key role in that. By this time I was still at Lincoln but was working with other companies that were providing military weapon systems that were to work with the SAGE system. I was not involved in the transistorized development work at MIT, but Ken was.

He was getting a little restless and that's what gave rise to something new in our lives. Ken had been part of a group of individuals that was going to start a new company that involved some outsiders. The outsiders were component manufacturing people and they had grandiose plans. Ken was going to be their chief engineer as I recall. He had asked me whether I would join it as an engineer and I said I probably would because I was getting ready to move on to something else. Well, that company never got started and the original group of people who had gotten Ken involved kind of fell apart. As I recall I suggested to Ken why don't we see if we could do something new on our own and so we explored the idea. This would have been early 1957. Starting a company was of course the idea. The natural thing for us to say was that we wanted to make computers. We approached the industrial corporation that had been the "would be sponsor" of the original company that this other group had tried to do. They turned us down flat because we didn't have any business experience and they had turned down the other group that fell apart so we didn't have a chance with them.

Hendrie: Now can you say what company this was or—

Anderson: I don't know that it had a name.

Hendrie: But the industrial company that—

Anderson: Oh, the industrial company—

Hendrie: --going to be the sponsor potentially.

Anderson: Yes. That was the Stromberg Carlson division of General Dynamics that had seriously considered the first company that had grandiose plans. They were going to make electronic components because their founders were people who had been engineers at Sprague Electric.—

Hendrie: What sort of components were they going to make—

Anderson: I'm not really sure because I was not part of that. I was in the wings to be an engineer working for Ken Olsen as chief engineer of that company. I'm sure it would have been computer components of one kind or another but I really don't know the answer to that because I was not deeply involved in that. At any rate we explored whether we could do something on our own and we tried the same funding source and they had turned down the bigger company with the experienced businessmen so they surely turned us down. And so our next move was to go to the Small Business Administration office in Boston, because we didn't know any sources of money. And we didn't have any money. So we went there and they weren't about to make a loan or anything but they did give us good advice. They said what you need is the earliest form of financing called venture capital. At that time there wasn't much venture capital. There were only three companies that did it plus angels, like Laurence Rockefeller and others. We had no entrée to them so we went on thinking about the three known venture capital companies. Only one of them was in Boston.

Hendrie: Do you remember who the other two were?

Anderson: I don't. One of them was some part of the Payson Track Investment Company and I don't remember who the third one was but it was also in New York was the point.

Hendrie: Both of them were in New York.

Anderson: We weren't about to spring for the time nor money to go to New York. We were pretty naïve and frugal on these things. So we wrote a letter to American Research and Development Corporation briefly outlining what we wanted to do. The tone of our letter was warm but we had not been invited to submit a proposal yet. A staff person was assigned to respond to us. His response was warm but guarded. In the events that followed he became a dear friend of Lois and mine for the next 45 years.

Hendrie: Who was that?

Anderson: That was Bill Singleton who passed away a few years ago.

Hendrie: I didn't realize he had passed away.

Anderson: Yes, a dear friend. We are still very close friends of his wife. He was the one from A.R. and D. who was told to respond to us. He answered our letter politely and invited us in for a meeting which we did and they seemed somewhat interested. The environment in the computer industrial world was not particularly good at that time. RCA and General Electric had already entered and left the computer industry as something that they couldn't make a profit at. It was a pretty tough sell to convince these people that two engineers with no business experience could make a go of it. They didn't turn us off or turn us down but we were on the back burner.

Hendrie: Was Ken's brother involved at this point yet?

Anderson: No, Ken's brother was not a founder or a cofounder. He became probably our first or second employee a month or so afterwards. But I think Ken had in mind bringing his brother in early on. Stan was a very important player from early on in the company, no question about it. So the question was how could we make ourselves look like businessmen to this investment group. We were still working at Lincoln Lab and we hadn't discussed our new venture idea with anybody at Lincoln. So we took our lunch hours and went into the Lexington Public Library and looked at annual reports and Standard and Poor's reports for companies that were industrial. We discovered words like 'balance sheet' and 'income' and 'cash flow' and we really didn't know what those meant. We knew what the personal level of cash flow meant in keeping your checking account balanced so it was always positive and don't spend more than you put in.

So the next step in this business education for ourselves was to learn something about accounting. Accounting textbooks were much too thick but we found Professor Paul Samuelson's textbook on economics at MIT which was widely used for many, many years throughout the country. He had written an appendix to his economics textbook on accounting in a very simplified form. He did it by taking a company that was an example and showed what their balance sheet looked like, showed what their income and expense statement looked like, what their cash flow looked like and how these things all related to one another. It was called the Apex Toothpaste Company. We studied the accounting of the Apex Toothpaste Company so thoroughly that we probably could have started a toothpaste company.

We used that experience plus looking at all these real income and expense statements and balance sheets from real companies to make our Performa financial projections for Digital Equipment Corporation. We did it four years in advance and in later years the actual results came out amazingly close. When we approached ARD, American Research and Development, we said we needed $100,000 to start. Well, they couldn't believe you could do anything with only a $100,000 but they said well, you certainly can't make computers with that. So although the first name for the company was the Digital Computer Corporation, the first thing we did was to change that to Digital Equipment Corporation. They said could you do something less ambitious than make computers, to show that you can manage a company and make a profit?

For a while we thought about making power supplies as our first product. That wasn't a very exciting thing. So then we realized that now that transistors were available we could make digital test equipment equivalent to the old Burroughs vacuum tube digital test equipment. These were flip flops and gates and clocks and things and they were used by engineers who wanted to generate patterns for testing digital systems. We made counters and all kinds of things like that. They were really printed circuit modules and each one was in a very hardened case so they couldn't be abused. There were no pins sticking out. They were all female connectors with patch panels on the fronts and power connections on the back. This test equipment was now our first product that we planned to make. The second product line was very similar but they were system modules that could be used to make a permanently wired system. They plugged into a back panel wiring system. So those were our first two products and we made a profit at the end of the first year selling them.

Hendrie: Let's roll back to that was what you proposed doing to them and tell me a little bit about the story of how you eventually got to cut an agreement with them.

Anderson: Our sole investor, American Research and Development Corporation, kind of bought the idea but they weren't about to risk much money on it. They said we'll give you $70,000 and if at the end of a year things are going well we'll loan you another $30,000. On the surface it seemed like they had met our financing requirement, because we had confidence that things would be going well at the end of a year. The thing that we had no experience in was negotiating a business deal like this. They said we would like to split up the ownership of the company 70% for American Research for our $70,000, 20% for you and Ken. We think you need a business partner and we are going to hold 10% of the stock in reserve for him. They trotted several people by us as candidates for the job. Oh, incidentally we accepted this deal.

Hendrie: You said we'll do that.

Anderson: Yes. Now I know the venture capital people of today and the entrepreneurs of today can't believe this. But we accepted it because there were no other alternatives as far as we were concerned.

Hendrie: You thought that you could succeed with this.

Anderson: We thought we could succeed with that amount of money and we wanted to do the computer company so badly that we were willing to accept the terms so we did it. The excitement of creating a company was more important than the terms of the deal for us.

Hendrie: Did you leave right away, Lincoln, or did you—

Anderson: The time span was not long. We first contacted American Research in roughly April of 1957 and by the time these gyrations that I've described and the negotiation or lack of negotiation occurred—

Hendrie: And your education in business—

Anderson: --and our education in business. We started the company in August of 1957 and we did have to announce to our superiors at Lincoln that we were thinking of leaving because American Research wanted to do a reference check. Lincoln Lab at MIT had been a very collegial place in all ways. There was no big deal about who owned the rights to transistor circuits or anything like that. Everything was thought to be in the public domain. There were no patents or copyrights or anything that stood in the way of wanting to do this.

We started in August of 1957 and accepted A.R. and D's business advice carte blanche. When they said we think you ought to use Coopers, Lybrand, Ross Brothers & Montgomery as the auditors (now called Price Waterhouse Coopers), we accepted it. - They were also A.R.D.s auditors. So they became our auditors. And then they said you ought to use our law firm for incorporating. So we did. General Doriot, whom I have not mentioned yet was the legendary professor at the Harvard Business School but also president of American Research and Development Corporation. He wanted to meet our wives before he would give his final okay to start the company. He was very much into the role of the wives as an important part of being an entrepreneur.

Hendrie: Because they must be very supportive.

Anderson: Well, and he met with them privately without Ken and me so he could really size up are we really going to work hard at doing this? I think the wives left the impression that they were willing to give it a try.

Hendrie: That's what she reported?

Anderson: -This was not quite the ringing endorsement that he had wanted but he accepted all of that. This was at a pre meeting before we did the legal incorporation at the law firm's office. His advice was that we should use the Shawmut Bank which was A.R.D.'s bank. He told us when you go to the law firm don't stay too long because they charge by the hour. His whole course at the business school was folksy advice of that kind. His advice for us also included businessmen must wear a hat, and don't be late for an appointment. When you lay your products out for a sales prospect, particularly these print circuit modules, lay down a velvet cloth first. Then lay your product on this purple velvet cloth to make it look important. So he had lots of homey advice and we took all of it lock, stock and barrel.

Hendrie: It sounds like some of it was pretty good advice.

Anderson: No real problem with any of that—

Hendrie: You said something about the business. He wanted you to go—

Anderson: To find a businessman—

Hendrie: Who did he introduce you to? Do you remember any of them?

Anderson: I don't think it's appropriate to enumerate them because they didn't become the businessman but we had a candidate of our own. We only knew one businessman as I recall who had anything to do with a manufacturing company. He was retired from industry and had been working at MIT Lincoln Lab and was a very nice fellow. He was working as an assistant to one of the officers of Lincoln Lab and we offered him 10% of the company for his joining us as a partner. He turned us down. So the quick answer to that whole situation is we never did hire as a business partner a businessman. The question kept dragging on and by the end of a year we were making a profit without him and so the- American Research people relaxed that requirement so they ended up owning seven ninths of the company instead of seven tenths. So that was kind of the startup phase of things.

Hendrie: Who did you hire as your first employees?

Anderson: Well, Stan Olsen was the first employee, Ken's brother, who became a very key person.

Hendrie: He was hired for what? What was his job?

Anderson: Well, everybody did everything. There was no organizational structure. We did everything including erecting the office partitions. The location for the company was in Maynard which became the historic location and we rented space in an old woolen mill that had over a million square feet of space. They had built a new building for this complex every time there was a war because the woolen mill had made blankets for the military. That was their bread and butter business. The company and the town flourished every time there was a war. One of the buildings was built for the Civil War, another for the Spanish American War probably and World War I. Well, these were very old buildings and Maynard at that time was a rundown town that had really fallen on hard times because its major employee, the Assabet Mill, was out of business.

Anderson: There was large unemployment. So a group of businessmen had bought this old mill that had over a million square feet of space. They renovated it to a minor extent and rented it to anybody who would take small pieces of it. They had rented quite bit of it by the time we approached them and they had the second floor of one of the buildings that was vacant. The first floor was already rented to something called Arthur's Discount Furniture Store. We got the space above Arthur's Discount Furniture Store. No elevator. It was a walkup. There was a hoist where you could hoist up heavy things that you needed and we used that extensively.

We did our own printed circuit board etching in this building and it had wooden floors. Occasionally our etching solution would overflow and go through the wooden floor and damage

the furniture downstairs. We had to pay the discount furniture store for its damaged furniture. But it was fun. And we really did everything ourselves. The rent was 40 cents a square foot per year and at the time that seemed like a fair rent. It was particularly fair when you realized that included parking, heat, electricity and watchman service. At 40 cents a square foot, we thought we had really negotiated a good deal. But, again, we weren't much in the way of negotiators. We found out some years later that the businessmen who had bought the mill had bought it for 15 cents a square foot so they were doing well at 40 cents a square foot rent per year. We expanded many times into vacant space in that old woolen mill and eventually into most of the building.

Hendrie: Occupied almost the whole thing didn't you?

Anderson: Well, after I left the company the company indeed bought the mill buildings and occupied the entire set of buildings. Our goal was still to make computers and you asked earlier whom we had hired. Most of the engineering people came from MIT. There was a whole group of Lincoln Lab people who were pretty much the same as Ken and myself. You know, we wanted to move on and do something else. We'd been around Lincoln Lab for a number of years and it was changing, so we decided to leave. There was no problem in hiring those kind of engineers from Lincoln. I don't think Lincoln was terribly unhappy at this because they felt a responsibility to put their developments in the public domain. After all they were being financed by the government, the military to be sure. So one of those that we hired was Ben Gurley, who had built the TX-0 computer and was working on the TX-2. He and Ken had worked together on the transistorized computer development at Lincoln Lab. And Ben joined us.

Hendrie: When did he join you?

Anderson: I'm guessing it had to be very early 1959 or maybe late 1958. Probably early 1959.

Hendrie: So that's a couple of years into your history. You started August of 1957. So late 1958 or early 1959.

Anderson: A year and a half.

Hendrie: Now was Dick Best one of your early…?

Anderson: Dick Best was hired earlier. Dick Best was a key engineer he was an excellent circuit designer. He was hired before Ben and had the title of Chief Engineer but that really meant circuits. At that time we were only doing printed circuit modules, system modules flip flops and things like that.

Hendrie: Now who designed the circuits in that original product line? Who was responsible for the circuits?

Anderson: Ken and to some extent Dick Best. But Ken Olsen did a lot of those himself and certainly did the packaging. He was very good at packaging things. So Ken would have designed the original circuits probably himself and then Dick Best helped with augmenting that because that was a growing line of products.

Hendrie: He continue add circuits.

Anderson: Adding new circuits all the time. Dick Best would have done that. And then Ben Gurley was more a computer architect. That was his real contribution to the company.

Hendrie: When Ben joined, did you have any feel how big the company was or in terms of technical people, in terms of engineers?

Anderson: Very small 'because we stayed very small. We had this ground rule that we were going to try and make a profit every year. We didn't get out in front in terms of employees and things like that at that time period. So the company would have been pretty small. I guess it would have been that the sales level at the time Ben joined was around $1 million. So I could be off on that but it was small. But it was profitable.

Hendrie: Yes, always profitable.

Anderson: Always profitable during that time period. Losses came many, many years later after I had left.

Hendrie: Not on your watch?

Anderson: Not on my watch. The next exciting phase of the company began with Ben arriving because now (we didn't ask for formal permission from our investors) it was clear that we wanted to do a computer product. And our system module products were ideal for that. We didn't have every type that we needed but we had enough to get started on designing a computer Before starting the computer design we had also built another small system product line that had a limited market. These were memory test machines. They weren't complete computers but this was important technology for building a computer. We sold these to manufacturers of magnetic core memories, people who had taken licenses on the Forrester memory patent. So we had all the memory driving technology down because of those memory test machines. They had similarities to computers but weren't quite stored program computers at all. So that was an important step in getting into the computer business. We started designing our first computer sometime early in 1959.

Hendrie: Now, was Ben hired specifically to do the computer?

Anderson: It wasn't laid out in quite that specific term because we didn't have specific authority to make a computer from the investor board of directors. But, yes, the answer was we wanted to make a computer and Ben was going to play an important role in it. So without a document that said that, the answer is yes in my mind.

Hendrie: You don't have to necessarily write it down.

Anderson: Well, that's right. We could always back off and say well it was really another memory tester. But no, we did the whole thing. One of the customers to whom we sold these memory testers was RCA, which had another spin-off from Lincoln Lab and it was a group that set up shop in Needham, Massachusetts. Their sole cause for existence was to make coincident current magnetic core memories under the Forrester patent. RCA had been just bridling to get into the computer memory business for years. They had a different memory technology developed at their Princeton laboratory. They had two memory groups that were competing within the company. But the clear winner from a technology standpoint was the spin-off from Lincoln that was in Needham. And we sold our memory testers there as I mentioned.

The memory for our first computer came from that group at RCA and my recollection was that it was almost a surplus magnetic core memory that they had built and we got it for a bargain price. It happened to be 18-bits in word length and that determined the word length of our first computer. Now that's my recollection. I don't know whether others would have recalled differently or not but I'm pretty sure that that was the situation. So there was no big analysis whether it should be 12-bit, 16-bits or 24-bits, it was 18 because we had a cheap memory.

Hendrie: It wasn't as though TX-0 and TX-2 had been 18-bit machines.

Anderson: No. The longer the word length the better. You can have more instructions, more memory addresses and all those good things. But the longer the word length the more expensive it was to build. So, 18 seemed like a logical number and then we found a cheap memory available and we bought it. That was it. So Ben got busy with this and he had others that helped him but he was clearly the architect of the computer. Ken helped with the packaging because that was a very important part of the design. Ken was very expert and did a good job of making it look reasonable and made a product out of it from a packaging standpoint.

The PDP-1 our first computer was ready for the announcement of it on December 1, 1959. It was approximately nine months after Ben had started on it. And one thing I should go back to concerning the Lincoln Lab experience. Group 62 of Lincoln Lab, which we were part of, was the hardware part of Division 6. There was also Group 61 which was the software group. And there was always a little tension and competition between hardware and software. So we were not keen nor thoroughly experienced in software. We felt confident in the hardware area and as a result the PDP-1 was developed with minimal software -- practically none by today's standards. It wasn't quite none but it was very little. I should diverge from the lack of software to something unique that we did have.

We included a cathode ray tube display, which was not a standard part of commercial computers at the time. But we really didn't have much to display on it. It was almost just generating patterns of interesting graphics. But it didn't have anything very interesting like alphanumerics or anything like that. It generated parabolas and things that were not useful software in any sense of the word. So when we were getting ready for our first public demonstration of the computer on December 1st 1959, there really was no software for it of any consequence. We had a macro assembler so that we could assemble machine language programs. Everything was done in machine language. There weren't any high level languages. We had this assembler but that was about it.

However, on November 30th the night before the public showing, we were at the Statler Hotel in Boston, where the Eastern Joint Computer Conference was going to open the next morning. We had moved our new PDP-1 computer down there. It weighed 1500 pounds and took a moving company with practically a crane to move it. Fortunately it was on wheels. They got the thing installed and we turned it on and it didn't work. So Ben and I were down there long into the night trying to make this monster work. It was much smaller than the computers of the day, but it was still a monster by today's standards. It was getting later and later and I had planned to go to my home about 20 miles away and get rested for the formal introduction with the trade show opening the next day. I finally called my wife at 1 o'clock in the morning and said I'm not coming home tonight. Well, that was an unwelcome call because she had just given birth three weeks before to our third child. All three of the young children were under the age of five and were sick.

We did get the thing working and just before the trade show opened we looked down the aisle at other exhibitors and here was IBM's enormous booth. We had a very tiny booth. Apparently they were having troubles that were similar to ours but they had screens around the outside of their booth so nobody could see how much trouble they were having. In spite of all of these problems the announcement was well received, the computer really didn't seem to work very well because it didn't have any application software to speak of. . The fact that it was the first transistorized general purpose computer and it was offered for sale at $120,000 attracted enormous attention. And we were swamped with people word of mouth etc. and they all wanted to see this thing.

One of them was a Cambridge based consulting company Bolt, Beranek and Newman. We didn't really have any relationship with them at that time but they were dabbling in the use of computers. Their only computer at the time was a drum memory computer that was very slow. But they got interested in our PDP-1 and followed up after the trade show. One of the other things we did within the first year was to donated one of these machines to MIT to be made available to undergraduate students who did lots of exciting things and created lots of software. Not software in the usual sense that we think about today like the stuff that Gates does but software nevertheless.

It was software like the Space War game that demonstrated the interactive possibilities for our computer. Space War was probably the first ever interactive computer game. A very big industry today. Real time "man machine" interactivity in commercially available computers was totally new at the time. They also did a digital debugging tape DDT, which was a way to debug your

program, which was an important part of writing programs at the time. Anything in machine language was prone to a lot of problems. So they did that and they did programs like Expensive Typewriter where this $120,000 computer simulated a typewriter. It was a very sophisticated typewriter that could duplicate things, edit text and could make punch tapes and duplicate tapes.

Hendrie: Yes, but the beginnings of word processing really.

Anderson: It was the beginning of word processing exactly. And they didn't necessarily use the term "word processing" It was Expensive Typewriter.

Hendrie: Now do you remember the genesis of the idea, you're a very profit-oriented company, you're a very cost conscious company, as I understand it, of giving away a computer, a $120,000 value computer. Of course, it didn't cost you that to make it.

Anderson: Well, maybe it wasn't done quite as early as I said. One of the panelists at our program later today told me that it was September of 1961. We were quite profitable when we gave it to them. Our early customers struggled along with practically no software other than the assembly program for machine language. The gift to MIT had two aspects to it. One, of course, is Ken was an MIT alumni. The second aspect was that we had gotten something very valuable from MIT Lincoln Lab, namely the technology to start a company from. There was also a third aspect which never really got discussed. It really cost us no cash money to give it because of tax savings related to the gift. At that time period the Internal Revenue Service tax rules were such that you could deduct from your profit level fair market value of the computer you were giving. So we could deduct $120,000 from our profits when calculating our taxes. But the incremental cost to make one more PDP-1 computer was like $40,000. So if you do the arithmetic on this and put in the tax rate, we actually generated cash out of giving that gift. Now, the tax laws changed after we did that, not because of us. In future years you could only deduct your cost to manufacture the item, not the fair market value.

Hendrie: But at the time it was…

Anderson: It was legal, we were not…

Hendrie: It was legal and the secret was it didn't cost you anything.

Anderson: It even generated cash for the company. That was all incidental to the fact that we had a whole generation of MIT engineering graduates in the electrical engineering department who cut their teeth on our computer. They couldn't get near the big IBM computers that were at MIT at the time.

Hendrie: And you had every expectation they would go out into industry and if a computer was needed they would have a predisposition.

Anderson: Since they were probably new employees they would start out by saying, "well where is the PDP-1 computer?" to their first boss. And we sold quite a few computers based on that. Now, some of the early PDP-1 computers were sold into unusual applications. The physicists who were doing bubble chamber physics work tracing atomic particles on photographics were trying to do pattern recognition of these particles floating around. They were willing to buy a computer without software, write their own software and we provided them with the cathode ray tube display. Later we made a variation on display which was a precision cathode ray tube where they could put their bubble chamber films in front of the cathode ray tube. The computer generated a scanning dot image and with a light sensing device they could read their films into the computer for pattern recognition studies. That pattern recognition application was so important to those physicists that they would put up with the fact that we didn't have software to do it. They had to write specialized software in machine language for their application anyway. We sold quite a few of these configurations of the PDP-1 into the physics research field at major universities around the world.

Hendrie: I think that I read somewhere that one of the major applications of the PDP-1 was for ITT doing some sort of message switching. I hadn't heard you-- you probably hadn't gotten to that one, but I'd like to hear a little bit about that and how you manage to, you know, how that evolved and how that happened.

Anderson: Yes, that was a very important and interesting part of the PDP-1. And the reason was ITT bought a quantity of PDP-1s. I think it was 10 or 12, something like that. And the way that came about was that a fellow MIT Lincoln Lab staff member named John Ackley had left Lincoln Lab-- nothing to do with our leaving, didn't join us. He was a very bright fellow. He went to work for IT&T. And he said this business of manually rerouting teletype messages through message centers was very cumbersome and costly. And he told his boss that this would lend itself to a computer doing the rerouting of teletype messages. As an example of how they had been doing it - take a message from San Francisco to Detroit. Well, you might send it to the Chicago center and there it would be manually rerouted to Detroit. And that had been done, I gather, with relay switching or something. And before that it was totally a manual process. So he said, "Why not do it with computers?"

Hendrie: Well, yeah, I think at least one of the technologies that I'm aware of that Western Union used was what they called a "torn tape" system. And they'd literally punch it out in Chicago, and then read the header and say, "Oh, it's going to Detroit," and they'd go over to the machine on the Detroit line, and the reader, and put it into the reader.

Anderson: That's what I refer to as the manual system.

Hendrie: Yes, exactly.

Anderson: And maybe they never did do it with relays. But at any rate, however they were doing it was people intensive, cumbersome and slow. And we had had data hook-ups with the Whirlwind computer at MIT over phone lines, because that was an important part of the SAGE system. So it was a natural thing to think about phone lines, lots of phone lines going in and out of a computer. John Ackley who was the fellow that brought that idea to IT&T was somebody we knew, or he knew us was probably more important. And he suggested that our computer would be a good one to do that. So that was a very important sale that we made. I don't know how successful that business was for IT&T. They certainly used their PDP-1's that way. Whether that became a core technology for their message switching business, I really don't know whether they changed it later or what they did, but for us it was an extremely important sale.

Hendrie: Any other particular applications that you remember because you were sort of involved in them?

Anderson: Well, some people tried using it for business purposes. And of course, some of the computers we sold into university environments were modified for other purposes. For example, John McCarthy at Stanford fixed up theirs for time-sharing, because the original PDP-1s were not specifically designed for time-sharing. The key fame to the basic original PDP-1 was it was cheap, and it had a cathode-ray tube output device, so you could see graphically what was going on, if you wrote the right program. Those were some of the unique design aspects. When coupled with very imaginative users it created a lot of diverse applications.

There were people who just bought the computer because it was inexpensive and they were willing to add things to it, including software for their application. We sold some into speech research, we sold them into just about everything you could imagine. We had a Nobel Prize winner buy one for some research purpose, I don't know what his use was. And one has to suspect that some of the customers that we really never had any contact with might have been using them for classified military projects. So we just sold them a computer, and they had enough technology skills to add what they needed.

Hendrie: They took it away and...

Anderson: Yes. They had enough technology within their laboratories to do whatever they wanted. That's what I imagine, because we didn't really have a lot of follow-on on that. We did have a user's group called DECUS, D-E-C-U-S. And they exchanged ideas with one another about what they were doing with their PDP-1's.That became quite an active group of customers.

Hendrie: One of the things that I actually have is a brochure from Digital that lists your PDP-1, PDP-2 and PDP-3 computers. Could you comment on those last two? Since I don't think any were built, how were they disposed of? What were those machines?

Anderson: Well, the PDP-2 never got very far even on the drawing board as I recall. The PDP-3 did get on the drawing board and into the brochures and sales department, and one was

sold, but never built. By this time Gordon Bell had come onboard, and he played a key role in the PDP-3. He was also deeply involved with the PDP-6 later. The PDP-3 was to be a 36-bit machine. It was really a crude attempt to get into the IBM 7090 series, because they were 36-bit machines. And we weren't ready for that Big League, and we recognized that after we announced the computer. But there was a description of it, and we had an order for one. And then we discontinued it. Well, it fell to me to give the bad news to the customer. I was successful in talking that customer into taking two PDP-1s in lieu of the PDP-3. Now a PDP-1 was 18-bits and if you had two of them, that's really 36-bits. That was kind of my simplified sales pitch, and he accepted it. And they took two PDP-1s instead of one PDP-3. The PDP-3 was never built.

Hendrie: My goodness! That's amazing! All right.

Anderson: I don't want to say it's a testimony to my salesmanship. Probably a testimony to his flexibility in wanting to have some of our product in his laboratory. It was a military speech research lab, and they wanted our technology in the worst way. They were willing to buy this explanation.

Hendrie: This approach.

Anderson: Otherwise, I suppose they could have called a default on us and said, "You never delivered on a contract," but...

Hendrie: That didn't happen.

Anderson: That didn't happen.

Hendrie: You avoided that bullet.

Anderson: We avoided that pitfall; so the PDP-3 was never built. PDP-4, I believe Gordon played an important role in that one also. And that went into the process control industry that you know quite a bit about, because Foxboro was an important customer for that. as I recall. You can probably help with that bit of history....

Anderson: Yeah, we bought the four and we actually then moved on and bought PDP-5s. And then eights

Hendrie: You didn't go the seven?.

Anderson: We did not go to the seven. So Ben Gurley did not design the PDP-4 as you remember. That was really Gordon.

Hendrie: It was Gordon?

Anderson: That's what I remember that it was Gordon.

Hendrie: Gordon had designed that?

Anderson: Yeah, he came in and he got to design the next computer.

Hendrie: Right. When did Ben leave the company?

Anderson: That's a good question. He left to join Information International, Inc.

Hendrie: Yes, I was aware of that.

Anderson: Which was a company started by Ed Fredkin.

Hendrie: And we could probably ask-- do it the other way around, and ask Ed later when he hired Gordon.

Anderson: If I were to look in my notes, I think I could probably reconstruct that, or I have some reference material. It was December of 1962

Hendrie: Now why did he leave? Do you have any idea?

Anderson: Well, I think he wanted a broader systems approach to things. I really can't answer that easily. Digital Equipment was growing quite rapidly, and there were many stress situations. We were tending to get over-committed engineering-wise, into too many things. And the collegial atmosphere that had existed at MIT Lincoln Lab and in the early years of Digital Equipment Corporation was being stressed and tested from an organizational structure standpoint. Cost control, and meeting delivery dates, and getting everybody working on the same team was becoming a real problem. I cannot speak in detail about why Ben Gurley left the company of course. His murder was a tragic loss to the computer industry.

Hendrie: Yeah, right.

Anderson: But I suspect that some of the stress and the collegial atmosphere fading was difficult for him.

Hendrie: Yes, that he felt more comfortable working in a very young, entrepreneurial...

Anderson: Informal.

Hendrie: Informal, figure it out, make it happen.

Anderson: That would be a guess on my part, but you might want to ask Ed Fredkin about that.

Hendrie: Yeah, I will. I'll ask him.

Anderson: He would have an answer from his perspective.

Hendrie: Exactly.

Anderson: That might differ.

Hendrie: Exactly. So do you remember how long it was after the PDP-1 came out before you went and did the-- you know, started working on the PDP-4? Was that...

Anderson: It wasn't very long. It was a couple of years at most. Now I didn't really develop a timeline so I can't give you hard answers on those questions.

Hendrie: That's okay.

Anderson: But I could certainly get you answers, because those are all well-documented.

Hendrie: So what, you know, personally so what are you doing at this period? Are you chief salesman?

Anderson: I was primarily trying to sell things for the company. We had had a series of financial officers who didn't really work out, so I was the temporary treasurer of the company at various times, and things like that, while we held things together. But there was a lot of jack-of-all-trades for everybody. And Ken was primarily a designer and production engineer, and certainly the leader of the company. And my job was more the business end, the sales end, the finance end, and kind of the outside relationships.

I did a number of speaking assignments, and I was active in the professional societies at the time. I had a fair amount of contact with outsiders. And in fact, I ended up being the general chairman of the Eastern Joint Computer Conference in 1966. And that was an important time period for the company, because we were really making the transition from being a collegial

entrepreneurial thing into something that was firmly controlled by Ken. A different structure evolved in the company at that time.

Hendrie: At some point, the company switched from a primarily functional organization with sort of, you know, to the extent there was an organization of engineering and to more of a product line organization.

Anderson: Well, this occurred after I left.

Hendrie: Okay, this did not occur while you were there.

Anderson: Well, it was just occurring. And it was the famous matrix organizational structure. And I don't know whether any other company had quite the matrix that existed at Digital. But it evolved and was the structure for many years after I left the company. Essentially on one dimension of the matrix were product lines. And the other dimension of the matrix were functional activities like engineering, manufacturing and sales. And somehow those were supposed to intersect and meet and caused a lot of authority and confusion. That's a subject for somebody who stayed with the company longer than I. Perhaps Alan Kotok or someone like that.

Hendrie: So we've gotten through the PDP-4. It was done. Help me with the history here. Where're we going next?

Anderson: Well, the next big engineering and product thing for the company was the PDP-6. And that was a Gordon Bell design through and through. Ben had been out of the company for a while at that point. And Gordon was the architect of that. And it was a 36-bit machine planned for time sharing applications. It was much more powerful than the PDP-3, which was also a 36-bit but never built.

Hendrie: Yes, it would have been, yes.

Anderson: "Would have been" is the right phrase on that. And a number of those were sold, but that stressed the engineering department too much. And there were other product lines as this new organizational structure was emerging. The PDP-5, the PDP-4, and the Linc Computer and all those things were all competing for engineering resources. The PDP-6 was not thoroughly engineered when it was first delivered to customers. There were technical problems (not conceptual problems) that had not been thoroughly tested and corrected prior to shipment to customers. But a number of those were delivered to customers, and they worked, but the peripheral equipment for them like magnetic drums hadn't been thoroughly tested before they were shipped out to customers. So that was a serious problem for the company. The product line was essentially discontinued and the next product go-around after my time was the PDP-10 computer. The PDP-10 had some similarities to the PDP-6, and was the product development of Alan Kotok.

Hendrie: And it was actually a reengineered and expanded and sort of...

Anderson: And hopefully better tested...

Hendrie: Well, yes.

Anderson: --than the PDP-6.

Hendrie: Okay.

Anderson: But the PDP-6 was clearly a stressful time for the company, and a lot of people left the company. That was the time that Gordon Bell left to go to Carnegie-Mellon. And Jay Forrester resigned from the Board of Directors.

Hendrie: Oh, I didn't realize Jay was ever on the board. Okay.

Anderson: Oh, he was a very important member of the Board of Directors.

Hendrie: Who were the other early members of the board?

Anderson: They were all from American Research, plus Ken and myself.

Hendrie: So Jay Forrester was the one outside board member?

Anderson: Yes. He wasn't an original board member, but he came relatively early on, and also served as a consultant to the company.

Hendrie: Okay.

Anderson: But not a technical consultant even though that was certainly his early background. He was a management consultant.

Hendrie: Very interesting, okay.

Anderson: He had left Lincoln Lab by this time himself, and had become a professor at the Sloan School of Industrial Management at MIT.

Hendrie: And was into his system...

Anderson: Industrial Dynamics.

Hendrie: Yes, his Industrial Dynamics, right.

Anderson: He was into that. And so that was another phase of the company.

I had a non-compete agreement with the company when I decided to leave. That was part of the business arrangements. So I was looking about for something else to do that would be interesting, and I snagged into something that was very interesting. It certainly wasn't anything near the center of the computer industry. But it met the letter of the non-compete agreement. It wasn't in the computer industry at all. I went to work for Time, Inc., the owner of *Time* magazine, and *Life* magazine. You might ask "Why did they want an engineering person, and a computer engineer?"

Hendrie: Right.

Anderson: Well, the answer was that the chairman of the board of this media empire had become concerned that the printed word might be obsolete, because of emerging technologies, such as television and computers. There was this guru named Marshall McLuhan known to a lot of old-timers. Younger people probably don't know him. He was a professor at McGill University, and he was preaching the end of the printed word in 1966. He had written books like "The Media is the Massage," and all that stuff. This media empire was worried whether is was going to be right. His message was "The printed word is soon going to be obsolete." So they wanted somebody from the technology world onboard as a staff person. I became that person on the corporate staff, and met with the chairman of the board frequently. All the officers of the company and editors had to come to several retreat seminars that I arranged to indoctrinate them into this new world.

I had people like J.C.R. Licklider come and speak to the group. It was a two-day seminar, and every top person, editorial and administration was required to attend one of the two sessions that I held. It was an overnight session. And I remember holding up a piece of coaxial cable at the time, and said, "This is going to have 100 television channels on it not too long from now." At that time cable television was a nothing industry. It was for the sole purpose of creating reception in areas that were mountainous, where you couldn't have conventional TV antennas. Cable companies didn't have any content to put on the unused channels, other than the over the air broadcast channels. One of the cable companies of that era had a camera very much like you're using today. It was trained on a fish bowl with a fish swimming by it to provide entertainment on one of the unused cable channels. The rest of the extra channels had nothing on them. So cable TV was in its infancy, and my job was to try and explain some of the technology that was likely to come. I certainly couldn't visualize all the things that we have today at that time period. Certainly not the Internet. But we did have J.C.R. Licklider come as a

speaker. Being originally a psychologist, he was a real visionary about the interactive possibilities of man-machine interactions.

Well, after three years there in 1969, my own personal conclusion was that the printed word as we know it was threatened to some extent. But it wasn't going to be obsolete any time in the near future. Today we have Barnes & Noble and Borders, and all kinds of printed word. Now forty years later newspapers are struggling a little bit, but they're still very much a part of our life. The clincher for me was when I read a story about the sage of all this pessimism, Marshall McLuhan. As a professor he had a reserved parking place at McGill University, and some student had parked in his place. He put a message on the student's windshield that said, "To whomever owns this car, you have taken my reserved place. Professor McLuhan." The student wrote back and said, "Professor, this is the first thing you've ever written that I've understood." So McLuhan was becoming a buffoon in the world of predictions.

In the meantime, Digital had gone public, and my own stock ownership, which I retained most of, had increased significantly in value. I decided that I did not need to commute from New Canaan, Connecticut an hour-and-a-half into New York City, and an hour-and-a-half back at the end of the day. I resigned from Time Inc. and continued as a consultant to them for another year. In total I spent four years there. I met some wonderful people, saw how large corporations worked. I didn't necessarily like all the things I saw. When I left I started doing small-scale venture capital with my own funds. I did that for quite a few years. I invested in about 20 start-up companies, and tried to help them get going. That worked out very well. And then I got into the non-profit world, and became a trustee at Renesselaer Polytechnic Institute for 16 years.

Hendrie: Now you didn't go to Renesselaer though?

Anderson: No, they gave me the alumni award, even though I didn't go there. The alumni key award.

Hendrie: Oh, my goodness. All right.

Anderson: And I got active at the University of Illinois, and a lot of local non-profits in Connecticut where I live. I also became a trustee of the Boston Symphony Orchestra. Met a lot of interesting people through these charitable non-profit organizations. And that's really what I've done the last 20 years, and it's been a very satisfying part of my career. Now I'm phasing out of those things, too, and looking forward to full retirement-- telling people about how it was in the old days. You know, grandchildren aren't necessarily interested, so I'm going to force it on them by writing my memoirs.

Hendrie: Really? Okay! That sounds good.

Anderson: So that's where we are, and I appreciate the opportunity to give you an oral history here.

Hendrie: Well, thank you very much, Andy, for taking the time to do that.

END OF INTERVIEW

