[INTERVIEW WITH BOB EVERETT, 12/4/90

INTERVIEWER, JAMIE PEARSON.

INTERVIEW AT BOB EVERETT'S OFFICE AT THE MITRE CORPORATION]

BE: The Digital computer lab environment [at MIT] really stemmed from three different things. One was MIT's environment itself. The effects of the war started a lot of activities at MIT. It was clear what the goal was. Things like internal politics, and all that stuff got relatively minor importance. There was a feeling about the job, the freedom to work on it, the importance of technology, the importance of accomplishment in doing good things, and a minimum concern about writing proposals and things of that sort. So that was one. The second one was the general attractiveness of working on a computer anyway. The computer itself was such a fascinating opportunity. It was obvious that these things were going to be important. Even the most optimistic, far-out predictions, were under the mark. But it was obviously demanding, so that this gave the whole place an attractiveness, and it made it possible to attract good people. Thirdly, it was [Jay] Forrester, who was a very unusual individual. Not only very bright but very self-confident, and a strong leader, decisive. This combination was quite unusual.

JP: Can you characterize the team that you and Forrester made? You worked together.

BE: I went to work for Jay in 1942. I came to MIT to go to graduate school. The war was on and they came around and said, 'We can't have any just plain students. You've either got to go in the military or you've got to go to work.' So I said I'd go to work. Jay came and interviewed me, and hired me; I think he would have hired anybody. So I went to work in Servomechanisms Lab, Gordon Brown's lab, for Jay working on hydraulic controls to stabilize radar mounts, and spent the war doing that. So that's how I got involved. That was a fairly small group. Gradually we got into the computer business. I guess I was kind of number two, but there was no real structure. It wasn't a hierarchical organization. Jay was clearly the boss. The rest of us worked for him.

JP: Why was Jay clearly the boss? Because he was there for one thing, but because he had certain leadership qualities?

BE: It was both. He was there, and he'd gotten there first, and he had Gordon Brown's confidence. So he was the project leader. But he was also, by far, the strongest leader. Which comes first, I don't know. Had he not been such a strong leader, he might not have been

the project leader. I don't know. All I know is he was both formally the boss and the boss by character.

But there weren't levels of supervision and so on. As I look back on it, it was sort of a group of people. We changed the organization all the time, not so much in the sense of who worked for whom, hierarchically, but in the sense of what it was organized around, and what had to be done. As I look back on it, we went through various stages of building the machine, and this had to be done, and that had to be done, and when new things had to be done we picked some people who seemed to be the right people to do it, and gave them the job, put somebody in charge of that group. Very often we moved everybody around the building, so that the small groups were only three or four people, who sat together or very close to each other. It was all in one building, and you could do that.

JP: You would move people around to foster communications and make sure that everyone knew what the other person was doing?

BE: Sure. There was a lot of effort put in to make sure that everybody knew what was going on. The biweekly, that was a very unusual sort of thing.

JP: Why was that unusual?

BE: I've never seen an organization that did it except that one.

JP: The biweekly report was a written report by every member of the team and shared amongst each other.

BE: Every two weeks on a Friday. Every other Friday afternoon, everybody in the place was supposed to write a paragraph or so about what he was doing. This was all typed up and sent around to everybody, so everybody had a report every two weeks about what everybody was doing.

JP: Would everybody read it?

BE: Oh yes, people read it, of course. They were often interested in what everybody else was doing.

JP: The reason I ask is because Ken took that idea to Digital. In the archives of the early years, up through '63 there are biweekly reports.

BE: Yes, he told me that he continued that for several years. Another thing that went on which is kind of unusual although not everywhere, is that there was a tea. I think that was every couple of weeks, too. It was in

Jay's office. Jay's office was, as I remember it, about the size of this office [15x20' approx], with a desk, and and a long table with chairs around it. On Friday afternoons about 4:00 the senior people -- there wasn't enough room for everybody -- would get together and there would be tea and cookies and the conversation was generally about things of interest or importance. Real informal. There was no agenda, no speeches. It was an honor to be invited to tea. You were getting somewhere in the organization if you got invited to tea, because there was a limited amount of space. As far as I know, Jay never even considered the idea of getting a bigger room to have more people, because that was the size of the group. It was pretty full. I was talking to Ken about this the other day. I think it was interesting for several reasons. It was not a committee. There was no thought, or impression in the slightest, that anybody was making any decisions in this group. It was just a way for people to get together and talk about what was important, what was going on outside and what was going on with the budget and what was going on with the technology, and who was visiting and whatever. It really was a very useful thing. It helped give a sense of community and common purpose.

JP: Did you discuss during those meetings what was happening outside MIT in the context of other labs, other

universities, institutes, industry?

BE: Of course. Everybody was interested in everything that was going on. The whole community was small. Everybody of any importance in the computer business could get together in one room in the convention or something and did! There might be 100 people. Everybody well-known in the organizations would be there. People were talking about what they were doing. Then there were some people like Sam Alexander from the National Bureau of Standards, who used to travel around and see everybody. He would come and sit down and tell you the gossip from all the other people and you'd tell him what was going on in your place, go to the next place and tell everybody what was going on there. So...

JP: Sort of the roving reporter.

BE: There was no feeling that I can recall, certainly not in our place or any other place, that we had much dealings with, no feeling of proprietary, patents, no feeling of ownership. Everybody was enthusiastic about this marvelous new opportunity we had.

JP: What kinds of people did you hire when you were looking, what kinds of characteristics did you look for?

BE: The major source of people at the computer lab, technical people, were graduate students. They came to MIT just after the war. There was this marvelous set of people who had gotten their bachelor's degrees and gone into the service and gone to radar school or other technical schools, were radar officers on ships or in the field, then came back and went to MIT graduate school on the GI Bill. Many of them were married, lots of them had children. They were in their early or mid-20s. It was just a tremendous group, because first of all, they were highly selective, anyway, as engineers. They'd had all this great experience about what life was like and dealing with people and making stuff work in tough [situations]... They were anxious to get on with their lives. No dilettantes. MIT had a very tough screening itself, so only the very best people came in. Since we had this marvelous job of working on computers we really got the cream of the engineering or the electrical engineering people, which annoyed the professors on the campus, nonetheless. These people were almost all masters degree candidates; we got a steady stream of them. Then when they graduated, we were usually able to keep the ones we wanted. Almost all, not all, but almost all of the people came through that route. We'd hire some people from the outside, especially if you needed a specialist of some sort, somebody who knew glass or how to build vacuum tubes or something, which you didn't get

out of this graduate school. Most everybody was young.

JP: Young, enthusiastic, energetic.

BE: One of the interesting characteristics of the place I always thought was that we didn't pay very much money. A graduate, with a bachelors, in the graduate program, we might pay $250 or $300 a month or something. Those were different dollars than today, but even so, that wasn't very much money. They were supposed to be part time, but we worked them fulltime. They did their course work on the side. Many of them were married and had families that lived in the barracks at MIT. MIT had a bunch of temporary housing for the graduate students and their families. A lot of the people who worked in the lab lived in those facilities. But we didn't pay them very much money. Even the fulltime people didn't get paid very much money.

JP: That was because there wasn't a lot of money to pay or for some other reason? I know Ken has always said, it's a sin to pay someone too much.

BE: It's just as bad as paying them too little.

JP: That's right.

BE: Why? Well, I think it was mainly because those were the pay scales at MIT. MIT paid that kind of money. You got paid in exchange for having the opportunity to work on this new technology. People who didn't want that, or wanted something else, or more money, or something would go work somewhere else. So the people in the lab, almost all of them, felt that they could easily get a job somewhere else and make more money. And it was true. You stayed because you wanted to, and they got treated that way; they got treated as if they were there because they wanted to be there, and that they could leave anytime they wanted to. Therefore you treated them differently.

JP: But it sounds like it was almost a privilege to be part of that team.

BE: As far as I'm concerned it **was** a privilege and I think most of the people who were there felt it was a privilege, and if asked now would say that it was a privilege. It was a privilege.

JP: Did Forrester foster loyalty with his people?

BE: When you say 'foster loyalty', I guess there are two parts to that. One is, were people loyal to him and secondly, did he make an effort to make them loyal to

him? I think first of all, they were loyal. They were loyal because they had respect and confidence in him. The one thing a leader has to have is followers. I mean without followers, he's not very successful. So a strong leader, obviously, is able to get people to follow him, and he was. Did he pay much attention to that? The answer was no. He was utterly objective about things. There are a lot of successful leadership styles; you can't go look at a leader and find out how to do it. It's something else. It's good to feel confidence in the boss, that he knows what he's doing, and he's thinking about it. Part of it was that there was never any question of game playing, or favoritism, or anything of that sort. If you did your work, and delivered, you were an honored member of the organization. You got plenty to do, you got treated like an honorable person, you got invited to the tea. You got told what was going on. You got as much money as anybody else. If you didn't do your job, couldn't do your job, then you didn't. But there wasn't any question of who was cozying up to the boss, or anything. Nobody ever cozied up to Forrester, that I know. It wouldn't have done him any good, and he would have probably had his head bit off! So I think that's important, too. Ken speaks about the confidence that people in those days had, and I think that's true, but he says it's confidence that the management would look after them. I don't think so. I think it was that

people had confidence in themselves. They had confidence that, in fact, management was looking out for the outfit and that they, if they did their job, would be treated well. And they were.

JP: If you look at the history of computing, a lot of major events in the industry, or the pre-industry, if you will, have occured as a result of technology changes; the change from vacuum tubes, to transistors to LSI to VLSI, and the semiconductor has caused an incredible change in the industry. I think the same is true with computer memory, and the change from drums or Williams tubes to core memory. I'd like to explore that a little bit with you, because you were so much on the edge of the development of core memory, and how that occured and what kind of climate there fostered it. How it was seen inside to the people who were working so hard on that invention?

BE: Well, I'll tell you my view of it, which may be loosely related to the way things were. Memory has been crucial to the computer. It's always been, and may still be, the weakest point, the thing that limits what you can do. That was especially true in the early days. We made a CPU out of vacuum tubes. It was capable of running at several hundred thousand operations per second. It was capable of being reliable, but the memory was a real problem. We were working on real time machines. Those

had to be fast and they had to be reliable. There had to be enough memory to do some pretty complicated things. So mercury delay lines were not suitable, and neither were drums. We used drums for auxiliary memory, but for the main memory they just weren't suitable. The only technique that looked like it would work, was storage tubes. The Digital Computer Lab built its own storage tubes. A lot of other people used William's tubes. We fussed around with Williams tubes, but it never seemed that they had the characteristics we were after. Anyway, we made these vacuum tubes and they were a marginal device. They were expensive, and you had to work very hard to make them. They didn't last very long. They needed a lot of maintenance. Most of the machine errors came out of the memory. Computers would never have been anything like they are if we had been stuck with vacuum tubes. Jay, of course, was well aware of this. We were all well aware of this. He kept thinking about other ways of doing it. He first thought of a way that used electric discharges of plasma. It was a two dimensional framework with wires going this way, and wires going this way, and if you put a positive voltage on this wire, and then a negative voltage on this wire, you could get an arc there to discharge between the two of them. He worked on that for a while, because it had a two-dimensional selection scheme. But the characteristics of the discharges were just not

sufficiently reliable to make a reliable device. He sort of gave up on that. Then, this is my understanding of it, he read about, or somebody told him about, square loop magnetic materials which had just come along. These were thin ribbons which were wound on a bobbin. He got hold of some of these, and measured their characteristics, as a way of getting this device that he was looking for which would enable you to do two-dimensional select. It looked like these would work. He did some work on it himself, but he had a fellow named Bill Papian, who's still around, to whom he assigned this job. Bill was the guy who was off in the corner measuring these things with relays and all the vibrators, oscilloscopes, trying to figure out what its characteristics were, and what you had to do to get something that you could use. Not only did you need something that was sufficiently square -- the hysteresis loop was sufficiently square but the selection of it wasn't -- but they had to be sufficiently consistent, so that you could make something with it. I mean making one MIP wouldn't help you. So my recollection is that Jay worked on this, and he finally persuaded himself that this looked like a promising thing, and he talked to me about it. I pointed out that two-dimensional selection wasn't going to get you where you wanted to go. [There were] not enough squares to do you good. So we were talking about a lot of ifs. So, darned if he didn't go

off and invent three-dimensional selection, which is what really made it go.

JP: So going from the two to the three-dimensions was...?

BE: He invented the whole thing. No question about it. He had that idea, and there is a paper on the subject, and he did some more work. Then SAGE [Semi-Automatic Ground Environment, defense computer] came along. We finally had enough money; we were always short of money. I remember about 1949 we prepared a detailed proposal for the Office of Naval Research that was the $900,000 program which we were after. There was the $600,000 minimum program, and there was the $1.2 million dollar generous program. They all included work on Jay's memory but not very much. Once we got mixed up in Interface and the Air Force and we decided getting lots of money, we decided that vacuum tubes as a storage system just weren't going to hack it. So we were going to make a memory. Well, we had lots of problems, we [couldn't] get good cores and so on and so forth. So I said, "We'll make one anyway." About this time also, maybe a little before this time, cores came along. Jay heard about those someplace, I don't know. He got some from General Ceramic, and these were these ceramic materials which also had square loops. We got a bunch of those. So the

first core plane we made was actually a wound ribbon core. It was probably better than storage tubes, but it wasn't good enough. But the cores came along at the right time and we built some core planes, built a memory, Ken built a computer to test the memory. It really worked. The best thing that ever happened for memory. Because you could make the rest of it. I was sitting over at the Whittemore Building, [which] we had acquired by that time, and we had the first 30 x 32 core memory working in the Memory Test Computer. Pat Yutes (?) who ran the tube shop came over to see me. He used to come over to see me every once in a while and see me and tell me these terrible things like there was a strike in the mica mine, and I'd learned after a while to just listen patiently, and tell him what a great job he was doing, and to go back to work, and we were counting on him, and everything would be all right. But this time he came and told me the way things were. It was obvious they were pretty serious. We were down to about one weeks supply of tubes. So I figured the time had come. We built another core stack, and we built the controller that went with it. We shipped the two core stacks and the controller over to Whirlwind, and replaced the storage tubes. It doubled the speed of the machine, quadrupled the transfer rate from the drums, the maintenance went from four hours a day to two hours a week. The mean time to failure of the memory went from about two hours to a

couple of hundred hours, and it freed up the whole tube shop to work on the display problems. It was just one of those great things that happens once in a while.

JP: And everyone thought it was a wonderful thing?

BE: We all thought it was a wonderful thing. The only people I know of who didn't think it was a wonderful thing was the group at IBM who was working on Williams tubes. They didn't think it was a good thing! The 701 was made with Williams tubes. But all the subsequent machines were made with core memories.

JP: Was there a lot of press at the time? A lot of external interest in what had occurred? No? Did the word just sort of leak out by someone like Sam Alexander that this had occurred at the lab and it was worth taking a second look at?

BE: I think the informal communications channels spread the word instantaneously around. But you know, there's Jay's paper, but it was mostly informal. There was very little in the papers about computers in those days, very little. The papers haven't caught up with it yet. The ideas slowly leaked overseas and that took longer. I can remember it was very early at Lincoln lab that George Valley, the associate director, came around one day. He

said he was going to England and he was going to stop by and see Williams. Williams had asked him to bring some cores, and I remember I gave him a little bottle of tested cores, and some sheets that showed the core characteristics and things of that sort. Giving them to George to take over and give to Williams. It wasn't just falling off a log; there was a lot of work that had to be done. Some years ago, I can't remember now when, Ken took me over to see the core fabrication facility in...

JP: Natick?

BE: I don't remember where it was. We used to have lunch once in a while. We got in his truck and drove over to this place. There were all these pill machines, you know, whamming out cores and all these core testers with their shake tables, and these cores running up and things going through, and shuffling them off to one side or the other, and the bins and things for shoveling them... All of that was done by us back in the Digital Computer Lab, all of those techniques.

JP: When I did that small exhibit on core memory I went back to the computer lab to tell the story because that's really how it evolved. I think that probably accounts for some of Ken's interest in the purchase of the RCA facilities to manufacture the cores. It was a personal

interest as well as a business.

BE: Yes, and the price was right!

JP: And the price was right. So Ken came in and working for Norm Taylor doing the MTC.

BE: He came in as a graduate student.

JP: Can you talk about your observations of him then, or were you that close?

BE: One of my jobs was to look after the graduate students. They were all grown people, they could take care of themselves, but they all had to have theses. We were allowed to supervise theses. We got masters theses in the lab, not doctor's theses. My job was to make sure they all got theses and they were all busy, and if they had any problems I would see if I could sort them out. I remember talking to Ken a few times. He was just one of the guys when he showed up. By that time we must have had a 100 people in the lab or so. This was still down on the campus. He got involved in the core memory business. He invented this core switch. After a while, you know how these things are, people come in and they're all kind of alike, and then after a while some of them appear to be better than others. The ones that are not so good

disappear, and the ones that are better than others [are paid] attention to and [given] jobs. It was obvious that Ken was very superior, both in his abilities and in his personality, his internal discipline, hard work and so on. When it came time to build a machine to test the core memory he was the obvious guy to do it. So I've probably told you this story before, but I had been working on the storage tubes, and we had had a facility down in the basement for testing storage tubes. It was made out of this standard test equipment that we built. A lot of it was multi-vibrators. We had a whole rack of stuff, and if you wanted to run a test in a sequence, you plugged it all together and it would generate a set of pulses and things which were required. We finally got the storage tubes to the point where we could put them in the computer. It struck me how great the computer was for testing the storage tubes. To change the sequence, or something of that sort, you just changed the software and flipped a few switches on the switch memory and the machine would generate all these things. You didn't have to go around and plug them all up and test them all out. So we came to the decision to build the core memory and we had to have a test facility for it. I wanted to build a computer as a test. I talked to Jay about this, and he said, "Oh, you just want to build a computer." I said, "No, this is what we need." So we made a deal. He agreed that we could build a computer to test the core

memory if we would make sure it couldn't multiply. If it didn't multiply -- you didn't need to multiply to run tests, but if you wanted to make it do any computing you needed a multiplier -- [we could build it.] I told Ken we could build a machine, but no multiplying. He said fine. So we built the machine, and it all worked great and it's really a wonderful test device. It's just great. People buy computers by the thousands these days for test machines. But the MTC was the first one ever built for this purpose. One day I was talking to Jay, and I said, "We got the MTC working very well, and people are starting to make noises about wanting a unit for other purposes. How about moving here on the construction of the CAM multiplier." He agreed. I called up Ken and I said, "Ken, Forrester says we can multiply." I think it must have been about a minute and a half before the machine multiplied. There was one cable that had to be plugged in! For all I knew it had been multiplying for weeks.

JP: So Ken was superior as an engineer and as a member of the team?

BE: Yes, it's not just his ability to do things -- his engineering abilities -- but he was innovative and aggressive. If you said something like, "I need a computer to test a core memory," you didn't have to sit

down and decide what it was or anything. That was enough instruction for Ken. He saw what had to be done, he'd go off and do it. He was very inventive. He's just a tremendous guy, a tremendous guy.

JP: How long did you work together?

BE: Oh Lord, he must have come in '49 or '50. And he left in '56 or '7 something like that. Seven years.

JP: Did he discuss with you about his idea to start Digital?

BE: He never discussed it with me. He came around and said he was going to go off and start a company. I was unhappy to lose him, but he and Andy, [Harlan Anderson] who's another good guy, very different.

JP: That's my understanding. Ken was the more engineering/entrepreneurial type and Andy was strong in an administrative way...

BE: Yes, he was more on the management planning analysis side as opposed to Ken, who was the builder. It seemed like a good combination to me.

JP: Once they got going with the company did you have an

opportunity to come out and see what was happening at Maynard?

BE: Once in a while. Every couple of years maybe I'd go visit Ken or he'd come and have lunch or something. We sort of kept in touch. But it was never a close relationship. One of the things he'd done toward the end at Lincoln was to build this transistorized test equipment. He built the TX-0, which was another machine that was built to basically test the transistor driven memory.

JP: Was the move from vacuum tubes to transistors happen slowly or was the news of the transistor invention at Bell Labs seen as...?

BE: When we started on the SAGE job, and it was necessary to design a new computer for that purpose. Transistors had been invented, and they were the early ones with the whiskers of germanium. We got some of them, and considered for a short while the possibility of making a machine out of transistors, because it was obvious that the transistors had enormous advantages. But it also became obvious that they just had not reached the stage where you could commit something like that that had to work. We believed we could build a machine out of vacuum tubes. It was '53 before we had a running core

memory. We really were sticking our neck out to say we were going to build this machine without really knowing how we were going to build a memory. It's my experience, though, that if you're going to build something and if there's one thing you don't know how to do you can usually make it go. If there are two things you're starting to ask for trouble. If there are a whole bunch of things you don't know how to do it takes a miracle! And miracles are rare. So we decided we would build SAGE out of vacuum tubes, but we also started working with transistor circuitry. Then that led to TX-0 and then TX-2. There was never a TX-1. It was obvious, after a bit, that transistors were the wave of the future. But if SAGE had come along a few years later we would have probably made it out of transistors, but it was just too soon. I never regretted that decision.

JP: Of course the transistor led to development of many heavy hitters in the industry, with the start of other companies besides IBM.

BE: Well, there were other companies. IBM got a tremendous leg up out of the SAGE. Because they got a lot of money, they could hire and train a lot of people. They learned a lot of lessons, they built a lot of service, all kinds of things came from that. Then the production money, a lot of that was of value, too. The

independent research and development money that the government allowed them to spend was a fraction of the production money. That was a tremendous step that they got from IBM. IBM would have been a force anyway, [but] I'm not sure it would have reached quite the dominant position that it's in if it hadn't had that big injection of money and technology at that time. But there were a lot of other companies. We used to think at lunch about printed circuits. Nobody knew how to do that. But I can remember agreeing that after a while people would have a computer on their desk, and it would be in the desk someplace, you didn't even know where it was, it would be too small. That's happened. Not that anybody had the faintest idea how to do it in those days, it's just that it seemed like it was the kind of thing that was going to happen.

[END SIDE A -- BEGIN SIDE B]

JP: I'd like to get your sense of the comment that I made about the individual shaping the corporate culture. When you look at Digital and its growth and now as a board member, how do you characterize the company's culture, if Ed Schein's comment that it's shaped by an individual who founded the corporation is true?

BE: In the first place I do think that founders shape

the corporate culture. It does seem to me that Digital stems from the MIT culture. MITRE stems from the MIT culture. It's one where a great emphasis is put on engineering and engineering ability. Relatively less, even a little grudging emphasis, on things like marketing and finance and sales. All those things which are necessary, but that's easier for MITRE than for Digital. Everybody sells what MITRE sells, but it sells in a special kind of way. Its finances have to be properly done, but they don't have first order effects on the company's ability to do things. So it's easier at MITRE to have an engineering-dominated culture. Digital is much that way. The trouble comes as the organization gets bigger and bigger. The founder, or creator or manager, of the culture, gets further and further away from the mass of the people that work there. There's a big danger that after a while he thinks the organization is the way it is, but it's not. That's a tough problem. It does mean you can't stay in your office and listen to what people tell you. They tell you what you want to hear. You have to go talk to the customers. MITRE always talks to the customers. This afternoon, I'm going to Huntsville to the subcommittee of the board of trustees of the Army-Navy Technical Committee trustees, of which I'm chairman, and we're going down to Huntsville, to see what MITRE's doing [there] and talk to the people we're working with. We do that all the time.

But also, we have to go down and talk to the people who are working in the organization, and find out what they think is going on. That gets harder and harder as the place gets bigger and bigger. I remember with fondness the old Digital computer lab days when the place was smaller and you knew everybody. Back in the days when we were in the Barta building at Whirlwind, I used to talk to every engineer. It might only be a few minutes. I'd get out of the office. I'd go around and see what they were all doing, and talk to them. Boy, did I know what was going on. I lost that when we got to Lincoln and the place got bigger. Several hundred people, 500 people. Now MITRE's got 7,000. I don't know how you do it with 185,000 people. That's a big problem. I think Ken complains about the fact that the place is different from the way he wants it, and it probably is. It may not be different than the way it **has** to be at that size. I don't know, that's a very difficult question.

The other thing that happens is that the founder gets older, which is a scheme worked by mother nature to keep flexibility in life. It's a harsh system, but it really works very well. I can say that now that I'm getting old! Eventually he'll go away. Then the question comes, has the culture proved sufficiently useful, or important, that the people in the organization really believe that it's not just a matter of the right kind of rituals, but

that it has something to do with the effectiveness of the society in which they live. If the culture is appropriate and people believe in it, then it will continue. Cultures have long time constants, but they do change. MITRE's just going through this. Its president is 47 years old. He wasn't on the "long march" as they call it, at MIT and MITRE. The people on the "long march" are fewer and fewer, and in a year or so there won't be any senior people left who came out of the Digital Computer Lab. But that's right, because the outside world changes, and the technology changes and the company has to change, too. One of the things that happens to you if the founders stay too long and you can see this going on in various parts of the industry is that he's reluctant to change. He has all this background of success, more than just a mental way, emotional, religious fashion. The new people don't have quite that constraint. If you can't rejuvenate the company from time to time it's not going to succeed. There are always things. But the culture is very important. One of the problems comes when companies bring in outsiders, because outsiders very often have different cultures. If the culture in the company is wrong, it's not succeeding, then it's better to change it. You've got to do something. But if the company is successful, and the culture is appropriate then you have to be very careful about bringing in outsiders. If the

outsider is strong enough, you change it and maybe damage it in the process. If he isn't strong enough then the organization will refuse to follow. Ken's getting older. It would be nice if he lived forever. Unfortunately, I don't think he can manage that. He's managed an awful lot of difficult...

JP: He's managed a lot of things.

BE: He's managed a lot of things, but that one's pretty tough. So 25 or 30 years from now, Digital will be a different outfit. All you can hope for is that it's at least as good as it is now. I was thinking the proper goal is that the organization should be better every year than it was the year before. If you can manage that then everything else will go alright.

JP: What are some of the roles and responsibilities that you have as a board member?

BE: That's an interesting question that I've asked myself a number of times. I'm not a professional board member, so... Board members represent the stockholders, who need some representing. What does that really mean? It means, to me, that the board members are first of all responsible for the management acting in an appropriate manner, because there have been organizations where the

management got out of control and were just running the company for their own benefit. That's no problem as long as Olsen's running it; he's about as honest and straight-forward a guy as I've ever met. One of the ways that the board lives up to that is by proving major financial investments, talking about spending stockholder money and these are stockholder representatives, and that also means that the board has to know enough about what's going on to make reasonable decisions and not just rubberstamp whatever comes. The board plays a role in compensation for the management; generally it's not wise policy for the management to decide its own perks and remuneration, even if they're the most honest guys in the world, it's a terrible position to put them in. But the most fundamental thing I think that the board does is it picks the CEO. Of course, as the CEO's retire and get old and get run over by trucks or something and somebody has to pick a new CEO, that's the board's major job. And if a CEO isn't doing his job because he's no longer able or he no longer fits the situation, then the board has to do something about it. That's one of the most difficult things that boards do, is replace the CEO. It seems to me that's sort of the set of things that I see the board doing. Also, it's a bunch that the CEO can talk to. He's got his lieutenants that he talks to and the people in the organization and that can be, depending on personalities, a very important and valuable tool. But

the board has a somewhat different attitude. They don't have to come to work everyday. They don't have to fight the day-to-day problems, so the board makes a group of people that the CEO can talk to about long-term problems and troubles he might be having with vice-presidents and so on. To that extent it's useful too.

JP: It's a sounding board for long-term kinds of issues. Is there a communication amongst board members frequently?

BE: The board meets every month, except for February and August, I guess, roughly ten times a year. It has audit committee meetings, and compensation committee meetings, and sometimes extra meetings. The board probably gets together 15 or so times a year, most of the board members. Not all of them come to committee meetings. The board is quite small.

JP: Is that unusual?

BE: Yes, I think so, for a company that size.

JP: The board hasn't changed significantly either.

BE: Well, it's been changing. Of course, the General died. And [Phil] Caldwell came in ten years ago, and I

showed up four years ago. Colby [Chandler] showed up a year ago. I think we'll have some others in the not too distant future. That's turning over, too. Arnaud [deVitry] and Bill McLean, have been around a long time. I don't know what the optimum size is. MITRE has a fairly sizeable board, about 20 people. But MITRE's different, there aren't any stockholders. The board of MITRE represents the public interest, and therefore has different kinds of people on it -- lawyers, academics, industrial people, ex-government people, ex-generals. It has a sprinkling of people to represent various parts of society. It meets three times a year, with a lot of other committee meetings of a much smaller size.

JP: Ken is the only employee on the board and that's been the case since Harlan Anderson left. Can you comment?

BE: Yes. I assumed that Andy was on the board, but I don't know. I wasn't around. But Ken is the only inside worker. There are big organizations who have a lot of insider board members, and then there are others where they are almost all outside board members. Certainly with a very small board, I think it would be inappropriate to have -- I think it's inappropriate for any board to be largely inside board members. MITRE has two inside board members, one now, because the Executive

Vice president was made President, and there is no Executive Vice president although there probably will be after a while. But for some years, for a long time only the President was a member, and then starting ten years or so ago, the Vice president was made a member, so there are two. That's reasonable.

JP: If the goal of the board is to really represent and be an objective voice then...

BE: Well, it's to represent, at a minimum, the stockholders. More and more it kind of also represents other people also. The management represents the stockholders too, but the management represents itself and also the employees. In Germany industry they put employee members on the board. I think that's probably a bad idea. Chrysler wanted to put somebody from the union on the board. I'm not sure he's still on it, but it's a rather difficult position. It sounds good to begin with, but then when it comes to the point where he wants to squeeze the company he's got mixed responsibilities. So boards are necessary.

JP: When you look at Digital's 30 years from 1957 and from the wider perspective, an industry perspective, technology perspective, what have been the main contributions in your mind?

BE: The impression I had is that Digital largely was the pioneer of the mini-computer business, and also the pioneer of interactive processing and time sharing. It's done a great deal in networking, so those are sort of the technical areas in which I think it's been the strong pioneer. In addition to that, it seems to me it's made a viable alternative to IBM, which has been a good thing for the industry and the country as a whole. IBM has a lot of strengths, but you don't want anybody to be too optimistic; they've got a lot of problems themselves. After all, they're a huge organization. I think Digital has done good engineering work, in many cases it's done the best engineering of any of the companies. If there had been no Digital, if there had been no Ken, there would still be mini-computers, there would still be networks, and all those things would be around, there might be a different balance amongst the companies. It might be a little different. It might not be quite as efficient as it is. But I think Digital has been very good for the industry and very good for the development of the technology. That's one reason it's survived and grown. It started out as a little fellow amongst a bunch of big fellows and there have been others that have disappeared for one reason or another, but Digital keeps sailing along. It's doing some things fundamentally right.

JP: What about the next 30 years, what do you see as the major challenges in the industry and in computer technology?

BE: I can't see the future, but the interesting thing about computers is that the technology continues to change. It's about 40 years old now and it's changing faster now than it did then, which is almost unheard of in technology. It will continue. I think the machines will get faster, and memory will get cheaper, and the software will get better, and that we'll see enormous improvements in the communication between human beings and their machines. I think we will start seeing progress in unattended things that do a lot of work that people do now and we'll do something else, sit on the beach, or something. I think that a lot of progress is slowly going to be made in [for instance], artificial intelligence, improving the ability of machines to learn and to do more complicated things. It isn't that the thing is maturing. I think it's roaring along just as fast as ever.

JP: But you think it's changing shape from the kind of interesting hardware relics like Whirlwind to less interesting hardware but...

BE: Well, they're interesting to the people who work on them, but not to the people who use them. It's like automobiles. You look under the hood and you get tired all over. Automobiles are filling up with computers. Everything's filling up with computers. I think there are going to be tremendous steps forward in simulation, training devices. The need is a bottomless pit. This may have big effects on companies. If you look around now and see what's happened...there will always be mainframes, but they're not going to be the heart of the business. The whole question of how you do the systems work, the software business, the system engineering business. Is it important to make hardware if you're going to do those things, and software. Can anybody do it all? I don't know. Exciting opportunities, lots of change. Change is opportunity, change is also danger. Somebody like Unisys can go down the tubes pretty fast. It will be interesting. Problems and opportunities.

[END OF INTERVIEW]