ST: I joined Digital in 1969. I worked for three years at MIT at the place called Project Intrex at the Electronics Systems Lab. We worked at the Electronic Systems Lab on automated _____. And we built one of the first schemes for transmitting microfiche through a terminal based on computerized search. It was one of the last of the efforts I think based on CTSS, which was IBM's _____ system. And I worked on the hardware part of the project. I joined Digital partially because a friend of mine who was Ed Kramer (?) was our salesman at MIT, and he became marketing manager in the PDP-12 group, and he called up one day and said why don't you interview. And I had interviewed a couple of places but I decided to stay at MIT. But then I got a job offer at Digital that was 30 percent higher than my MIT salary. So I decided to do it. I joined the PDP-12 group and the PDP-12 group, we were just beginning to ship and I worked in diagnostics with a gentleman named Harold Long, who it happens has just had a very serious heart attack. I think he still works at Digital in Field Service. And Harold was doing some diagnostics, and I was doing some diagnostics. And we tried to ship this machine. And I worked on the manufacturing floor for a bit because they had trouble with random _____. It was kind of like just get something done. Then what happened is Digital hired a gentleman named Len Hughes who had a Ph.D. in physics from McGill, and marketed the PDP-12

group. And also a fellow named _____ Specter (?) joined the group. _____. Now Len was hired, they hired him because he was so smart. They didn't have a job for him. So I was talking to him in the cafeteria with Charlie, and Charlie was interested in somehow participating in the _____ chemistry market, where they needed _____. And there was another guy, _____ who had come from Barian (?). And we started two projects. One project was called the analytical instrumentation package, which was just a tool for adding to the PDP-12 to get data from direct systems memory. And the other was a floating point processor for the PDP-12. We started off trying to just do some floating point arithmetic as an enhancement and ended up deciding to build a whole new computer, called the FPP-12, of which about a hundred were built. And Richie Larry, who was the author of OS8, he's an amazing guy, and a guy named Jared _____.

BL: [INAUDIBLE]

ST: Right. Well, he actually did a lot more than that. He and Jeff Leonard and a guy named Jack Ferness, Jed has since left and started a consulting firm, Jack works for Loren Beal and augment (?). Loren Beal was actually my boss at DEC. We actually built a whole processor. It had a program counter, it had index registers, it had 24

bit addressing, and it could do single _____ point. And we built a real fast Fortran for it. The whole operating system. We actually built about a hundred of these machines that were faster than our floating machines. It was the first floating point for a mini-computer.

BL: With a PDP-12 processor?

ST: Well, the 12 processor was kind of the host for the whole thing. And we used the EMA board. We took over essentially the 12, we started off with and this thing would take over and it would actually run the Fortran program. The 12 was just used as an I/O processor. But it was massive. I mean the thing was very large. Later when the PDP-8 was built many years later they took this thing which was a giant of logic, because there was no microcode in it, it was all straight logic. And they built it on to _____ cards for PDP-8. It was the first use of a lot of MSI products, like 74181 _____. So we learned a lot on that. And then a little bit later there was a major problem with Data General, in that Data General people had just about in this time had left and come out with the Nova. And Digital's answer was the PDP-1120. And the PDP-1120 was a giant machine. I mean it must have had 12 or 13 words of different sizes. And _____. Gordon Bell, based on his analysis

of ISP had decided that the PDP-11 was too complicated to compete with the Nova. And Gordon, and Chuck Kayman and a few other people started a project -- Gordon was at Herman _____. He used to come back on weekends and used to meet with Ken and Gordon on Saturdays. And I think I got involved in it because my boss was away one day or something and they needed somebody to come to the meeting, so I went to the meeting. And Leonard Hughes... I don't know if he was still involved or not, maybe not. Bob Cusick, was still doing things. Mike... maybe Bob might have been involved.

BL: Were these strategy sessions?

ST: No, no, no. What happened is we got started... I know Bob Cusick was involved. But there were a few of us who used to sit on the side and somehow Bob Armstrong was also involved. And Bob, I don't know if he still works for DEC or not? If you look in a phone book he might still work in Western Massachusetts. But he became a sheep farmer in the western part of the state and he used to do software. But there was a guy named Bob Armstrong who is a brilliant circuit designer and PC lab (?) person. Bob Cusick, myself and a couple of other people used to go to these meetings and we worked with Chuck Cayman to design a machine that was not a PDP-11. And we were up on 5-5, and were were doing our thing to design

this machine. It was a 16-bit PDP-8. We were working on the logic design and Bill _____ came in the office and said that Steve Rothman (?) who was one of the _____ guys who had proposed designing a PDP-11 with _____ instructions. And his comment was, while we guys have worked on this toy, Steve Rothman is working on the real machine. So in the middle of the night (?) we sat down and we looked at the PDP-11 manual. We never looked at the prints. We just looked at the user's manual. And what we figured is Gordon had made a very large error in the calculation of how big a PDP-11 was. And the error was due to the fact that the PDP-11 could be microprogrammed. And at that time Gordon was against micro-programming and hadn't looked at the economics of it and we said if we microprogram this machine and we can use ROMs which were six times more dense than logic and we could build a complete PDP-11 on the same space as we were building this other machine, in fact, it didn't make any difference what we built. So, the next day I called Gordon and I said, had you thought about this, it's the same number of parts and Gordon said, oh well then build the PDP-11 then - it's obvious. I got scared because we had a professor for six or nine months or a year, was working on this thing and he had never actually done the calculation I was wondering how many other calculations he hadn't done, I learned since then that whenever you got an idea from somebody high up you ought to do the

arithmetic and go back and ask them. That was a big piece of learning. But we started doing the 11 in '75 and our problems in the early days from '71 and '72 was that Digital was very conservative technologically. Extremely conservative. We needed to use 15 ml lines and spaces so you could run wires between pads they preferred if you used single sided boards use them double sided, they didn't use multi-layer boards, it was extremely conservative place, so we had a hard time doing the PC layout. They wanted us to lay it out with 20 ml etch which means you couldn't run between pads which severely restricted the layout so we said we'd try it, we couldn't get the regular PC layout group to do it, they wouldn't even let the consultants they hired sit in their area because they didn't want to be stuck with this project. We built this machine in time to go to the Ball Joint Computer conference. Actually what happened was that there was a WesCon meeting in August of '75 and they introduced the machine but we had never built one, those were the days when you introduce things and build them later. Ken Davis introduced a 3 1/2 inch high machine. So we introduce a paper machine and we're supposed to go to the conference with the real machine. And we had no way of making it. It was just impossible, what we did was - we tried to lay out this machine and it was not to be built so we said, okay we'll finish it and build it. I designed a writeable control store, some guy named Joe

Rizzi from Intercel showed up in the lobby one day and they wouldn't let him in past the lobby and this guy shouted out - I can sell you a 1 K prompt for $5.00 and I said, come on - let's go, I took him up to a room and said what the hell are you talking about? And he told me that Intercel had developed this prompt that they could build a 1K quantity which you could blast with a blaster and they didn't know exactly how it worked because it worked by destroying diodes in the prompt, but they could build a few. I said, well I need a hundred of them, he said, we can't build that may but we can maybe build 50, so I said, how much are they and he said well, we'll charge an exorbitant price for the first ones and I needed a purchase order for $18,000 signed so I went around and I saw Andy Knowles, I said Andy I need this purchase order signed for $18,000. So it bought this thing and they sent me a blaster for it, it was a nice unit except the fan was outside, it was an add-on separately and a box of small quantities of prompts and I built this writeable control store and we put this machine together and, the conference was on a Monday and we got all the stuff together the week before. And then one of the greater comedies of errors there was a decision to maintain the mill and turn off all the electrical power in the mill that weekend and I protested, I said You guys can't do this to us, and Roger Cadey was around then and he got a giant extension cord

from another building to building 5 okay, and he powered up our area and we kept going because the last step was that we had the boards and all the parts on and the last step was to dump the writeable control store. Well, right as we were doing it some turkey walked up to the DEC-10 where we were doing all the programming and turned the switch off. I still remember it, the programmer who was working on the project, he just got up and left. Well, then we, I came up with this idea of how to dump the writeable control storage out of a programmable box because it had a memory in it and to write it and we did it and we got everything working one night, the night before we went to Las Vegas to the show, and we had it all put together and I said, put it on and if it runs for fifteen seconds we'll ship it. I turned it on, it ran for fifteen seconds, we put it in a box, we all went home, got one hours' sleep and the next morning we picked it up we bought a seat on the airplane and took it to Las Vegas and in Chicago they tried to kick us off the airplane because they had sold all the seats, so we put it under a seat, and that airplane had one more passenger than the number of seats. We got to Las Vegas, plugged it in and the damn thing ran for a week. In fact, some of the other machines that had been better engineered didn't work through because their power fail circuit worked and the power was bad and our power fail circuit didn't work so we never shut off and the power went low.

We just kept plugging, but we had all kinds of problems during production but we built a bunch of them. That was the 1105 and Roger Cadey saved my career by = we used to fail a thermal test and I wanted to turn it down to make it less strict, but I just did not make it more strict and that was lucky as hell. We had so many problems that the only way to make things work in those days was to test them to way over the limits. So when customers used them they could drive them way over the center, and I learned a lot from that project, I learned about project management, everything that could go wrong went wrong sometimes in the middle of the project as we go into production they say we're going to move to Puerto Rico, and I said that's funny. They said well everything is stable now and this guy named John Patel who was manager for Diagnostics and John _____- stable and I said what's that disk under your arm John? because they had introduced this new diagnosis system with ACT using computers and automatic something test. He said it's a new set, and I said, John how come they are stable if you keep carrying them under your arm. So we had this enormous hassle and I said we can barely build this thing here we have two people who could test it. We had no understanding of what was happening in all these different processes, how can you transfer this to Puerto Rico? So they said, this is what I'll do, we'll send the whole crew to Puerto Rico and the way they transferred the th ing to Puerto Rico, is they didn't transfer

anything, they took the whole U.S. crew and sent them to Puerto Rico for about ninety days and these were wild times, they were just--- After that started production. I'll give you another one. We had a million dollar of ECO of 54.97.28 it was a power supply that had been built - it was one of the first switcher power supplies that we used and it was built that it would fit a 3 1/2 inch profile ----

[END OF TEICHER INTERVIEW]