COMPUTER HISTORY MUSEUM

Oral History of Franklin Dean

Interviewed by:
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Gardner Hendrie: Today [January 17, 2006] we have with us Frank Dean, one of the founders of Computer Control Company. Thank you very much, Frank, for agreeing to do an oral history for the Computer History Museum.

Franklin [Frank] Dean: Right.

Hendrie: Maybe we could start, and you could tell me a little bit about your family background, where you were born, you know, what your parents did, what siblings you had, a little about where you started out in life.

Dean: Well, I started out in Edgewood, Rhode Island, and I have two brothers, or I had two brothers, they're both dead now. I was born, brought up, educated in Rhode Island, and my first job was with Westinghouse Electric down in east Pittsburgh. My wife tells me I went down a blonde and came back a brunette, because of the pollution down there.

Hendrie: Well, could I ask you a little bit more about your background? Now were you the oldest?

Dean: No, I was the youngest.

Hendrie: You were the youngest. All right, so you were the baby of the family.

Dean: I was the baby of the family.

Hendrie: How much older were your brothers?-

Dean: There were two years between us.

Hendrie: Two years between each of you. All right. Now what did your parents do?

Dean: Well, my father started out in the printing industry, and it was rather rudimentary back then, as you might expect, and then during the depression he lost his job, and we really had a tough time. He, for a while, had a small printing press in the garage, and he did things like note cards and things like that, and then he went into the painting and paper hanging business, and he made a fair living that way. And my brother who was one step older than me, joined my father and they ran the business.

Hendrie: All right. So originally he was a printer and he worked for a printing company?

Dean: A printing company in Providence, Rhode Island.

Hendrie: In Providence, Rhode Island. All right.

Dean: Of course, my mother was a housewife, and she brought us up.

Hendrie: You had a stay-at-home mom.

Dean: That's what they did in those days.

Hendrie: Yes, exactly. I think that's what most of them did. Now, did your father have anything besides a college education?-

Dean: My father did not have a college education   I'm not so sure he even graduated from high school, but he might have. He had very little education.

Hendrie: Okay. All right.

Dean: I was going to say that my wife Marge and I have two sons, and they are married, and both have a couple of kids. They all live out in San Jose, California, because they both went into the computer business.

Hendrie: Oh, my goodness!

Dean: --and if you go to Silicon Valley for a job you tend to stay there.

Hendrie: All right. Well, very good. Do you ever go up to see them, or do they always come to see you?

Dean: Oh, no, we go there a few times a year, and they come here, too..

Hendrie: All right. Good. Well, when you're there, if you have the time, we'll get you a tour of the Computer History Museum, which is in Mountain View, and you can see some 3C computers.

Dean: I certainly would like to do that.

Hendrie: We even have a DDP24 Apollo mission simulator computer--

Dean: I'll be darned.

Hendrie: --that somebody kept, after it was decommissioned, in their basement.

Dean: I'll be darned.

Hendrie: And when he passed away, his wife called us and said, "We have this. Does anybody want it?" So, we have some nice things. You'll be interested.

Dean: Oh, that's good.

Hendrie: Let me turn back with a little bit more on your history. What's your earliest memory, growing up, of what you thought you might want to do when you grew up? What's the first memory?

Dean: Well, my first memories of that were in high school, and I had a good physics teacher whom I liked. Unfortunately, I can't bring up his name. When I graduated my mother insisted that I go to college-- my other two brothers did not go to college, so she insisted that I go.

Hendrie: You were her last chance.

Dean: She insisted I go, for which I thank her, yes. But, anyway, the only college that we could afford at that time would be Rhode Island State College. It had a very low tuition and was very easy to get into . I was a good student, I think, and the reason I chose chemical engineering when I went there is that I had heard that the best education there was in chemical engineering. So I graduated with a B.S. in chemical engineering in 1943. We normally would have graduated in 1944, but during the war it was advanced and we went all summer and graduated early.

Hendrie: You didn't have summer vacations!

Dean: Didn't have summer vacations.

Hendrie: Well, the physics teacher sort of inspired you, and he's the one who sort of directed you toward chemical engineering? Were there any other influences?

Dean: No. No, he, of course, thought that was good, but it was more the fact that Rhode Island State College had an excellent chemical engineering facility there.

Hendrie: So if that's where you're going, you might as well take their best technically oriented course.

Dean: That's right, yes. Now, unfortunately, my first job was with Westinghouse Electric, and I was a real naive chemical engineer there.

Hendrie: Now how did you get that job?

Dean: They came and interviewed at the college.

Hendrie: Now did you have other offers, do you remember?

Dean: I don't remember whether I did or not.

Hendrie: But you picked that job.

Franklin Dean: I took that one.

Hendrie: And where was that located?

Dean: That was down in East Pittsburgh, Pennsylvania.

Hendrie: Now did you live at home when you went to college?

Dean: No, No.

Hendrie: They had dorms?

Dean: They had dorms, and they had fraternities, and the fraternities would take in a certain number of new people, and I joined Tau Kappa Epsilon, and to pay my way, I was the house boy, the cleaner. I cleaned the house.

Hendrie: Okay, very good.

Dean: And that's how I got there. A little side issue here; the last year I had to borrow 600 bucks to stay in college, and in my job at Westinghouse, I caught my finger in a press and lost part of it, and I got $600 from Workmen's Compensation, and I paid off the loan that I had to borrow to finish my college years.

Hendrie: Oh, my goodness! Wow! All right. .

Dean: So what else would you like to know?

Hendrie: Well, so you went to Westinghouse. Please go through your story.

Dean: Well, I went to Westinghouse.

Hendrie: What did you do there?

Dean: Well, I got shifted between various little places to see if I could find one where I'd fit. Well, frankly, I didn't fit. I didn't like it. Chemical engineering just was a wrong choice for me. But it so happened, at that time, that anybody who had graduated from college with an engineering degree was invited to become an officer in the Navy.

Hendrie: I see. All right.

Dean: So, even though I had cut my finger partly off, they still said, "Can you pull a trigger?" and I said, "Yes," and so they made me an officer, an Ensign in the Navy. Well, that was the best thing that could ever happen to me. I went to schools. I went to Bowdoin, I went to MIT, I went to several places and learned all about digital engineering, computers, and radar.

Hendrie: Ah, yes.

Dean: It was radar, the very beginning of computing was radar, I believe.

Hendrie: Yes. -

Dean: And that's where I learned something that I liked, and that was what I was going to be in when I got out of the Navy.

Hendrie: Okay.

Dean: So, I got out of the Navy. I was a radar officer on a ship at the end, but I never saw any action.

Hendrie: On a which? On a destroyer?-

Dean: Destroyer, yes.

Hendrie: Okay. How long where you in the Navy?

Dean: Uh, I went in in 1943 and got out in 1946.

Hendrie: Okay, so you were there for three years, but part of it was your schooling.

Dean: Oh, a lot of it was my schooling. I did get overseas, over in Japan, but the war had ended then. And I wasn't disappointed, frankly, because, these destroyers were being used as picket ships, and the kamikazes were kind of picking those things off pretty well. So, anyway, after I got out, I was looking for a job, and I interviewed at MIT. Marge's two brothers worked there. That didn't pan out. I interviewed at Raytheon, and they were looking for some people with my type of background, and I was hired in 1946 there.

Hendrie: All right. Now, you mentioned that Marge, your wife, had a couple of brothers at MIT.

Dean: Yes.

Hendrie: Can we go back -- I'm just curious, how did you meet your wife?

Dean: Oh, well!

Hendrie: There's always a good story lurking there.

Dean: Oh, it was back in college, and during the freshman year I was at TKE, the fraternity, and of course they had a lot of dances, and one of my fraternity brothers brought Marge to the dance. Well, I was kind of taken with her, and so I danced with her a lot, and that was the start of our romance.

Hendrie: Very good, very good. When did you actually get married?

Dean: We got married in 1945, October 13th, which brings up the fact that this past year we were married 60 years!

Hendrie: My goodness, that's wonderful.

Dean: And one of our daughters-in-law thought, what you ought to do to celebrate the 60th is all go to Hawaii. So we took our whole family, 15 of us, to Maui, and spent a week there and had a great time.

Hendrie: That's wonderful!

Dean: Yes, that was very nice.

Hendrie: All right. So, you did decide to join Raytheon?

Dean: I picked Raytheon, yes.

Hendrie: Okay, now what did you do there?

Dean: Well, when I first got there, Raytheon had a contract to summarize in a big book all of the pilotless aircraft that were being manufactured in the United States.

Hendrie: Pilotless.

Dean: Pilotless.

Hendrie: Okay.

Dean: And there were many, many, many. And there were all kinds of devices for operating these. Some used radar beams, you know, some kind of a beam that went up to it. And what we had to do was look at all of these devices. Maybe we'd go to where they were being built, take notes on it, and write them up and put them in this big book, and it was a big volume.

Hendrie: Okay.

Dean: Then, from there, I went into Lab 30.

Hendrie: Now what was Lab 30 supposed to do?

Dean: Lab 30 was in the digital business.

Hendrie: Okay.

Dean: Raytheon got a contract from the Navy to build a digital computer which they named the RAYDAC computer.

Hendrie: Oh, okay.

Dean: All of the founders of Computer Control Company were in Lab 30 and were part of the group that designed, built, and delivered that RAYDAC computer to Point Mugu, California.

Hendrie: All right. So, you joined this group, when?-

Dean: It was in maybe 1947 or 1948. I can't really remember now exactly when it was, but it was a progression from being a writer into the computer group.

Hendrie: Now what were they doing? You know, what was going on? Do you remember what was going on in the-- where were they in this project? Had they gotten the contract yet, or were they just sort of in the proposal stages?

Dean: I'm trying to put a time scale on this. There were some other projects that we worked on that we got from the Bureau of Standards, and one of them that I worked on was to develop a system using flip-flops and gates and so on to create a raster for a television set.

Hendrie: Okay.

Dean: And we did that; that was one of my projects. And I'm not exactly sure when that contract for the computer came in, but it was in that time frame.

Hendrie: All right, but you did some other things before you actually started working on that contract?

Dean: Yes. And then because all of the people who joined Computer Control worked in that area, when the RAYDAC was finally accepted, things were sort of going down a little bit in Raytheon, and I'm not sure of the timing, but Honeywell was going to take it over.

Hendrie: Pardon my interruption, but rather than getting to that, I'd like to understand a little bit more about what you did on the RAYDAC computer, you know, what your first assignment was.

Dean: Well, my first assignment was in the control unit of the computer. A lot of the logic had already been done at that point, and I, of course, went over it and maybe changed a few things, but most of the logic had been done.

Hendrie: Now, were there a couple of other people also working on the control unit? If some of it had been done, somebody had worked on it previously.

Dean: Well, somebody had done the logic of it, so I had a logic block diagram of it.

Hendrie: Ah, okay.

Dean: It was my job to convert that into hardware.

Hendrie: I see.

Dean: And I had some other people working with me. I can't bring back all of their names at this point, I'm sorry to say.

Hendrie: That's all right.

Dean: But we had to design the flip-flop, find out what we were going to use as a flip-flop, and we used a couple of little miniature vacuum tubes and diodes and so on, and made the flip-flop and the gates and all of the various things that were needed.

Hendrie: Now did you actually have to design the circuits for it?

Dean: Oh, yes, yes. We had to design all the circuits.

Hendrie: And did you do the circuit design?

Dean: Yes. Yes, I did the circuit design.

Hendrie: And then?

Dean: And then it was packaged up. This was a water-cooled, or rather Freon-cooled, computer.

Hendrie: Oh, my goodness.

Dean: And so it was quite a different set-up. The flip-flops were encased in a little plastic container which had an aluminum stud sticking out the bottom, and the stud went into a bar, the bars went to the sides, and the Freon flowed up the sides, cooled the bar, and the bar cooled the vacuum tubes.

Hendrie: Okay.

Dean: It was a fairly elegant design.

Hendrie: Yes.

Dean: And so we did all of that.

Hendrie: I don't know whether anybody made a Freon-cooled computer after that until Seymour Cray made the Cray I as Freon-cooled.

Dean: Oh, is that right?

Hendrie: Yes.

Dean: Yeah, well, all right. I think it was Freon. I don't think it was water, I think it was Freon, but I'm not positive.

Hendrie: Yeah, okay.

Dean: So we did that, and then all the other people were designing other aspects, the memory, and the memory, by the way, was a mercury memory, acoustic memory, where you'd put a pulse in one end, it would travel down the mercury and come out, be amplified it and put back in, so it was a circulating memory.

Hendrie: Yeah, a delay line memory. Do you remember who worked on that?

Dean: Wow! Who worked on that? No, I can't remember, unfortunately.

Hendrie: All right.

Dean: A lot of my memory has disappeared over the years.

Hendrie: I understand. All right.

Dean: So there were other groups which worked on the various other aspects.

Hendrie: So there were quite a few people working on this thing?

Dean: Oh, yes, oh, yes, it was a good, very big group.

Hendrie: Now who was leading the effort? Who was the project engineer?

Dean: At that time, it was Charlie West.

Hendrie: Okay.

Dean: And Charlie was in charge of the hardware end of it. The software-- not the software, but the logic

design of it had been done by another group, and that, I don't believe, was under Charlie.

Hendrie: Oh, my goodness. So somebody had done the logic design, or at least the system design, the block diagram?

Dean: The block diagram, right.

Hendrie: Now had that group taken the block diagrams right down to gates and flip-flops and registers?

Dean: Yes.

Hendrie: Okay, so the whole logic design had been done by another group?

Dean: It was the logic design, right, right.

Hendrie: All right. And so you were in the implementation group.

Dean: I was in the hardware end of it.

Hendrie: The hardware end of it. How do we take this logic design and build circuits that make it work?

Dean: Yes.

Hendrie: Okay.

Dean: So all the pieces of the computer were built, and then it was tested. And as most computers in those days, it really wasn't terribly reliable, but it did work, and it did pass all of the tests that we had to pass, and it was installed in Point Mugu, California.

Hendrie: Do you remember any particular moments during the design or testing that stick in your memory because they were either exciting or traumatic?

Dean: Well, I remember during the testing, at one point it failed, and we were trying to figure out why it failed. And it turns out that the gain in one of the memories was not high enough to really circulate the information properly, and that caused the failure. So actually all we had to do was kind of turn up the gain a little bit and then it worked fine and we passed the test.

Hendrie: Oh, my goodness.

Dean: That was one of the things that happened, and I'm sure there were many others.

Hendrie: That's one that you can remember, because everybody was pretty nervous!.

Dean: Well, I remember it mainly because I had to give a talk at an IEEE conference on how the computer was tested and so on, and after I had given my talk, somebody in the audience said, "Well, did you have any problems?" I told them about that problem, and that's how I happen to remember it.

Hendrie: Oh, very good, all right. So there are a couple of IEEE papers on the RAYDAC?

Dean: Yes, and I had one of those, and I don't know what happened to it. If I had it, I'd be glad to give it to you.

Hendrie: Well, I'm sure those can be obtained from the IEEE. I'm sure they would have those.

Dean: Yes.

Hendrie: All right. Okay, well, let's see. We probably ought to continue with the story - it's now commissioned--

Dean: It has been accepted.

Hendrie: And you all go out to get it working.

Dean: Yes, yes, that was very nice. The government was very good to us. They allowed us to take our wives and children out, to allow us to go back and forth. We stayed in Santa Monica, California, and we went back and forth to Point Mugu and set the computer up and got it running and passed the tests out there, too. And then, at that point-- oh, I might add that most of the founders and some of the employees that were initially hired by Computer Control all worked in this same division of Raytheon. And after it was accepted, Lou Fein, who was the original organizer of this whole thing, went around and said, "Gee, maybe we ought to think of starting a company."

Hendrie: Now what was his position at Raytheon?

Dean: You know, I was trying to remember that, and he obviously must have been a project engineer or a leader of some sort, but I couldn't remember his exact title. Several of us got interested in this. I believe there were maybe 10 - there might have been a few more - but at least 10 who were offered the opportunity to be founders of Computer Control Company. Well, eight actually did join. But I'd like to talk a little bit about this unusual company, the start-up of this company, because it was very unusual. First of all, we were all engineers. We didn't have any experts in sales, marketing, finance, production and

manufacturing. We didn't have any of that. We were all engineers, which is quite unusual, or at least it is nowadays. Maybe back then it wasn't. But even more so, we were terribly underfinanced. We didn't have an angel who came in said, "Here's a pot of money for you."

Hendrie: There was no seed money.

Dean: No. We didn't go to a venture capitalist and say, "Hey, give us some dough." We didn't do that. As a matter of fact, the only money that went into Computer Control Company as capital was what each member of the start-up group was able to put in. I believe that was 4 thousand, and for that they got their stock stake in the company. Well, four thousand dollars to us at that age was a lot of money.

Hendrie: That was a lot of money, yes.

Dean: I know we took most of our savings to do it. Some couldn't actually do it right away. They had to do it on time, but they eventually did and put in the 4 thousand. Well, you can't start a company on that. I mean, that would be impossible. Fortunately, the government came to Raytheon and said, "We need somebody to operate this computer, to maintain and operate this RAYDAC computer we've got out there in Point Mugu."

Hendrie: Yes, there's nobody in the Navy who's going to do it.

Dean: Nobody in the Navy could do it. Well, lo and behold, good old Computer Control had all the talent to do this, and we put in a bid, and won it, and so we got the contract to maintain and operate the RAYDAC computer.

Hendrie: Well, was Raytheon mad about this?

Dean: No, no. Raytheon was getting out of that business anyway. Honeywell was going to take it over. I don't know exactly when they did. I may even have worked a little bit for Honeywell myself before I went in on it. But no, there was no problem with Raytheon. And that gave us some income. Another great thing is it gave us some way to allocate some of our overhead, because that contract was big enough to accept some overhead. And so we could start the company. Well, I might digress now and tell you who the people were.

Hendrie: Yes, that would be good.

Dean: All right.

Hendrie: Yes, I'd love that.

Dean: The first three I'm going to mention left the company at various stages, so they were not there the whole time, and certainly weren't there at the end. The first one who left was the one who started the company, Lou Fein. He was the president at that time, and I won't get into the reasons, but he left the company.

Hendrie: Well, can you say a little bit about him? I think he has passed away.

Dean: He has.

Hendrie: Could you say a little bit about why he left, from your perspective?

Dean: Well, from my perspective, he left because there was a conflict between the East Coast and the West Coast. He wanted the West Coast to be the prime location of Computer Control Co. - the center.

Hendrie: The center, right.

Dean: All the rest of us back East did not want that. We wanted to stay in the East and have that be the center. We outvoted him, and we wanted it back East and he said, "All right, if that's the way it is, I'll leave," and he did.

Hendrie: There weren't enough of the founders who were out there who wanted to stay there?

Dean: No, no there weren't. I believe that's the reason. [Reichard: "I believe one of the founders was Clifton (Clif) Kinne, who was a suberb circuit designer. Clif had a profound admiration for Lou Fein. Clif told me that for some period of time he was manager of the early West Coast operation."]

Hendrie: Yes, okay.

Dean: The next one who left was-- I'm not sure of the time frame, but he did leave. It was Ken Rehler. He was stationed out there in the West coast, and if you want to know the reason why he left, I'm not positive, but I think he didn't feel that the company was going to be successful, and he left.

Hendrie: Now while we're still talking about Lou Fein, you said he had been some sort of project engineer or supervisor. What had Ken Rehler done?

Dean: He was just an engineer.

Hendrie: Do you remember what part of the computer he worked on, what was his expertise as an engineer?

Dean: I believe he was doing some of the circuit design, as I recall. I think that was what he was doing.

Hendrie: Okay. Now do you know how to spell his name?

Dean: R-E-H-L-E-R, Rehler, R-E-H-L-E-R, Ken.

Hendrie: Yes, Ken. Okay.

Dean: Now the next gentleman was Bob Brooks. He took over as president when Lou Fein left as president, and after a while he left the company, too. Now you're going to ask me why he left.

Hendrie: Of course I am. <laughter> Why wouldn't I ask that, right?

Dean: Well, you have already interviewed Bob Brooks.

Hendrie: Yes, but I'm interested in your perspective. It's often very interesting to hear different people's perspectives.

Dean: Well, he's still my good friend.

Hendrie: That's good.

Dean: So I don't want to say too much, but I believe that it was because Bob wanted to be what you would call a true president. He wanted to run the company, and the rest of us were not too sure we wanted to give up that responsibility. We were sort of unique, and the company was almost run by committee, with the president being the head, but it was pretty much that everybody was in there when decisions had to be made. And I think that's the reason he left. Now the remainder, five people of the original eight, stayed all the way through till we were acquired by Honeywell. Ben Kessel took over as president when Bob Brooks left, and he remained president all the way through.

Hendrie: Now what had Ben done at Raytheon?

Dean: Pretty much the same. It was in circuit design and I can't remember the details.

Hendrie: All right.

Dean: I can remember some of them, but I can't remember a lot.

Hendrie: Did he do the arithmetic unit?

Dean: I don't think so. He might have been part of it. He's dead, you know.

Hendrie: It's a long time ago.

Dean: It's hard to bring that stuff up, I must say. But anyway, he became the president, and he stayed all the way through, and he actually stayed with Honeywell after Computer Control was taken over. The next gentleman was William Wolfson. Bill started out on the West coast, and then he realized that there was more action back on the East coast, and he wanted to get back into that action, so he came back East, and little by little he took over He was in charge of sales and marketing, and he did a good job at it. Now Bill Wolfson was in charge of the input-output equipment on the RAYDAC, so I do remember that.

Hendrie: Oh, okay.

Dean: The next person was Robert Massard. Bob Massard, he had sort of an inkling towards accounting and such for some reason, and so when we started up he worked into that area, and he eventually took over and became treasurer of the company and did all of the various accounting and so on that the treasurer did, and a good job. And I worked with Bob quite a bit in setting up the pricing and so on, on the various products that we made. The next gentleman of those five was Bill Horton. He was an engineer at the beginning, and he remained an engineer, senior engineer, throughout the course of the company. That leaves me.

Hendrie: Well, now, what did Bill do at Raytheon, do you remember?

Dean: No, I don't.

Hendrie: Okay.

Dean: Gee, you know, I ought to know who was doing that arithmetic unit, and he may have been working on that. I really don't remember. And then that leaves me. When I joined the company, I was given the title of Chief Engineer, and I was in charge of engineering mostly.

Hendrie: And you stayed?

Dean: I stayed an engineer, yes, thank God.

Hendrie: Okay, very good. .

Dean: So those were the people in the company. Now when we started out, we didn't even have any space. The R. D. Brew Company let us use a room that they had. He was the one that was making delay lines and things like that at the time. And then, of course, when we got a little money and so on from our contract operating the RAYDAC, we did move into some area in Babson Park. It was a second floor of one of their buildings, and I don't know how many square feet, but probably a few thousand square feet. And when we first got in there, we were pretty lonely. There wasn't much in there.

Hendrie: Not very many people there?

Dean: No. And we were more or less jacks of all trade. If a wall needed to be built, we built the wall. If floors had to be swept, we swept the floors. So we started out quite small, but then we got some engineering jobs, consulting jobs, and I started to get developing of various building blocks, digital building blocks, for building digital systems. The first one was built around a vacuum tube. It was a dynamic one megacycle device, and then it was soon redesigned to a transistorized device.

Hendrie: Can we go back to some of the early work that you did? Did some of the people stay on the East coast and work on consulting projects and such?

Dean: Yes.

Hendrie: Or was everybody doing the RAYDAC?

Dean: Oh, no, no, no. Several stayed on the East coast. Bob Massard did. I did. Bill Wolfson came back, so he started out there, so there were a few of us that stayed on the East coast. We hired some other employees, too, to come in and work. We started very slow, but we developed.

Hendrie: Do you remember what the first projects were, or any of them?

Dean: Well, I remember some of the projects. I don't know what the first one was. I think maybe - -

Hendrie: What are some of the early ones?

Dean: The early ones? Well, there was one that was built out of what we called our M-PACs, which were small static devices, and it was for a company in the photo business of some sort. Boy, I can't really remember.

Hendrie: Kodak?

Dean: No, it wasn't Kodak.

Hendrie: Oh, this was not the minicard?

Dean: No, but that was one thing that we consulted on. Anyway, I built that one. I designed that and built it and tested it, and it went into production, and we built not a large number, but several of them anyway.

Hendrie: Okay, now, did you design these circuits just for this?

Dean: Oh, no, no. These were building blocks.

Hendrie: You built some building blocks?

Dean: Yes. We called them PACs.

Hendrie: You came up with the idea that you needed to have building blocks to execute these special systems?

Dean: Exactly, exactly. Yes. The first one, as I say, was a vacuum tube one, and that was duplicated in a transistorized version.

Hendrie: What was that called?

Dean: The first one was called V-PAC, V for vacuum tube. The second was called T-PAC, transistorized. The little one that I used in that system I talked to you about was called the M-PAC. That was static but we had flip-flops and gates and all of those various things.

Hendrie: Okay. And was that transistorized, too?

Dean: Oh, Yes.

Hendrie: There was only one vacuum tube PAC?

Dean: Only one vacuum, yes, right.

Hendrie: Okay.

Dean: And there were some others along the way, and the last one was the S-PAC. The lead engineer on that, I might say, was Bob Baron, and a very good engineer. By then, transistors had become more

reliable, they were faster, and the manufacturing quality was better. It was an excellent design, and we made all of the various packages you would need to do a digital system.   And it went into very good production.

Dean: Well we soon found that we needed somebody to do the manufacturing of these products and we hired Ed Hampson.

Hendrie: Where'd you find him?

Dean: You know, I don't where he came from.

Hendrie: You were not in charge of this search?

Dean: No I wasn't and I didn't hire him but so I don't know where he came from. But anyway he took over the manufacturing and actually built a subsidiary up in Peterborough, New Hampshire and they did all the manufacturing up there and it was very enlightening to see it go from the etched boards that we used where you individually put in the components and then turned it over and individually soldered all of the connections.

Hendrie: Ok with a soldering iron?

Dean: With a soldering iron, that's how it first started.

Hendrie: That's how you made the first?

Dean: First few and then of course he got automatic insertion tools and he got a wave solder, I don't know if you're familiar with that where you had a wave and ran the board across it and it did all the soldering all at once.

Hendrie: Do you remember when you hired him, when he joined?

Dean: No I don't--- it was not too far along when we started to make these packages that we needed help and we hired him in. Now at that point where we had the S-PAC, which was a really great product, we had also developed memory systems, Bob Reichard was in charge of that and we had all of the ingredients that would make up digital systems, would also make up computers. Well it was the West coast, there was an operation - we had an operation out on the West coast.

Hendrie: They did products or special systems?

Dean: Special systems.

Hendrie: Ok so they used the PACs?

Dean: They used the PACs to do the special systems and the lead engineer in that was Bob Waller, an excellent engineer, and I think he got some inputs from a sales person, I his name was Doug Chamorro, who knew what the field wanted in the way of a computer and they put together the specs on it and they built the prototype using S PACs and then after that the prototype was shipped back to the East coast and the East coast was going to go into production on it. Well that was the first computer.

Hendrie: Did they have a customer when they built it?

Dean: No.

Hendrie: No?

Dean: No I don't believe so. It was sold to somebody though, but I can't remember who got it.

Hendrie: This was the DDP 19?

Franklin Dean: Yes.

Hendrie: Yes, this was the DDP 19.

Dean: DDP 19 and then of course we had a progression of other computers of which you were responsible for one of them, what was that the 260?

Hendrie: That was the 116.

Dean: 116 OK and there were others along the way and I think what was the last one was the DV224 or something like that?

Hendrie: Yes there were the DDP 24 and the 124 and 224.

Dean: So we really got into the computer business in a fairly big way. I had some reservations on all that but in any event.

Hendrie: Share them; was there a lot of discussion among the owners, the founders?

Dean: Oh yeah absolutely and we wanted to be in the computer business but at that time the packages, the digital packages were the big source of money, they were the ones that were making most of the money and so it was hard to switch from packages to computers and so the allocation of funds in looking back at it, we should have put more emphasis on computers. You can probably answer that yourself why you left Computer Control but anyway you can add that if you want.

Hendrie: No that's fine; I didn't leave for a long time, way into the Honeywell era.

Dean: Oh you didn't?

Hendrie: No, no.

Dean: Is that right?

Hendrie: Yes I didn't leave--- we did the 116 in 1964 and I didn't leave until 1973.

Dean: Well I guess looking back at it we should have taken your talent and brought in even more talent to design even more sophisticated and better computers, but we didn't. We did allocate funds to the computer and I think we should've made a bigger switch from PACs to computers and I think we would have been better off if we had done that. Anyway so that's pretty much the evolution of the company, obviously we had to add as we went along, all of the various ingredients of inspection and quality control and all of that.

Hendrie: I'd like a little bit more on what your--- in the early days what was sort of were some of the personal things that you felt responsible for, sort of pushed through this is what we oughta do?

Dean: Well in the early days these were my favorite days of the computer, I enjoyed that immensely and as chief engineer I knew everything that was going on as far as in the engineering department. It was interesting that many times we would hear of a customer's need, we would write a proposal, figure out the cost, submit it to the customer, if we got the job, we'd order the parts, build the device, write a manual for the device, ship it to the customer and install it. That was something a person would do which to me was Utopia.

Hendrie: Project Engineer - handle all the parts, every aspect.

Dean: Exactly.

Hendrie: And if it worked and was very successful it was very clear who did it. It was yours; if there were problems it was very clear.

Dean: Right, but anyway I enjoyed that.

Hendrie: What were some of the ones that you did that you remember, you told me a little bit about - you told me about an M-PAC one.

Dean: I mean I can remember one other one, the Oldsmobile. What they wanted to do; everything they made, all the cars they made were made with the accessories tabulated on a punch paper tape and what they wanted was a device that would take these punch paper tapes, read them and store into I guess just little counters all the various options. And so I designed it--- this one was done all with relays and because it was fairly slow and so I designed all the relays and got the paper tape and whenever something came across it would go into this array of solenoids and so on and out on these little counters would come the answer.

Hendrie: Now what was the purpose of these paper tapes?

Dean: What they wanted to do was an inventory of all the different options that were going on the cars and these paper tapes carried the information about all the options.

Hendrie: On each car by car?

Dean: Car by car.

Hendrie: Oh so there was a paper tape for each car; a strip of paper tape for each car they built and that way they could accumulate them and understand what was being built.

Dean: They never told us what they were going to use it for and after it was there and installed I never heard another word about it so I don't know whether they actually used it or not.

Hendrie: Or it was just incredibly reliable and they didn't have any problems or they didn't use it.

Dean: I don't know, but anyway that was an interesting job, oh gosh I'm sure there are others but I can't bring them to mind right now. There was a big project that was not mine but they designed a system for a large bank in Boston and it did all of the work that was normally done behind the scenes for the banking industry.

Hendrie: Do you remember who?

Dean: I can see him, but I can't come up with his name.

Hendrie: At one point you hired Paul Bothwell to be - tell me a little bit about that, I mean that's in this evolution of the company gains, growing larger and larger, you obviously were significant part of that, could you tell the story there?

Dean: Well, yes, I hired Paul Bothwell.

Hendrie: Tell me the story about when you decided to go do something like that?

Dean: Well we had progressed to the point where we had a certain number of packages of the M-PAC and so on but I was getting a little stale on that and so were the other engineers, we were running out of ideas and not only that, we needed another good engineer in the group anyway to do more systems work or whatever and so we hired--- I hired Paul Bothwell, he came from Adage and - [Reichard: "Burge Jamieson came from Adage.]

Hendrie: How did you find him?

Dean: I don't know whether we used one of those guys.

Hendrie: Search guys?

Dean: We have might have, that might have been they because we did use them once in a while. So Paul came on board and he certainly was a great addition and as I was saying at the beginning I really enjoyed what I was doing. As the company got bigger and bigger and my job became more administrative and less hands-on hardware I didn't really like that as well.

Hendrie: Wasn't quite as much fun.

Dean: So I was bringing Paul to be my successor and little by little I transferred over to him pretty much of my responsibilities and at the end there I really was pretty much out of the direct day to day and Paul had taken that over.

Hendrie: Now did he bring the idea for S-PAC?

Dean: Yes. Well I say yes, I think Adage had done some of that kind of work; I think Bob Baron also came from Adage.

Hendrie: Now are you sure it was Adage or Epsco?

Dean: Oh you're right, you're absolutely right.

Hendrie: I'm thinking that Paul was at Epsco, same kind of company but--

Dean: No you're absolutely right I'm wrong it was Epsco, yeah it was Epsco, yeah I'm glad you caught that and I think Bob Baron also came from Epsco.

Hendrie: Yes he would have because of course Paul Bothwell came from RCA and Bob Baron was also at RCA in Camden so I had previously known him before he got to 3C and in fact that's how I ended up at 3C because Paul knew of me and went and got Lowell Bensky whom he had hired to come and see whether he could recruit me out of Foxboro, that's that connection. But Paul and Bob came?

Dean: Paul and Bob. Bob was really the lead engineer on the S-PAC. The S-PAC started out one megacycle, that's what I used to say all the time til someone said its megahertz, don't you know that.

Hendrie: It was megacycle when you were doing it.

Dean: When I was there, yes. And then that was upgraded uh… to a 5 megahertz product. You spoke of Lowell, in the latter part of my existence in the computer control company I did a lot of special engineering and Lowell and I were closeted in a room designing a computer. And don't ask me the name of that computer because I don't remember it; in fact we were the cause of them making--- he was doing the arithmetic unit and I was doing all the rest of the stuff, the logic design and then the conversion to our packages. That was just a little aside. What was I talking about?

Hendrie: Well I had asked questions about, you know, about Paul.

Dean: Paul was an excellent addition, he could just take over and he was good at anything he did. He was given a fair number of stock options and he deserved them. Bob Baron as I say did the S-PAC and, boy, he deserves a lot of credit for that because that was a good money maker.

Hendrie: It was one of your best yeah; one of the most popular products.

Dean: It certainly was.

Hendrie: I remember the S-PACs. Now when did you decide to get into the core memory business, could you--- when and why did you decide to do that, do you remember that?

Dean: Well I don't remember exactly when but we knew we needed memory of some sort, we had to have memory.

Hendrie: To build these special systems.

Dean: Yeah you needed memory and so that's when we started that up and as I say Bob Reichard I believe was the main engineer on that and they went into our first computer, a DDP19 computer and some of the later ones too.

Hendrie: One of the things that I know you did was at some point you decided to move from transistors to integrated circuits which were, you know, pretty rudimentary at that day, could you tell me a little bit about that story

Dean: Oh sure that is an interesting story.   We knew that the way integrated circuits were going that they were going to--- and when they were already coming out with little packages of not just transistors and diodes but a group of them of some sort.

Hendrie: Yeah little flat packs.

Dean: Little flat packs right and we knew that that was the future. Well at that point we thought geez, you know, maybe what we should do is try to at least feel our way into that a little bit. So we hired Colin Knight and he was the person who was going to get us into integrated circuits. We built a clean room, we ordered some of the equipment that was needed and he actually got it going but we never really made an operating device from that. It was expensive and we soon realized that it was too expensive; you needed a lot of money to get into that business. So we really had to give it up. [Reichard: "Colin Knight established the IC fab facility and in fact did produce some devices which were used in memory, if not other places."]

Hendrie: Yeah you thought that there would be S-PACs on a chip sooner or later and so if you were going to continue making S-PACs you needed the chips.

Dean: We needed those, however it was a good advertising ploy, I'm sure when Honeywell was going to buy us, they saw this and they said that's pretty unique isn't it? And I think other people looked at us as being progressive in having such a thing, but it really was a very expensive. Speaking of expensive it brings up another memory that I have. We were hardware men, we didn't know anything about software, the RAYDAC computer, we were programming it in machine language, if I'd go to the console to test something out I'd put it in machine language and test it out. When we went to Point Mugu and they hired a whole bunch of programmers, they were programming in machine language. Well after we built the first computer, they came to me and they said, you know, we really ought to have a higher-level language of some sort and Fortran at that time was the one, that was the only one at that time and I said being a hardware man I said, you really need that? And they said yes and I said OK. We didn't have that talent so we let it out to a company and I remember the bill for it was something like $50,000. That was a lot of money to come out of our research budget, but we did it and we got the Fortran language and it was put into the computer and I couldn't resist putting that story in.

Hendrie: So that was hard to swallow but you bought the argument?

Dean: I know that after I left Computer Control Company when Honeywell took it over I thought to myself

now you've been a hardware engineer; you ought to learn something about software. So I took what was then the easiest language, BASIC, and I actually programmed in BASIC a nice little program that I put on my computer from IBM that would keep all of our addresses and all the names and their telephone numbers and their birthdays and whether we sent a Christmas card to them and some of the things like that and, by gum, it worked!

Hendrie: That's wonderful and I bet that was fun to do.

Dean: It was I got a good deal of satisfaction in doing that. I never did follow up in any other languages, however.

Hendrie: If you enjoy doing logic design, I think you enjoy programming because it's really the same sort of mental activity. Tell me a little bit about the steps that led up to the decision to maybe sell the company, what do you remember about the talk and the thinking in the founding group, which they still were the board, you were still the board?

Dean: Still the board. And I know that I for one at that point was getting a little disillusioned with the company because I had gone through all of this stuff and I enjoyed it and I was getting down and I was ready to do something else. And I think maybe some of the others had that same feeling that maybe it was time to cash in some chips and go onto bigger and better things. Honeywell came along and I don't know how that contact was made, probably through Ben Kessel but I'm not sure or maybe Bill Wolfson and they were very interested in obtaining the company and we decided that maybe it was time and we should do it. I might add that after Honeywell took over, Bill Wolfson thought it would be a good idea to start a venture capital firm so he invited Bob Massard and Bill Horton and myself to enter the venture capital field and we were called Financial Technical Assistance company. Now that's a whole new story.

Hendrie: Let's try to roll back a little bit before we get there, we'll cover that too. At some point Bill Wolfson moved from being the VP of Sales and Marketing, became Executive Vice President, what was that all about?

Dean: Well I think the thoughts there was that the company could do a lot better than it was doing, in terms of profitability and where it was going and so on and this was, you know, fairly near the end of it but Bill Wolfson took that job over after he was Vice President of Sales and Marketing but he took that job over and he created a form that I thought was excellent. I can't tell you what was all on it but it had all the detailed financial and so on data of the company and we had periodic, I think they were at that time monthly meetings where we'd get around and all of the founders, but also other executives in the company at that time, and we would discuss what had happened, where we were going, what needed to be improved, and it was excellent.   And Bill did a great job at that and I think the company did much better after that.

Hendrie: So you were in some sense doing what Ben had been inclined to do that or had, you know, if he had thought of that.

Dean: But Ben didn't get it down into an operating mode and.

Hendrie: And Bill sort of did and Ben didn't mind?

Dean: No Ben had enough to do. He had other things to do and that worked out very well, I'm glad you brought that up because that is something that really was important to 3C at the time.

Hendrie: I know the people that further down in the organization always looked at that that might have been specifically a precursor to selling the company that he went into that position and sort of fixed up the company so it could be sold.

Dean: Well I don't think that was.

Hendrie: You don't think it was to be sold it was just the company needed some shaping up a little bit.

Dean: Right and Bil - .

Hendrie: And improving its profitability.

Dean: Bill knew that and he did a good job of it, maybe you can bring up more things that'll bring up memories with me.

Hendrie: That's the interviewer's job, right! To ask questions about things. Well tell me a little bit more about what you did after you left, you were not interested in staying on?

Dean: No I was probably one of the first ones to leave. Bob Massard left too and for a very short period of time we thought maybe we could operate some kind of a little partnership, it was called Investment Research Associates and we had a little office in Needham and it really didn't amount to very much at that point.

Hendrie: You were basically investing, because you got cash from Honeywell, you had this cash that you weren't just going to put in the bank?

Dean: No, well we actually had a little what there was called a Quotron I think at that time, which you could get quotes.

Hendrie: So you were looking, yeah, you said we'll make some stock investments.

Dean: We did, we did a little trading and that sort of thing but it didn't really amount to much and then Bill

Wolfson came along with the idea of starting this venture capital company and we thought, boy, that's great and that's what happened there.

Hendrie: So Bill stayed a little bit longer then?

Dean: A little bit. I can't remember exactly when he left.

Hendrie: Did Honeywell consider whether they wanted to have--- because Bill had sort of been running the company for a while as Executive Vice President, whether he should run it instead of Ben or I mean was there, that wasn't something on your watch?

Dean: I wasn't there.

Hendrie: You weren't there, you'd gone.

Dean: I don't know.

Hendrie: Now when did Bill Horton join you in that?

Dean: Well he joined when Bill Wolfson wanted to start the venture capital, that's when he joined.

Hendrie: What did Bill Horton do during this period, he was still at the company?

Dean: He was an engineer.

Hendrie: I don't remember where he was involved.

Dean: Well I'm afraid I can't answer that either, I know he did engineering work.

Hendrie: They did special systems.

Dean: Yes and he was a good engineer, he was a good engineer so he did well, but I don't really remember exactly how he fit in.

Hendrie: So you started a new career?

Dean: We started a new career and I believe if I remember correctly Bill Wolfson put in $600,000 and the

other three of us put in $300,000 so he was the lead man and it was a very, very interesting time because we would find these ambitious young engineers who would want to start a company and we would loan them the money to get started and we would either take options or stock and we would get on the board of directors and thinking that we had experience in bringing along a company from the very beginning we could help them, and I think we did. After a few years Bill Horton was in Arizona and he did not want to really partake too much in being on the boards and things like that so he was bought out at that point and there was just the 3 of us left. Eventually when Marge and I had retired to the Cape I wanted to get out at that point too so they paid me off and I retired to the Cape and that was the end of my official working career.

Hendrie: When was this about, do you remember what time, what year?

Dean: I ought to know that, but it must have been in the later 1960's early 1970's I guess, something like that, but it was an interesting diversion for a while.

Hendrie: Were there any companies that you invested in or you were the one who followed that you remember as being particularly noteworthy?

Dean: No I guess I don't, I think the first company that we invested in was not a startup, well it was a startup but it was not an engineering company, it was a bunch of doctors and I was trying to remember what the heck they were actually doing but anyway we thought it was intriguing and so we did invest in them and I remember that along the way we joined the Small Business Administration and got a loan from them. But didn't really like that for very long, there were too many strings attached so we got out of it but at that time we had this stock in this company, which was run by a bunch of doctors and we thought, you know, we could really use the money that we put into that and the stock had gone up. So we were given permission, even though it was limited stock, to sell it and we did and we made a nice profit and that was I think the first profit that we made. Now let's see, there was--- boy I'd like to drag up the name but there was a company that--- oh by the way we also invested with other venture capital companies, the New England Capital I think was one of them, we even got together with Harlan Anderson [Reichard: "Harlan Anderson was one of the founders of Digital Equipment Corporation."] from time to time and he was in venture capital I think by himself at that time and we got together with him on maybe one or so investments. There was one that I recall it was rather interesting, there was a gentleman Hussein Yilmass and he wanted to start a company that would get into speech recognition and he had some mathematical calculations that looked very intriguing that we really didn't understand, frankly, but he seemed to think that they would lead towards good speech recognition, well at that time everybody was trying to do that, it was just the beginning of it. And nobody was really that successful so we did invest in that company, I think maybe one or two other venture capital firms came in with us, I don't remember and we started the company and they began to work on this and it soon became apparent that they weren't going to do it. It just wasn't going to work and so I think we bought out Hussein because he wasn't being very useful at that point and one of the lead engineers - Bob Massard would remember this because he worked with him very closely, I can't remember his name. But he was a very good engineer and he did do some speech recognition work but it was not any great shakes and after I left FinTech, they carried that on and it became a fairly successful little company, I'm not sure what they did and I don't know how it ended up, whether they remained successful or not but I know for awhile it was successful.

Hendrie: Do you remember the name of the company?

Dean: Well, I ought to remember it, it'll come to me, you know, that's the trouble. After you leave I'll remember.

Hendrie: That's what always happens.

Dean: As I say it was a great diversion and I enjoyed it and we made money too, so that was nice. That was the end of my working career.

Hendrie: Are there any other things that maybe I skipped over or didn't ask you that -

Dean: Well, after you invited me to do this, I had been thinking about this, and that's why I could come up with a lot of those names 'cause I was thinking about them. But no I don't think I have anything else that would be of any importance.

Hendrie: Well thank you very much Frank for doing this and for doing an oral history for the Computer HIstory Museum.

Franklin Dean Photo Identification:

Hendrie: Well, now we have Franklin Dean back with us and we're just going to go over this book of pictures and Frank can at least comment on some of them. . Well - just - you could tell us what that is.

Dean: That was one for Eastman Kodak; we designed a system for them. There it is there, that's the Kodak mini card system and here's Bill Wolfson working on that system. This is an acoustic delay line that - I think you're right - we probably designed that for R D Brew and Company, that's probably what we did. And more delay lines; this is the first package that we developed. It was the V- PAC; it used a vacuum tube product and it was a dynamic system that if you made it into a flip flop, it recycled; there was a delay line on there and it would recycle one pulse width around and it had a series, well you can see on here the logic that you had going into each of those PACs, there were several gates and ANDs and ORs.

Hendrie: So you could do ANDs and ORs or it could be a flip flop.

Dean: Right or both, I mean you could have logic going into the flip flop and then turn it into a flip flop.

Hendrie: How fast was this?

Dean: It was 1 megacycle I believe. You know, I get confused on that because the RAYDAC computer

operated at 3.1 megacycles or megahertz and this was a take off on not the RAYDAC computer but another small computer that Raytheon built, that the original design came from the Bureau of Standards. The Bureau of Standards was the one that developed this idea of a circulating flip flop and delay line. That's Lou Fein with one of the systems. This is a system that I developed as well.

Hendrie: Yeah you talked about that in your history about that.

Dean: For Oldsmobile, yes.

Hendrie: And it's all made with relays, is that?

Dean: Yeah, there may have been some vacuum tubes in there but I think it was all relays. And this is just an example of acoustic delay line that we made and this is where we first set up shop on the second floor of a place in Babson Park. This is an example of system using our M-PAC, that's the M-PAC; the design engineer on the M-PAC was Sig Yalen. [Reichard: "The space in Babson Park was unused classroom space at Babson College, next to their Library."]

Hendrie: And the reason you developed M-PAC - you had the T-PAC which was a transistorized V - PAC; why did you design the M-PAC?

Dean: Well because we wanted a static system rather then a dynamic system. Everybody else in the world was using static stuff and so we thought we better have that too.

Hendrie: Just to be competitive, that's a very good reason.

Dean: This is the Time-Life tabulator, used both sides of it, I designed that system, it was a data error device and it was for some - I wish I could remember but it was like some kind of a photographic company or something, I don't remember the details on it. We made quite a few of those.

Hendrie: And there's the back.

Dean: There's the back of it, yeah, and that was a machine tool design and this is where we took the V-PAC and then made it into transistors. [Reichard: "The V-PAC and its equivalent, the LE-10 T-PAC, had an input structure of four 4-legged AND gates, OR'd together. LE stood for Logic Element, and with that structure it was a powerful one. It had both positive and negative outputs as well. T-PACs were contained in a T-BLOC, each of which provided power (-16 volts) and a clock repeater; one such in a multi-BLOC system provided the master clock. This structure was repeated in the H-BLOC family."]

Hendrie: So it's the transistorized version?

Dean: Transistorized version and this has the same plug in with the same logic gates and everything that the V-PAC had.

Hendrie: Was it basically the same speed too?

Dean: Yes. There's just another example of that probably some of the other different PACs that we had that went with them that you had to have an oscillator and a pulse generator and so on. This is the plug board for the M-PAC. That was not used very much; the M-PACs were mainly used and wired without the plug in feature, but some were. That is the T-PAC, yeah, and this is probably a specialized version 'cause it's got two delay lines in it. That was a military version that we made; had to be ruggedized and withstand temperature and vibrations and so on. More T-PACs of the various kinds we made. This is an NRL unit, I don't remember what it was, a tape searcher that thing there, another system that we made and various PACs that we made for the systems, Busac, I don't remember what that was.

Hendrie: Bunch of delay lines.

Dean: That's the very first big building; I think it was around 20,000 square feet that we built in Framingham. Various systems that we made, shows how we were building 'em in sort of somewhat assembly line. And here are more systems.

Hendrie: Tape to tape converter apparently.

Dean: Tape to tape converter, some kind of a UTTC panel, I don't remember the exact part of that. This is more of the militarized version. [Reichard: "UTTC was Universal Tape-to-Tape Converter, made necessary by lack of standards for recording data.]

Hendrie: What did you do to make it militarized?

Dean: It was just mainly strengthen to withstand vibration, yeah; I don't think temperature we had to meet with that restrictive. Allegheny Ludlum - we made systems for them, this went into a submarine, a very specialized government contract. This was the S PAC. That's the one I told you had that stabistor in it, did you want me to?

Hendrie: Yeah, say a little bit about that.

Dean: It was a very unique type of device in that - there was a stabistor, which in essence was a reject diode. When you put a back voltage it, it caved in very early, very low voltage, so if you applied and you connected that to the emitter of a transistor so if your pulse came along it had to get up to the breakdown voltage over the stabistor before the pulse could get into the transistor and it eliminated the need of bias

voltage, which you usually used to bias it down so the pulse, all the noise and stuff would get eliminated. That's got to be a unique little thing.

Hendrie: Very good circuitry.

Dean: This is an H-PAC and it operated at 20 megacycles, which in those days was a very, very high frequency. [Reichard: "In fact a significant number of H-PACs were sold. Their speed solved a classic problem- that of the requirement that a test system should be a few times faster than the equipment that it tests. A small division was formed, called Memory Test Products, and they provided sophisticated test systems, primarily for memory systems but also for other systems and components."]

Hendrie: Yeah where the original S-PACs were just one megacycle.

Dean: They were one megacycle and then they were improved and we had another series at 5 megacycles.

Hendrie: So this was very fast?

Dean: Very fast, yeah.

Hendrie: Now was this also dynamic?

Dean: This was also dynamic, yes.

Hendrie: Ok, dynamic logic.

Dean: That's the way the S-PACs were put into a BLOC and the H-PACs were put into a block

Hendrie: H-PAC didn't sell that well?

Dean: They were too expensive. Nobody needed that high frequency and it was quite expensive so it didn't really sell very well, I think maybe we sold some out of curiosity but that's about it, unfortunately. A Grumman target simulator, Honeywell PAC-tester which we made, the other systems, tape transport.

Hendrie: Nothing particular that you remember - something special?

Dean: No. That's Dot Cavanaugh, who was Ben Kessel's secretary and mine at the end. Nothing much here. This is where a lot of the systems were assembled and here was Gerber Scientific, that was a project we did for them, one for Perkin-Elmer and this is of course for core memory and how they were

stacked up and this was a delay using just wire, which you put the pulse down and it would go around the wire. This is another of the sonic line that we had. This was from a company we bought, it was a analog to digital converter from shaft to digital, another system I don't remember that. These are some of the wave forms that we had, some of the people in sales, video analyzer and this was Teletron, another big system that made. This was the second big building in Framingham, which was two stories and 40,000 square feet. This was a project that we did for JPL, it was the Mariner series and because of the constraints on time, this was a special group that was put together, we built a semi-clean room for them, it wasn't really clean but semi clean room and they without any red tape, they went ahead and built this - designed it and built it, encapsulated it and shipped it to JPL and it was a very successful system in the Mariner. These are just some more of the individuals who were there.

Hendrie: Teletron was the banking system that you provided. [Reichard: "The banking system was for Provident Bank and the Project Engineer was Don Benson.]

Dean: Oh that's right Teletron, that's right and I was trying to remember, I think he was the one that went with it to the bank and kept it going.

Hendrie: A young Frank Dean.

Dean: Yeah. Bill Wolfson.

Hendrie: Bill was VP of Sales and Marketing.

Dean: These are more of them here.

Hendrie: Here's how all those little modules were packaged up for the Mariner system.

Hendrie: Who designed the M-PAC?

Dean: Sig Yalen..

Dean: The M-PAC. This is a Navy trainer that we built, it was a specialized thing. Phil Connor was in charge of personnel. This was EPAC up in. Peterborough, New Hampshire.

Hendrie: Is that an early picture of it before they built their bigger building?

Dean: I think that might have been a liquor store or something, initially they went into, yeah. Ed Hampson was in charge of production and manufacturing and he was the one that transferred it up into a subsidiary in New Hampshire. Oh, we're going way back to the RAYDAC when that was the external memory of it. This was the bigger, second addition, 40,000 square feet and I guess that's when we were

opening it up and had open house and had guides and so on.

Hendrie: This is 3C's first computer, the DDP19.

Dean: Yep.

Hendrie: Which was named that because they had 19 bit word length; last computer with a prime number for its word length.

Dean: That's interesting isn't it?

Hendrie: Systems assembly.

Dean: Systems assembly, yeah, and more of that, we had to have quality control of course and inspection and that was a PAC tester that they went through before they were okayed. Here's one of the first <inaudible>.

Hendrie: DDP19 at Penn State or at least, well you can't see that it's at Penn State; maybe it was the one going to Penn State.

Dean: Yeah could hCW been. Some of the memory systems that we made. That was the DDP24 down there.

Hendrie: There's another DDP24.

Dean: That was one of the offices out in 3C West where they did some system work and where they built the first computer.

Hendrie: Yeah, the DDP19 was built out there. I think the museum actually has one of these Apollo systems in its collection, yeah.

Dean: This was your baby?

Hendrie: Yeah, I designed that 116.

Dean: I guess that's about all.

Hendrie: Yeah these are all of the RAYDAC with something about who worked on which ones.

Dean: Yeah they're all RAYDAC devices, I guess. Yes.

Hendrie: Thank you very much!

END OF INTERVIEW