Oral History of William (Bill) Davidow

Interviewed by: Rosemary Remacle

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Rosemary Remacle: This is Bill Davidow. I'm Rosemary Remacle interviewing him for the Computer History Museum's archives. Bill, introduce yourself? What's your title, what are your responsibilities today? and then we'll take a step back and talk about all of it.

William (Bill) Davidow: Well I'm Bill Davidow and my responsibilities today are grandchildren and philanthropic things and I spend a lot of time with sports and a lot of time with the family.

Remacle: Can you talk a little bit more about which sports and what comprises family?

Davidow: Well the most important thing is family and my family is my wife and my two daughters and son-in-laws and four grandsons. And then the usual family pets, a dog and a cat who think they're very important. And the second part of the question?

Remacle: The second, what sports are you engaged in? And we'll talk about the philanthropy later.

Davidow: Well I play a lot of tennis. And then I love to ski and I still ski and then I windsurf and then a lot of exercise things. I don't know whether you want to call that a sport, but it's walking or working out.

Remacle: Let's take a step back and talk about how you got to be who you are today. Where were you born, brought up, who were your parents, siblings, that kind of thing?

Davidow: Well I was born in Reading, Pennsylvania in 1935 and my family moved to Chicago. It was either sometime 1937, 1938ish, and my father moved to Chicago to start a publishing company. He had been running a newspaper distributorship in Reading, Pennsylvania, which was a company that brought in newspapers from New York and Philadelphia and distributed them to the newsstands in Pennsylvania-in Reading. And he was a very creative person and published a cookbook, “The Pennsylvania Dutch Cookbook”, when he realized there was no cookbook that had Pennsylvania Dutch recipes all in one place. And if he didn’t like onions, he left the onions out of the recipe, so there were some complaints about that. My grandmother edited the cookbook and it sold so well that he needed a bigger printer. And he was introduced to John Cuneo who owned Cuneo Press, which was one of the largest printing companies in Chicago and met him and in the course the discussion Cuneo said, “I've always wanted to be a book publisher”. And my father, who had never completed high school, said, "I'll make you one." And he moved to Chicago to make Cuneo into a book publisher and he formed a company called Consolidated Book Publishers.

Remacle: And you lived in Chicago up until you went off to college or did you move around from there?

Davidow: Well I basically lived in Chicago until I was 18 and then went off to college and came home in the summers. But--

Remacle: Did you have siblings?

Davidow: I have a sister who is a couple years older than I am, Ann, and she lives in Boulder, Colorado.

Remacle: And your mother worked in the home only or did she have--

Davidow: She was a full-time mother and but very active in the Girl Scouts. And she served on the National Board of the Girl Scouts of America. And the Girl Scouts were her passion.

Remacle: At what point did you start to show some proclivity for science or science-related things, engineering things?

Davidow: Well I was always good at math and was always interested in things like that. I can remember getting a crystal radio set while I was a kid and putting that together. And then being very interested in geometry and I remember spending a lot of time trying to trisect an angle, even though I knew everybody said it was impossible. But that didn't stop me from trying to do it. And then I took science in high school, physics and chemistry and I remember going to the Museum of Science and Industry in Chicago and just having that general interest. And then when I went off to college, I decided I wanted to be an engineer.

Remacle: Were there any people who influenced that choice do you think, your parents, teachers?

Davidow: Well I don't think too many people influenced the engineer choice. But the thing that really set me on the course to getting a PhD was Sputnik. And I was sitting in class in October, I want to say October 10, 1957, but I'm not sure that's quite the right date. It was definitely October of '57. And Millett Morgan walked in the class and announced that Russia had just launched Sputnik and that it weighed something like 56 pounds and that our satellite wouldn't be available for another six months and it was only going to weigh eight pounds. Then he explained the difference in the rocket power required to launch a 56 pound satellite as compared to an eight pound satellite and how far we were behind. And I just decided that anybody who had any scientific ability at all, owed it to the country to learn how to use it and save the country as a result of that and so--

Remacle: Millett Morgan was a college professor?

Davidow: He was a college professor.

Remacle: Okay so let's take another step back. When you left, when you finished high school, you went off to go to…?

Davidow: Dartmouth.

Remacle: Dartmouth. And how did you choose Dartmouth or how did they choose you or was it some combination [of the two]?

Davidow: Well I applied to Dartmouth, Yale and Amherst and the Colorado School of Mines and I got into all of them. And then I had friends who went to Dartmouth and I wanted to learn how to ski and so it was about that intellectual of a choice. It was not a particularly rational decision, but I also loved the out of doors and Dartmouth was not in a city and so that was great too.

Remacle: And you were at Dartmouth for all four undergraduate years?

Davidow: And then I got a Masters Degree from Dartmouth.

Remacle: A Masters Degree in?

Davidow: In electrical engineering.

Remacle: Okay and then you went from there to--

Davidow: Caltech. And then I subsequently got a Masters Degree at Caltech and then I went up to Stanford and got a--

Remacle: So you have two Masters Degrees?

Davidow: That's correct and then I got a PhD from Stanford.

Remacle: How did you migrate from Dartmouth to Caltech to Stanford? What were the decision points?

Davidow: Well I decided that I should go to the toughest graduate school in the United States if I was going to save it. And that was what brought me to Caltech. And then I was accepted back in the PhD program but there were 14 of us accepted back in the PhD program and they were graduating about six PhDs a year. And I went to talk to the head of the Electrical Engineering Department and I said, "Where in the pecking order do I stand?" And he said, "You're somewhere between 12 and 14." And I felt the odds weren't particularly good that I was going to be able to get a PhD from Caltech or would get a PhD from Caltech. And so I applied elsewhere. And I also, by that time, I had had two years of graduate school and really came to realize that probably I was not that interested in doing research. And so I just wanted to get a PhD and get through with it.

Remacle: Get out?

Davidow: Get out, right.

Remacle: What did you write your thesis on?

Davidow: On logic design for computers.

Remacle: When did computers come into your life or when did you begin to know about them?

Davidow: Well I obviously knew about them when I was at Dartmouth and then I can remember I had a very good friend of mine, Bob Rosen from high school who was very interested in digital computers. And I went to Caltech and Caltech had one of the best analog computation programs around. And I used to argue with people, I used to argue with Bob Rosen about how important analog computing was and he would say, oh, digital computing is really the thing. And a lot of the really complicated problems that people had to solve, like there was a problem called the flutter problem, which--

Remacle: I'm sorry, the what problem?

Davidow: The flutter.

Remacle: Like flutter?

Davidow: Yes and it happens in airplanes and it's the same reason why the Tacoma-Narrows bridge fell down. But you get a harmonic vibration in the wings of airplanes and airplane wings would fall off if they weren't designed properly. And the analog computers were pretty good at simulating that phenomenon. And Caltech was doing a lot of work in that area at that time. But they also had digital computers. They had a Burroughs 205 and an LGP-30. And when I was there, you couldn't get credit for taking a course in computer programming or anything like that at that time, because it wasn't an academic discipline. But I remember studying all the logic equations in the LGP-30. And it was designed by a fellow named Stan Frankel who spent some time at Caltech. And so I knew everything that went on in the LGP-30. Hard to believe, it had a 4000 word magnetic storage, which were, I think, 16 bit words. And it had either 8 or 16 instructions. I think it had 16 instructions. And it had 14 flip flops and which were made with vacuum tubes and I think 754 germanium diodes. And that was the machine and it worked and I learned how to program it. And then I took a course in numerical analysis at Caltech from a Professor Joel Franklin. And Joel really understood a lot about computation. And he used to talk to us about all the problems with computing these things numerically. And we programmed the Burroughs 205 at that time to do some of these things. And that was how I learned initially, to program. But I mean that was very primitive programming.

Remacle: Earlier you were talking about how difficult it was to do some of these things. Can you talk about that in a little more detail?

Davidow: Well I mean it was just that at that time, we were programming pretty much in machine language, which meant, I mean you wrote down-- there was very little machine help for programming so it was extremely tedious. The interesting thing is that the IEEE floating point standards that are used in microprocessors today, were directly a result of my taking a numerical analysis class from Joel Franklin. And a number of years later, like 30 or 40 years after that happened, I went back and told him that the IEEE floating point standards which are used in all computers today, were a result of taking that course.

Remacle: Can you explain a little bit more how that came about or what the connection between the two is?

Davidow: Well the problem that he pointed out, was that in lots of numerical calculations, you had something called round-off error. And where-- you multiply two numbers together, you multiply two 10 digit numbers together and you get a 20 digit number. And then if you multiply two 20 digit numbers, you get, you know, a forty digit number. And at some point the number gets too long for the computer to hold on to all the digits. So you approximate in the last digit. And that approximation is an approximation. And in certain calculations, it sort of seeps its way back through and can cause the whole calculation to fall apart. And when I came to Intel, I realized that we were going to put microprocessors in a lot of people's hands and that there was a very real possibility that people would be computing with them and not understand this and get the wrong answers. And so I decided that we should come up with algorithms that were reliable, that people could use and that those algorithms, whether you had a hardware assisted piece of silicon that did the computation or whether you were using a software routine, should produce the identical result. And so when I came to Intel, we hired John Palmer to work on that problem. And there was a fellow named Kahan at Berkeley, who was very interested in the problem. He used to play around with calculators and he would multiply and divide and show that calculators would give vastly different results based on their numerical algorithms. And he worked with us and then ultimately, that became- those algorithms became the basis for, I guess it was the 387 floating point chip, 80387 I think that was the number of it. And then that algorithm ultimately worked its way in and became a IEEE standard for floating point computation. It was ironic that, oh gosh, after I left Intel, this was-- I probably shouldn't say this-- but Intel ran into the floating point computation problem and--

Remacle: I was thinking about that.

Davidow: -And that I kept telling people. The initial response was that it wasn't a problem and I had some communication with them saying, "Hey don't tell people it's only one error in 10 billion. If you have an error it's a problem." And--

Remacle: Did you have-- can you take any credit for convincing Dr. Grove to change his mind on that?

Davidow: I think Andy [would say that] I gave him some advice that he listened to.

Remacle: Which turned out to be good advice. Let me go back and ask you to put dates on your degrees, your undergraduate, your two Masters Degrees and your PhD.

Davidow: Well, '57 for my bachelors from Dartmouth, '58 for my Masters from Dartmouth. Then I went to Caltech and actually I left there and didn't have a Masters Degree but they subsequently gave me one, because they thought that I had met all the requirements. And then I got my PhD from Stanford in '61.

Remacle: Okay. So, in 1961, you were able to get a real job, what I call a real job, in the industry somewhere. How did you go about figuring out where you would want to go?

Davidow: Well I liked the idea of living in the Bay Area. And IBM was here and there was not much computer activity--

Remacle: Now were you married at this point?

Davidow: I got married in '65.

Remacle: Oh, okay.

Davidow: And General Electric had an R&D lab because General Electric had developed ERMA, which was the first transistorized digital computer. And then their Computer Department had become established in Phoenix. And I believe that's where ERMA was initially manufactured. And Joe Weizenbaum [who was running part of the area and there was a fellow who worked with him and I think I probably met Don Aufenkamp at Stanford. Anyhow, I got introduced and I wanted to do computer research at the computer research lab they had here at the time.

Remacle: “They” being GE?

Davidow: GE, yes.

Remacle: So, your first position was an entry level engineering research?

Davidow: Yes, yes.

Remacle: And what about GE attracted you besides its Bay Area location or was that--

Davidow: Well I mean I don't think it was a particularly rational choice. I had two opportunities. One would have been-- I don't know whether I got an offer from IBM. I may have accepted the GE offer, but Mort Astrahan was doing the SABRE system for IBM down in San Jose and I had talked with Mort and for some reason I picked GE.

Remacle: You know, I think of you as being an ultimately, very logical person. And I'm finding out that you have these two kind of irrational decisions in your background.

Davidow: Well maybe it was rational at the time. I just don't- I don't remember the great rationale.

Remacle: <Laughs> Okay. So did they provide some training or did you work within a group? Talk a little bit about what that job was.

Davidow: Well there was a group there and I was just- I went there and I was doing research. And then there was a group there that was trying to design advanced peripheral equipment. And GE--

Remacle: What were, I'm sorry, what would advanced peripheral equipment be? Would it be tape drives and--

Davidow: No. This happen to be-- they were working on things that went around the computer and in one case, GE was one of the leading suppliers of check-sorting equipment, that read the magnetic ink on the bottoms of checks. And it turns out IBM came up with a much better, more reliable reader. And so I took on a project to try and improve the reliability of the GE check-reader. And that was one of the things that I worked on while I was at GE. And we came up with a scheme for doing that. And then GE decided they were going to close down the lab and move us all to Phoenix and I didn't think that was a very good idea. And I had a friend of mine from Stanford who was working at Hewlett-Packard and Hewlett-Packard had bought this small computer company in Michigan and decided that they were going to get into the computer business. And so Kay Magleby was running the Hewlett-Packard engineering effort. And I went over there to work in that engineering effort.

Remacle: When you were at GE, did you have any sense at all that the research you were doing, the work you were doing was connected to customers or were you pretty isolated from a customer interface?

Davidow: Well, I think, reasonably isolated- reasonably isolated. I used to spend a lot of time in Phoenix and I had friends down there and we-- I mean it was a- I learned a lot about computers when I was at GE and also one of things I learned was that IBM had a research budget that was larger than GE's sales. And I decided that that was probably a losing battle. But GE was working on some very, very advanced designs and one of them failed, was just too complicated. And there was another division in GE that had a different design. It was not- it was one of the defense divisions I think. It was being run by John Weil and the Computer Department took over that design and that became the GE 6000 or something, which was the computer that they ended up selling.

Remacle: You said you learned a lot about computers at GE. What did the Bill Davidow who entered GE- how had he changed when he left GE? What were the key things that you took away with you that you built on going forward?

Davidow: Well I learned a lot about digital computer architecture and how-- I was trying to think of the other fellow that was there, Jim McKnight who went on to become a professor at some place in Texas. Anyhow, we talked about these things and I thought I really understood how a computer should be architected. And so and I was all excited about going to work with Hewlett-Packard, which was designing a new computer. And I thought I could bring some of that with me.

Remacle: So you went to HP in 1965, '66?

Davidow: It would have been, see I was married when- I got married when I was with GE. So it would have been probably '66.

Remacle: And what was your first assignment there?

Davidow: Well I was, I was working on the computer. It was a very strange thing. The computer architecture was just horrible, was just horrible.

Remacle: What was horrible about it? What made it horrible?

Davidow: Well the guy who was heading- the intellectual leader of that program was a fellow named John Kodella and there was somebody else named Gene Stinson who was a very good logic designer. And John had these ideas about the way the op codes of the computer should be designed and they were all wrong, in my opinion. And Roy Clay who, you probably ought to interview sometime, was running the software group and he ultimately revolted because he said the computer was going to be impossible to program. And he got that changed. And I became friendly with the people in marketing and decided that I'd always been interested in marketing and had read a lot about marketing and I had sort of self-educated myself on marketing. And I decided I wanted to go to work in marketing. So that was good use of my PhD. <laughter> But they had nobody in marketing who understood anything about computers. So I went out to do marketing at Hewlett-Packard.

Remacle: And how did HP define marketing? Was it product marketing, was it--

Davidow: In this case it was product marketing, what I was doing.

Remacle: So you were working with the customers to define the product--

Davidow: Well this involved more promoting and learning how to- and educating the field and what have you. And the first HP computer was the 2116 and it was designed in such a way that the HP instruments plugged into it, which made it great for use with instrumentation. But the computer was the slowest, the heaviest, the largest and the most expensive mini computer available at the time for what it did. And the challenge was to figure out how to sell it. And so that was something that I became involved in.

Remacle: And how did you figure out how to sell it?

Davidow: Well I learned a lot about marketing at HP and HP was run by Bill Hewlett and Dave Packard and I think it was and I don't know that much about the current HP, but at that time, probably one of the finest companies in the United States. I mean it was- it was a technology leader. It had tremendously loyal customers. It was very responsible and took very good care of their customers. They had leadership, I am inclined to say, a monopolistic position in the instrumentation market, the electronic instrumentation market. And they had this wonderful corporate philosophy about taking care of customers and what have you.

And here I was with this division that had designed what was arguably, one of the worst computers on the market. And you know, it was a philosophical crisis for me. Like here I am and, do you look a customer

in the eye and say “this is the worst computer in the market, don't buy it” or do you say, “I will create a customer experience for you that will take a computer that isn't particularly good but because I'm working for a great company, I can create a better customer experience for you than if you buy this computer from somebody else, because even though the computer isn't so hot, you know, I'll provide you with service and support. If you have to use an HP instrument, it all plugs in and I've got all these services that go along with it and I can provide you with good software and things like this”. And if this sounds like the 8086 at Intel, it is.

Then I remember going down to the Los Angeles sales office and you know, going into the field was not a pleasant experience because I was trying to get them to sell this computer that every time they presented it against a competitive machine, they got their heads kicked in. And I can remember Phil Scalzo down there saying, at the office. He said, "Every salesman comes back to the office at the end of the day and tells people about something good that happened when they were trying to sell the computer." And so I learned a lot from that experience. And ultimately, you know, HP became successful in the computer business and I suppose if we had not made the 2116 succeed, HP might not be there. So I learned an important lesson, that if you're working for a great company that's committed to the customer, you can take a product that maybe isn't technologically as superior, but turn it into the best thing for the customer to buy.

Remacle: Were you aware of Ted Levitt's at Harvard's thinking about total product at that point?

Davidow: About, oh no, I was not aware of that. I don't know where I learned about Ted Levitt.

Remacle: Probably from Regis [McKenna]?

Davidow: I don't know. But anyhow, I somehow learned about Ted Levitt and--

Remacle: Later though.

Davidow: Later, right.

Remacle: Because this is certainly a parallel concept.

Davidow: Yes it is. Yes it is. But I- I mean, I think he articulated it very well and but I don't think that- I mean I think his articulation was really good. I mean the idea was something that people had been using for a long time.

Remacle: Which is not unusual with innovation, certainly. Let's go back to HP. So you were part of a marketing team. Were you marketing manager? What--

Davidow: I was running Computer Marketing and then Tom Perkins came along and he became the division head and I ran marketing for him. And then we formed a computer group and I became the head of marketing for the computer group. But that was sort of a staff job and I was trying to-- the calculator division was involved in it and the computer division was involved in it and I was trying to coordinate these things. And that was not a great job because the divisions all were very independently-minded and they didn't need somebody on the corporate staff running around working with them, so…

Remacle: And how long where you at HP all together?

Davidow: About four years.

Remacle: What made you decide to leave HP and go someplace else?

Davidow: Well I, a lightening bolt may strike me from above, but I invented the microprocessor when I was at HP. I've always said, I was one of the 10,000 people who invented the microprocessor and I remember running into Bob Noyce and Ted Hoff at a full joint computer conference in Las Vegas and talking to them about my ideas and that they were very interested. And I even made a presentation to the Intel board about microprocessors--

Remacle: While you were still at HP?

Davidow: And I went and talked with them and I remember Tom Perkins warning me about this, that I could run into problems and what have you.

Remacle: Because you were working at HP and talking to Intel [at the same time]?

Davidow: Yes, but Intel was, I mean it was Bob Noyce and it was something, so. And then I somehow-- I'm trying to get all the chronology straight-- but you know, I had met Bob and I had met Vic Grinich when they were both at Fairchild. And somehow, I don't know how it all relates, but anyhow, somebody from Signetics approached me about, it was setting up a memory company. And this was- it would have been probably 1970ish and I said, "well gee, it would be fun to go over there and take the memories and develop a microprocessor". And there was a fellow at GE named Glenn Oliver that I hired to come to work. And he came to work and we developed a microprocessor at Signetics Memory Systems that was a bi-polar microprocessor but aimed at doing logic replacement. Then we developed design aids that would go with it.

Remacle: And these design aids were like precursors to the development systems?

Davidow: Yes.

Remacle: I'm getting ahead of your story…

Davidow: No, I mean but what we did is, we developed a ROM simulator, a Read Only Memory simulator that you could plug and programming tools so you could program the microprocessor and then you could plug it into a system and you could enter the data in this Read Only Memory simulator and execute programs. It was sort of our answer to the EPROM and I don't know whether EPROMs- EPROMs had to have been available or just becoming available at that time. But this for bi-polar, did something very similar to the EPROM for MOS. And so we had all of these tools and I was running the marketing for it but I was sort of the intellectual leader of the idea. Glenn Oliver was the brains. And the company ran into problems because we couldn't fab anything in the fab area.

Remacle: Were you sharing the Signetics name certainly but were you using their fab or…?

Davidow: We had our own fab.

Remacle: Owned by Corning?

Davidow: It was owned by Corning but- but I mean it was just a manufacturing disaster. Corning then put in a new manager and he and I didn't get along at all. And I wanted to quit and I think I went in and quit about two hours before he was going to fire me and I walked back to my office and the phone rang. Ed Gelbach was on the phone saying, "I'd like to talk to you about coming to work at Intel." And that was in 1973. And so I started talking with Ed and that was how I ended up at Intel.

Remacle: Let's look back, because I think I interrupted you on the microprocessor invention story and jumped to the development system. Do you want to be a little more complete about that?

Davidow: Well no, I mean that was just, I think that there were a number of people who had similar ideas about building these types of computing devices. And Intel, really got to the market first with it. I think it's great that they did. But it's always fascinated me and certainly when I was at Intel, I promoted the idea that Intel was the inventors of the microprocessor. But it was always fascinating to me because I don't consider myself to be the world's greatest technologist. But if I came up with the idea and I was working on it, I had to assume that there were 50 other people who were doing the same thing. And I think it's great that, you know, Intel--

Remacle: Took the credit?

Davidow: Took the credit, sure.

Remacle: One more loop back and then we'll move on to Intel. What was the bone of contention between you and your manager at Signetics Memory System? Do you remember?

Davidow: No.

Remacle: It just was not a relationship made in heaven?

Davidow: It was not a relationship made in heaven.

Remacle: Okay. Let's talk about Intel. In 1973, today it's hard to think back what Intel must have been in 1973. Can you describe the company, who were the leaders, what was going on, where did they fit in, in the semiconductor universe, at that point in time?

Davidow: Well I thought Noyce was running the company. And you know, I knew Bob and I knew Gordon and I think Bob gave Ed Gelbach my name and I know that there was some debate as to whether I was too old to be hired, because I was 38. And I know that, because my parents had a friend named Sam Rosenthal who was on the board of Grinnell with Bob Noyce. And he told my parents that. And--

Remacle: And how old was Bob at that point?

Davidow: Well, if I was 38, Bob was probably five years older than I was. So he was 43 or 44, so.

Remacle: A really old man. <laughter>

Davidow: Yes, well '73, I don't know how old Bob was. But I don't think he's-- I mean Bob--

Remacle: That seems about right to me.

Davidow: Maybe a little older than that, but not much, not much.

Remacle: And so what was Ed's role at that point in time and what was--

Davidow: He was running sales and marketing and the microprocessor marketing and the development system activity. We had something called the Intellect. And I got there and I looked at that box and I was seriously concerned that somebody was going to electrocute themselves if they used that box. I mean it was just- I mean it was just-- the development tools that Intel had were, you know, extremely primitive, extremely primitive. But they had a board that Ted Hoff had designed for prototyping with the 4004 and they had- they had these blue boxes called-- you used for the 8080 but all they were, were, they were boxes that you could develop software on. They didn't let you really get involved in the design at all. So I had this idea that we could--

Remacle: How many employees did Intel have at that point do you think?

Davidow: Well Intel finished the year at about $60 million [in revenue] and I don't know how many employees there were, a little over $60 million, $66 million I think.

Remacle: And was the company organized by function still or had they started going into business units?

Davidow: It was by function.

Remacle: By function, okay.

Davidow: I knew a lot about ROM simulators at that time, Read Only Memory simulators. And the idea was, you could plug these things in and change the programs and what have you. And so I began talking about doing that kind of thing at Intel and we had hired Terry Opendyk and he thought the idea- he was running software and he thought the idea was just stupid. And--

Remacle: The idea of?

Davidow: Of this kind of hardware simulation tool. And I felt that that was what engineers would want. And Hap Walker was working in the microcomputer area and so I either talked with Hap or convinced Hap or Hap convinced me, but anyhow, Hap came up with a much better way of doing this and he became the engineer on the project. And that's what led to the development system effort. And then we began to once again, create all of the support that went around the Intel microcomputer. And so we had software programming languages. Gary Kildall had done PLM and we had assemblers and we had these boxes and we had all these tools that made it easier for the engineer to debug his designs. And then I hired somebody from-- who I'd worked with, I believe at both GE and Hewlett-Packard, named John Pavone-- to come in and run customer training. And so we set up these customer training programs where we would go out and educate customers on how to use Intel microprocessors. So we were--

Remacle: And you're still the marketing manager for the microprocessor at this point, reporting to Gelbach?

Davidow: Yes, yes.

Remacle: Okay.

Davidow: And so we created something like a whole product at that time. I mean trying to provide a comprehensive set of solutions to the customer.

Remacle: Make it easier for them to be able to design in?

Davidow: That's right.

Remacle: Where did Intel fit in this semiconductor universe at that point in time? There was Motorola, the rest of the U.S. semiconductor universe?

Davidow: Well we were the leaders in the semiconductor memories and the microprocessor thing, I remember the arguments because Ed decided or I think from an accounting point of view, we got credit for the profits on the memory sales that went with the microprocessors. But the microprocessors themselves were not a very profitable device. In the case of the 4004 I think we figured out we were spending more money on printing the manuals than it cost to manufacture the microprocessors. And so, it was kind of like, everybody around the company was-- we're a memory company and the microprocessors are kind of there. And it was not a prime focus of the company I would say. Let me put it this way, from a PR point of view, there was a lot of enthusiasm about it. But from an internal inside the company, all the money was being made on the memory. So there was tension there.

Remacle: Who were the champions of the memory business and who were the champions of the microprocessor business?

Davidow: Well the marketing group that I was running, were obviously the champions of it. And there was Ted Hoff and Frederico [Faggin] and Shima who were all very enthused about it. And I think--

Remacle: What about Les [Vadasz]?

Davidow: I think Les was enthused about it. But I think Les got more and more enthused about it over time. But all these guys initially were memory guys. And Les might, have you interviewed Les? He might tell you something different, so. Did he?

Remacle: No. I've obviously had conversations with him over the years and I actually had a conversation with him in preparation for this interview, but we did not discuss this particular aspect.

Davidow: Yes but Les got ultimately very enthused about it. I mean there are all these stories about how- how Intel developed a microprocessor. The marketing guys weren't going to announce it and bring it to the market and Ted Hoff said, “if you won't, I will”. I was one of the first computer guys to go to work at Intel. I'm trying to think whether Opendyk was there. I think Opendyk may have been there, before I got there. But there were very few people who understood anything about computers. And it was, we had a hard time recruiting anybody who understood anything about computers, because these microcomputers were just *Mickey Mouse* little devices that didn’t do anything. And they weren't really used for computation. They were used for logic replacement. And so today they are used as computers. But at that time they went inside cash registers. I guess that was a computer application or they went inside a stop light which was more a logic application, so. They went in the milking machines.

Remacle: Milking machines?

Davidow: Yes. Yes.

Remacle: I'd never heard that story.

Davidow: Oh yes, yes, that was one of the big [design] wins. <Laughter>

Davidow: I'd run this ad. Regis had come up with this ad, Regis McKenna - that had the chicken in it and the ad was: “which came first, the chicken or the egg” or something like that. And I wasn’t too enthusiastic about the ad. But it had this big chicken in it, we ran it and the engineers went absolutely crazy. They thought it was [bad]…

Remacle: The marketing guys were--

Davidow: I don't know, I probably should have not let the ad run. But the executive staff at Intel---and this is a sexist story for you Rosemary---they just sided with the engineers, so they [said they] were going to approve all microprocessor ads from there on out. And so I had somebody do a storyboard with an ad with a cow in it, because the microprocessor was in the milking machine. You know what's happening?

Remacle: I have a sense of where this is going.

Davidow: So the headline on the ad said, “Intel sucks hind tit”. <Laughter>

Davidow: And Gordon Moore said “it's a teat, T-E-A-T”. <Laughter>

Davidow: --And so after that, people decided that maybe they didn’t need to review all the ads. So that should go down in history.

Remacle: I think it should. I thought you were going to tell me you also had a very attractive young woman go in and present the storyboard. <laughter>

Davidow: No, no, no.

Remacle: Okay. Let's get back on track. I'd like to talk about--

Davidow: Oh, it's not on track? <laughter>

Remacle: We've been talking about executive staff. You were part of a fairly iconic executive staff team.

Davidow: Yes.

Remacle: How did they work together-- let's talk about who was on that executive staff. It was Grove, Moore, Noyce, Gelbach, you, House, was he on yet?

Davidow: No. No.

Remacle: Vadasz.

Davidow: Vadasz, Carsten.

Remacle: Carsten.

Davidow: And Larry Hootnick.

Remacle: Larry Hootnick. Okay, that's a bunch of pretty A-type of folks. So talk about how that group acted, interacted.

Davidow: Well I think we interacted pretty well. I remember one of the- we were in one meeting and Andy looked up and said, "Has any one in this room ever run a $300 million company?" And everybody looked around and shook their heads and we were a $300 million company at that time. But I think that we worked pretty well together. It wasn't that there weren't some tensions, though.

Remacle: What about Intel culture before we go jump into the microcomputer group responsibility. What about the Intel culture? What stage was it at? That's not good English but--

Davidow: I think the Intel culture was pretty well formed at that time. And I probably fit less well in that Intel culture than anyone on the executive staff other than-- I mean I was-- if there was somebody who didn't fit it--

Remacle: Why would you say that?

Davidow: Well I never believed very much in constructive confrontation. And it worked well for some people. It didn't work particularly well for me and I think-- but you know, so that was something I never felt completely comfortable with.

Remacle: Let's talk a little bit about the elements of Intel culture and how they worked in favor of the company and helped to move the company forward at the pace at which it moved forward ultimately.

Davidow: Well Andy, I think, taught a lot of us how to manage. And he put in place great mechanisms for keeping things coordinated. And I think that, I mean whether it was the MOMRs where you really

learned what was going on, MOMR stood for Monthly Operation Management Reviews, and one month the marketing guys would present and the next month the engineering guys would present. You worried about what was going on around you and that was like going to business school in many respects. It kept things coordinated and then there were the strategic planning processes we put in place. So I think Andy was very committed to getting everybody trained. So Andy put great processes in place. And he was very organized and great at following up and I always said that Intel was the best managed company I ever worked for.

Hewlett-Packard was the best led company I ever worked for. There was a difference in. Dave Packard could make a comment and this was before email, in a meeting and everybody in the company would know about it in 20 minutes. And I'm sure it took longer than that but he sort of got everybody following his lead and I think Intel drove everybody to follow the lead. So it was different.

Remacle: How was Andy to work for?

Davidow: Well I think Andy was fine to work for, you know, and--

Remacle: As long as you were willing to put up with constructive confrontation?

Davidow: Well I don't think Andy was the most comfortable person I ever worked for and I, at one time, had a discussion with Andy. I said, "Look Andy, you don't have to yell at me. All you have to do is tell me what you want done and I'll do it." And I thought that was a pretty good meeting.

Remacle: So you are still leading marketing under Gelbach or microprocessor, microcomputer marketing under Gelbach?

Davidow: Yes.

Remacle: What was your next responsibility?

Davidow: Well, somehow Les [Vadasz] and I-- Andy wanted to put Les and myself in a box because the development system thing was becoming a pretty big business--

Remacle: You might want to explain what, when you say “in a box”, because that was something fairly unique to Intel.

Davidow: There were- he wanted two of us running the operation. And I think Andy, well I know Andy had a great deal of respect for me as a marketing person and not much respect for me as an operations manager, was the way it went. And so he decided that putting Les and me together to run this would be a good thing. And so Les had the engineering and Keith Thompson was running the factory for us and manufactured the development systems or I think Keith was. But anyhow, the two of us were together

there and that worked for a while and then I just decided that I wanted to go run the development system business. So I took the development systems and that became a separate division.

Remacle: So you and Les were no longer two in a box by the time you're running development system or are you?

Davidow: I don't remember.

Remacle: Okay.

Davidow: I don't remember quite how that all worked out. But anyhow, I took the development system thing and Les, I don't think Les was involved in that because I moved Jim Lally up to Oregon and we started the- we started selling the boards from the boxes as individual systems. So we started the board business. And that was the business that I wanted to be responsible for. And that grew to be a $100 million a year business or something that size. And you know, the development systems, we ended up selling them for $25,000 a piece. It was a great business.

Remacle: Well as I recall, didn't Intel use that as a way of predicting processor sales?

Davidow: Well the argument that I gave people, is you sell the development system and then after a year, you would sell so many dollars in microprocessors. So as to whether- I mean this was more, you know, putting a finger in the air. But anyhow, we were going to use the board sort of in the same way. And it was a- it turned out that all ultimately, the development system got done in by the PC. But I guess that came- we needed a PC before that was going to happen, because people began to take the PCs and design their own in-circuit emulators to go with them and then a $25,000 development system was suddenly worth $10,000 and it was not as great a business and we should have done the same thing. But that's a different story.

Remacle: Are you implying that Intel had a PC and didn't--

Davidow: Oh we definitely- we had a PC and actually we had-- ISIS was the operating system that we were running and that was every bit as good as MS DOS. And what we should have done is, sold it to IBM or given it to IBM. But we tried to protect it as being a proprietary thing. And I remember Opendyk was the greatest proponent about that. I bought into that idea because we were going to undermine the development system business if we put this in the public domain. Had we put it in the public domain, it might have obviated the need for Microsoft and I'm not trying to argue that I was as smart as Bill Gates or I could have pulled off anywhere near what Bill Gates did or that Intel could have done what Microsoft did. But had we let that operating system go in the public domain, IBM might not have had a need to buy it from Microsoft and the shape of the industry might have been very different and Intel's future might have been very different. So I always considered one of the mistakes I made was to keep ISIS proprietary because--

Remacle: Was there anybody who fiercely opposed it at the executive staff level?

Davidow: I don't-- I mean I think we made that decision at our level.

Remacle: It was never kicked upstairs for discussion?

Davidow: We didn't know what was going on. I mean we were busy selling development systems and I don't think we understood the home PC. Nobody had any idea what you were going to do with a PC. I mean, you know, at the time all of this was going on, I don't know when I would say, Excel, but what were the first spreadsheet was introduced.

But we were working with IBM for a long time and they were using Intel microprocessors in word processing equipment. I mean it was, the whole PC thing just sort of arrived. And you know, people would talk about home PCs and what were people going to do with them and housewives were going to keep recipes on them. And nobody had any concept of what this was going to come out as, so.

Remacle: So at what point did Intel reorganize and go into business units?

Davidow: I don't remember, Rosemary.

Remacle: I think by the time I got there, which was '78--

Davidow: I was going to- the number I was going to pick was '78.

Remacle: And I think that had just- because Les had just gone to Strategic Staff.

Davidow: It could well be.

Remacle: That's when I think. So we are now kind of the '78 time frame and you are doing what? Still development systems or have you--

Davidow: I was doing development systems and--

Remacle: When did you--

Davidow: I don't- I'm not quite sure of the year Crush occurred.

Remacle: 1980, your book says.

Davidow: '80 was the year the Crush occurred because I remember getting this telegram from Don Buckout from the Eastern Region telling us that we were getting our heads--

Remacle: This would be an Intel sales guy.

Davidow: Yes. Casey Powell was back there and we were getting our heads kicked in by Motorola. And I went to the executive staff meeting and said, "You know, we're losing all these designs to Motorola and you guys who are marketing the microprocessors are a bunch of wimps. And if you don't keep getting designs, my business is going to go to hell." And Andy looked at me and he said, "You fix the problem." And that was when Crush and that was when everything I learned at HP and what we did was based on a lot of that stuff. I mean not based on the specific mechanics we used at HP but based on the fact that the 8086 was not as good as the 68000 but we could create a device that was much more usable for the customer because the customer had to get something in the production. He had to write software. He had tremendous design risk if the project was late. And we had all these peripheral circuits that he could use with the device that would reduce his cost of the end system. And so we came up with the concept that the microprocessor you chose is the most important corporate technical decision you're going to make for the next decade. And we would then go in and explain this.

Remacle: Who is "we"?

Davidow: Well--

Remacle: Who were the people in the Crush team?

Davidow: I don't remember all of them. Jim Lally was there. I'm not sure who else was there. Well Regis was there because I asked Regis to join the Crush team.

Remacle: Regis Himself, not some of his--

Davidow: It was Regis Himself that I asked to join in. Regis and I will disagree as to whether Andy asked him to do that and start Crush or whether I did. But I did.

Remacle: I don't doubt that.

Davidow: But, anyhow, that and I know it was Jim Lally and Regis and myself and I don't know who else but we got everybody supporting us. And I wrote about that in the book ["Marketing High Technology"] and it probably describes it better than I can do from memory now.

Remacle: Talk a little bit about the importance of Crush to Intel at that point in its history and what was the impact of Crush or the Crush program at that--

Davidow: Well ultimately we won the IBM PC account and people will tell you, I remember talking to Colin Crook who was the head of marketing at Mororola, that it had nothing to do with Crush. You know, the success of Intel in the PC business had everything to do with winning the IBM account and you could forget about everything else. And I think that you'll probably never know the whole story about how it happened. But we really unleashed an assault on the market and you know if you look at it today, Intel is effectively out of the memory business and they would have been out of the memory business whether they had a microprocessor or not. And so winning the microprocessor was important to its corporate survival or its corporate success. And so, the fact that Crush worked, I think was key in making Intel, what a $40 billion company. Had Crush not worked, Intel would probably be--

Remacle: Well from my own perspective in corporate marketing at that time, working for [Dick] Boucher, it galvanized that organization and everybody knew what they were doing relative to Crush. It was an absolute priority and I think that was probably true out in the product groups and across the company.

Davidow: Oh it was, because the great thing about Crush was that Noyce bought into it and Grove bought into it and everybody knew that Grove wanted it done. And so anyplace you go, people would say, “we're going to help”. And my job was basically a staff job at that time and I think I was still running the microprocessor development system division. But I was working with all of these other people the EPROM people, this, that and the other thing. Everybody was committing to making the program a success. And so Andy was supporting it. I mean had Andy not been supporting it, it would have been an absolute disaster. And I think House was working for [Jack] Carsten time if I'm not mistaken.

Remacle: And so Jack would have had the microprocessor group?

Davidow: I think Jack had the microprocessors.

Remacle: I think so too.

Davidow: --If I'm not mistaken.

Remacle: Okay. What do you think the biggest lesson that you had to teach and I'm thinking about “Selling a Dog” and the HP experience? Was that the biggest lesson you had to teach the Intel organization or to get buy-in to or--

Davidow: I think the problem is that everybody wants to hold up a sheet of paper and say, “this spec, this spec, this spec, this spec and if my specs are better than your specs, I've got a better product and I ought to win”. And I guess maybe one way to think about that is, suppose that you buy a Mercedes and I buy a Ferrari. And if you look at it spec for spec for spec, the Ferrari is going to be better. And then I say to you, “do you want to drive your car anywhere?” And you say, “yes”. And I say, “how would you like to get it fixed if it breaks down”? And you say, “oh I really would like to get my car fixed”. And then I say, “well do you really want to own a Ferrari because you can't get your Ferrari fixed if you're up at Tahoe or in—“

Remacle: You can't even drive it to Tahoe…

Davidow: And I think it's hard for people to realize that there are a lot of things that make a product great, rather than just the basic specifications. One of the things I learned from somebody who was selling for IBM-- my friend Bill Cramer. "What do you do when you go in and your computer is slower and more expensive, et cetera, et cetera?" So he said, "I just look the customer in the eye and say, if you buy from that guy, you won't get me. And so what does that mean? So I'm going to make sure you succeed." And so the idea was to say, “hey if you buy the microprocessor from us, we're going to ship them to you. We've got a fab area that's reliable. But if you buy from this other guy and he doesn’t know how to make MOS and this, that and the other thing. And you've got a development team and it may take you one year to design this or it may take you five years to design it. With our help, you're going to get it done in one year with somebody else's help that may take you three. So what's that worth to you? And—“

Remacle: So this is really a big shift a mindset shift in semiconductor marketing or microprocessor marketing.

Davidow: Well I- I--

Remacle: I mean because the whole company was focused on benchmarks and all that kind of--

Davidow: Well and we wanted benchmarks too. But--

Remacle: That was only one thing though.

Davidow: Yes, but the whole idea was that everybody uses the word “solution”. All we hear about is “sell solutions”. Well that's absolutely great but it's one thing to say “I'm going to sell you a solution” and it's another thing for me to make it so that you can buy a solution. And, the words, “I'm selling solutions”, well marketing people tell you to say that or advertising people tell you to say that. But the difference between selling somebody a solution and saying “I have a solution”, is very different. And so somewhere you need training programs, you need application engineers, you need software, you need development aids, you need a reliable manufacturing area, you need documentation, you need this, you need that. And the person with the best specs goes in and says, “I've got the best specs” and it's a matter of training the field sales force to say, well--

Remacle: So what?...

Davidow: --You know, does he have this? What does this mean to you? And how long it's going to take you to program it if that happens?.

Remacle: So was the Crush responsibility what got you into-- I think you were a VP of Corporate Marketing, ultimately?

Davidow: And sales, yes.

Remacle: Marketing and Sales?

Davidow: Oh--

Remacle: Was that [Crush] the stepping stone to it [VP of Marketing and Sales] or…?

Davidow: Well I went in sometime after Crush and Andy and I had a little disagreement. And I went in and I talked with Andy and, no. That wasn't-- that's the wrong sequence. Somehow I got into discussion with Andy and he said to me, "You're an average general manager." And I said, "What does that mean?" He said, "Well," He said, "You can always be a general manager for me but you're average basically. But if I asked you a question about operations, you say 'I'll get back to you' and a week later you come back to me and you've made the right decision." He said, "We're talking about marketing and I say something to you and you say this is what we should do."

But I know what provoked the discussion because I was thinking about going into venture capital because I had a job offer from Kleiner and Perkins. And he said, "You know, you would be much happier working here if you were just doing marketing." And I said, "You know, you're right and I'll just do marketing." That discussion really defined the rest of my career for me. I was, I'm going to say roughly 45 years old at the time, and what that really taught me was to do the best at what you are best at. Since that time in my career, and I learned that I was a lot better general manager than Andy gave me credit for because I observed a lot of general managers and presidents, but be that as it may, the world perceived of me as the marketing person and that I could make my best contributions to business and for that matter philanthropic institutions by just saying I'm going to help you with your marketing problems. What I did when I left Intel to position myself in venture capital was I wrote a book on marketing, because everybody who wanted to talk to me about being involved in their ventures wanted to talk to me because I had marketing sense and then as I've gotten involved in philanthropic things I basically said I'll work with you on your marketing issues. So that's what I do.

Remacle: What do you think your impact, looking back on how many years total at Intel?

Davidow: It was basically 11.

Remacle: Okay, looking over those 11 years, what would you say where you had the biggest impact? And maybe you've already given me the answer but I'd like to ask the question.

Davidow: I think everybody says it was the marketing of things.

Remacle: That's the way I think that the organization saw you certainly.

Davidow: Yes, that was how it was perceived of.

Remacle: Because Intel transformed itself. Maybe that's too strong of a verb but certainly there was a big shift in the way of thinking about SLRP [Strategic Long Range Plan] when I first got there, how they talked about the customer and solving a customer problem, meeting customer needs as opposed to seeing everything through the lens of "what cool [engineering] thing can we do?".

Davidow: I'm not sure that I affected that that much, but we'll see.

Remacle: Well if you didn't, who would you say did?

Davidow: I don't know. I don't know. I think these things happen. I guess at least as far as computation devices go, whether it was the presentation on selling a dog or Operation Crush, what I convinced them of was that it was about something more than the spec sheet and that I demonstrated that but I am not sure what effect that had ultimately on the corporate culture.

Remacle: Okay, you're going to be modest. That's okay.

Davidow: No, no. I don't know how things like that happen. There are certain things, you could say, Crush would have never happened without me. I know that. I'm having a big impact on the development function at Caltech right now and I head the development committee and I've worked on that problem for 13 years and I know that I will have impacted that dramatically. Now there are going to be other fallouts that are going to occur as a result of that but I don't know that I'm necessarily responsible for them.
Remacle: What about Regis McKenna's role? You mentioned him earlier in Intel's marketing evolution, or, the evolution of Intel marketing I guess is a better way to say it.

Davidow: Well I think Regis is one of the best promotional minds. I would like to distinguish that, and this is not to take anything from Regis, but as opposed to marketing, because Regis was really great at articulating, positioning, and coming up with ways to promote yourself within the industry and to network and to get recognition and what have you, and Regis had an immense influence that way. He was really good at that. That to me is one component of marketing and I don't think there was anybody who was better at what Regis did than Regis.

Remacle: What would be the other components of marketing you think that Regis himself as well as the organization were not as competent at?

Davidow: I was talking to somebody about this the other night at dinner who was doing music to go with ads and I was saying "Look, marketing is about strategy, it's about positioning, but it does no good to have the position being all outlined if it doesn't line up with the customer base you're trying to serve and, in fact, if you can't align the organization behind the marketing it doesn't work". I think what marketing is about is getting all of the pieces defined and working together so that they can have that impact. So what Crush was about was defining a message and having a promotional scheme. But then there were all

these mechanics that went behind it, of what products you design, what documentation you needed, what training you needed, how you train the field sales force, how you motivated the field sales force, and it was getting all of those pieces to mesh that made Crush a success. Gosh, the guy who did the fundamental book on product positioning, I forget what his name was, but I met with him back in New York and he was saying that Xerox, I think it was or something, should become the document processing company or something and that if they just promoted themselves that way they would be great. It was Jack Trout I think. It was either Trout or Al Rees, I forget which one. I think I met with Trout, and I was thinking, or maybe he said that to me about Wang. I think it was about Wang. And I was thinking "you don't understand". His idea was perfect. The problem was that it was varnish on a rotting hull and unless all the pieces support that message, you're never going to be able to promote the message. The problem was he came up with a storyline. Great storyline.

Remacle: What role does the fact that both Regis, and both Trout and Rees to my knowledge, never have been inside a company, really understanding at a visceral level what it means to make a decision like that and execute against it?

Davidow: Well I think that's the same problem that McKinsey has. It's great to come up with a corporate strategy or a financial analysis. You look at these things and you're in the management of a company and somebody says, "You dumb guys, if you only did this wouldn't that be great?" and you're sitting on the inside and saying, "Boy, I'd love to do that. Here's what it takes to do that," and you start adding up the bill and I was involved with a discussion today and we were talking about the solution of a problem for a particular company and the problem is it's clear the thing you'd like to do. it's like me telling you, "Look you really ought to win Wimbledon and all you need to do is improve your backhand, your forehand, and get a little more stamina and this and that and the other thing."

Remacle: Lose about 40 years. <laughter>

Davidow: Yes, and I'd really love to win Wimbledon but my backhand isn't that good and I worked on it. And so you say, "Well, if I can't win Wimbledon maybe I ought to just win a match at the tennis club I play at and I better play in a different league."

Remacle: Let's go on to your decision to leave Intel. What generated that decision?

Davidow: I was 50 and I thought "Do I want to spend the next 15 years at Intel"? There were a lot of young people who I thought probably should have my job and Intel was a billion-and-a-half dollar company and I thought what am I going to do at Intel for the next 15 years? If I had been smart enough to know that Intel might become a $40 billion company I would have said "Well, there would have been a lot for me to do", but I didn't have that vision at that time. I had always said I had a plan where I was going to get educated for the first 25 years of my life and I got educated for 26, and then I was going to work in industry for 25 years, then I was going to do venture capital for the next 25, and I didn't want to get into venture capital when I was too young, so I decided I wanted to get into venture capital.

Remacle: How did you go about that? At what point did you make that decision vis-à-vis the point at which you actually exited Intel?

Davidow: Well a disagreement that Andy and I had was the thing that caused me to make the decision at the time. I had been working on building those relationships with venture capitalists for 15 years. So I had everything lined up so that I could do it and I didn't know how I was going to do it but I had been doing due diligence for them, I had been serving on boards, I had made venture investments on my own prior to that. So I had everything lined up. Andy and I had this disagreement.

Remacle: What was the disagreement about?

Davidow: Oh he wanted me to do something. I forget what the specific thing was and I really didn't want to do it and I went into him after the executive staff meeting and I said, "Andy, if I continue to work for you, I've got a great deal of respect for you, but I'm going to end up having no respect for you and I guarantee you will have no respect for me," and he said, "You're right," and I said, "I think I ought to leave," and he said, "You're right," and that was I think in February and he said, "I'm going to make some of these management transitions, will you stay around while I do it?" and I said, "Sure, I'll help you through them," and I guess about October of that year Andy and I were talking one day and he said, "You know, I really appreciate how hard you've worked and what you've accomplished in this time," and basically he said to me, "I never thought you would have attacked this with this dedication that you did." By that time Andy and I were getting along fine, but the die was cast and so I went off to do venture.

Remacle: How did you get to be Mohr Davidow Ventures instead of a general partner, at say, Kleiner Perkins or something?

Davidow: I had talked with Kleiner Perkins about that. I had talked with Sequoia about that and I had talked with other people about that, then Larry came along. Art Rock introduced Larry and myself. Larry had this small venture and he said "Why don't you come and be my partner?" and I said "Fine".

Remacle: What was appealing to that as opposed to going into an established firm?

Davidow: These firms have very strong cultures. I had almost started a venture fund with Tom Perkins when I was at HP and had it been Tom and myself or two or three people it would've been one thing but trying to figure out how all the relationships work and what have you and I just decided I'd be better off doing it on my own.

Remacle: What was the focus of Mohr Davidow in terms of investments, in terms of positioning?

Davidow: In terms of positioning? Well Larry was doing mostly medical devices and medical things and I was doing semiconductors and some software and then as we hired other people we did more information processing things and networking and I continued to do mostly semiconductor things, although I did some software things.

Remacle: What are the key differences between working inside a venture firm and working inside an industry company?

Davidow: I'm sure it's different in every venture firm but number one I think in venture firms you're a bunch of individuals and you generate your own deal flow and you look after your own companies and there is teamwork but you're a bunch of individual contributors. "I've got my five deals, you've got your five deals and you make yours successful and I'll make mine successful". Venture firms tend to be groups of Texas rangers. One ranger, one riot.

Remacle: What lessons that you learned during your years in industry carried forward into and added to your ability to be a good VC?

Davidow: I think I knew how to operate things, I knew how to help teach people to operate things and I understood what it took to run a business and I think that a lot of what goes on in venture capital today, especially during this bubble where too much money was raised and this and that and the other thing, was that a lot of people got involved in venture who are very smart and who had no practical experience and because they thought they were smart they thought they knew how to fix problems and manage things and do things. I also realized that being a venture capitalist is a staff position. You're trying to get people to do things but you don't have a lot of direct authority. You can fire them ultimately but that's a very tough thing to do. You can't do it too often. So you really have to earn people's respect and get them to want to do things that they should do. A lot of people think that because they give people money they can order them to do things and it doesn't work too well.

Remacle: You mentioned the bubble where there was too much money, too few good deals. What about the dot com bubble? What was the impact there from your perspective?

Davidow: I stopped making new investments about two years before the top of the bubble. I really had a tough time with the entrepreneurs because a lot of them weren't my kind of entrepreneurs. They would come in and say, "We want to be serial entrepreneurs," and I would say, "What does that mean?" "Well, I'll work for this company for two or three years, I'll get it started and then I'll go off and do another one," and I would say, "Who's going to do the hard work?" and they were getting paid phenomenal amounts of money or valuations for ideas and I could remember Dave Packard always saying, "Good ideas are a dime a dozen." He was interested in people who could implement them and get stuff done and I felt that about venture capital, and then one of the things that Tom Perkins had told me was that one of the keys to his success was to get the risks out early and what he meant is spend a little money, get the risk out of the operation, and then really pour money in. The money was going in, big amounts of money were going in before people had gotten the risks out early. So I just felt that there were a lot of things that were going wrong with the venture business at that time.

Remacle: What were the key lessons that were learned or identified? Some of them probably haven't been learned fully yet, but what were the key things that came out of the bubble in 2000, 2001 timeframe that you think people have internalized?

Davidow: I think people learned that they paid too much for concepts but we've been doing that since the South Sea Bubble. We just learned that lesson over again.

Remacle: To loop back to the questions about the lessons learned from the bubble burst, you said that MDV didn't really invest that many--

Davidow: I said I didn't.

Remacle: You personally didn't, okay. You personally did not make that many internet or e-commerce-oriented investments, but what is your observation in terms of the VCs either in your firm or others who made some of those early investments and how did that turn out overall?

Davidow: I think there were some great investments made. I mean, Amazon, things like that. I invested in a company called Viant, which was an internet services company and our sales just ramped and ramped and ramped and as a result of the internet bubble we had everybody who wanted to bring up a website and we were helping them integrate that with their business and what have you. We got the company public and I think we made 50 times our money on the investment and then the bubble burst and all the business evaporated. So that was a company that had a real business that was generating lots of revenue during the bubble but when suddenly Ford and American Express said hey, it's not as urgent that we have all this capability instantly, then a lot of our business went away.

Remacle: In order to wrap up a little bit here, let's go back and kind of take an overview looking back. What were the things that you were associated with in your career that you were the most pleased with, the most proud of, were the most rewarding to you?

Davidow: I obviously was very pleased with the way Intel worked out and the role I played there. I think I had some pretty good venture deals. One of the most recent ones was Rambus, which--

Remacle: They just had a nice--

Davidow: Yes, and I think that's going to prove to be a vindication of some--

Remacle: Of IP as a business model?

Davidow: Well yes. Here was an industry that wasn't inventing and we could not get in as a country. We could not form a dynamic RAM business and make it viable and so we said "hey, if the Japanese and the Koreans have driven us out of that business we can still invent something" and we did. The invention was so valuable that they formed a cartel to drive us out of the business but it's taken us 20 years, right? I was chairman of the board for 15 years and I'm not going to argue we did everything right because if we had done everything right we would've had fewer problems. I think we made a tremendous contribution to the industry. It was a big risk on that business model because sort of nobody had ever tried something like that. You could say Qualcomm did but I don't think Qualcomm got there quite the same way we did. This was we aren't going to have any products at all but what we are going to do is invent and license and that was something that had been going on in the pharmaceutical industry but nobody had really tried it in the semiconductor industry.

Remacle: Would you say that Rambus is your biggest investment success?

Davidow: Well no. I made in my career about 25 investments and I only invested around 75 million dollars and I returned 750 million, and 5 of them did better than 10 to 1, of which Rambus was one and Viant was one. I could go through, I've got a list of them at home of the ones that did that and I'd have to look at the list to tell you.

Remacle: Bill, you've written three books. What drove you or what was the inspiration to write the books one and two? What were the key things you learned in writing them?

Davidow: When I was getting in the venture business I said I needed a brand and said everybody knew me as the marketing person and so I will establish my brand by writing a book on high-tech marketing. In that book on high-tech marketing there was a chapter on why companies give bad service and after that book came out I realized that the chapter was very incomplete and there was a service boom going on and I thought gee, I can get more flow of business and I understand a lot about service so I'll write a book on service, so I wrote the book, *Total Customer Service*. Then I began understanding the implications of service and the virtual economy and I had given talks on this on virtual products and I was talking one day with Mike Malone and I say, "Here, I've got this speech. Why don't you turn it into a book?" and he said, "I think we ought to write a book on this," and so that led to us writing the book about *The Virtual Corporation* which, when it first came out, I thought maybe we've overstated our case and then within about three years I realized we had understated it. I'm working on another book now which I hope is going to be out this fall on how the internet has affected the structure of society and actually be an interesting thing for the Computer History Museum to think about, because the argument is that what you're connected to is your environment and if you change connections abruptly you go through abrupt environmental change and this looks at the adjustment process of what is happening and what you must do to adjust. So I hope that will get done.

Remacle: All right, and then how did the book writing exercises affect the rest of your business life? In other words, what did you get out of them that was some dynamic exchange between that experience and your other experiences?

Davidow: There's obviously been business flow that's come out of them. One of the nice things is that a lot of people, if books are good, read them, and then you get a chance to engage with a lot of people. So it's enriched my life in that respect.

Remacle: Is there anything that I should've asked you about your career, your life, that I haven't asked you that you would like to make sure gets captured for posterity?

Davidow: My wife is great, and so are my kids.

Remacle: All right, that's wonderful. One last question and this leads back to the discussion that you and John [Hollar, CHM CEO] and I were having over lunch. Why do you think having a computer history

museum as you understand this is to be, why is that important to the semiconductor industry, to the computing industry?

Davidow: Our history is an integral part of our future and it shapes our future. If you don't believe that all you have to do is look at all the different cultures around the world and see how what has happened before determines a lot about what is going to transpire in the future. History sets you on a path. I was talking to John about this because I'm deeply involved in Caltech and I've tried to understand why I should be deeply involved in Caltech and finally what I concluded was that it was really important to the country to have these beacons of technological achievement because ultimately those would inspire the next level down and the next level down and the next level down. I think, and I don't know quite how the message for the computer history museum should be articulated or how it's articulated, but to have a beacon for the level of achievement that has gone on in the Valley in this area is important because it will inspire achievement in other areas but it will also preserve the legacy of this achievement and motivate other people to do the next thing. I think you've got to think of it in those terms because if the message is preserving the past, I think that's important but it's the implications of preserving the past that are really important so that a lot of the vitality of the Valley is going to come from extending these achievements and letting people know and have some perspective on how those things happened is really important.

Remacle: Okay, thank you.

Davidow: Thank you, Rosemary. This was great.

Remacle: I really appreciate it.

END OF INTERVIEW

