Bill Terry Interview 5, December 14, 1995

KIRBY: This is Dave Kirby. I'm conducting a fifth interview with Bill Terry. Today's date is December 14, 1995, and we are in HP's offices at 1501 Page Mill Road, Palo Alto. Last time, Bill, we were talking about when Dave Packard went to the Defense Department early in 1969 and was replaced by Hewlett. At the time, Bill made a comment to the effect that he wanted the company to have a "more professional management". You didn't recall that; I'm not quite sure what Bill meant but I think he wanted to put more value on people who would go on to business school, among other things.

TERRY: Yes, some of that.

KIRBY: This brings up the subject of MBAs at Hewlett Packard. Some managers have been impressed with young people who have an MBA while others think it's not that big a deal. Based on your experience, how do you come out on this issue?

TERRY: Well, let me comment on the professional management, just thinking about it. I think one of the reasons Bill might have made that statement was this was, you know, to point out to everybody that he and Dave weren't going to live forever and that the company was going to have to move on to other managers, and the fact that Dave was gone temporarily kind of just got everybody's attention that there were going to have to be other people in the company that were going to take key leadership positions. The MBA ... I don't know exactly how that got started or whose idea it was. Certainly Dave and Bill must have thought it was a good idea or nothing like that would have happened but I think some of it was brought about by just the size and shape and growth of the company that it was getting to the point where a deeper understanding of all kinds of business fundamentals was called for by all of the managers. Things were just getting a lot more complicated. Prior to that, the recruiting had been done almost exclusively in engineering. There might have been a modest amount of recruiting done at schools for finance people, although I don't think there was very much of that. We hired our finance people from our public auditors in many cases. But I think it was the idea that just people with a broader gauge business background on top of an engineering degree—an incidental of the emphasis was an undergraduate in engineering degrees plus an MBA—some of this formal business training, and then later on, it was an undergraduate degree in finance or accounting plus an MBA and a career in finance and accounting that came on. But it did get started about that time. John Young was ... I don't know who the first one was. If I think deeply enough, I could remember but John Young was—he wasn't the first—but he was in the very early wave of people coming from business school. I didn't have a business school degree but I did get involved on business school recruiting teams and I remember going to Stanford and Northwestern, and I remember very well going to the Harvard Business School. We had a very organized recruiting team go to the Harvard Business School and we'd go through a series of interviews in the morning and then, as we went along, we would decide people that we would ... think about people that we wanted to probably know more about or eventually make an offer to, and we would invite them that evening to go to a dinner at a place called Lochover's in Boston, which was kind of near the school.

KIRBY: Oh, yes! The old restaurant. An old German restaurant.

TERRY: The old time restaurant and we'd all—I think there were three of us; I can't remember who else was on that team (John Young may have been on the team)—and we would all, every hour or two, we'd sort of compare notes on how many we had invited because we were doing this on the fly as we went along.

KIRBY: Oh, I see, I see. That's pretty interesting.

TERRY: At the end of the interview, we'd say, "Dave, do you have anything doing this evening? Would you care to join us for dinner at Lochover's at 6:30?" and so forth. And I remember that's how we got to know Dean Morton. I don't know who interviewed him first, but we invited him to dinner at Lochover's and subsequently made him an offer and he came to work. So, again, I never had a formal business training but I did have a lot of fun going around on those MBA recruiting calls.

KIRBY: So in some cases, you'd wrap people up in one day, I guess.

TERRY: Oh, yes! Yes, you want ... These recruiting sessions are heavily organized by the universities so you'd usually have only 30 minutes with a student. You do usually get a resum6 in advance, so the night before you'd all sit around, you'd get to Boston at 6 o'clock at night on the airplane and then you'd sit around and look through all these resumes to kind of get a feel of who was going to talk to whom, and you'd talk to them for about 30 minutes and you could, really, just get kind of a feel and then we'd invite them to dinner and get them liquored up a little bit and get to know a little bit more about them, and then we'd come home and we'd have to make a decision on who we would invite—is, I believe, the way the routine went. We didn't make an offer at that point. We invited them back to Palo Alto and they spent a full day going around and talking to a whole bunch of different people, and almost always we ended up making an offer because we had kind of weeded it down to a fairly small number of people and of course, we didn't get all the people we made offers to but it, again, it was ... I think it was driven by just a feeling that we needed people with a business background. We were growing fast. We needed people that could get into managerial jobs pretty fast and we needed people with a background beyond engineering. We just didn't have the time to rotate jobs and learn all those kind of things, and I think it worked out pretty well.

KIRBY: And I guess you think that MBAs were pretty good for the company at the time?

TERRY: Yes, I think they were good for the company. There was a, you know, there was an acceptance problem just like there always has been at HP. You know, even ... Not so much recruiting college engineers, you know, because that had gone on for a long time but recruiting anybody else, including MBAs or experienced managers...

KIRBY: More senior people.

TERRY: ... more senior people—and there was very little of that done—and the few people that were recruited like that, they had a really difficult time of acceptance and I know we used to really—I did and I know my colleagues used to—really worry about that because these were expensive people. They had good credentials and the damn Hewlett Packard tribe, you know, really put them on probation and made life really difficult. And some of them made it and some of them didn't. Yes, I talked to one guy who said that he thinks it took him 18 months to be accepted. Yes, some of them came in and very quickly kind of adapted. They knew, they could kind of sense, even though it wasn't written down, what the culture was and how you did things and showing up at the coffee pot and all that, and others never did get it. I don't know. In recent years, Joel Burbaum is the kind of a guy that, you know, four months after he was here, you didn't even remember where he came from! It just seemed like he was here all the time! That s right! And there were other people that just... they stuck out. There was a fellow named Ed Rechtin, really good credentials but he just never did quite figure out how to get things done.

Editor's Note: Rechtin worked at the Department of Defense during Packard's time as Deputy Secretary, Dave brought him to HP at that time.

As I recall, he came from a military aerospace background and he was pretty reserved and he thought the way to get things done was to write reports and sit in his office and he had a way of talking that was... it came across that he was talking over your head, that he really

wasn't interested in you or what he was saying, that he was just kind of play-acting but he just never did get accepted and people sort of resented it. And he lasted about two and a half years.n Another guy I remember was C.B. Foos, who was hired by John Cage. ... to be a kind of second-in-command of HP Labs when I guess John was in charge of HP Labs or a big section of HP Labs. It must have been a large section of HP Labs. And he came from Raytheon and he was really kind of a strange character. I guess he was a, you know, military aerospace administrator at Raytheon, a pretty big job, and he came in here and he sat in an office over in Building 1 over here and we hardly even knew who the devil the guy was! And he was known as C.B. Foos and he lasted about six or eight months before he moved on to something else but...

KIRBY: I can remember Ed Rechtin had a corporate staff job and about once every two weeks, staff managers used to have to a meeting and go around the table and just report on what was going on in their area of responsibility. And the financial guys were there and Chognard from law, legal, and Ed was there. Well, it was all very informal and Ed would show up at the meeting and he'd hand us each about a 4-page memo of what he was going to report that day. Really organized! [Laughter] Oh, yes! So we had ... each of us had a copy of the memo. I remember I got this originally and said, "What is this?" You know? It was so unusual. But that was probably the military aerospace background...

TERRY: Absolutely! ... where you never made an extemporaneous remark. Everything was written down and documented and it was "cover your ass" was the name of the game!

KIRBY: Yes, that's right! That-was exactly the reason, you know?

TERRY: But you know, that problem has been with HP for a long time and it may even still be here today, and it was a real problem in the computer business because here we were trying to start ourselves in the computer business with a bunch of people who knew about instruments and both marketing and engineering and manufacturing, and so we did hire in the early days of the computers, and we'll get on with this. People from outside the company and that was a real problem. We needed them because we didn't know as much as we should about computers and they had this real acceptance problem. The rest of the company thought they were a bunch of yo-yos because they hadn't, you know, done 20 years of penance in audio oscillators!

KIRBY: That's right, right. Well, in our last interview, we were also talking about the difference in Packard's and Hewlett's management styles. When it came to one-on-one communication, I always felt a little more comfortable with Packard than with Hewlett, but other HP managers felt the opposite. How did you feel about it?

TERRY: I felt exactly the same way. I felt... I just felt more comfortable with Dave. It was easier to talk to him. I don't know what it was about Bill. Maybe it was that huge intellect and the fact that he just knew so much about so many different things but it was just kind of a personality thing. Dave seemed to be a kind of warmer individual in many ways. Dave would ... Dave was quick to criticize and point out where things needed to be better but he was also very good at thanking you or congratulating you on things that had gone well. And Bill was a little bit the same way but Bill was always probing, you know, he was always asking different difficult questions and kind of digging in and I remember it used to kind of put me on the defensive. I always felt a little bit tense with Bill and I wasn't sure I was going to have the right answer although I was smart enough with both of them. If I didn't have the answer, I'd say, "I don't know. I'll go find out!"

KIRBY: Well, I always felt intimidated by Hewlett's seemingly endless stream of questions. In fact, there are countless stories told by HP managers who, faced with a visit by Bill Hewlett, tried to think in advance of every possible question Bill could ask.

TERRY: Yes, I'd be in that category!

KIRBY: So they'd be prepared and then, sure enough, his first question was one they hadn't thought of!

TERRY: Yes, right! Although I remember having meetings with Hewlett–this was in, again, the early days of the pocket calculator–and fortunately, I would have brought along or would have included in the meeting–Bill would have me include in the meeting people like Barney, or Tom Osborne–and so, you know, I was... it was real easy for me when Bill got into something that was over my head to just sort of look at Barney or somebody else and they answered the questions, so it took me off the hook!

KIRBY: This was especially true of the people, the international people, you know, a country manager. Bill would show up and he liked to ... had a curious mind about the country and sure enough, the first question was something about the average rainfall...

TERRY: ... or history. History, particularly. Or history mixed up with opera, German or Italian opera. Bill Hewlett–and I've said this in talks–is a very broad gauge individual! He knows a heck of a lot about a lot of different things. And I used to tell people, you know, if you are ever in the woods on a hike with Bill Hewlett and he grabs a leaf off of a tree and says to you, "What is this?" My advice is you say it's a leaf! Because he knows the name, he knows the Latin name, he knows the entire history of the tree that the leaf came off of and he was the same way on these international trips with history, you know, and he'd say something. We'd be on a bus going from somewhere to somewhere on a review, and we'd go by an old castle and he'd say to the host guy in Scotland or wherever it was, "Who's castle is that?" And they'd say, "Well, that's William, the Conqueror." And then he'd start in on a quiz on the entire life history of William, the Conqueror! If the local guy didn't know it or perchance if the local guy had made a mistake, then Bill was quick to point out that was a mistake and then he'd tell him exactly the history of William, the Conqueror. And he did it in a nice way but it was ... it put everybody a little down on the defensive.

KIRBY: I know that in 1971, while you were still in Colorado Springs, you received a very important call from Bill. We'll get into that in a moment, but first I want to talk a little bit about 1970. That was a year of declining business for HP and a very unusual and creative program to help weather the storm, the so-called "9-day Fortnight". Can you describe the program and its effect in Colorado?

TERRY: Yes, business was down and I can't remember who was the president but it was not as an HP problem as it was a nationwide or worldwide economic problem.

Editor's Note: Nixon

TERRY: The nation was having a recession. I don't remember if it was Kennedy or Johnson or who it was. It might have been Lyndon Johnson. And HP in typical style had been kind of looking ahead because HP always has been a very conservative company, particularly when it comes to hiring, this idea of hiring people for a long term and don't get too extended too fast, so the storm flags had already been flying for about four to six months. You know, the hiring had been cut off, we could see the orders were slowing down and everybody was trying to economize and cut back wherever they could but business kept getting slower and slower, and at the same time, the inventory started to increase. We cut down the purchase of parts but there's a lead and lag time on that. So we began to use up cash and the inventory started to increase and we had warehouses full of finished goods of instruments sitting around in various places, including Palo Alto here, and people knew that something was going to have to happen. The trends were just all going in the wrong way and we were going to run out of money. We could get into a really serious financial problem. And that's when there was some discussion. I was not privy to the initial discussions. I was in Colorado

Springs at the time but the discussions went on here in Palo Alto about what to do about it. I did attend one meeting here of what was called, I guess, the Executive Committee in the Boardroom over here, where there was a discussion about alternatives and the subject of layoffs was not on the agenda. There was a whole bunch of discussions about reducing salaries and, you know, all kinds of different variations of things to be done: running sales campaigns, and cutting prices, and just a whole potpourri of things. And that's where this idea finally emerged. I don't remember whose idea, frankly, it was, whether it was Bill's or not. It probably was Bill Hewlett's. And it may have come from other companies, although HP was fairly unique in the United States in doing this but this was the idea of taking every other Friday off without pay and there were discussions about, well, can people take vacation? And the answer to that was 'no'. We want to cut the payroll expenses so they can't take vacation for these Fridays. And there were other, you know, ground-rules that had to be worked out that I'm sure Ray Wilbur worked on, the Personnel people all the mechanics of doing this. And it was top to bottom: it would start with the chairman of the board and it would go right down to the newest engineer that we hired, and the lowest paid employee in the company, and everybody would do this. And then there was some discussion about exceptions and I don't remember where all the exceptions were, but there were probably 5 to 10 percent of the people in the company in the United States that were exempted from the every other Friday off. As I recall, they were probably the IC operations either here in Palo Alto or in Santa Rosa or Santa Clara, wherever they were at the time. I believe they were exempted because shutting down these IC factories is a real tough proposition.

KIRBY: Integrated circuits, right?

TERRY: Yes, the integrated circuits. You've got to heat up the ovens and cool down the ovens and it's a real hassle!

TERRY: You just don't want to do that. And there were other exceptions. When I was in Colorado Springs, we had—for better or worse—taken a contract to ship about 1,500 or 2,000 oscilloscopes to the U.S. Navy and they were going out the door at about 100 to 150 a month. So our commercial business was just as bad as everybody else in the company but we had this military contract and we had taken it with full knowledge that it had narrow margins on it and when we took it, we didn't realize there was going to be a slow-down in business but this military contract kept us very busy. In addition, we had, you know, a contractual obligations with penalties attached to shipping 150 scopes a month, period and we wouldn't let down on that. So we were made an exception and we worked. We did take a few Fridays off, probably toward the end of the program, because we'd shipped all our military scopes but we were initially exempted from taking time off and we worked a full schedule and got our military scopes shipped. But, as I recall, there were only a few exceptions. The total program went on for about five or six months.

TERRY: And then business began to pick up. The recession or whatever it was in the U.S. began to get over and everybody came back to work full time, and this was written up in the press as a wonderful example of HP's concern about its people and that, for sure, was at the bottom, was a reason to do this, but also at the bottom of it was just plain smart business because the HP management was pretty sure that this was caused by factors outside of the company. We did not have a giant internal problem, and that the problems outside of the company would rectify themselves over a period of time, and when they rectified themselves, we had everybody on board. We did not have to ... if we had to lay people off, we would have had an expense of laying them off, then we would have been hiring them back six months later, right? And we didn't have to do that. Everybody was on board; everybody was trained. Everybody agreed that tightening their belts a bit was a wise thing to do because it was temporary and HP came roaring out of that recession just a heck of a lot stronger than many of our competitors and other industry members who had laid people off and went through the

chore of hiring them all back again. You didn't ask this question yet, Dave. I don't know how many times we've done this; at least three ... the first, the initial time, plus a couple of more times. And we have used that same theme with a whole bunch of variations on top it. That is, asking people to uniformly share the pain—it might be a division at a time—of cutbacks in schedules and cutbacks in pay in order to get ourselves through a kind of a tough economic situation but keep the whole team together. In later years we added things on top of that, such as voluntary severance, voluntary early retirement programs and other things where people, if they chose to, could leave the company.

KIRBY: And I think what worked to that program's advantage was the timing because, as I recall, it took place sort of in the Summer, people liked the day off anyway but Bill Hewlett has said if you got into the Fall and late Fall and sort of into the holiday season, it really would have ... people would have felt a little differently about it.

TERRY: They probably would have. And we didn't ... you know, we asked everybody to really economize, you know, because this is your company and your money and don't throw those paperclips in the wastebasket and, you know, everything you could think of. But we didn't chintz; we didn't cut off the coffee! I know a company, Tektronix, at one time got in a pinch like this and decided not to serve coffee anymore. Well, hell, you know, you could probably cut the wages 30 percent and people wouldn't scream as much as when they cut the coffee off!

TERRY: We didn't cut the coffee off. We didn't cut the profit-sharing off. I don't remember the numbers but the profit-sharing was probably low, but there was still a profit-sharing check. We didn't cut back on any of the benefits, you know. We didn't cut back on supplies for engineers. In fact, in many cases, Colorado Springs and other divisions, we asked engineers to work the day, voluntarily, we asked them to work the day that they would have had off without pay if we had an important new product program underway. And we had a number of engineering groups that said, "Yes, we'll come in on Friday even though nobody else will be there because we've got to get this darn product invented and if we can get it out in the market, we can probably work our way out of this problem." So there was a lot of that that went on. It was also fortunate that we didn't have to do it too long because these things sort of grate on people, financially and otherwise after a while.

KIRBY: Oh, yes. Yes.

TERRY: So, you know, it was... you're right, it was a Spring to late Fall kind of a deal, and they we all went back to work.

KIRBY: And I know in our public relations department, we had, since we have to be available if the newspaper calls or something, we had to have a skeleton crew come in and it worked all right.

TERRY: Right, there were a number of places like that. I mentioned ICs; there were other places that we did. Incidentally, we did not apply this to the sales organization. We asked them, if they wanted to to do this in certain administrative areas. If we had less orders coming in, we needed less people in order processing and I believe some of the sales regions decided to do this in some areas where they were having problems also: some of the administrative areas, perhaps the service departments, I'm not sure of that. But the individual salesperson that was out there trying to beat orders out of the customers was exempted from this. In fact we told them, "Look! Everybody else in the company is tightening their belt and they're really depending on you to get every doggone order that you can find out in the marketplace!" So if anything, they worked harder than they would normally because we were trying to get orders to work our way out of the problem. European organizations were exempted at that time also. There were a whole bunch of complicated laws and regulations in Europe.

TERRY: We have done this later on, in later years, where we got into problems that affected international organizations so we have learned how to do things, like short work weeks and

cutbacks and all kinds of things, early retirements even in places like Japan and Germany, where they have some fairly strict laws. But at the first pass when we did this, it was U.S. only.

KIRBY: Now, HP's business picked up in 1971. Several new products were introduced, including a portable counter, a new X-Y recorder and some portable oscilloscopes from your division. Another new measurement product was a surveying device that electronically measured distances up to about two miles. Whose idea was this? Do you recall?

TERRY: Well, it was an HP Labs project and I don't recall–although I certainly got involved with it with the DMI product line–who the individual was. We could ... we'd have to go back to the HP journal and probably find the author of the articles that would give us a clue, but it was an HP Labs project.

KIRBY: That's right, we called it the DMI, didn't we?

TERRY: Yes, distance measuring instrument. And I don't remember, Dave. I'll have to go think about it but it moved from HP Labs to the Loveland Division, Loveland Instrument Division. It became a part of Loveland. A fellow named Bill McCullough ran it.

KIRBY: That's right, I remember Bill.

TERRY: But it started in HP Labs and then moved out into the operating divisions and it was a complicated product! Boy!

KIRBY: Was it?

TERRY: Oh, it was more complex than I think anything we'd ever tried, including the disk drives because it had all the challenges and then some of a mechanical disk drive plus optics plus lasers and it was really a big, big bite to take!

KIRBY: Is that why it eventually sort of disappeared?

TERRY: No, we were in the business for about–oh, gosh, I'm guessing now–six or eight years. I was responsible for it. This was after my computer tour and we had gotten it up to about 20 or 25 million. It barely made a profit. It was an exceptional day when we made a profit because this thing was really complicated. And we put a fair amount of capital into the machine shop of Loveland in order to make these really complicated parts. We got it up to about 20 or 25 million, and it had made very, very little money over the entire life of the program. It was expensive. At the same time, we had real distribution problems. Selling these things to land surveyors was a real challenge. There were some avenues of distribution available but they were dealers and they were classical land surveying equipment dealers, and they sold poles and boots and trucks -and-they sold classical..

KIRBY: —And plumb line or whatever!

TERRY: plumb bobs and lines and tapes and stuff like that but they also sold the classical theodolites and leveling devices that were made by the Big Boys. This was K&E–I'll have to search my memory for the names–but they were the two or three traditional manufacturers of optical products for surveyors. They were European, Zeitz; there was one in Switzerland whose name will come to me. And what was happening was that these traditional land surveying guys that made these optical things, they saw this electronics thing coming along and they knew that was a pretty neat idea because it substituted for the manual taping with measuring distance with tapes, and so they started inventing their own. Now the dealers of these products knew that this was happening and the last thing in the world they wanted to do was to alienate these classic guys by taking on a new product line! So we went around and talked to all these dealers and they said, "Gosh! You've got a nice product and you're nice guys and so forth but we can't afford X-Y-Z..."

KIRBY: Someone upset with us.

TERRY: Yes, exactly. So we had a direct sales force of about 15 people beat the bushes of the United States mostly, you know, and I really mean beating the bushes! You had to go out in the field to find the land surveyor and sell him one of these things, and it was expensive to do that, and tricky. We had to lease a lot of them because these land surveyors, they didn't have $15,000 or $20,000 in cash to buy one of these things. So there were credit risks and there were financing challenges, and there was a real marketing challenge. And then about six years into it, the competition was coming on. The theodolite manufacturers had modified the generation of their traditional optical theodolites. Frankly, they beefed them up so you could put a ... So here we have a classical theodolite manufacturers with an attachment that goes on their theodolite. It isn't quite as good as our product but our product is expensive and all it does is measure distance. So we saw that we were going to have to start a new generation of DMI machines. We were going to have to make attachments that went on theodolites and we were going to have to have a new family of DMI machines to kind of compete, and it was a problem on who we were going to sell the add-ons to because they already had arrangements going on on their own, or with Japanese suppliers. So the whole thing looked really awfully bleak to me. So I sat down with Bill McCullough and we went through kind of an analysis of what we might do, and I decided—Bill and I decided—that we were going to get out; we were going to shut this thing down. We were going to gracefully retreat. That is, we would continue to service the products we had. We had, also, along the way, by the way, transferred manufacturing of this thing—really assembly of it—to Grenoble. Grenoble was looking for things to do. We had started the plant there making card readers, Franklin Chang card readers, and we were looking for other things to do and Europe presented itself as a good opportunity for surveying products, even though it's been awfully well-surveyed over 2,000 years! And we started ... we made DMI machines in Grenoble. But anyway, Bill and I decided we were going to shut this thing down and I knew that there was enough sensitivity about it, particularly with Bill Hewlett, that I decided I'd better go do my homework so I ... it must have been ... Noel Eldred was really happy to hear that this thing was going to go away because it was an impossible marketing job or selling job.

KIRBY: I bet he was, yes!

TERRY: And the people that were selling it, with a very few exceptions, we were able to transfer into other parts of the sales organization. They were good sales people; they could sell computers or instruments, so that wasn't a problem. The people in the Loveland Division, the Loveland instrument division and the desktop calculator division were really growing so we could easily absorb the people in the DMI organization—there was about 200 total—into the other parts of the Loveland organization. There were some problems in the machine shop. We did absorb the people; we had to do some training and there was probably $1 million worth of machine tools that we had to obsolete because over a period of time...

KIRBY: They couldn't be used for anything else.

TERRY: ... they couldn't be used for anything else. They were really high, high tech, high precision machinery things. But we did all this homework and I convinced Ralph and Noel without too much trouble at all that this was something that just wasn't going to take us anywhere and the prospect of starting a whole new R&D program with all these other competition and marketing problems was just really untenable. And I came and I talked to Bill about it, and he didn't like it at all!

KIRBY: Yes, Bill Hewlett. That was sort of something he loved?

TERRY: Oh he really loved this thing! He had one that he had down on the ranch and he'd use it all the time and call us up and tell us how he liked it or didn't like it. And it was a wonderful high tech product but it just had some real big business challenges and, you know, I think I finally wore Bill down and he finally said, more or less, "All right, well, you're in charge. If you think that's what ought to be done, blah, blah, blah." But he used to remind me years

afterwards, he'd grumble about shelving the DMI thing. I don't think he's ever really forgiven me. I think he's ... he was as good a businessman as the rest of us, but, I mean, he wanted ... he wanted more than the rest of us to find some way, somehow to try to keep this thing going. Now, I did try to sell it as an ongoing business to Spectra Physics here in the area, run by a guy named Herb Dwight, who is a friend of mine, made a laser... a series of laser products, laser-based products, for land surveyors. They were used to level sewer pipe. They were also used, interestingly application, to grade rice fields. The name of the game in the grading a rice field is to get it really level and that's hard to do and what they do is they put this laser in the middle of the rice field and it would rotate and then on the thing you'd drive around, there'd be a receiver and it would stay level with the beam as it came out across the field. So it would automatically go up and down. So you could just drive your grader over the rice field and you'd automatically get the thing perfectly level. It was a really neat deal. So I talked to Herb Dwight and I said, "Herb, you've got these great leveling laser devices for land surveyors and other folks, and how'd you like to have a distance measuring thing?" And he went out with a team of people and spent a day in Loveland. He came back and it was really funny. He told me on the phone the 20 things that were wrong with this and that out of the 20 things, I think 19 of them were the same as the ones on my list! He saw exactly the same kinds of problems with marketing and competition, and said, "Thanks but no thanks!" And we'd looked around for a few other people but we didn't find anybody who wanted to buy it so we gracefully shut it down. There was some gnashing of teeth and I'll bet you today, 20 years later, we're still servicing these things. Probably we have one service location in the world because this was a $15,000 or so investment and people expect like a classical theodolite that it's going to last 50 years.

KIRBY: Really? Sure.

TERRY: We're probably repairing them somewhere. Hah!

KIRBY: Another product introduced in '71 was ESCA, an acronym for electron spectroscopy for chemical analysis. Can you tell us about that?

TERRY: Let's see, if I can or I can't. There were two... there were two products. One was before that, there was a microwave spectrometer and the ESCA followed that one. These both were done by a special group of people that eventually became a scientific instrument division here in Palo Alto and I can't remember exactly, Dave, how the ESCA worked. I can remember how the microwave spectrometer worked.

KIRBY: It was to ... something about surface materials. It would analyze surface materials. TERRY: Exactly, exactly. Okay, I remember the machine. In fact, I got coupled up with the machine 10 or 15 years later with a board I was on, but I'll have to think about the people.

KIRBY: It was a great big kluge.

TERRY: Oh, it was a giant! It was a giant kind of a scientific apparatus, just like the microwave spectrometer was. The microwave spectrometer came out of the microwave division. Howard Harrington worked on it, a number of people worked on it and it was along with the ESCA an example of a very complicated product, very expensive and it had a worldwide market of probably 20 to 40 units, period! That was it!

KIRBY: That was it?

TERRY: Yes, forever. The whole market so if you got 100 percent of the market in, let's say, two or three years, at a half a million dollars each, you know, you were talking about $20 million and then from then on, you had to invent something else or service these machines and that just didn't fit HP's style of business very well and it was, you know, very complicated and not very reliable. And it went away. I think we shipped, I would guess, probably 50 microwave spectrometers. I'll bet we shipped probably 10 ESCA machines. The information it produced was important surface analysis of semiconductor wafers particularly, or just basic materials

research in universities. It got canceled or we just stopped making them and we told the people that owned them that they could send them back and we'd give them their money or we'd continue to service the thing, which we did. The technique survived and years later, I got on the board of a company called Kevex and they acquired a company who made the HP ESCA machine. It had moved off with some ex-employees into another company and it probably still survives today but it probably sells 5 per year, 10 per year, at $1 million apiece. During 1971, the field sales operation was reorganized into eight specialized sales forces. What the motive for doing this and how well did it work? Did it last very long? Let's see, the '71 organization was ... must have been heavily influenced ... well, the reorganization was undoubtedly heavily influenced by just the growth of the product lines. Sales forces were product oriented and the number of products that were expected to be understood by a particular salesperson, you know, was a finite number. And as the computer business started to grow, that was one of the big impetuses of organizing a separate sales force for computers. In the very beginning, the computers were sold by the same people that sold instruments but as things got broader and more complicated, there was a computer sales force set up. There was a desktop calculator sales force set up because it was a fairly different product. There was a DMI sales force; it was very small and sold to civil engineers. There was an analytical sales force. There was a medical sales force. There was a component sales force, but mostly distributors. That's six. And the other one must have been electronic instruments; that was the basic sales force, the original sales force and the largest by far. And so what we were seeing there was an expansion of the product line and the establishment of these new relatively smaller, specialized sales forces.

KIRBY: Now, let's carry that out further. How did that evolve as the years went by?

TERRY: Pretty much... there'd been a lot of changes along the way. It was shortly after that, as I recall, that there was some discussion about reorganizing the instrument sales force into two sales forces, and this was known as the A-bag and the B-bag. The "bag" part of it came along because the salesman was the person who carried a bag; it was a big square leather thing and it had all these data sheets in it. So the "bag" was what the salesman carried on his calls to talk to customers about products. And that came about heavily influenced by the microwave division. Bruce Wholey had moved to Waltham and John Young was the division manager. The microwave folks were very strong—they always have been. They made very good profits. They had some pretty complicated products—microwave has always been a bit of an art—and they felt that they deserved and needed their own sales forces exclusively to sell microwave products, and that we ought to have a microwave sales force—I think that was the A-bag; I can't remember. And then all else was the B-bag, and "all else" was volt meters and oscillators and oscilloscopes and power supplies and all these kinds of things, X-Y recorders, strip chart recorders. And that was actually done in the field, or it was attempted, dividing the "bag" up, and there were some of us—I was in the scope division at the time—that were really upset about this because I all of a sudden had half as many salesmen out there selling scopes as we did before.

TERRY: We felt this was going to be a damn disaster! And there were other problems with the customers, too, because at least at that time, the electronic instrument customer didn't want to be bothered with, you know, frequency spectrum below a gigahertz, I talk to Joe; above a gigahertz, I talk to Charlie. For Christ sake, why can't you guys get yourselves organized! So there were some problems with that and there were some problems with field sales management and who managed whom, and much we could afford because if you duplicated the entire overhead structure for two sales forces, it got pretty doggone expensive! It only lasted about six months, as I recall. We could look in the history books but it just had too many problems and we went back to one instruments sales force and some specialization at an individual field engineer level based on the customers' interests but a single district

manager, not two sales forces, and so the specialization kind of started to creep in but right at the salesperson's level: "I'm assigned to a bunch of customers who have a whole bunch of microwave challenges, therefore I'm going to know more about microwave than anything else and I'm going to go to the microwave seminars but I'm also going to sell them oscilloscopes and power supplies and volt meters, and stuff like that, and I'm going to have the same boss as somebody who doesn't have any microwave accounts at all, but just sells general purpose instrumentation." So that's where we ended up on the A-bag and the B-bag. And then since that time, except for one big reorganization in the '80s, it has pretty much stayed that way. We went through a period of time in the '80s—this would be in the early to mid-80s—where, again, the product line was getting very broad. We'd made some changes in the organization of the groups and divisions. McKinsey & Company consultants had come in here and sold themselves to HP management—John Young in particular—about doing a study of the company and its organization and the organization of the sales forces. We'd had continuing problems in the field with what got to be known as "The Gray Area." The "Gray Area" referred to the application of different products across different product lines. Let me explain what I mean by that. We had the product specialization: you sold computers and I sold electronic instruments. But particularly in the electronic instrument area, we had invented something called the Hewlett Packard Interface Bus that allowed you to connect a desktop calculator and an instrument together so that you could control them under computer control, and this proved to be exceedingly popular! Part of the selling challenge in the field was, with this product specialization, we had a tough time calling in two sales people—"You sell the computer and I'll sell the volt meter"—where the total sale was $12,000, and yet at the same time, if you had strict product specialization, the instrument person "could not sell the calculator" because that was somebody else's product. So we had continuing turf battles about who was responsible for selling these things. The same thing happened with the computer guys. The computer folks would go in to a customer at a General Motors research lab and the customer would say, "Boy! You've got these great computers but I want to build this data acquisition system to collect all the information out of this engine test cell, and I need a whole bunch of volt meters and scanners... instruments, and the computer guy would say, "Well, gee, I don't get any credit for the instruments." The instrument guy, he wouldn't call in the instrument guy, and so we had more turf battles over who is selling what. It was the collision in technology and it was brought about by the computer and the Interface bus, So that got to be a big hassle and we made all kinds of rules and regulations about you can get credit for this if you do that, and we were trying to preach harmony and peace. I think, frankly—and this is my own opinion—the instrument guys did a reasonable job at trying to produce peace and harmony, but the computer people were young and brash and new and they had a tough road to hoe anyway. They were pretty picky about the whole thing. McKinsey came in and it was part of that "Gray Area" problem that they suggested market oriented sales forces, and they wove a story here about being marketing-oriented and isn't it good to be marketing-oriented? And how could anybody possibly be against that? And so we moved toward both in the field and the division. This lasted about three years in the mid-80s. Market oriented sales forces, that is, we combined the instrument and computer sales forces under one management. I'll never forget in a conversation while this was all spinning about me with John and a number of other people... John Young? John Young... McKinsey proposed doing this for the entire company and I really took umbrage with that and so I was able to exempt the medical, the analytical, and the components people from what turned out to be really quite a giant thrash! Because, boy!, if we had done that even though analytical and medical, there's computers and instruments involved, but if we had done that, we'd have probably sunk medical and analytical businesses. So they went off and continued to do their own thing but we combined the managements of the instrument and computer sales force into a common management. It reported to Dick Alberding not to the product groups, and it was set up along so-called

marketing lines: military, aerospace, telecommunications and so forth. There was specialization at the salesperson level. The individual salesperson job didn't change that much but they had a boss who also supervised computer people and instrument people and there was some crossing over of products at the individual salesperson's level with a whole bunch of new rules and regulations. We had instituted something, or there was instituted something called "Legal Quota" and "Management Quota" which the last time I tuned in when I retired, it was still a giant mess! But they had a common boss and what happened was, as time went on, the boss became less and less familiar with the products because there was too damn many products! These district managers were responsible for—we've lost count!—four or five thousand instruments, all kinds of different kinds of technologies plus a whole new line of computers and software and systems. And so the district managers became less and less able to really manage and coach their salespeople, and they became more and more glad-handers and arrangers of lunches and major account fluff went on with great regularity, and the sales force just kind of ran itself while the management went off thinking giant thoughts about market orientation. The whole thing just kind of fell of its own weight at about three and a half years into it. When I was in instruments, a fellow named Larry Potter that worked for me with great personal risk and he and I together took on Alberding and finally convinced John Young that we really ought to go back to the way we were. And we went back to the way we were and we had an instrument sales force, with instrument management, and a computer sales force with computer management, and there was a certain amount of cooperation that needed to go on all the time anyway, and particularly the selling of products that hook up to each other. And that's the way we are today, and we just tried this market orientation. We tried it in groups and divisions. That didn't work very well either, and we just went back to our good old product orientation, and it's got its problems, too. An expert can take a blackboard and tell you all the problems with each one of these but on balance, we seemed to have gotten better results and been a lot more comfortable in managing these things on a product basis.

KIRBY: Probably no company in the world has really solved the problem of what happens when you have hundreds of products, you know, how do you organize marketing?

TERRY: That's true and I ... also, I watch ... I have watched with great interest how to you organize a computer business? I mean, we've had problems with that. IBM, Digital Equipment; you just name it and it's a really tricky proposition of how do you organize your sales forces. You've got markets, you've got products, you've got peripherals, you've got dealers. And then back in the divisions, you've got this concept of systems. Everybody's got to be together because everything has to fit together and be more or less available as the same time. So it is a real struggle and HP has gone through several versions. There was a computer reorganization here about three months ago. business?

RETURN TO PALO ALTO, COMPUTER OPERATIONS

KIRBY: That's right. Now, let's get back to the 1971 phone call you got from Hewlett, who wanted you to come to Palo Alto.

TERRY: Oh yes!

KIRBY: What was that about?

TERRY: I've got to tell you about a phone call story and I'll tell you about that one before that. Just another turn of the wheel of how do you organize managing a computer business.

TERRY: This was in the latter days of my duty in the Springs, so this would be '71 also, probably early 1971. I got a phone call—it's funny how you remember phone calls, because they're surprises. I got a phone call and I always answered my own phone, and incidentally that was

something that was the way of life at HP in the early days and every once in a while at HP, I'll find somebody. I called Milt Liebhaber to compliment him the other day, and doggone if he didn't answer his own phone!

KIRBY: Did he really?
TERRY: Yes.

KIRBY: That's rare now.
TERRY: Yes, it is rare now. In the old days, it was a Noel Eldredism and it may have come from Bill and Dave, but I think it was Noel particularly, and the name of the game was, you know, it might be a customer and we don't want to bother a customer and Norm Neeley was also very famous guy about answering his own phone, and people would use to call ... or Norm would call somebody and get a secretary and the secretary would say, "May I tell Mr. Jones who's calling?" and Norm would always say, "Does it make a difference?" But anyway, answering your own phone was the name of the game and so anyway, a phone rang and I answered it and it was Noel Eldred and it wasn't a secretary, it was Noel. He knew how to dial a telephone! And he said, "Bill, how are you? And how's it going?" and so forth and so on, and he said, "Bill, I have something to tell you here." He said, "We have received a letter from the Federal Trade Commission and let me read you the first paragraph." And the first paragraph of this letter from the Federal Trade Commission says, "We are concerned. We are going to conduct an investigation in the area of Hewlett Packard Company's efforts to or results in"—I forget which—"to dominate the oscilloscope market." And I said, "Noel, you've got to be pulling my leg! What do you mean 'dominate the oscilloscope market'?! Tektronix has got about 80 percent of it!!" I said, "Noel, you've got to be kidding!!" And this voice came on the line—I didn't realize somebody else was on the line—and this voice said, "Bill, he is not kidding at all. This is Bob Brown."

KIRBY: Oh, the attorney.
TERRY: Bob Brown, the attorney and also HP board member. I kind of gulped hard and he said, "Let me tell you more about this." And we had gotten a three-page, four-page letter from the Federal Trade Commission saying they were going to conduct an investigation in the area of Hewlett Packard's business practices and domination of not only the oscilloscope market—that was just the opening shot—but the microwave business particularly. You know, and we found out later that this was instigated by an ex-employee named Bill Jarvis, who had left the company and went out and started a business called Wiltron making microwave network analyzers and the microwave division took this pretty hard. They didn't like this at all and they said to themselves, "We are darn well with every legal means available, we're going to make sure that this upstart ex-employee doesn't get very much of our business." So they were inventing new microwave network analyzers and they were cutting the prices and they were making Mr. Jarvis' life, you know, in a good legal business sense, they were making his life as miserable as possible as a competitor. They didn't like that and wrote this letter. Well, I don't think they ever did come to Colorado Springs, the Federal Trade Commission, but I know that the microwave folks had to go through some interviews and they had to put together a lot of data and prove that they weren't doing anything other than standard business practices, and the whole thing finally went away. But it was a funny phone call and it got my attention!

KIRBY: I bet it did!
TERRY: Real quickly! Now, we would have loved to have dominated the oscilloscope market but Tektronix was not cooperating at all.

KIRBY: Yes, that's right. That's right, since they have what? Eighty-five percent?
TERRY: They've always had 80 percent, 85 percent; we'd gain a couple of points and then they'd come around and invent or copy or do something else, and we'd fall back a little bit and then

we'd gain a little bit. It that's old entrenched competitor story. But the other phone call you referred to was... This must have been in the winter of '70 or '71. Probably the winter of '70. It was the time of year when division managers made recommendations on stock options. We had an annual stock option program. You got a package of information from Palo Alto; it would come in August or September and then you'd look at all the guidelines. You'd have meetings within the division to talk about stock options for people. You had an allocation; you had so many options. You got that all put together, your recommendations. And then I would add to that recommendations for the functional staff, the people who reported to me, and we'd send the whole package to Palo Alto and usually it was accepted if we did our homework right. The way we sent it in, there might be a few. And then you would get back—usually in late November or early December as I recall; it may have been January—the actual options. These were the official documents and you'd pass those out to the people in the division and I would give an option to my engineering manager and my manufacturing manager and so forth. And usually you got an option also and you were given that option by your boss—it would be Ralph Lee, in my case. So if things were going well, and your division was doing well, and you were giving out options, you'd probably get one also and you'd get a letter from Ralph or Ralph would come by with the option and hand it to you, as it was.

TERRY: But anyway it was that time of year and I had gotten the options for all of my people so Bill Hewlett calls me up and says, in his inimitable way—Bill is pretty... I wouldn't say 'curt' but he's pretty quick on the phone. He'd say, "Bill," he used to call me up and said something pleasant and then he said, "Bill, I have something important to talk to you about." And I said, "Okay." And he said, "I'd like you to come to Palo Alto." And I said, "Gee, Bill, I'm looking at my calendar and, man, I got a customer coming in here tomorrow and I've got to go to Cleveland the day after that to go see this customer, and I've got this meeting" and so forth, and I said, "Bill, you know, if this is about stock options and if I were to get one, you know, I'd really appreciate that and perhaps you could just put it in the mail." Bill says, "This is not about stock options."

KIRBY: There you were, hanging out there.

TERRY: There I was. There I was being facetious again and hanging out, and he says, "This is not about stock options. I want to see you in Palo Alto as soon as you can get here." And I said, "Yes, sir! I'll cancel that customer visit and I will be there tomorrow." So I got on the plane and I came out here and I had no clue as to what he wanted to talk about. I'm sure I agonized over results in the division and some giant mistake I had made.

KIRBY: Trying to think of all the negatives that could have happened!

TERRY: Exactly! And I came out here and met with Bill, and I think it was... It started out it was just with Bill, and Bill told me that we had problems in the computer group as it was called at that time. Those problems were pretty well known throughout the company. I mean, we a ll... the clan is close enough that we knew the products and we knew what the financial results were and the fact that things weren't going as well as people would like was not news to anybody. But Bill said, "I'd you to come out here and head up the computer group, and here's what I think the problems are" and recitation of the problems, and "Will you do it?" And I said, "Well, I've got to go back to Colorado Springs and see what my wife and three children I think it was at that time...." I had been there six years: three years as the marketing manager and three years as the division manager.

KIRBY: You first went there in '75, didn't you?

TERRY: That's right. So that would be the six years: '75 ... '65.

KIRBY: '65, excuse me, yes.

TERRY: '65 to '71. So ... and I didn't talk to anybody else. I might have talked to Ralph. Dave was in the Defense Department. I might have talked to Ralph and I might have ... I don't know

Noel had died.

KIRBY: 1970.

KIRBY: Bill, we were talking about your conversation with Bill Hewlett, wherein he asked you to take over the computer group at the time, that eventually became the data products group.

TERRY: That's right. I don't remember. It may have had that name at time, Dave, but shortly thereafter. We had the data products group and the electronic products group. That was the bulk of the company, plus medical, analytical and components.

KIRBY: Now, so you had to make up your mind and you told him you would check with your family. So you went back and ...

TERRY: I went back and I talked to my wife and what I got was "Okay, I guess so, if you think we should do this." And I had had calls from ... or I had ... there weren't offers. Dave Packard one time wanted me to move back from Colorado Springs to run the components business. I remember talking to Dave about that. This would have been probably in about 1969 or '70, to run the components business. The components business, in many ways, was founded by ... or the early leader was Jack Melchor and Jack moved on to run the Palo Alto division and they needed somebody to run the components division and I may have told you this story of ... I don't know that it was on the phone. It was a fairly casual kind of a conversation. I could tell just by the way Dave approached it. I made the tactical mistake of saying to Dave, "I don't know anything about the components business." And good old Dave leaped on that instantly. He said, "That's exactly what we need! We need somebody with fresh ideas who doesn't know anything about the components business!" And I told Dave at that time that, gee, I'd been the division manager in Colorado Springs for about a year. I really liked that job and I really thought I could make some progress there and this was really not the right time for me to pick up and move back to the Springs. When the Hewlett call came, I had been the division manager for three years. It was clearly a bigger job. It was in some ways like the Colorado Springs job. It was an organization in trouble so I was the guy who was going to fix it. And I could tell about the way Bill talked about it and Ralph Lee. Bob Boniface must have been here at that time replacing Noel but I don't recall talking to Bob. I think I talked to Bill. I talked to Ralph a little bit about the problems and I may have talked to Barney, although I don't remember doing it at that time. Barney was getting more and more interested in computers. It took him a while to get interested in computers but he was getting more interested. I went back home and I talked to my family and my wife said, "Well, I guess." The family was not royally enthusiastic. We loved Colorado Springs. The kids were in high school.

KIRBY: Yes, by that time they were in high school?

TERRY: Junior high or high.

KIRBY: Boy, that's difficult.

TERRY: It was a tough time to move but we came back here. I decided...

KIRBY: Tell me first, let's close out Colorado. So you left the division. Then who took your place? Was it Hal Edmondson?

TERRY: Yes, it was Hal. I had ... that was part of the deal of trying to figure out or make a recommendation as to a successor and when it was known that I was going to be leaving, I thought about people throughout the company. I'm sure I had some ideas of people I'd like Tom Kelly and others that I knew who were functional managers. Within the division, Hal Edmondson had been the manufacturing manager and he was serving them as the marketing manager and doing what I thought was a pretty good job and so I recommended to Ralph that they give Hal the job, which they did. Hal replaced me as the division manager in the Springs. But I came back here. We bought a house in Los Altos Hills that was pretty

large. It was a bit of a financial stretch. But we'd had a large house in Colorado Springs. When you live ... houses are a lot cheaper there plus a big family, everybody could have their own bedroom and you had a rec room.

KIRBY: You had a lot of land usually.

TERRY: We had a reasonably small lot in Colorado and an acre here in Los Altos but we moved into a nice house and everybody had enough room to rattle around in and the kids got into school. And then I got overly involved in the computer business from day one.

KIRBY: Now, I want to get into that. I just wonder, as a preface to that, the data products group had two principal product families: calculators and computers.

TERRY: Desktop calculators they were called.

KIRBY: Desktop calculators? Yes. Now, I was thinking maybe we could, you could, go back and we could talk about how these things originated and grew up to the point where you ... So, let's talk about the calculators first. That... the springboard for that was the 9100.

TERRY: It was the 9100 and when I got involved in the early '70s, that was the only product. We had a whole new product line on the drawing boards but the 9100 was the name of the game and it was rip roaring success! And so that organization was really in great shape; they were the envy of the company in many ways! They had growth, they had really good profitability. They had HP Labs turned on. Hewlett was in love with the machine. Everything was really going their way and what we had ...

KIRBY: That was the one that Tom Osborne came in to HP. I guess that story has been told.

TERRY: Tom, you know, the 9100 ... we'll really have to check the record here but I believe the 9100, the first desktop calculator, got started even before Tom. Tom came along mostly with the pocket calculators. But he must have something to do with the desktops but I'll never forget coming back from a trade show in Boston, where a company called Mecatronics) They were actually the first developer of the desktop calculator and I brought back a bunch of information on this machine and gave it to John Cage and he and Barney started pouring over this stuff because there was good info. What you had to do to make a desktop calculator was to invent something called an algorithm and an algorithm is essentially a mathematical shortcut. For example, in a calculator for a trig function or a log function (sine, co-sine, log, antilog, base 10, base E, all these scientific things), you wanted to calculate what it was. You didn't want to store in memory the entire math and trig tables; you just couldn't do that. So you had to calculate each time...

TERRY: ... and so you invented a formula like an algorithm it was called, in order to get from here to there to calculate these things every time you wanted. If you wanted the cosine of 30 degrees, you made a calculation on how to do that. So this development of algorithms was really important. There was an algorithm that was invented at Bells Labs. Barney knew about it. It was called the "Tukey Cooley Algorithm" and it calculated trig functions for an automatic anti-aircraft gun, called the "Skysweeper." It was a gun with a radar attached to the side of it that was developed toward the end of the Second World War to shoot down aircraft and part of the development of this thing was this Cooley Tukey algorithm in order to calculate trig functions, a shortcut, fast way of calculating the functions so you could aim this gun where you wanted it to go. And that Barney got very interested in that and he got very interested in this whole subject of algorithms and these clever algorithms, these mathematical shortcuts, that was very much at the heart of the 9100. You know, you could press a button and get a trig function real fast!

TERRY: You know, algorithms also have a ... They're not 100 percent accurate. They have an accuracy and they also have some propensities at the extremes to do some strange things. So if you're calculating the co-sine of zero, which as I recall is 1 (I'd have to look up my trig

tables), you might not get 1. You might get something or you might, in some cases, the algorithm would blow and it would go into a loop and never stop or you'd get some really wild number. I mean, these were the extremes. Nobody in their right mind would ever calculate the co-sine of infinity or the sine of zero but you were really concerned all the time about the accuracy of these algorithms and whether at the extreme limits, it would do something really wild. And this is probably the era where bugs, a term used in the software industry all the time, crept into HP. You got bugs in the algorithm. And then what is the severity of the bug and is it an anomaly? Or is it a real problem? And all kinds of semantics went around it to describe how these things behaved. Hang on just a minute. As memory serves me, the 9100, at least the beginnings of it, pre Osborne. Now, Tom got involved both with the 9100 but particularly the pocket calculators. Tom had been working at Smith-Corona Marchant across the Bay at San Leandro. SCM was one of the leaders in desktop calculating machines. They were mechanical. People like Ed Van Bronkhorst and Frank Cavier, any accountant worth his salt, had one of these SCM mechanical calculators on his desk. And it was a big complicated mechanical.

KIRBY:I remember those!... and it had a … in the early days it had a Hand crank on it and then later on, they put an electric motor in it. It had this character that went back and forth. But these dials kept whirring.

TERRY: Yes, yes, it made a lot of neat noise. SCM, they had a giant investment in a machine shop in San Leandro to make these things and they were the king of the hill. And they had a small electronics group at SCM that invented probably the first electronic calculator in the world It was about the size of a typewriter. It had a cathode ray tube, a small cathode ray tube, on it and all it could do was add, subtract, multiply and divide, and store numbers. It was a big, about the size of the 9100, but it was a simple 4-function calculator and that ... Tom Osborne was part of or worked in conjunction with that electronics group at Smith-Corona Marchant and he got interested in making something like that but for scientific applications. These trigonometric functions and logarithms and so forth. And the SCM management, they weren't doing very well with their 4-function calculator because it was very expensive for what it did and they didn't really want to get into the electronics revolution because they had this giant investment in this machine shop which was not going ... and they were going to have to change all their technologies. So they poo-pooed the whole project and Tom left SCM in kind of a huff and said, "If you guys can't see the future, I'm going elsewhere!" And of course, SCM proceeded to go down the tubes over a period of about 10 years, when typewriters went away and the mechanical calculators went away and the electronics revolution rolled over them. Tom is a very unusual guy. I see him occasionally. He did not want to be an employee. He just felt like he didn't want to be tied down. It's not that he didn't want to work hard. Gosh, he was here almost every day from 8 to 5! But he just didn't want to be an employee so we worked out, Bill Hewlett worked out a consulting agreement with Tom, plus he gave him a bonus, a calculation on a certain percentage of the profits that were earned by I guess it was the 9100 and then by the pocket calculators over a certain period of time. It had a ... it didn't have a dollar maximum in it but it did have a time limit. As memory serves me, we paid Tom something like $6 million over the contract.

KIRBY: Yes, I heard from some people that the arrangement was very generous with Tom,but of course, some of that was because we didn't know how this would ...

TERRY: I don't know the percentages. It wasn't that they were so generous. It was this thing took off like a rocket! And I mean, we paid Tom a lot of money but the Hewlett Packard Company made a lot of money also.

KIRBY: That's right; everything is relative.

TERRY: And we had to budget this and stick it on our financial statement as "Other Expense"

and it was a certain amount of "hostility", I guess is the right word, within the ranks of the engineering community on why are we paying Osborne all this money when we do all this work? It wasn't real serious but you could kind of feel it occasionally. All you'd have to do is say, "Look! A deal is a deal. We signed a piece of paper with this guy and look at all the money we're making on this thing, and by the way, you're not doing too bad either, Mister Engineer!" So sharing your success with those who make it possible. But it really was unusual for HP to enter into that kind of arrangement. But Tom was ... he was not only very bright and very smart, he was very personable. He got along great with the divisions. He was great with customers. A very unassuming kind of guy.

KIRBY: Yes, he was.

TERRY: So if it were a different kind of person paying this money to, it may have been a bigger problem but it wasn't that big a problem. Anyway, we had the 9100. Now, in the computer biz...

KIRBY: Ah, excuse me. Some other people involved in the 9100. I guess I remember Paul Stroft

TERRY: Paul was involved, that's for sure. I can't remember all the names up here.

KIRBY: No, I can't either … Dick Crawford, Greg Justice, people like that. Again, the journal articles would give us a kind of who's who of who'd been involved in it.

TERRY: The 9100A had a real manufacturing challenge that the Loveland people were good at taking on. They had a pc shop at the time. This machine had a read-only memory. That is, it had instructions stored in hardware, instructions for these algorithms and the basic operating system that ran the thing. Incidentally, it also had a real challenge in inventing a thermal printer. We had a little printer on this thing and instead of a mechanical noisy printer, it was a thermal printer. That was a whole separate challenge in inventing a quiet thermal printer that could print the information and give you a tape. But one of the biggest challenges was the read-only memory. It was not feasible at the time to do this in semiconductors and so instead it was done on a printed circuit board. It was about a 6- or 8-layer printed circuit board that was approximately 10" x 12" or 14" and it was in the printed circuit pattern and the way you put this whole sandwich together that became the read-only memo Barney got very involved in this. There was a lot of technology, printed circuit board technology, developed in order to implement this read-only memory. We only used it in the 9100. Semiconductors came along soon enough. There was a 9100B, and I don't remember exactly what changed between the A and the B; the product records would tell us. But the pc rom did not last a long time. Semiconductor memory advanced enough that we could do it, the read only memory, in semiconductor memory.

KIRBY: In looking at annual reports, in 71, they introduced the 9800 Model 10 Programmable. Was that kind of a child of the 9100?

TERRY: No, it was a whole new product family. It took a lot of things that we had learned from the 9100, obviously, in terms of the algorithms but it was a whole new, it had a new case, new styling. It had a different readout. The readout on the 9100 was a CRT readout and it worked all right. The tube was a special tube made in Colorado Springs; kept people there very busy making tubes. But it had some problems and it was kind of expensive and light-emitting dials had come along to the point where we used them in the 9810 and you know, there was shared technology in the plastic molding of the keys. The 9100 keys, by the way, were a two-shot molding. That is, inscription for the number or the alpha on the key was actually a second color of plastic that went all the way through the key. It wasn't just put on top of the key and IBM typewriters are made the same way. And this was really tricky to do and slightly expensive but it was real quality! These things would never wear out. There is no way you could wear the legend off the top of these keys so it was an example of a whole bunch of things that traditional HP, you know, it was going to be the best! And it really was that good

but the 9800 was totally different.

KIRBY: And then in the annual report, it showed a calculator products division in Loveland.
KIRBY: And it was back there because of this technology?
TERRY: It was back there because the 9100 was there. The 9100 had been moved from here to Loveland.

KIRBY: Who was the manager then? Do you know?
TERRY: Ray Demere must have been in charge but Tom Kelly, who was the marketing manager of the Loveland instrument division, soon became the division manager of the calculator products division and worked for me when I became the computer guy. The 9100, let me tell you one story about the 9800. The product that was going to replace the 9100 was called the 9820. It was a very different machine in terms of the way you programmed it. It was named "Keyper", "key per function". Again, Barney was right in the middle of how this thing worked and it was quite an innovation but it was a little bit more radical than the 9100 and a little bit more expensive. It had a different kind of readout on it, more lines. But a really neat machine. We sold a lot of them but the story is that we envisioned a family of products stretching from what was called the 9810 to the 20 to the 30, and we had different models in mind and we were working on the 9820, this fairly radical machine. At the same time, we had a competitor called Wang Labs. Now, Wang Labs later became fairly famous in the computer business and failed. They had some similar kinds of machines, scientific calculators, and Dr. An Wang, who ran the place, tells some interesting stories about competing against HP in this era that are in a book that he wrote about the early days of these calculators. Anyway, we're working on the 9820 and Wang introduced a new product that looked like a real threat to the 9100. It was less expensive than the one we were working on called the 20 and we were really worried and we thought our business could go down the drain. So we decided that we had better get this thing called the 9810 introduced faster than this thing called the 9820. So we rearranged the priorities schedule and Barney didn't like that at all! And he really took us to task.

TERRY: But we were following kind of a combination of our business instincts and he was following his scientific instincts, and we were both right; it was just a matter of timing. So we switched over to the 9810 and got it in the top of the priority list. Now the story I wanted to tell was we had plastic molding products, tooling, being done by a sub-contractor in the New England area. When we'd send the drawings to this plastic molding sub-contractor, we'd have a model number on it (9820, 9810) and we told the plastic molding tooling guy that we were ... slow down on the 9820 tooling and we're going to go full blast ahead with the 9810 tooling. I don't remember how, but somebody within the division in probably a casual conversation with this plastic molding guy found out that they did molding or tooling and molding for Wang Labs and that Wang Labs had found out that we had changed the priority, and you could tell by the model numbers that we were going for the "Stop Wang Labs" product before we got to the 9820. And what this touched off was the beginning of model, names instead of using model numbers, of using names. This was Tom Kelly. Tom told me this whole story and expressed his concern and I said, "Well, why don't you just name these products until we get them on the market?" Like IBM does; IBM was famous at doing this. And I frankly can't remember what we named the first product.

KIRBY: But that's how it started?
TERRY: That's how it started, with this concern about competitors finding out through vendors what you were doing, because there was a certain amount of intelligence in the way these model numbers rolled up.

TERRY: I can't remember the first name but I can remember the second or third name. Bob Watson was the R&D manager of the calculator division and he had a very nice looking

secretary named Carol Smotherman, and one of these products got named "Carol" and of course that really alienated every other female in the entire division because the engineering manager's secretary has got a product named after her! And this thing kind of backfired on us or on Tom Kelly and Bob Watson. But, you know, it wasn't a bad idea. We agreed these names were not going to escape outside the company; we'd use another name. But everybody had a little fun naming these products and of course, it spread like wildfire all over the company and today you get all kinds of wild names of printers and calculators and other things going on, but that's how it got started.

KIRBY: Now, let's switch over maybe to the handheld calculators, the evolution of those, how they started and so forth.

TERRY: Well, again, I was sitting in Cupertino. I had moved back here. I was called a group manager of the data products group. I don't think I was a vice president yet; that came along a little later.

KIRBY: That happened in '72, according to the annual report.

TERRY: Right. That would have. This would be '71. I was down on the Cupertino site. Now the Cupertino site it's still there today was about a 90-acre site, 70- to 90-acre site, that was originally purchased owned by Varian and they had put up a building down there for I believe it was their vacuum products division, and that division got in trouble or had some change of strategy or something, and before I got involved, HP had purchased the land and the building from Varian and moved what was the Palo Alto division to Cupertino. This was Tom Perkins would be in charge of it at the time, and it became the Cupertino division. It later ... That name didn't last too long; it later became the data systems division. But it was sitting down there as the Cupertino division and as group headquarters. There was at the time a low ceiling office building, a single story, in front of a two-story manufacturing building. And this low ceiling office building was really scandalous by HP standards! The darn thing had carpet in it, of all things!! That was looked upon by the rest of the company as absolutely, you know, scandalous that this thing was totally carpeted. I'll never forget somebody in probably the instrument part of the business told me one of the really scandalous things that went on down there was people had electric pencil sharpeners!

KIRBY: Oh, really? That was there?

TERRY: That was really scandalous!! That was a big deal. Nobody else in the company had an electric pencil sharpener but when Tom Perkins had moved down there, he decided ... The carpet we had inherited from Varian; the electric pencil sharpeners were put just by the people and there was a certain amount of "We are different. The computer business is different. We're better. To hell with the rest of the company. We're going to do it our way." Blah, blah, blah. And there was a whole bunch of things like that. Probably the cafeteria food was different and the donuts were different and stuff like that. But I'll never forget the electric pencil sharpeners; really scandalous! But anyway, I was sitting down in Cupertino and again, the phone rang. I had known that there was something going on in HP Labs called a "pocket calculator." I was so busy learning my job and fighting fires in the Cupertino data systems division, that was about the last thing in the world I needed and working with Kelly and peripherals was a whole other story. The phone rang; Hewlett says, "Come on up here. I want to tell you about a project we're working on and I want you to read a report." About two weeks before that, a group of people had been in here from Stanford Research Institute. Bill had a young marketing guy by the name of Jim Treybig, who had been working in the Cupertino data systems division, working with Stanford Research and HP Labs on the whole idea of market research for the pocket calculator, the HP35. And Treybig was doing this as a kind of a project and I didn't hear this presentation by SRI but Bill sent me the report and said, "I want you to read this and then come up here. I want to talk about it." So I read this report from SRI about the HP35, which was being developed by HP Labs and Bill Hewlett

and Barney. And it essentially says that "We don't recommend that you go ahead with this project. You can buy a really good slide rule for $20 and this thing is going to cost several hundred dollars or more, and it will have a really very limited market." It was kind of the market size versus price more than anything else, not that we couldn't do it. So I had read this report and, you know, I didn't know a heck of a lot about it and I was kind of skeptical about what they said and I was kind of mostly skeptical as I think a lot of people at HP were because it would be a helluva lot of fun to try it! Whether there was a big market or a little market. And so I read the report and I came up and I talked to Bill and he asked me what I thought and I told him. And we sort of talked about it and we sort of, on the back of an old envelope, figured out that if we could sell 10,000 of these things, we could cover the out-of-pocket costs of the tooling, including the integrated circuit tooling and the plastic case tooling, displays and so forth, and you know, if we sold 10,000 and then it kind of flopped after that, well, we'd have been out the money we spent at HP Labs but that was kind of high risk money anyway and we'd have earned enough money that we could cover the cost of this tooling so, nothing ventured, nothing gained. And besides, you could tell both Hewlett and the labs and me, too, we wanted to do it! It seemed like a helluva lot of fun!!

TERRY: Now, the product was being developed in the labs. A really great guy named Tom Whitney was the, you know, kind of the appointed leader. There were a lot of leaders: Tom Osborne, Bill Hewlett, Barney and a number of other people. But Tom Whitney was the guy that had to make this thing work and it had a number of innovations all over the place: the keyboard, the displays were being developed at HPA (I guess it was still called HP Associates), the components group. That turned out to be one of their really big challenges. This was 5 digits times 3 different displays and they cost, 15 digits cost almost $5.00 a digit. So we were talking about $75 just in the display alone.

KIRBY: Really, in the display.

TERRY: There was a lot of really clever things in the software and the algorithms. There was no such thing as a commercial microprocessor really available, particularly to handle this chore, so there was a custom microprocessor being designed at MosTek in Texas. I'll never forget going down to visit MosTek and watching them working on a layout of this special IC that went into this thing. The way they worked, this was the days before fancy computer-tools. They had a piece of paper on the floor that was about, oh, 12' by 16' paper and they had these little tiny oriental girls in smocks and gloves going around, making marks on this piece of paper!

KIRBY: On this huge piece of paper?

TERRY: On this huge piece of paper that was the layout of the chip.

KIRBY: Incredible!

TERRY: Really done crudely and MosTek, of course, we were totally dependent upon these guys. There were some really good people there: L.J. Sevin, who went on to on venture capital and the guy named Barry Cash. But we stayed real close to them in terms of the layout of this chip because it was state-of-the-art kind of stuff. These were ex-TI people and they pretty much knew what they were doing and they really made major contributions in this thing. But we agreed and we would try and go ahead. HP Labs rolled along with the invention. Hewlett, in some discussion, I believe at a kind of an executive committee meeting, said something about organization and who was going to be responsible for taking this on from HP Labs.

KIRBY: Okay, Bill, you were talking about the 35.

TERRY: Yes, the 35. The initial design objectives included many of the things that were in the 9100: the trig functions, logarithms. Those were the major things. But Bill Hewlett was the one that said, "The design specification has got to be big enough to ... or small enough to fit

in my shirt pocket." He gave those instructions to HP Labs and the story goes I wasn't there that they quickly got their ruler out and measured the width and depth of Hewlett's pocket to make sure that they could get something. But it was ... Bill laid out a real tough design challenge and it was a tough challenge to get all these things packaged up with a battery that would last a while in a pocket-sized device. So Bill says, "Terry, you've got to figure out how to get this thing into production and make something out of it, okay?" We had been this thing pretty darn quiet. There wasn't any competition out in the marketplace but we had learned the lesson through the years about the premature introduction of products and we wanted to really get this thing well under our belts, so to speak, before we told anybody about it. So there was a certain sense of security and secrecy about this. So I decided that we would call this "The Advanced Products Division" (APD). That was about as innocuous as a name that you could think of...

KIRBY: That's right. It could've been anything.

TERRY: ... versus the "pocket calculator division" and I was in Cupertino and I went to the division manager of the division there, data systems, George Newman at the time, and I said, "I need about 10,000 square foot of space in this far corner of this building, so I want you to move this warehouse." And he kind of grumbled about that and said, "Why?" And I said, "I'm not prepared to tell you why. I just want 10,000 square feet of space." And we carved out a corner of the building and we put up a 10 foot high partition all the way around it, a locked door around it and we started some early prototypes. I recruited some people from manufacturing Ray King, who became the manufacturing manager and mostly people from HP Labs. We bought some equipment. We got this thing. We started building prototypes. It was a lot of HP Labs' labor and work but we had a kind of fledgling team on the other end to cut or receive this idea. And then I must have talked to Hewlett about this. I decided this thing was going to need a leader and I looked around for people that I thought might be good at this and I, for some reason or another, decided that marketing and distribution was going to be a huge challenge. I had a lot of faith in HP Labs engineering. And I talked to a guy I had known before named Alex Sozonoff, who was in Europe and I sold him on the proposition of moving to the United States and taking on this thing. Now I was getting a lot of flak from the Loveland calculator division because they thought they ought to take this thing on.

TERRY: This is another calculator and I didn't think that was a very good idea and neither did Hewlett. He really was worried about that and it was because the Loveland calculator division had a real tiger by the tail.

KIRBY: They had the 9100 series.

TERRY: The new 9800 series was about to come out and, man, the last thing they needed was another huge challenge on top of it and they had Wang Labs just beating them up, too, and they didn't know anything about the distribution and neither did anybody else, but if we were going to build it, we might as well start it within a separate organization. So a separate organization was set up and Loveland swallowed their pride pretty gracefully, and Alex moved here from I believe it was in Geneva and he became the leader of this thing. He recruited a number of people and we got the first announcement out in January of '72 ,I think.

TERRY: And you know the story. The thing just took off!

KIRBY: We introduced it in New York at a press conference...

TERRY: I believe so.

KIRBY: ... in February, I think.

TERRY: And a number of prototypes we had probably produced maybe a hundred working

models, prototypes, call it what you want. And of course, people who had them were the hit of the airlines as they showed this thing off or at scientific meetings because people just went crazy over this ability to calculate particularly the trig and log functions with the press of a button. What you could do is you could call these things up where before, you had to look them up in this big table, the calculations with them.

KIRBY: Now, it was called the Model 35 because it had 35 keys?

TERRY: It was called the Model 35 ... Those of us Alex and I and probably others we were learning about consumer electronics and retail marketing as we went along. We didn't know anything about it. But one of the things that we thought would be neat is to brand name it and we didn't hire a consultant but we went around to people in the labs, Alex and I, and we had about a 4-page list (I'm afraid it's lost) of names to call this thing. One of them was "Captain Billie's Whiz Bang Machine"! Billie being William R. Hewlett. One of them was the "Math Marvel" and we had all these names and we were looking for a Coca Cola or a Xerox ... ... some name like that and we went up and down this list, and I remember we over it with Hewlett and we had a great deal of laughter over the list and we never did find a good name. We just couldn't find one! So we said, "Well, hell! It's got 35 keys; we'll call it the HP35." "Well, we can't call it the HP35," somebody says, "because the corporate rules are that model numbers from zero to 100 are reserved to somebody." It was probably the Santa Clara division; they made a frequency standard call the 100. And beside Boonton has got a model 37 and so forth and so on. And I said to whoever said that, I said, "That's a bunch of bullshit! You let me handle this." So I called up whoever was the keeper of the corporate model number records and I said, "Bill Hewlett and I have decided..."

KIRBY: That's great!

TERRY: This is how it's going to be and they kind of gulped hard and so they reserved zero to 100 for calculators. Small numbers for small products. So we got to call it the HP35. You know the story. It just took off.

KIRBY: Let's talk about the pricing.

TERRY: Ah, yes!

KIRBY: How did that occur? It came out at $395.

TERRY: Well, the way to price things, most people agree with, is you have got to go into the market and say what is this worth to the customer? That is where the price is set and what you do is, as you're developing, you keep listening to that number and as long as your costs are less than that number, you keep going ahead. The minute your costs get to be higher than that number, you stop and change. Well, there wasn't anything in the marketplace that was comparable. The only comparable thing was a K&E slide rule. It was $20; a really nice slide rule was $20 with a case that you could wear on your belt and remind me to tell you about the case for the pocket calculator. So there wasn't anything in the marketplace. So what we did, you know, add up our costs and they were pretty high. The MosTek chip must have been $50; the displays were $75; then the labor and the overhead and so forth got this thing up to at least, oh, probably about $300, and so we just picked a number out of midair: $395.

TERRY: That was a little bit of bush league pricing. We had been encouraged by people like Noel Eldred and others not to use numbers like that; it was either going to be $400 or $800.

TERRY: It was not going to be $99.95.

KIRBY: Like the car dealers.

TERRY: Exactly, you know, trying to make it seem a little less than it was. So that was a bit of a breakthrough and I'm sure some people who I will remember grumbled about that, you know. $395 bush league pricing. But at $395, we were not making a scandalous amount of money

on it, particularly because of the costs of the display. But you know what happened? Once the volume started skyrocketing, the costs of all these components came down really fast and we started making a huge amount of money and at the same time, maybe I'm getting ahead of this story, we got absolutely overwhelmed. I mean, the orders were just pouring in! And we had this little 10,000 foot rinky dinky corner...

KIRBY: Corner of the building.

TERRY: ...corner of the building in Cupertino and we leased the one across the street that was available but our ability to keep up with the manufacturing was just sliding by every day and that's the reason we went to HP Singapore and said, "Hey! We need some help here, guys. This thing is about to explode and we need another manufacturing source and you guys look as good as any." And they started taking it on. Now, years later, the IRS came wheeling in here and unloaded on the Hewlett Packard Company because they accused us of trying to avoid U.S. taxes by moving a great deal of this production offshore. And I remember giving a deposition to some IRS attorney and that wasn't my intention at all. I didn't know anything about taxes. The operating people were immune from taxes.

KIRBY: Yes, the last thing in the world you would think of.

TERRY: All we needed was volume. No ... Forget the taxes! We settled up with the IRS and inter-company pricing thing, and so forth but the thing really took off. We started getting orders.

KIRBY: Now tell me, the projections of various people were so conservative. I guess I heard along the way that Bill Terry's projection was among the high projections and it was 10,000 units, and that became because of your conversation with Hewlett.

TERRY: 10,000. That 10,000 thing was kind of a go/no go. Shall we do this or should we not do it? And this was kind of a "Let's see, how much do we have to sell in order to pay for the MosTek tooling, the plastic molding, the start-up of the displays?" and we added that whole number up and said, "Well, if we can sell 10,000 of these..." and Bill and I said to each other, "I'll bet you we could sell 10,000 to our friends!" Just people we knew in the scientific community.

KIRBY: And then if you take the United States and split it into 50 states and, you know, how many do you have to sell?

TERRY: We didn't even go that far. After it took off, it was just a thrill a minute in terms of, Jesus Christ, how many of these things are we going to sell? Is it going to be 1,000 a month? I mean, probably the largest selling product that HP ever had, single product prior to this, oh, maybe 150 a month, 100 a month was a big deal. A big deal! So now, we're talking about thousands a month and then later it became 10,000 a month so whole new ideas about order processing and manufacturing all had to go into place to say nothing of distribution. The order processing was a thrill a minute. We were inventing it as we went along. I'll never forget. I think I either got directly in the mail a nice letter from a guy named Gold at Cornell University who was either famous; he may have been a Nobel Laureate in astronomy and he had bought one of these things and we had ... I think he paid for it with cash or credit card and in setting up a credit card relationship. Setting up a credit card relationship, that was a whole new deal! Got that started off the ground. Anyway, we sent him an invoice for a penny. He had underpaid by a penny and so our computer sent him an invoice for a penny and he wrote a really nice letter that said, "You know, you better take a look at your system." So we figured out how to cancel invoices for less than a dollar and all these things you learn as you go along.

KIRBY: And then you had to figure out how you were going to sell this through retail.

TERRY: The first thing we did was, you know, how are we going to sell this thing? Well, like we said, we're going to sell it to our friends and they're in the electronic instrument business and

so what we'll do is we'll let the standard instruments sales force sell it. Now I remember John Young and Al Oliverio, they didn't like that at all because they wanted the instrument sales force to sell instruments and not not fiddling around with all this glamour because it was a helluva lot of fun to march into Hughes Aircraft and show this thing off! And I must have gotten some help from Hewlett or Boniface or somebody because we said, "Yes, we're going to have the instruments sales force sell this and we're going to have the computer sales force sell it." Although they were a relatively smaller group. So the early sales all came in through our standard customers. Raytheon bought 50 and Joe Blow Engineer at Hughes would buy one and they all came rolling in through our standard system. And we started thinking about other means of selling this and one of the first things that we did, Alex and I went over and visited the Stanford Book Store. That was actually the first retail outlet and we talked to somebody at the Stanford Book Store and they said, you know, "This looks like a really intriguing thing that students would like" and we were real neophytes in terms of the kinds of margins in pricing that goes on in retail thing and we said, "We'll give you 20 percent off' and of course, they exploded! And they wanted 40 percent and we learned real quick like that we couldn't legally or otherwise control the prices. Once we sold the product to the Stanford Book Store, they could do anything with the price they wanted. That's what happens in the retail chain. You can't maintain the price. So we ... Our costs were coming down fast enough that we agreed. We compromised. I think we gave them a 25 or 30 percent margin and the demand was so high, they had no reason to cut the price at that time, so they sold it for $395 and we learned how to ship them over to the Stanford Book Store. And then about two months after that, and I think it is in the Packard book, the story about going to Macy's.

KIRBY: That's right.

TERRY: And Macy's was starting up these things called "Electronic Boutiques" within their stores and we went to this guy in San Francisco who had a Jewish name. A lot of the people in the retailing, particularly big department, stores are Jewish by background or ethnicity and this guy was really smart. I mean, he'd spent his whole life in retailing and Macy's, and we showed him the product and he didn't know anything about science and engineering but he thought it was really neat, and he wanted a 40 percent margin and we agreed that we would try that and see what we could get out of it and then that's the part of the conversation that's in the book where one of us, either Alex or I said something about "Send us the orders", you know? We were thinking we would...

KIRBY: That's right, sight unseen!

TERRY: The consumer would walk into Macy's, they'd look at this demo, they'd say, "Yes, I want one of these!" The guy at Macy's would send us an order. We would send it back to Macy's. The consumer would come in a week later and pick it up. That's how we thought it might work. That's when the guy looked at me and said, "Sonny, you young boys don't understand! If we don't have it in the store, we don't sell it. So we've got to have them in the store." "How many do you have to have?" "We've got to have 50." "Oh, my god! Where are we going to get 50 of these things?!" So anyway, we stocked them up and they did pretty well. It was not a rip roaring success for Macy's. These electronic boutiques have come and gone within the big department stores.

TERRY: But they sold some. It was a very prestigious item and we sure learned one helluva lot about dealers and retailers ... real fast! I bet, I bet. So then it eventually was carried by a whole bunch of outlets. We signed up big department stores in Boston, Fileen's, in Chicago, in Atlanta. Many of these department stores were doing this electronic boutique thing. And then later on, it spread into book stores. We went to all the major colleges, particularly engineering colleges, so we had a list of those, to places HP recruited. And we signed up all the big college book stores and got that going and...

KIRBY: What happened if someone sent you a check and a letter and said, "I want one of
TERRY: Oh, we got a lot of checks and we got cash and we had people showing up at the doorstep down here with $400 in cash and we had to figure out how to handle all these things, fumbling along. As I said, we got the credit card thing established and how to take credit card orders over the telephone. And you know, it was learn as you go and a lot of people worked a lot of long hard hours setting up these early systems that supported the whole thing.

KIRBY: Tell me about "Reverse Polish Notation." Is that what it's called?
TERRY: Well, yes, it is, RPN

KIRBY: Why that?
TERRY: It started with the 9100. It is a more efficient way to enter data and make calculations, particularly scientific calculations where you may have to enter more than two numbers. The other technique is there are other notations or techniques but the other most popular one is called "Algebraic" and it is what is normally used on a 4-function calculator: add, subtract, multiply and divide. Where you have only have two numbers and you put in a number and then you put times and then you put in the next number and you press and equals sign and you get the answer. That works pretty good for a 4-function calculator. But if you have a scientific calculation where you have six or eight numbers that are interacting, it doesn't work so well.

KIRBY: Okay.
TERRY: It takes a lot more keystrokes to do it and it's fairly easy to lose track of what you're doing as you go along. And so this thing called "Reverse Polish Notation" where there is no equal sign, there is this arrow and you store numbers in registers and then you can have them interact with each other, is the way the thing works. It had been used on the 9100. Barney and Bill Hewlett also and HP Labs were absolutely adamant about the Reverse Polish Notation. This is the way to do it; there is no other way. Real scientists use Reverse Polish Notation. It is the unwashed 4- function man on the street that uses algebraic notation, and we won't have anything to do with algebraic notation! So it was Reverse Polish and then the argument began not too soon after that about Reverse Polish versus Algebraic. And today, you've got a mixture in the marketplace of our calculators and others. So we finally succumbed and built some 4-function machines for some of the business applications.

KIRBY: Oh, is that right? I didn't know that.
TERRY: Oh, yes. Oh, yes. We finally did make some 4-function machines and some of the machines today I believe (I'm not sure of this, Dave) you can switch back and forth between notations if you want to.

KIRBY: How did the word "Polish" get involved?
TERRY: It was invented by some guy with a big long complicated name, a mathematician.

KIRBY: Okay, with a lot of Z's!
TERRY: Zmazierowski or something like that and that was too hard to say so it became ... and I ... There was a difference between Polish and Reverse Polish and I can't remember exactly. Tom Osborne could tell us one versus the other. But this was the way to do it and it didn't take people, particularly scientists, very long at all to figure out how to do this. The instruction manual for the HP35 was a bit of a challenge. It wasn't quite written by the time we got it out. It was sort of in mimeograph form and we learned pretty darn quick about the importance of writing good instruction manuals that people could understand.

KIRBY: Okay. Now, I'll tell you what, Bill. I want to now get into the computer activity.
TERRY: Let me tell you one more pocket calculator story.

KIRBY: Sure, sure.

TERRY: ... that I remember. I wrote it down. Advertising. We ran ads in scientific journals that were typical HP product ads. It had a picture of the product, it talked about the features and the benefits, it had the price. Typical HP advertising. And that worked fine with the direct sales force and so forth but as we got off into these new areas book stores and retail outlets we decided that we needed some different kinds of ads going into different kinds of publications. Two stories that I remember. This was HP35 days and people in the United Kingdom decided someway, somehow, without really telling Alex or me in Cupertino, that they were going to run an ad in Playboy International!

TERRY: This was really something else! Hewlett Packard Company is going to be in Playboy International!! I'm not sure what Bill Hewlett thought about that, but... So they designed an ad. It was called "The Young Lion" ad. It was a full page color ad and it had a picture of a young guy with very long blond hair, kind of standing in profile, with his hand like this, punching buttons on something and then this sort of British text that really didn't tell you a heck of a lot what was going on here. It was kind of a teaser ad.

TERRY: It said "calculator" but, you know, it didn't say very much. But anyway, they ran this thing in Playboy International and it was expensive; it was $10,000 or something like that. And they had a either a bingo or an 800-number, I forget which, for response. And they ran this ad with great pride. And they sat back and they waited for the response. And they waited. And they waited. And they didn't get one! They didn't get one response from this thing!

KIRBY: They didn't get one response?

TERRY: So that was our one and only experience in Playboy.

KIRBY: That's terrific.

TERRY: We had ... I don't remember who the ad agency was. I don't if L.C. Cole or who was involved. If I think about it, I might remember.

KIRBY: I can't remember either. It was not L.C. Cole.

TERRY: But we were reaching out and we may have signed up some new relationships but we had a... They came up one time with a series of ads, dummies, sketches on their end and Alex and I brought them up here to show them to Bill Hewlett and we thought we knew what we wanted to do but we were really sensitive about, as we got out with something other than a standard product ad, about sensitivities in this thing. They had dreamed up an ad. There was a movie on at the time called "Bob & Carol & Ted & Alice." It was name of this movie: two men and two women.

KIRBY: Oh, yes, I vaguely remember it.

TERRY: They dreamed up an ad or sketched up an ad that had two men and two women, sitting in bed naked from the waist up, and each of one them had a calculator in their hand and the headline on the ad said, "Bob, Carol, Ted and Alice calculate the possibilities."

KIRBY: Oh, really? Is that what it was?

TERRY: And Alex and I looked at this ad and just went, "Oh my god! No way, no how!" But when we came up here to see Hewlett, and we had some ads that we liked. We knew this one was not going to go anywhere! We showed it to Bill with a straight face.

KIRBY: Oh, did you really?

TERRY: Yes, we did and Bill kind of looked at this and said, "Harumph! Well, I don't think this is appropriate." Or some words to that effect. But we had a little fun pulling his leg about this really sort of scandalous ad that somebody thought. I think they wanted to run it in college publications in college book stores, so they thought that this would really turn on the college kids but we did a few ads that were somewhat different but we never really went too far out

on a limb because, again, it was a scientific product, headed towards scientists and engineers.

KIRBY: Yes, and then I suppose you had to prepare point-of-purchase materials? For the stores.

TERRY: That came along. The Macy's people brought that up pretty fast. We went invented a demo stand, a plastic thing with a calculator in it and we started learning about, you know, they didn't want a data sheet to hand out; it was scientific. They wanted a little colorful point-of-sale material and you had to have posters and you had to help train the store personnel, college book store personnel, for example, and so the beginnings of a direct sales force calling on dealers and college book stores came up. People would be referred today as detailers; they went to these places and they trained personnel and they arranged the shelf space or the point-of-sale materials and they put on contests and they did a whole bunch of things that you do when you service dealers. And how you paid them and whether they were on a commission or not was a real challenge in the early days.

KIRBY: Okay. Now, but you did not go outside and get marketing consultants.

TERRY: We did not. We did not that I can remember, Dave. We may have gotten some along the line. I'm sure we got some different help in advertising because we were really doing something different but no, we did not. We'd had this SRI experience and, again, in traditional HP style, we thought learning as we went was probably a lot more wise than hiring a bunch of other people. SRI, even though the first experience wasn't too good, we did hire them later on when we started into the first business calculator and that was not a very good experience at all. They weren't really very helpful but the thing that was even worse about it was the people who were doing the consulting assignment, after they got into our labs and found out what we were doing, they quit and they went to work for Texas Instruments.

KIRBY: OH!

TERRY: ... who went into the calculator business in competition with us. And I got really upset and I called in the head of SRI, whom I saw here just the other day, talking to Frank Cavier, and I kind of read him the riot act. I was probably a little more angry than I should have been because these consultants can't control their employees and you always have a risk that they're going to take off with your ideas.

KIRBY: That's right. That's true.

TERRY: But I threatened not to pay the bill to SRI on this consulting assignment and I think we paid the bill, but we put a discount on it because these guys had stolen our idea and TI really didn't do that well in the calculator business but they were kind of pesky at the time.

KIRBY: While we're there, let's talk to the end of the tape about TI, about the competition, that appeared for this.

TERRY: There were at that time 4-function machines. They were fairly large. There was one made, I believe, by Sharp but it was ... You could put it in your overcoat pocket if you had a pretty big overcoat. It had a lot; it was the size of a book, about halfway between what we had and the full-size desktop calculator. And we were really totally alone without any competition for I bet two years in the scientific area, at least. What we did begin to see pretty quickly was smaller and smaller 4-function machines, and these were Japanese or Asian and we had some discussion about, you know, should we really slide down the price scale and invent a really simplified 4-function machine. We decided not to. We decided that it was a helluva big market with scientific and business sophisticated calculators and we didn't have a heck of a lot of a contribution and it raised even larger distribution problems than we already had, so we didn't ever go into the 4-function business and I think that was a correct decision. We never have. We've lowered the prices as technologies matured but, as you know, you can buy these things today for $1.50 or $3.00, just made in China by the zillions.

KIRBY: Yes, so Texas Instruments came into the market.

TERRY: They came in with a scientific machine and a business machine. And they were really the only U.S. competitor. The Japanese later.

KIRBY: Yes, that's the only one I can think of.

TERRY: Rockwell had a division that did some work. I can't remember the name of that division, but they had some things going on there also. In fact, I may have mis-remembered the people that left SRI, they went to Rockwell. That's where they went; they didn't go to TI.

KIRBY: Oh, they went to Rockwell?

TERRY: They went to this Rockwell start-up. But that thing lasted two or three years and it just kind of went away. TI came on pretty strong and even today, I believe, makes a pretty competitive line of scientific pocket calculators. And then the Japanese have got the 4-function experience under their belt, and then they started moving up the line and they, too, make a reasonable range of scientific pocket calculators. HP has had really, not to itself, but the bulk of the market for quite some time.

KIRBY: Right, right. And the profits were tremendous!

TERRY: Oh, the profits just rolled in because the price of these displays particularly, you know, $75 worth of display probably came down to $20 within the first twelve months. And we hung in there with the price. We didn't see any reason to change the price. And we hung in there with the price for quite some time. Now, as new models came along, we were competitively cautious. We started pricing them more aggressively and the prices started to come down. The next one that came along was the business calculator. That was an HP Labs invention and there were also a number of people in the finance department here. One bright young guy whose name I can't remember...the guy who used to work with Van Bronkhorst. assigned to HP Labs and he worked on a lot of the business calculations. These were the set-up keys across the top of the calculator where you could put in the period and the interest rate and the present value and the future value and making all these time value calculations. This was the HP80. The name "80" got picked out of our zero to 100 list as another place to go. We got the 35 in the low numbers are scientific and the 80 was business.