Lewis Terman: Reminiscences of Fred Terman

Interviewed by:
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Recorded: April 15, 2010
Mountain View, California

CHM Reference number: X5718.2010

Rosemary Remacle: My name is Rosemary Remacle and I'm here interviewing Lew Terman talking about his father, Dr. Fred Terman who was the Dean of the Engineering School at Stanford, Provost at Stanford and some called him the father of Silicon Valley. Lew, why don't we start with an overview, give us an overview of your father's career, his key milestones and things of which you know he was proudest. In whatever order you'd like to do it.

Lewis (Lew) Terman: Okay, thank you. Of course he got a PhD from MIT. He was Vannevar Bush's first PhD student. Vannevar Bush was FDR's Science Advisor during the Second World War and was quite a famous person, of course, in his own right. Dad had tuberculosis after he got his PhD and he almost died, as his father had almost died from tuberculosis. So he had a long recovery time and while he was recovering from tuberculosis Stanford made him an offer to come to join the faculty when he recovered, and that was...

Remacle: His own father had been at Stanford also?

Terman: His own father was at Stanford at the time, and [also] had had tuberculosis about the same time in his life, early, and had almost died from it. So Dad was very, very happy [to get the offer from Stanford] and mentioned that this gave him something to look forward to, that he would recover and he would be able to join the faculty at Stanford and start his career. At Stanford he, in 1932, wrote the first edition of Radio Engineering, and then the second edition, I think, was in 1937. Those books were very, very successful, and really made his name, I think, in the industry. He was very proud of the books. The third edition, which was done right after the Second World War, came out, I think, in 1947.

Now there's a story that's told about my father: he said that if you write one page a day, you'll have a 365-page book at the end of a year. And the point was made that that means you worked every day of the year. This says something about him. However, it also says that if you're going to write a thousand page book of all the things that happened in the Second World War, it's going to take you about three years. That book came out in about two years after the end of the war. He realized that there had been a lot of advances in the Second World War and somebody had to come out with the book and whoever got those advances worked into their book was going to be a big hit, a big seller so to speak. He did it. He was the first and he kept his reputation as having the leading book in radio engineering. The last edition came out in 1955 and that was the final [one]. He was made Provost [at Stanford] that year.

So he kept [writing] those books and did it. And I have met literally hundreds of people around the world in my IEEE efforts and my work with IBM who have learned from that book, still have that book, recognize the name and ask if I was related to the Terman who wrote the book. And my brothers and I call that, "The Question." So he was very proud of the books and he made a comment to me that some people write books for prestige. He wrote books for the prestige, for the knowledge, but also because they made money. And he was proud of the fact that they in fact made money. His textbooks were the major textbooks [in the field] around the world.

He was extremely proud of [Bill] Hewlett and [David] Packard who had been graduate students of his, and had started Hewlett Packard Corporation. And the thesis topic that he gave Hewlett turned out to be their first product that they made. So he was very happy. It was a lifelong relationship with them very happily between the three of them. And we would, upon occasion, have them over to the house, talk with them and meet them. When I worked summers at Hewlett Packard both Hewlett and Packard came by and talked to me. The people I was working with, just the assembly line for the signal processors

[generators], were amazed that I knew them, but that wasn't that unusual [for the people in the assembly area to see Hewlett and Packard].

There was a relationship between Hewlett and Packard and their workers, which Dad thought was excellent. It's the kind of relationship he thought companies should have between the management, and the people who run the company, and the people who are working there. I think it's the kind of relationship he had also at the Radio Research Laboratory (RRL) in the Second World War. He was very proud of the results that were obtained there. They were in radar counter measures. The Germans had a series of radar systems set up, [waves of radar installation], so that they could see the aircraft that were coming in on the bombing runs. And this was a work to confuse the radar to make it look like there were more planes here and no planes there. And also the ground fire was-- the antiaircraft fire---was based on the radar finding where planes were. If they couldn't see the planes, they wouldn't know where to fire and they were much less effective. So he was very, very pleased with that.

Remacle: How did he get recruited to The Radio Research Lab?

Terman: He never said, but I believe it was through Vannevar Bush. Bush was with FDR. Here was somebody who knew something, and he had been president of the IRE in 1941.

Remacle: IRE stands for International Radio...???

Terman: It's the Institute of Radio Engineers, the predecessor of the IEEE. So he was known by the East Coast establishment. And I think between them and Vannevar Bush, whom he knew pretty well, of course, having been a student [of his], the decision was made that way. I don't know the details of it, but my guess is that there was something along that line. He mentioned when he was President of IRE one of his big accomplishments was he got 14 issues of a monthly publication printed. That was the Proceedings of the IRE, got them back up to speed [on schedule]. So then he came back [to Stanford after WW2] and was Dean of Engineering.

Remacle: At Stanford.

Terman: At Stanford, yes. He came back to Stanford. I am told by my brothers that there was discussion at the dinner table or breakfast table, I'm not sure which, which I don't remember at all, that as head of RRL, which [employed] 800 people at its peak, he just simply had too much experience to go back and be head of the Electrical Engineering Department. And the Dean of Engineering at Stanford was a young person who was a perfectly good person and there was no reason to remove that person, but for some reason he left and so my father was offered that position, apparently still during the war, and came back as head of the Engineering Department [at the end of the War].

Remacle: So he accepted it during the war and then came back after the war was over?

Terman: Yes. That's my understanding, reading the legendary book by Stu Gilmore [about him], for which I really thank Stu for writing, an excellent book. So he came back and he had a vision. And the vision was the Cold War was starting. There's going to be government funding for research, so money's going to be coming in. Get that money into academia.

The professors got the money. They used the money to subsidize students to get their degrees, to get an education. Remember his view was that you get [the best] people. You don't jump seven feet by getting two, three foot or three and a half foot high jumpers. You get a seven-foot high jumper. So you educate people as well as you can. Get them as much education as you can, and then let them go out and perform in the industry. So he wanted people to get educated. The money from the government to do the research would educate the people [students], and the faculty and industry would work together. So the faculty was directly involved with industry. The problems that the students and the faculty were working on were relevant to industry, and industry would get the students who were trained properly in the right kind of areas, but were also trained to have the flexibility and the breadth to go out and do things which were beyond what they'd just been narrowly trained for. They could go on and may be valuable for a year, but then where do you go next? If they've got the right level of education they know how to go out and expand themselves and go everywhere.

Remacle: Was he the first Dean of Engineering or educator who took such a strong position on this interrelationship between industry and academia?

Terman: The only other place that was doing that was Route 128 around Boston where there were a number of companies, but I don't know if they were really doing that, whether they were interacting with MIT and maybe to a lesser extent Harvard or not. I think there was some interaction. That was the previous...

Remacle: Perhaps not so orchestrated?

Terman: That was the previous center of electronics around that area. But whether this view of academics really working with industry was done before, I'm not sure. I think his view was “we're at Stanford. We want money. We know it's going to come from the government. Let's take advantage of that and work that through for [going] forward”.

Remacle: I was interested that in Gilmore's book he pointed out that he [your father] took his students to visit companies, what we would call startups today, entrepreneurial companies, which I suspect was relatively groundbreaking at the time?

Terman: I think so, yes. There weren't that many startup companies for one. Silicon Valley, the Bay Area, was really a place where things were happening. New things were getting started and there was this opportunity to go in and say, "Hey, here's a new technology, a new area. Here's the opportunity to go and talk with them," and Stanford had people go from the university to companies ever since. And that's something that people do pretty regularly now.

Remacle: It's one of the things that when people are listing the reasons that Silicon Valley is such a success, the interrelationship between the companies and the locations of the academic institutions certainly. So when he went back to Stanford did he expect to stay there as long as he did do you think, or do you...

Terman: I'm sure he had no plans on leaving. He saw engineering, great opportunity. Yes, he was an electrical engineer from the past. He saw a great opportunity there, but he saw the other engineering departments also as being important and ones which could be advanced. So I think another step in this

list of things that he thought were important that he'd done was the Engineering Department at Stanford becoming one of [the best], if not the best, in the world.

Remacle: Who were some of the key people he recruited?

Terman: For the EE Department. Well, let's see now. Ah, he was doing the recruiting just before I-- he became Provost before I got into graduate school, so who do we have there? As I pointed out in a previous interview I was taught by Rambo. My first EE class and that was Bill Rambo who had worked with him, and quite a good person. I don't know whether he brought in [Donald] Tuttle, who was a famous person in circuit analysis or not. He may have been there before. I don't know who he brought in that much. There were a lot of really good people. Joe Pettit almost certainly he brought in. Malcolm McWhorter, who he knew quite well, and he wrote some books with Pettit also, but I'm not sure I can give you a good answer on that.

Remacle: What was his philosophy in hiring people and getting them to contribute their best, to continue to grow Stanford's reputation and place in the universe?

Terman: One of the big things for hiring people was the location. He got people out of the East who were tired of the winters, and they'd come out here and thought they'd gone to heaven, which was true.

Remacle: I'll vouch for that.

Terman: He also, I think, he gave people the flexibility. There was the burgeoning industry out here which gave people a chance to work well. So I think he felt that there was a real opportunity for people to come here and go beyond just what they were doing before, but actually...

Remacle: Did he have a relationship with Bell Labs or RCA Labs?

Terman: Not that I know of. We had a number of people, two people that I worked with, Gerald Pearson, when I was getting my PhD, Gerald Pearson and John Moll came from Bell Labs, and of course Bill Shockley came here, although it was a circuitous route, not directly to Stanford, although they were very happy to get him. And I think he also had money. There was a Provost's Fund when he was Provost, money that he could go out and get somebody and offer them extra money to get them here.

Once they saw what was happening, I think, and also the weather and the environment, people would stay here. I don't think very many people left. They were pretty happy to get here. So he was pretty good, and I think just that people came here. They saw things were happening, they had good people to work with and the center was no longer the East. It was now the center of what was happening was split between-- good things happened in the East in Bell Labs and RCA and so forth, but also new things were happening out here. So people came and said, "This is a real opportunity to do things and advance the profession." Okay, now we go through the Dean of Engineering and then we go to being Provost. That's the last thing he did where he really felt that he had made the impact. He felt at the end of when he retired that he...

Remacle: How long was he Provost?

Terman: Ten years, '55 to '65. He was born in 1900 so it's easy to remember how old he was at each of those levels. He felt that he and Wally Sterling…he gave lots of credit to Wally Sterling, he thought he was a great person…...had really advanced Stanford because now as Provost it wasn't that he was looking for engineers. He was looking for people in all of the departments. I'm not sure when Carl Djerassi came in for the Chemistry Department, but he felt getting Djerassi here was an absolute red letter day because he got one of the top people in the world who, in fact, made the Chemistry Department outstanding. Just his presence helped, but it also attracted other people, and he also led the department very well. So he had this feeling that Sterling was with him all the time, he could get people if he wanted to and he brought the technical side of the university up and some of the other sides, the other departments in the university also.

Remacle: Did he and Sterling meet regularly? Were they personal friends? Can you expand a little bit on what was their relationship like besides that they worked together very well?

Terman: Well, okay - a) they worked together extraordinarily well, b) I was down at the office and the provost office is here, the secretaries- administrative assistants were there, and Sterling was over here. So they met every day, I'm sure. Whether they had regularly scheduled meetings or not, I don't know, I suspect that Sterling let Dad do his thing pretty well. Dad certainly would let Sterling know what was happening, but Sterling, I believe, had confidence in Dad in that Dad wasn't going off and doing something wild, and let him do his thing.

Remacle: He wasn't going to go do some wild crazy thing….

Terman: Because Sterling had other things [to worry about]. The president is president of the university, but he is also the interface to the outside world, which is at least as important as running the university, particularly when you have a Provost like my father. You can let him do that [be Provost] and you can focus on other things.

Remacle: What was his chief responsibility, or what were his chief responsibilities as Provost on a day-to-day basis?

Terman: Well, I never thought about that. It's [the Provost] the academic director of the university, which means that I assume he's got a responsibility for the budget, although he never really mentioned budget that much, probably he worked that out with Sterling. He was involved in hiring, particularly, I think, in Dad's case, in hiring new people [faculty, to improve the university]. If you want to upgrade a department what do you do? You go out and look for the best person you can to fill a vacancy in that department. Beyond that, good question. That's what he seemed to spend his time doing is looking for, searching for talent. There was the article in Reader's Digest [about him], “He Searches for Steeples with Talent”.

Remacle: So let's ask an obvious question here. So what was he like as a father and you as a son both as a kid and as an adult? What was your relationship with him?

Terman: By present television sitcom standards he was not a hands-on father who was there all of the time or “*Father Knows Best*” father. He was there. He was always accessible. I could walk into his office [at home] any time and ask him a question or say something or whatever, and he would never say, "Get out. I don't have time for you," or "Could you come back when I've finished writing this chapter," and so

forth. So he was always accessible. We always had dinner together. I think I went off to school before he had breakfast, but I'm sure there were times maybe over the summer that we had breakfast together.

Remacle: Where you had a family breakfast?

Terman: Yes. I never overlapped my two brothers in school. They were far enough ahead of me. I was the third child and so I was-- also I was, I could say modestly, was not a problem to anybody. In my own bubble I had my interest, my friends. I didn't get into any trouble and so forth. So there wasn't any...

Remacle: Why weren't you one of my sons? [laughs]

Terman: My mother used to comment. She said that other faculty mothers said, "Your children never fight. What have you done?" So I wasn't a problem. I didn't require constant attention. I did my thing. I knew what I was supposed to do. He was there. We did have some vacations. During the Second World War we spent a summer, let's see, we spent a month down at Martha's Vineyard where he was there on weekends and would go back to Boston to the laboratory during the week. And then on Buzzard's Bay which is, for those of you who don't know, it's in sort of the base of Cape Cod. One of our neighbors, [Charles] Claflin, who was the Treasurer of Harvard, they had a house down there which-- there had been a big hurricane in '44 which had not damaged the house, but it had washed away the beach and dock. They decided not to go down. They said, "Would you like to go down?" This was a great summer. We spent two and a half months down there. Dad did spend some time down there and then came down on weekends, of course.

Remacle: Did he have any athletic interests or outdoor activities?

Terman: Oh, he ran track in college, and in Gilmore's book there is a picture of him [in his track uniform]. And he did say that one of his proudest achievements was that he was running in a meet and he said, "I can catch that guy up there." The guy “up there” was from USC. He was the best USC miler. Dad caught him and beat him. So one of his things he was proud of in a humorous way was, "I beat the best USC miler." Now USC, when I was in school, was the big track school. I think we [Stanford] lost-- I don't know if we've beaten them in the last 40 years.

Remacle: How would you say your relationship and your brothers’ relationships with your father compared to that of your friends with their fathers? Was it just the standard for the period?

Terman: Pretty much. I think some people's parents had more interaction. We did do a few things, particularly during the summer when I was in college. He went up to Fallen Leaf. There was a Stanford camp up there, and I would go up with him. The other two brothers were off elsewhere. I don't remember them being there.

Remacle: What did you do when you went up there?

Terman: Walk around. He did walk, hike, and actually I think Terry was there. I'm not sure Fred was there. We walked out from Echo Lake to Desolation Valley and back which was probably a six mile round trip, something like that.

Remacle: That's a good hike.

Terman: Yes. And but he would also bring some things up to do, and there was a lake and swim, canoeing and so forth. It was not sitting around the campfire singing.

Remacle: No Kumbaya?

Terman: No. He did enjoy that, but it was one of the things he [did] was talking to Stanford people because he was a Stanford man through and through.

Remacle: Was there such a thing as an “average day” in the Terman household?

Terman: Yes, almost every day was an average day.

Remacle: What would make up a normal day?

Terman: An average day is that we would get up and I would go off to school or whatever, and[after] we'd have breakfast. This was during the week. And then he, I think, would have breakfast around eight, between eight-thirty, and eight-fifteen, and eight-forty-five. I think he would sometimes go into his study and read through things. He'd go off to the office which was a five minute drive, do Dean of Engineering things or Provost things, and then ….this was before '55 and doing this Dean of Engineering things. Come back at five o'clock, five-fifteen; let's say five-thirty, probably when basically things closed there [at the Dean of Engineering office]. Come back, do a little bit of work, dinner would be at six-fifteen. Mother would always complain she had trouble getting people to the dinner table. She would announce it at six o'clock knowing that people weren't going to show up until six-fifteen, but we'd have dinner together until about seven o'clock or so. He would go back into the study and rest for a half an hour and then start working writing his books.

Now this is interesting, because all day he was doing Stanford stuff then “chunk”, that part of his mind closed down. “We'll open up this part of the mind and here we'll start working on this book”. And he would be there, and occasionally I would go in there and he would be reading something or writing something. He had a Dictaphone, which was a wax cylinder that you could talk into, the voice recording. And he would record the pages of the books and then they would come back, get typed there and come back [from the office the next day].

Remacle: He would have them transcribed by somebody?

Terman: Yes, and then I would see him doing changes on it and going back. But he seemed-- one of the things that looking back was kind of interesting there weren't a lot of changes. He was pretty good. Remember Mozart was famous for writing his compositions out first draft, correctly from the beginning? Well, he was pretty good at writing his book, a first draft from the beginning, which means he had absorbed a tremendous amount of information and had it sitting up there, got it out and then got it done in pretty good form.

Remacle: Also he had it organized in his head. I mean he'd spend some time thinking it through, he must have?

Terman: Yes, preliminary setting up, “well, this chapter is going to be about that, and I'm going to have this, this and this thing”. Then we would go to bed around nine-thirty or ten o'clock, and it would repeat [the next day]. That was pretty much what he did.

Remacle: What was your parent's social life like? Did they have dinner parties, go to Stanford events?

Terman: We had some dinner parties, not a lot, people coming in, Hewlett and Packard, Watkins Johnson and some other people from the University, but not a lot. There was not a lot of social life at home. Now, I think he probably went out to other things elsewhere, but that was limited because, again, he was quite a bit focused on the work he was doing. Mother probably would have liked to have had a little bit more, but also like a lot of women, was cowed by the responsibility of putting on a dinner party, and so she would do it, but it also took effort.

Remacle: It was a lot of work.

Terman: It took a lot of effort, yes.

Remacle: He's described as shy, focused and a workaholic by Gilmore. What is your response to that living with the man?

Terman: Focused very much, focused on this part of his career at the University, writing the books, etcetera. Shy, I never saw the shyness. I do know that he didn't do public speaking very well. His talks had very good content. He delivered it rather stiffly, so I suspect he was not happy speaking to people in a public manner.

But shyness, I suspect that when he went into a room and he was prepared, and he was famous for being prepared, he knew what he was going to do. He's meeting new people. I think he wasn't shy. I think he was somebody who could-- he wasn't going to glad-hand you, but he was going to come in there and be a presence and feel comfortable with what he was doing. If he went to a strictly social thing, where maybe he felt a little out of place, that's another question. On the other hand, Bobbie, my wife's parents were in the movie and TV industry, had been a producer of movies and then later television shows, and they went down interacted very well. Bobbie had very nice parents. There was a little question about how well these people-- an engineer and a movie producer [would get along]. Worked fine and they got along perfectly well.

Remacle: They figured it out.

Terman: Well, they figured they had to. But I think it was the matter that Dad had his things he did, but he also came up and could open up to people and talk with them.

Remacle: What about the workaholic adjective?

Terman: Workaholic, yes, by current standards he was a workaholic. People in the academic world, particularly until they've gotten tenure, have to be workaholics because they've got to establish themselves. People in industry who want to move up in the company have to be workaholics. So by present day standards, it wasn't anything unusual, but he was very much focused on the University. The research, when he was doing research, which is really before my time, but he produced a lot of publications and focused on the university the books and so forth, getting all that together.

Remacle: But it sounds like some of the edge of the workaholic-ness was taken off by the fact that he lived so close to home, and the fact that he did the work at home in the evening, and had a personality that allowed you to come in and interrupt him if that's what you wanted to do. So, it sounds like you had some access to him, more than perhaps somebody whose father doesn't get home until nine o'clock at night.

Terman: Yes, or whose father, when they do get home, is doing all sorts of work. There's another point. His study was on the edge of the original house they built, and they added on a living room [next to it on the ground floor] and a bedroom above it. And he chose that room [for his study], which I think was the old breakfast room. May have been the old-- well, okay anyway, that room to be his study which is in the center of the house. You could walk into the entranceway, the foyer, and he knew when people had walked in. You had a conversation in the living room and he knew people were talking there. Probably I think the walls were thin enough that he could hear people talking, and the dining room [was] on the other side, [with] the kitchen. He was in the center, so he didn't shut himself off. He wanted to be at the center of the house, which is kind of interesting. He felt he should know what was going on and he had the powers of concentration that he wasn't going to get drawn out and it wasn't going to affect him. That's something that I think is pretty rare.

Remacle: You mentioned in another conversation that he followed Stanford football and was an enthusiastic fan.

Terman: Very much so, yes, Stanford athletics. He didn't get into the basketball and baseball. They were minor, but football, yes. He had been there when Frankie Albert, I guess, Frankie Albert was the Wow Boys and there was also the “Vow Boys” in the '30s [1936], one of those high-level things [successful teams]. And he really liked Stanford football. He stopped going [to the games] somewhere around '55, I guess. He had a seat up in the president's box up in the stadium, but I think somewhere, maybe when he retired, he stopped going. But he would go to all the games. The team was pretty lousy so I think he stopped going when the team really got bad. After the Second World War, it wasn't so great. But he really liked football. He followed Tom Watson, not the IBM Tom Watson, but the golfer who was from Stanford. And one day we asked him, "Why were you listening to the radio?" "Oh, Tom Watson is playing in the golf tournament." So Stanford was it and Stanford athletes. Now it's too bad Tiger Woods came along so late.

Remacle: He would have been a Tiger Woods fan?

Terman: He would have been a great Tiger Woods fan, yes.

Remacle: Are there any other adjectives that you would assign to him beside the shy, focused workaholic?

Terman: Yes, as I said, shy, not so sure about that because he could carry his own any place he went, I think. Of course I was a young kid and I looked up to him. Clearly dedicated, and not an adjective, but seeking excellence. He liked people that were good. And, by the way, people who were good---not okay ---there's this range between okay and real good, and some people are only going to be that good, but if they were that good they had gone up as far as they could go. He thought those were good people, and he had people from the Radio Research Laboratory in Boston that were mechanics and engineers, low level people and so on, but he thought they were good people because they did what they could do and they did it well. They were assigned something and they carried it off. So he was very happy about that when people did that.

Remacle: How would you describe his value system? What do you think he held in highest value?

Terman: Oh, the ability to think and to deliver, new ideas and then deliver on it. Now that's something that you get out of the university. One of his people that he mentioned over and over again was Bill Hansen, who there's a Hansen Laboratory unless it's been torn down, at Stanford, who was a physicist and an engineer who was extremely good. He was elected to The National Academy of Science and The National Academy of Engineering, and Dad knew him quite well. And he died of tuberculosis, …not tuberculosis, but pneumonia rather early in his life. Dad said, "Here was somebody who was really outstanding because he had brilliant ideas and he was able to carry them through." He also thought that Hewlett and Packard both were brilliant people who carried out ideas and then, of course, had the social responsibility to do a company that really not only grew but also treated their people right.

Remacle: And that had values at the center of it.

Terman: Yes.

Remacle: Did you have any sense of why he chose an academic life? I mean, it seems like coming out of World War II and with his experience in the Radio Research Lab that he could have moved into industry pretty easily. What was his thought process on that, do you think, or do you know?

Terman: I don't know, but my guess is he'd been with Stanford, had great success with Stanford, and the opportunity as Dean of Engineering was a new challenge. He mentioned to me later, but that during the Second World War when he was running 800 people at the Radio Research Laboratory, he found he really liked running the show. Those were his words, "Running the show." So he found that having-- and it's not the authority, it is having the responsibility with the ability to take these people, not just yourself or a small group of people, but this whole group of people and get them in the right direction and get them moving forward, was something that he really enjoyed doing. And so I think he said….. well, he could have done that at Bell Laboratories but there would have been all sorts of pressures, whereas at Stanford it was pretty clear. You make the Engineering Department the best Engineering Department, and he understood science, engineering, and he said, "Okay, I can do that. That's the direction." How to make the Political Science Department the best in the world, or the English Department, was a totally different ballgame and he would have been out of his comfort area at that time, I think. Then when he became Provost he began to realize that what he had done to make the Engineering Department better [and that] he could apply those same rules and approaches to making the whole university better.

Remacle: How did his own father, who was also an academic, I mean, if you do a Google search today his father's name comes up first most of the time.

Terman: If you search on me his name comes up first.

Remacle: But what was his relationship with his own father, and how did that influence his decision to go into academia do you think?

Terman: I don't know on the second part of the question, however he and his father, they met Sunday morning for the morning every day of my grandfather's life.

Remacle: Every week of your grandfather's life?

Terman: Every week, yes, every Sunday day, every Sunday day, yes. He would go up there Sunday and come back around noon.

Remacle: How far away did your grandfather live?

Terman: Oh, a five minute drive. It was two miles or so. And so clearly there was a very close relationship. I did not see any outward manifestations of that other than this interaction seemed to go on. We would have dinner up there upon occasion and so forth. And I think my grandfather, who was a psychologist, was very proud of the success that Fred had had. Mother made a comment that Fred went into engineering because it was something different than his father had done. I don't believe that. Dad had been a ham [radio operator] when he was growing up. Dad wandered around the Stanford hills, hunted with a rifle and so forth. My grandfather played golf and was devoted to his pursuits of measuring intelligence. [He] Also did some marriage and the family studies also, which has sort of gotten lost, but [he] was a very well know psychologist. And fundamentally different fields, different people, different personalities, quite different personalities. I remember by grandfather as a small, warm fuzzy man, yes, but he was in his 60s at the time.

Remacle: Grandfathers can be that.

Terman: Yes.

Remacle: Of the three major career roles that he had, engineer, administrator, and teacher, and you can put those in any order you want, I guess, which was his favorite or did that change over time?

Terman: I think it changed. I think when he was as a professor in EE the career there coming up with ideas and fundamentally understanding the field so that he could write the books that seemed to be very important to him. Then he goes on and as head of the EE Department, I don't think that was that much of a change. Then running the job at Radio Research Laboratory, the whole laboratory, [as] I said he found that very interesting, so that became something that he felt was important and that he had the ability to do. That carried over into the Dean of Engineering and then to being Provost of the university. So each of these there were different steps.

Remacle: Did he have a master plan for his career or did he just excel, do something, get it under control and then move on? Did he say at some point, "I want to be Provost" or "I would like to be the President of the University?"

Terman: He never said that. He just seemed to want to do what he was doing. He may have had ambitions. He never voiced them to me and Mother, never voiced specific ambitions for a specific position. She did say that one of the things that impressed her when they got married was that she knew he was going someplace. He had a goal, a desire to move and do things, but specific position to become President of the University, no. I didn't see that.

Remacle: Do you have an idea from him what period-- it's a similar question, but not quite the same-- what period of his career did he enjoy the most, or...

Terman: I think he was really, really happy with the work that he did with Wally Sterling on making Stanford the internationally known and recognized university. The last ten years as Provost, I think he really felt was the icing on the cake. He'd done a lot of good things to move things forward, but this is where it all paid off and the whole university was moved up and became nationally visible. In fact, electronics, of course, was internationally visible. He did make a comment, I think, about the time he became Provost. He read an analysis of universities and the analysis said, "Stanford University is the best university west of the Mississippi, and in electronics is unequaled," and he was very proud of that.

Remacle: That's a nice accolade. How would you describe his life philosophy? Did he have one he articulated, or can you kind of divine one by having lived with him?

Terman: In this case, actions speak louder than words. He was dedicated to doing things, doing it right, advancing things, learning what was necessary, don't go in and fake anything or come in half-prepared. Always be prepared. Do it with this view of improving, advancing what you're working on and making it better and better, and the rest of it will take care of itself. Now I'm not sure he thought the last thing, but that seems to be what happened.

Remacle: Stanford and he intersected with several famous people. You've mentioned Shockley, and Hewlett and Packard, and Wallace Sterling, and Carl Djerassi. Are there any other people of that-- I'm trying to say the word ilk---but that doesn't sound like the right word?

Terman: I'm sure he, of course, knew and interacted with Charlie Litton quite a bit, and had a great respect for Litton. He liked Joe Pettit. He thought Joe Pettit was outstanding and he made a comment to me when Pettit was my thesis advisor that Joe Pettit would make a really good Dean of Engineering somewhere, but he wasn't going to tell anybody.

Remacle: Didn't want to lose him?

Terman: And lose him, right. Then Pettit became Dean of Engineering, went to Georgia Tech and became president of the university. So he recognized people that were extremely good. Let's see. Was there anybody else? As I said, Djerassi, he was bowled over by Djerassi, thought he was just a great person who had done a great job with the Chemistry Department. Oh, John Linville came in from Bell Laboratories. I think he may have been the first person that Stanford managed to get from Bell Laboratories, and thought that Linville was a really good first person to come in there because he turned out to be a very good academic. He did good work from a technical standpoint, but he also sort of seemed to be a centerpiece about which they were able to get other people. So he was quite pleased with Linville and thought Linville was a very, very good person.

Remacle: Now, did he recruit Shockley?

Terman: No. Shockley came in-- Shockley came out for Shockley Semiconductor. Talking to Ian Ross [a one-time head of Bell Labs], Shockley, from what Ian said, Shockley wanted to become rich. And rich implied not only rich in money, but rich in having impact. He had a Nobel Prize. He'd invented the transistor, but what he wanted to do was to take something in semiconductors and make it a product that everybody would use around the world. He would become rich as part of that, but also he would be the guy who was running this company, which was indispensable around the world. So he came out here, did Shockley Semiconductor and pursued the four-layer diode which would be a switching device to replace mechanical relays. It didn't work out. And so his dream got lost. And Shockley kind of, I guess, was at that sort of odds and ends at that time. He was famous. He was a lecturer. I heard some lectures by him, but I don't remember him having real impact. Jim Gibbons, who was working up in the EE Department at the time said he worked very well with Shockley, but other people had real problems with Shockley. So in answer to your-- I think you asked the question about Father of Silicon Valley. Dad always said that it was Shockley who started Silicon because people, really good people, wanted to work for Shockley.

Remacle: Semiconductor…

Terman: Yes, in the semiconductor world. But apparently, they couldn't get along with Shockley and so they went out and they formed Fairchild and then Intel and so on and so forth. That's half the story because the other half of the story was this vision of industry, academia and students and government funding all working together to the mutual benefit of not only those four, three entities plus the government, four entities actually, but in fact the country, and as it turned out, the world.

Remacle: When he was appointed Provost what was his reaction?

Terman: As I remember...

Remacle: This was in 1955, right?

Terman: 1955 and it was, yes, in the early part of the year because I took his course in the second half of the year when he wasn't teaching it anymore. I think he wasn't particularly emotional about it. I think he thought this was a real opportunity.

Remacle: What about your mother's response?

Terman: Ah, yes. She was pretty pleased. Her husband had moved up to [Provost]—now, the only other position he could have been was president, and his name had been mentioned for president. But I don't think Dad would have been happy. Well, hey, I know Dad would not have been happy as President because the president, at least half of his time is glad-handing people. That wasn't Dad. Secondly there was all this responsibility that the President would have of interacting with people, all that stuff that goes on that's not involved with the things that Dad did well. I'm not sure he would have been particularly happy doing that, and so when he was made Provost that seemed to be the ideal thing. He was able to extend what he had been doing as Dean of Engineering to the whole university, but without all the things

that Wally Sterling was superb at doing. Sterling was outstanding at that, just a terrific person on interacting with people, that sort of thing.

Remacle: So there was no big champagne bottle opening and “hurrahs” around the house when he got to be Provost?

Terman: No. It was more, "Your father has now been appointed Provost." And my first question, "Well okay, what's a Provost?"

Remacle: …“Should we be impressed”?

Terman: It seemed like, okay, he's going to be doing the same thing except on a broader scale.

Remacle: In the later years of his life what did he think or talk about as his major contribution to Stanford?

Terman: Oh, I think getting Stanford-- the ten years with Sterling making Stanford better and better as things moved forward. He felt there were a couple of opportunities with departments that could have been improved that just didn't happen, which he was unhappy with.

Remacle: I just thought of a question that something you said earlier raised, so I'm going to loop back a little bit, Lew. In today's world, university professors often invest in their students’ companies. Did he make any money? Did he invest any money, make any money in, say HP or…?

Terman: Yes, funny you should ask that. He got in on the original [HP] stock offering. And in fact he told me about it and I got some of the original HP stock. And that was a pretty good investment. And so that was one thing. That was very nice that Dad had enough money from the original HP investment that he was able to be satisfied. In the years of his life when he was trailing off, he didn't have financial problems. There was money there that could support things, and he gave a fair amount to the University too.

Remacle: Did he invest in other companies besides HP?

Terman: There was some Watkins Johnson [stock], don't remember anything from Litton, so the two that I remember are Watkins Johnson and HP and that was funny.

Remacle: Both nice companies.

Terman: One of the things from the era when he was back in Boston and Charlie Claflin, who was the Treasure of Harvard, was some advice from Claflin on how to invest because Claflin was involved in investing the not inconsiderable [amount of] money that Harvard had, and it was fundamentally conservative investments. So going into HP actually was a change, but he knew the people. He had confidence in the people, and he knew there was opportunity there. And he said he was going to go in and invest. Mother said that he went and took everything he had and put it in.

Remacle: It made her nervous.

Terman: I think she had confidence in him, Hewlett and Packard.

Remacle: I think you've answered this question, but let me ask it again just to make sure that we got it straight, it's a direct answer. Why did he stay at Stanford do you think? He certainly must have had other opportunities. Were you aware of any other opportunities?

Terman: No I wasn't, although as I said my brother said that there were discussions around the breakfast or dinner table back in Boston. I think he was a Stanford person. He saw the opportunities. He was moving things forward, and he never stayed in any position too long. He was Dean of Engineering from '45 to '55 and Provost from '55 to '65. Well okay, that's ten years. That's enough time to do something, but hopefully not enough time to get bored. If you're working on improving something and you get bored in ten years you probably either have been a terrific person and done all you wanted to or maybe your sights weren't high enough. So I think he just said, "This is what I'm doing. We're going to make it better, and better, and better," and he was able to do that.

Remacle: Did he have any career setbacks? Were there disappointments that he suffered in his career?

Terman: Not that I know of other than he felt there were some opportunities missed in improving some of the departments as Provost.

Remacle: What kinds of opportunities missed?

Terman: Political Science and I'm not sure-- that's the one that comes to mind. There was a brouhaha and things just didn't work out very well. They were a little...

Remacle: Was it a personnel issue kind of thing?

Terman: There was an opening and he wanted to hire a really good person in, and the department didn't want-- he didn't want the person they wanted because he didn't feel the person was good enough. The department didn't want the people that he wanted, and I'm not sure exactly how this worked out.

Remacle: What role did religion play in his life or your family's life if any?

Terman: None, none in my grandparents, none in my parents.

Remacle: Were they just not practicing Christians or were they agnostics?

Terman: It never came up. Fundamentally it just wasn't a part….

Remacle: You didn't go to Sunday School every Sunday?

Terman: I think my grandfather was, I'm not sure, agnostic or atheistic, and it just didn't.… _____.

Remacle: It just kind of filtered down.

Terman: Yes.

Remacle: And what role do you think your mother played in influencing his life choices, people, you kids, how did they interact and what influence did she have on him?

Terman: Well, first let me speak about you-kids. I once made a [joking] comment to mother, "I was an after-thought," and she said, "No. All of our children were planned." So he [Dad] and she did have an interest in [the] children. Mother raised the children. Mother made the comment that Dad had his career and she raised the children.

She was a very intelligent woman on her own. She was involved in teaching reading, and she had worked out a system of phonics, and she spent time …. there were apparently a substantial number of faculty children who had reading problems. Obviously from very bright stock, but who had reading problems. And so she would sit down with them and work through phonics to get them reading, and she was very successful. She wrote a book with her brother, who was Charles Child Walcutt, who was a distinguished professor at Queens College in New York City for many, many years, called *Reading: Chaos and Cure*. And they published it in the same place [company] where my father published his book[s], McGraw Hill. And that sounded really good except that McGraw Hill also published textbooks, and the textbooks people were very unhappy about this. [It went against the current practice of teaching reading,]and so it was not a particularly big success. But she was very good at doing that and she had these ideas. She would have gotten a PhD except she married my father and at that time [if] you get married; you don't go on to pursue your PhD.

Remacle: Thank goodness things have changed.

Terman: She didn't have impact that he did. She supported the move back to Boston during the Second World War. She said, "It's going to happen. We'll make the best of it and we'll enjoy it while were there." And so she supported the various moves that were made. So I think she was supportive. The things that happened, now did we ever get to a decision of, "Well, am I going to do this or that?" No, because it seemed that he was moving up the ladder at Stanford. If it had come to a decision of, "Well, we can stay here in California and go to Southern California and work in the aerospace industry, or I can go out to some other place and work in some other thing," I'm sure she would have had some input there. But staying in Stanford it was really that the opportunities arrived and he just moved up the Stanford ladder.

Remacle: A slightly different topic. How did you and he manage the fact that you were a student at Stanford when he was a very visible member of that community?

Terman: It was no problem at all. The fact that I was the Dean of Engineering's, then Provost's, son was no problem one way-- people recognized the name, and I had my own people. The freshman wing people knew that I was the Dean of Engineering's son, but so what?, I moved in my own bubble with my own interests and so forth and got along with people. The Eating Club that we went to, that a group of us

joined the undergraduate and graduate years, again, were a different group of people. The Eating Club was El Capitan, which was focused on musical and drama people primarily at the time. But I had gotten to know a number of them in the freshman wings.

Remacle: Did your father interact with your friends at all?

Terman: No, there wasn't that much. I was there at the University. I lived off campus as an undergraduate. After we left Encina Hall where all the freshmen living on campus lived then, I lived off campus with a group of people that I still have contacts with. And then shortly into the graduate years, Bobbie and I got married after a couple of years. And so they knew these people, but there was not a lot of interaction.

Remacle: Did you and your father have a discussion about getting married while you were still in school, about who you were marrying?

Terman: No. He was presented with the, "I met this girl." And when Bobbie…. she was at Northwest and came back and went to Berkeley. They met her. And, I mean, they thought she was great. They better have.

Terman, B.: I went to Berkeley on the way to Stanford because there were different requirements at Northwestern, I was a journalist student there, than they had a Stanford, so in order to get into Stanford I had to fulfill these requirements in order to get in. So I went to Berkeley and then Stanford in that order.

Remacle: And that sealed the deal with you went to Stanford?

Terman: You were up in Berkeley for the first time they met you [to Bobbie, off camera]?

Terman, B.: What?

Terman: First time you met my parents was when...

Terman B.: Parents, yes…_____.

Terman: Yes, because your parents had met me when I was down in Los Angeles. They approved. But then we got engaged in the summer, actually in the spring and got married over the summer.

Remacle: You became an engineer and had a relatively illustrious career in engineering in many different facets and ways. Did your father play a role in that decision? If so what kind?

Terman: As I said, I was [interested] along that line. I liked the science courses that I took in high school. That seemed to be best thing. There are other courses that I took, but those are the ones that stood out. And the physics course in the twelfth grade from Mr. Martin, the legendary Henry Martin at Palo Alto High School, seemed to do it, and that got me going in the right direction. I moved away from physics, went into EE in my junior year, still graduating in physics.

Remacle: So your father never sat you down and said, "I want you to be an engineer," or "Here's some engineering things for you to do so you can become an engineer?"

Terman: No, and whereas he had been a ham radio operator when he was young, I did not do ham radio operating. I didn't do anything like that. Neither did either of my two brothers do anything like that. So we're different people, but I had a focus that was pretty much in that direction growing up.

Remacle: Of the many awards and recognitions that he received, public recognitions that he received, which one was he the most proud of? That's not good English….

Terman: I think it was getting The National Medal of Science from Gerald Ford.

Remacle: Why?

Terman: That [was] the peak. Very few people get that, they give a few a year. And it is recognition not merely from your peers, but from your country. And it was presented in the White House. We were actually there for the presentation, so it was a big deal. And he was very proud of that.

Remacle: Did you go out and celebrate as a family?

Terman: We were back East. He got it in the East, so no. There wasn't an opportunity to do that. My mother's health wasn't too good then, so she didn't make the trip.

Remacle: Are there any stories that we haven't talked about, about your father that you'd like to share that would help round out the picture 200 years from now about what kind of a person he was?

Terman: He had a sense of humor. I'm not sure it was, you know, he wasn't a glad-hander or telling jokes sense of humor. He did tell a story—well, first he always liked to tell this story. A leak in the Stanford laboratory where Hewlett and Packard were doing their research in the '30s and Hewlett and Packard there was a leak and they put a bowl to catch the water and they put a goldfish in the bowl. And so he always told that as one of the things. Then it led into his thing about, "Well, and we hired Hewlett and Packard at I think it was a hundred dollars a month each. You can't good get people for that price anymore." So that was his story. The only joke, joke he told just out of the blue, was about people in the trenches in the war somewhere, let's say it was the Second World War, and they look up at this hill which the enemy occupies and it's dug in. There's a machine gun nest and cannon and everything up there, and one soldier turns to the other, or maybe the captain turns to the sergeant and says, "The general is giving us a hundred people to take that hill," and the sergeant says, "Generous son-of-a-bitch, wasn't he." And that's about as bad as his language ever got.

Remacle: A different time.

Terman: I remember one story he told coming back from a Stanford board meeting when he was Provost, and I was working for IBM. And he said that IBM was coming in to try to-- IBM wanted to sell their computers to universities, so people would be used to using IBM systems, IBM software and everything. So they came in and the first thing they said is, "We're going to discount the computer which we're going

to give you by," I think it was something like 60 percent, okay, so there's this big discount. "We'll pay for installing and so forth. Then we will buy back third shift, all the third shift time. So you'll get revenue from this. And then if you have other time we'll work out with you to use the other time, and so bottom line is you'll probably make a little money on this." I don't know whether Dad said this to somebody or somebody said it to Dad, but let's say Dad turned to the man next to him and said, "Let's buy two." So he had a sense of humor. He liked things. He did joke about these things. He didn't make jokes, or superfluous jokes, but he was sensitive to humorous things that happened around him.

Remacle: What about Frankie Albert? What's that story?

Terman: Oh yes, Frankie Albert. As I said, he liked Frankie Albert. Frankie Albert, I believe, was the first T-formation quarterback. Clark Shaughnessy was the Stanford coach and installed the T-formation which became the legendary thing [formation] that people used for a couple of decades for playing football. And one of the stories he said was that he heard that every once in a while Albert would call the huddle, call the play in the huddle, and then as the huddle was breaking up he would go to one of the players and say, "Run down the field as far as you can, as fast and as far as you can." So there were two people who knew what the real play was, Frankie Albert and the guy who was going to catch it. Nobody was going to give away the play, and he [Dad] said it worked every time. He always thought that was very funny because it was just somebody being a wild duck coming up with an original idea and he was impressed with that, and he thought this was a hilarious story because it said somebody went out, took the initiative, did something and it paid off.

Remacle: We've covered a lot of territory about your father here. Is there anything we've left out that you'd like to throw into the mix?

Terman B.: I just thought of something. After he retired he worked about double. After he retired he actually got to a lot of places like Korea and Taiwan.

Terman: That's a good point. That's why I married her.

Remacle: One of the reasons…

Terman: One of the many. Yes, when he retired he started going over to Taiwan and Korea to help them with their-- see, Taiwan at that time was a good manufacturing area, but what do you do? We had all these Taiwan people, Taiwanese people who would come to the U.S. to get educated and then had no place to go back [to work]. So he started working with them to get their industry so that it had a place for people to develop and then eventually it would be [doing] research, and to get their academic institutions up so that people wouldn't have to leave Taiwan. He was very successful.

Remacle: So this was an extension of his industry and academia experience?

Terman: Yes, right. Well, Taiwan's a very small country and in fact the important active area in this electronics industry is just the top [north] area in Taipei and Hsinchu, so he worked with them to do this, and was very impressed with their attitude, their enthusiasm for working. He told the story about how Taiwan was a very small island, it had three million people, it had a very small arable area, and how the Taiwanese had figured out two things they needed to do. One was to figure out how to raise enough food

so that they didn't have to spend money buying food from outside. So it was an early green revolution with multiple crops and so forth to get the food production up. And the other thing was that it was a limited area country. So, get people educated because educated people don't feel they have to have eight children to support them in their old age. And so it was education, a job for the educated people and this culture of the country working together towards an end. And he was very impressed that they had done this and come up with a result. And then after he retired in '65, he could see Taiwan really growing, and I was involved in the conference in Taiwan. He was very impressed how well that worked. He did the same thing in Korea with KIAST [NOTE: actually KAIST], K-I-A-S-T, however that's pronounced, and people from Korea still remember the name and the fact that he worked [there] so much.

Remacle: Did he give you any advice over the years that was memorable? I think it's the nature of parents that they give advice, but…

Terman: Yes. I guess I was not much of a problem, so he seemed to think things were going pretty well. He did write Eugene Fubini, who was an IBM Vice President, asking how I was doing. Fubini came back with what I interpreted as, "Oh, somebody has asked about somebody who's an IBM person. Yes, he's a bright young engineer doing well." I can't put much credit. I did meet Fubini once. He seemed to be quite a good person, and he showed me the letter. So he [Dad] was proud of the fact that I was doing okay and had come up with things.

And [then] he was starting on the downward slope. The downward slope started in the late '70s. He died in '82. And his...

Remacle: Was it a physical downward slope?

Terman: It was physical and he was having some mental problems, but it wasn't clear whether it was him. When he got taken off drugs, the mental part cleared up, but then the fog got worse and worse mentally. But when I was made the Chair, I was going to be the chair of the ISSCC, which is the major circuit's conference; he was very pleased with that. I was on the program committee and then I was in line to become Chair of that conference. He said, "That's a recognition by your people." So I think he felt things were going well, and he didn't have anything to say. So if I had asked him for advice, I think it would have happened, but I never asked for advice because I could see the IBM and IEEE thing going pretty well.

Remacle: If you were to meet him today what would you say to him?

Terman: Thanks for the excellent model that he was and for all the things that I inherited from him, and all that he did for Stanford, which I think was a great thing…… What he did for Stanford and for the IEEE, and for the Silicon Valley, and really the electronics industry and through that to the country and the world.

Remacle: Well, thanks for taking the time to paint a little bit broader picture of your father and a more personal one, certainly, than a lot of documents that I've looked at. So thanks a lot, Lew, for all your time today.

Terman: Okay, thank you.

Remacle: Thank you.

END OF INTERVIEW

