Oral History of James (Phil) Ferguson

Interviewed by: David Laws

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David Laws: I'm David Laws with the Computer History Museum in Mountain View, California. Today is Thursday, April 29, 2010 and we're here with James P. Ferguson who everybody in the industry, enemies and friends, knows, I think, better as Phil. So I will be addressing you as Phil through this session if that's okay. What we'd like to do Phil, is to talk about your career and your experiences and any interesting stories that you can add to our understanding of what went on in the industry in the early days. Please could you tell us a little bit about your background, your family, where were you born and when?

James (Phil) Ferguson: I was born in St. Louis, Missouri in 1930, just after the Great Depression started. And when I was five my family moved to Texas where my mother's hometown was in Dallas. I grew up there, went to SMU, graduated with a degree in mathematics then went into the Air Force for five years.

Laws: Let's concentrate for a moment on those earlier days Phil. What led you to an interest in mathematics? Was there a professor or a teacher or a friend?

Ferguson: Actually because I needed to work and I couldn't take any labs in the afternoon. So I was looking for something that didn't require labs.

Laws: Okay. Very pragmatic approach.

Ferguson: Hard to overestimate my level of disinterest in the entire academic scene.

Laws: <Laughs> And were there any mathematicians in the family or anything like that?

Ferguson: I'm not sure there are any high school graduates.

Laws: Not even high school graduates huh? And what were you doing at work in the afternoons when you weren't in class?

Ferguson: I was a draftsman for a small company that made long haul telephone systems, mainly for the oil fields and other remote places where they needed to communicate over long distances.

Laws: Where did you learn the skills to be a draftsman?

Ferguson: I had taken it in high school and then I was a friend of a guy whose father was a chief engineer at this company. And I went down there to work one summer. And he said, "You want to stay?" I said "Sure." So I stayed.

Laws: So you're at SMU in the mornings and drafting in the afternoons?

Ferguson: Yes.

Laws: When did you graduate from SMU?

Ferguson: Graduated in June of 1952.

Laws: What kind of job prospects were there for you in June of 1952 with a degree in math?

Ferguson: Well I probably had very poor prospects for employment, but I it didn't matter because I was committed through ROTC to join the Air Force for two years to serve my obligation, and I actually went in and stayed for five years.

Laws: And what did you do in the Air force?

Ferguson: I was a fighter pilot in the Air Force. I flew the first three generations of our jet fighters. And then after I got out, I was in the Reserve for another 15 years, in the inactive Reserve.

Laws: What level of electronic sophistication or otherwise did those fighters have? Vacuum tube based equipment possibly?

Ferguson: It's kind of interesting because before the atomic bomb, the goal of fighters was to knock down bombers and/or make their rate of loss so high that they couldn't continue raiding. If a few slipped through to knock out some civilians, that was too bad, but it was unavoidable. The game was to get the bombers. I recall in London, we lost 40,000 people to German bombers during World War II. So it was a painful loss but not critical. When the atomic bomb came along, it became one bomber, one bomb, one city and our Air Force was faced with stopping the bomber leakage completely. And since you had to be prepared for attacks at night, and in bad weather as well as during the day in clear weather, So the Air Force was faced with how do we figure out how to knock these guys down in any weather, any time of day? And they set up what was called the Air Defense Command It was a separate command that had radars, long range radars sitting on mountain tops along the West Coast, the East Coast, across the northern border, Alaska, Newfoundland, Iceland, Greenland. They were looking outward from this country to pick up unplanned visitors. If you didn't file a flight plan that got you into the expected place within ten miles or ten minutes, you would get a fighter on your wing to check out who you were.

To do that, you had to be able to find people at night in weather and for that you needed an onboard radar set. I flew the first fighters that had onboard radar and onboard fire control systems that could theoretically, find the enemy plane in any weather. In other words, the pilot never had to see the target. The ground radar would detect the target on their ground radar and steer a fighter to a location where he was within 30 miles of the target and pointed at the target. The fighter's on-board radar would pick the target up and start computing steering instructions. The computer was the Hughes Aircraft E-6, fire control system, a special purpose computer. Its output was displayed to the pilot on a four inch CRT screen mounted in his instrument panel. The display was a circle with a bulls-eye in the center. A white

dot's location indicated which direction the pilot should steer, i.e., up, down, left or right. The pilot's job was to keep the white dot on the crosshairs. The problem was that the fighter's electronics weren't reliable. The system didn't work more often than it did.

We knew back then that a large share of the reliability problem lay with the vacuum tubes that populated the airborne radar system. Vacuum tubes didn't like temperature cycling or vibration. And that was exactly what they got, in spades, in the fighter environment.

Thank God the Russians never sent up the balloon. Had they ventured our way, the Air Defense Command's pilots had a dilemma that we referred to as the ADC one-two punch. We would fire our missiles and miss and then have to decide if we would ram the Russian bomber.

Whether or not to ram a Russian bomber that was on its way to obliterate Seattle doesn't seem a difficult decision but, then, I never had to make it. To the Air Force's credit, they never tried to propagandize us. They knew we had all thought about it and had made our individual decisions.

So I ran into the reliability problem from the user side and then I ran into it again when I got into the semiconductor industry. When I got to Fairchild five years later, the Pentagon was still struggling with the problem of airborne electronics reliability.

Laws: That's for sure. So it was 1957 when you finished your assignment with the Air Force?

Ferguson: Yes.

Laws: Then there was another couple years worth of reserve duty probably?

Ferguson: No. My promised two years of active duty in the Air Force resulting from ROTC was covered by the five years of active service. To get our wings we had to agree to serve in the Reserve, at the pleasure of the government, i.e., for forever if that was what the Air Force desired. In my case, I got a form letter when I turned 40 years old that said, basically, that they figured that I could no longer do whatever it was that I used to do for them and that my discharge was enclosed. I never felt so old.

Laws: So during that 20 year period, you must have seen some dramatic improvements in electronics of the aircraft.

Ferguson: I did indeed. The semiconductor made this all possible. It would have never been possible with vacuum tubes.

Laws: And talking of semiconductors, in '57 you finished your tour of duty with the Air Force and you ended up at Texas Instruments. Was that your immediate choice? How did you go about looking for a job?

Ferguson: I went back home and looked around Dallas. I never thought I'd survive the Air Force so I never saved any money. I was a little short of funds. So I went back and started looking for a job and the only two companies that were hiring were Chance Vought in Arlington, Texas who made planes for the Navy and this company called Texas Instruments. I didn't want to do Navy stuff so I went out to Texas Instruments having no idea what they did. They offered me a job in the semiconductor division; I had no idea what a semiconductor was. I didn't care what it was, I just needed an income. So I went to work at T.I. by default, certainly not by design..

Laws: What were you hired to do at TI?

Ferguson: I was hired in TI into the Sustaining Engineering Group which was the engineering group attached to manufacturing to solve the various engineering problems that came up in manufacturing. And I was there for three years.

Laws: And that was on Central Expressway facility?

Ferguson: The big facility on Central Expressway. That's where I met Jack Kilby.

Laws: What kind of products were you working on?

Ferguson: I worked on germanium, grown-junction germanium. Silicon was just coming along. Silicon had the advantage of being able to take the temperatures from minus 55 to plus 125 which was the requirement for military equipment. Silicon did that, germanium couldn't.

Laws: What kinds of problems were you were working on in sustaining transistors?

Ferguson: All sorts of things. We used a soldered steel can and the surface was completely bare and exposed to any kind of contamination. Also there were problems with the parameters of the transistors if you didn't get the base thickness adjusted just right. It was mainly a job of tweaking it to the right process. Nothing cosmic.

Laws: And they all used grown junction technology?

Ferguson: Grown junction. NPN grown junction, germanium transistors. Silicon was just starting at that time.

Laws: Did you make any silicon alloy devices?

Ferguson: I did not. It was being done there but I wasn't involved in it.

Laws: How did you come into contact with Kilby? Did you have to do some work for him or with him?

Ferguson: Kilby was in R&D and so I was around him but not very often.

Laws: I read somewhere that he wrote in one of his notebooks you had prepared some slices for him at some point. Do you remember what experiment that was for?

Ferguson: I was his runner. He would come and say he would like to have this or that. I'd say "yes sir, just don't hurt me."

Laws: <Laughs> I understand he was a very big guy.

Ferguson: Probably six five, very skinny

Laws: And hard of hearing?

Ferguson: Hard of hearing. But an impressive guy.

Laws: Did he talk very much?

Ferguson: No. He was very quiet. Very quiet.

Laws: A man of few words I understand.

Ferguson: Yeah, man of few words.

Laws: Did he give clear instructions as to what he wanted

Ferguson: I think so. Best as I remember.

Laws: I assume that it would have been in early '58 when or so you were doing this work for Kilby. Were you aware in September when he showed the first prototype of his integrated circuit? Was there knowledge throughout the company of this or was it a secret?

Ferguson: No, there didn't seem to be any secrecy. Maybe it's just a story, but I think that he was trying to improve some of the errors coming out of a differential circuit. He had two transistors and if their temperature was different, you'd get an error signal, which you don't want in a differential. So his idea was, well let's put both devices on the same chip as they should both have the same temperature. That

was the goal. He had them bonded up with wires and he was right. So in that sense, his motivation was to achieve a specific goal, which was temperature stability, rather than putting two devices together. That's why I distinguish between Noyce's contribution, which was to connect an integrated circuit, as being different from what Kilby did.

Laws: At some point, you were recruited to Fairchild. Was there specific experience that you had that they were looking for?

Ferguson: No. Actually one of the guys that came from Sperry to Fairchild before I did was a guy named Bob Norman. His wife Joan, who was nicknamed "Bunner", had grown up in Oklahoma living next door to my wife's house so they were good buddies. So I guess when they got to Fairchild and Fairchild was looking for some guys, Bob Norman says, "We ought to talk to Ferguson. My wife knows his wife." So Bob called me up and I came out here for a visit. Fairchild was sufficiently unimpressed so they offered me a job in the diode plant in San Rafael. I said no, I don't want to do two lead devices. So I turned that down and then they came back later and offered me a job in Mountain View, in the Sustaining Engineering Department.

Laws: Was that a tough decision to make? You were married at this time. Did you have family that you had to move as well?

Ferguson: I had one two year old and one that we brought to California in the back of our Chevrolet on his baby crib mattress. So I had two and two more to go. I'd been to Northern California on my way to Alaska in the service. I spent ten days up on Highway 80, near the Folsom federal prison. It used to be called Camp Parks and it was a transition point for people going overseas. I was there while waiting for an airplane to take me to Alaska. I had my car and drove down to San Francisco a couple of times. I remember thinking how nice this was. It wasn't at all like Texas. So I had always put in the back of my head, that it might be a nice place to live. So when Fairchild called me up and I came out a second time and visited the Mountain View factory and went home and asked my wife if we could move. She approved and so we did.

Laws: And that was 19—

Ferguson: Nineteen sixty. July 10 of 1960 was my first day at Fairchild..

Laws: It was an interesting time at Fairchild. Do you remember some of the people you interviewed with?

Ferguson: I saw Gordon (Moore) and I don't know if I saw Noyce or not. I saw Vic Grinich and Charlie Spork and did the usual routine. I actually worked for Vic in R&D when I ran the New Product Department.

Laws: So you moved and you worked in Mountain View for a while in manufacturing. What were you doing in manufacturing?

Ferguson: I was part of Sustaining Engineering. I worked there for about a year. And then the seven, I think there were seven, people spun off to start Signetics. The two I knew were Dave Allison and David James and they went with Signetics. Allison had been a part of the Device Development Group or Product Development Group in the R&D Lab. The R&D Labs were set up as the Product Development Group, which was probably half of the labs and individuals, Physics group and a Chemistry group and more pure sciences, maybe relating to Gordon and Bob's (Noyce) academic backgrounds. My group had about one-third of the employees in R&D. Our job was to develop products, and the related technologies, for the factory to use in volume production. Of course, the factory never wanted to accept the products but it was our job.

Laws: That's a different story. In Mountain View, you worked in the Whisman Road plant initially?

Ferguson: Yeah, I did—the Charleston Road Plant was still there for R&D, after manufacturing moved to the new plant on Whisman Road in Mountain View.

Laws: Mountain View was in production.

Ferguson: I think it was. Fairchild built a tilt-up and moved in there when they got some significant production. I remember one year, Tom Bay made an optimistic forecast for the year of $7 million in sales. That year we shipped $18 million, because the rest of the world realized how good these double diffused silicon transistors were. Particularly, the military started buying them.

Laws: Now were these the mesa (technology process) transistors?

Ferguson: These were mesa transistors and the R&D people were working on planar. With the planar it became so obviously a superior product that I think we were making both mesas and planars by the latter part of the time I was in Mountain View. But as I say, Signetics spun off. I read somewhere, it's hard to believe, that Fairchild had 43 spinoffs and I was (spin off) number seven at GME (General Micrelectronics). And we were the only ones Fairchild sued, which I thought was a little tacky.

I always thought that the problem at Fairchild Semiconductor was that they were a subsidiary of Fairchild Camera and Instrument of Syosset, Long Island. They were old time eastern industrialists where capital was everything and labor was nothing. And they had this company on the West Coast where people needed a piece of the action to be interested in the company. They would give you 200 shares, an option for 200, when all the people around you who were working for companies that weren't part of an eastern establishment were given 10,000. So I think that was the real motivation behind of all the spinoffs from Fairchild. It was just an impossible decision to decide to stay there when you saw what was going on in the outside world.

Laws: But that really didn't start until about the time that you left did it?

Ferguson: As I said, GMe was the seventh spin-off from Fairchild so there was prior investment interest in the market potential of semiconductors.

It was interesting that later (1966) when we sold our company (GME) to Ford. Ford had been looking around for some years for an electronics acquisition. They openly said that electronics would one day be very important to automobiles, maybe critically important. That was the whole reason that Ford bought Philco; they were trying to inject some electronics know-how and thinking into the Ford Motor Company. Unfortunately, the first thing they did was to fill a Corvair 340 airliner up with Ford vice presidents and flew them to Philadelphia to run Philco. That wasn't what they needed

Laws: Interesting observation Phil. So at Fairchild then, you were there just about the time that Jay Lathrop and his team were building the first planar integrated circuit, Micrologic. Were you involved in that at all?

Ferguson: I really wasn't.

Laws: Were you aware of what they were doing?

Ferguson: I really wasn't. I really didn't get involved until I got involved as part of the work in the Device Development Section of the R&D Lab.

Laws: How did you get involved with it at that point? Fairchild made the announcement in 1961, so you were trying to actually make them?

Ferguson: We were trying to make them with acceptable yield for maybe two years. Our yields ran below one percent. We just could not make them yield. They were not very complicated integrated circuits. There were, maybe, ten devices on a chip. So it was given to our section in R&D to try to figure out how to make these ICs yield..

And boy we tried. We knew what some of the problems were. Particularly there was a deep, heavily-doped diffusion to provide a connection to the outside world for the collector, which was the bottom layer. It had to have a low collector saturation resistance. (The wafers) would be heavily doped; otherwise, there was too much voltage drop along this layer. And they needed to be thick. So they used a triple diffusion. First diffuse in a collector region, deep and heavily doped to provide an acceptable resistance to the contact to the outside world for the collector and the bipolar device. And to get this deep, heavy diffusion, you had to run it for 24 hours at 1200 degree C, which is getting close to melting. It was very hard on the lattice of the crystal. It was very hard on the oxide and very hard on us. And so we struggled on and we could not make them yield.

So we were sitting there scratching our heads, trying to figure out what could we do. I don't know why I remember it, but we had a technician in the lab, a guy named Ed Porter. He came in one Monday morning; usually I spent Monday morning trying to remember where the coffee pot was and trying to figure a strategy to get to Friday. And so Ed came in to see me; Ed was a very enthusiastic young guy who was getting his engineering degree while he working at Fairchild as a technician. He asked "Did you read that article?" I said "What article was that Ed?" So he says "That article in Semiconductor Magazine this weekend." I wondered why a virile young man like Ed would be spending his weekend reading about semiconductors? I said "I must have missed that sucker. Tell me what it says." He said, "Well it's from this guy in Sylvania about an integrated circuit structure made out of epitaxial material. You put an N layer on a P substrate to get the collector junction that you need." We immediately realized that the structure got rid of the long hot diffusion and also reduced the amount of space it took on the surface of the chip for the spreading of the collector region, which decreased the chip density on a wafer. We said, "Boy, if this works, we've died and gone to heaven."

So we sat down and figured it out, made masks and did a couple runs through our prototype process in in R&D and, lo and behold, Ed's idea actually worked. Well, Ed's stolen idea. At Fairchild we stole a lot of ideas. I always thought that the planar process originated in Bell Labs from a patent by a guy named J. Andrus who described a structure using masks, photo-sensitive lacquer and such, i.e., the planar process. But, I digress.

Anyway, we started running some of these things and they were really yielding well. So I said "We'd better get this down to Mountain View where everybody hated us and everything we stood for. I was dealing with the sustaining engineering guys down there trying, saying "Hey, you could at least try this." So I finally went and grabbed Charlie Sporck who got together a meeting where we were arguing back and forth about it. Sporck finally said, "All right, run a batch of the triple diffused wafers, the old process, and the epitaxial process side by side in our factory pilot line and see how they turn out". And so we did that and came back a couple weeks later to view the results.

Charlie was, and is, a very funny, a very nice guy. But he had this voice that, when he got at all exercised, would turn from a normal voice to a bull-moose-in-rut voice. I mean it was extremely loud and extremely violent. And so Charlie went down the two run cards, trying to figure outwhat the cumulative yield was. And he looked up and he turned on his bull-moose voice. He says, "Good God almighty, this epitaxy stuff is yielding 50 times what the triple diffused run is".. Charlie had made a factor of two mistake in his mental calculations. The cumulative yield of the epitaxy "stuff" was only twenty-five times better than the triple—diffused run. I didn't correct him because his mistake was in my favor. Twenty-five times the old yield was good enough..

And so the epitaxial IC went into production and immediately started producing a cornucopia of integrated circuits. Charlie Sporck then went down and asked Tom Bay who was always complaining about lack of IC product, "We have 10,000 good ICs. Where shall we ship them?" And Tom's response was, "I think you guys may have ruined the market forever. Your yields were so bad for so long that no one will believe we can actually make these things." As for Ed Porter, I never thought he got enough credit. He was the first guy who realized the power of the concept.

Laws: Had you been doing some epi work prior to this?

Ferguson: We'd been doing epi work on transistors but that was the first time we tied it with the IC process.

Laws: It seems such an obvious thing to do now. Why did it take this young technician to read about someone else doing it?

Ferguson: He was smart and the rest of us were stupid. That's the only explanation I can think of.

Laws: Fascinating.

Ferguson: It is pretty obvious.

Laws: In hindsight. So much is obvious in hindsight.

Ferguson: I don't think he ever got enough credit for it. That's the kind of success that's frequently stolen.

Laws: Certainly Charlie Sporck gave you some credit for it in his book.

Ferguson: The only thing I did was that I knew I was going to leave to start GME, so I kept ramming that through until it got in the factory Maybe it would have been in my financial best interest to just low key that and take it with me, but I couldn't do that.

Laws: Sure. And so the work was done both at R&D and in the pilot line in Mountain View.

Ferguson: We did the first stuff in R&D until we could see the spectacular improvement. Then we started arguing to get it in the factory. And Charlie interceded and put it in the pilot line. And when the results came out, and after people got over the bull-moose-in-rut shock, it went in there immediately and the triple diffused version disappeared.

Laws: And Charlie Plough, was he was involved in running the line in Mountain View?

Ferguson: Yes he was. He'd been my boss when I was in Mountain View. And Charlie Sporcklater saw fit to send him to England for a while. Good duty..

Laws: What else do you do when you were at R&D, other devices that you worked on that you remember?

Ferguson: I remember my group had a packaging group and one of our jobs, supposedly, was to provide the new packaging concepts flow to the factory. We didn't do much in the packaging area..

Laws: Why was there this antipathy? Personalities or?

Ferguson: Well because factory people always think that R&D is transferring half developed products and they're generally right.

Laws: Then it's their problem to sort them out.

Ferguson: And it's their problem to sort it out. And they can plan on getting no credit for it. And so there's a natural animosity there that was very funny.

Laws: At R&D, you were reporting to Vic Grinich?

Ferguson: Yes, and Vic reported to Gordon.

Laws: Did you have much involvement with Gordon?

Ferguson: Oh yeah. They kind of split the Lab up. Gordon ran the Chemistry and the pure science part of the Labs and Grinich, who had a PhD in electrical engineering, was more the circuit guy. So their backgrounds matched well to their education and experience.

Laws: And you were saying earlier that R&D started in the building on Charleston Road and then it moved about 1962?

Ferguson: I got there in '60 and the Mountain View plant was up and running. So Charleston had become the R&D center which it remained until they built the Arastradero plant. And I moved up to the Arastradero plant. Our work was never as good up there as at Charleston. It was really spooky.

Laws: What changed?

Ferguson: I think people thought we must be successful. Look at all this, because it was rather grand.

Laws: When did it become obvious that integrated circuits would be an important contribution to industry revenue? There's a comment that Gordon made at some point "Well we've done integrated circuits, now what do we do?" That must have said that they felt that there were other important things to move on to.

Ferguson: Well I think the stimulus for the integrated circuit and for all silicon and for all planar devices was the government, the military. I think there were two main thrusts behind that-complexity and reliability. MOS was structure you can use to make long shift registers and things that are running around a lot of pieces of data. The National Security Agency was very interested in being able to make very complex electronics that people couldn't break. So you had MOS side of the business and the bipolar side. The main motivation, I think, was the ongoing thing that I ran into in the Air Force, the reliability shortcomings of airborne electronic equipment.

There was a big drive in the Pentagon at the Bureau of Weapons for microelectronics for more complex electronic systems. That section was headed by a Marine colonel named Art Lowell who became the first CEO of GME.

To get to more complex systems, we had to first find a way to make reliable electronics. That was what the Sylvania/Ed Porter/Fairchild solution offered.

Laws: Were you involved with MOS, in the device, development section?

Ferguson: We were. Tom Sah, who was the head of the physics section, had started to mess around with some MOS devices. The origination of the idea came from the original Shockley group (at Bell Labs). They were looking for some sort of a surface device when they stumbled on the injection transistor. We got looking at MOS and thinking that this is really slick because bipolar is three dimensional. There was the depth of the base and what have you. It was critically important, the most important thing. MOS's two dimensions would allow you much greater freedom and higher yields with smaller devices. So Tom Sah, as I say, was working on individual MOS transistors, and the underlying processes. But when we started GME, it was to pursue MOS even though we started out, like Intel, on bipolar, because we knew there wasn't any market for MOS devices. So we had technical interest because of the two-dimensional aspects of it. It was my interest.

Laws: Had anyone at Fairchild tried to build an integrated circuit with MOS?

Ferguson: I don't think so. I think it was really just a concept. It was something that was coming out of the physics group. But the dimensional advantages were startling enough. When I went to GME, the plan was to was to stay alive on bipolar while the MOS market developed.

Laws: When you were at Fairchild did you have any concept of the issues that you were going to run into to trying to build MOS devices?

Ferguson: No. And that was of course one of the many things that brought GME down.

Laws: Okay, so let's move on to GME. You mentioned that Art Lowell was the genesis of GME. Who funded it?

Ferguson: If I'm getting in too much detail, let me know. There was a company in Chicago. I don't know if they're still there, named Pyle National. I guess it was somebody's name. And they had started back, I think, in 1870s making headlights for locomotives. I guess they found there was an excellent replacement market because the Indians kept shooting out the locomotive headlights with their bows and arrows. And so, they had many re-orders. Anyway, they stumbled on making various kinds of electric devices, never with any particular success.

They finally got a young man in there as CEO, Bill Croft, who started making umbilical cords for the Minuteman missile. He started making bundles of money. He said, "Well, you know, we're collecting all this money, we ought to try to use it to break out into something that has better growth and is more stable than the kind of stuff we've been doing." So he hired Arthur Andersen to go and look for something. And in the course of their travels, Andersen went to Washington D.C. and talked to this very impressive guy named Arthur Lowell. They came back to Pyle National and said, "Well, we think that semiconductors are probably the best place to put your money. It's got an unlimited future." Bill Croft, the CEO of Pyle National, says, "Well, you know anybody." And Andersen said, "We know this guy, Colonel Art Lowell at the bureau of weapons. He might be interested in doing something." And so, Croft went out to see Art Lowell in Washington. Lowell was a full colonel but I guess he decided he wasn't going to make general. He had a belt line problem that didn't fit the Marine image,. so, he was interested. Croft asked, "Do you know anybody (in the business)?" Lowell says, "I know these two guys, Howard Bobb and Bob Norman, who are always in here trying to pedal stuff to me. I'll talk to them." And he did and they said "We'll go." And so, he put together the (GME) group. I was the last member to join.

Laws: So it was Lowell, Bob Norman, Howard Bobb and you?

Ferguson: Lowell was the CEO. Bob Norman was the electrical engineering circuit guy. I was the process guy and Howard Bobb was the marketing guy. It was a strange group. The day I left Fairchild, I went over and talked to Noyce and Sporck and they said, "We don't so much mind you leaving but you ought to leave differently." But anyway we had four guys. One of them was a Marine who had flown balloons; another one was in a submarine in the Navy during World War II. Howard Bobb had shot down three Japanese in the Mariana turkey shoots as a Navy fighter pilot. And I was the process guy. It was a very <chuckles> odd cast of characters.

Laws: Did you have a business plan as to what you wanted to accomplish?

Ferguson: Well, you don't have enough time for me to tell all the things that were wrong with GME. Howard Bobb over the years had gotten very close to NSA, as I mentioned, who were looking for an MOS kind of device or something that would be very complicated, very complex, very secret stuff. They were getting ready to buy ten zillion RTL circuits (A later name for Fairchild Micrologic circuits). And so, Howard Bobb and Bob Norman, particularly Bob Norman, wanted to do RTL. Possibly they were the only people in the world that wanted to do RTL. Howard Bobb was also interested in the MOS but he had tacit approval from the guys at NSA who said, "We'll give you lots of business" - over the phone not in writing. Howard always had a very good tie there.

But RTL had a noise problem. Its noise margins were very marginal and that's why when Signetics set out, they set out to do DTL. So we had a case of the EE guy wanting to do nothing but RTL forever and

the sales guy who was oriented toward NSA and several of their secret projects. So what did I know? So we started down that road and we made RTL for NSA. And we were the world supplier, I think, 98 or 100 percent for a couple of years. And none of their products moved into production in the near term. When they finally moved into production, Motorola got all the business but that was several years later and GME didn't have the financial endurance to stay the course...

Laws: I understand you were also built one of the Signetics DTL circuits and a TTL circuit for Litton.

Ferguson: We did them as custom circuits. We were doing TTL circuits for the TFX fighter plane. And we built those because we were desperate. We had this factory that was eating money. A lot of money and not much silicon, so we were just looking for anything we could make and sell. So those were kind of desperate efforts to get volume production. In parallel, we then cranked out an MOS process, which was mainly done by a guy named Frank Wanlass who had been in R&D at Fairchild and also joined us at GME. So we said well, let's see what we can build here. And even though we didn't have any experience on MOS products or yields we were really desperate to get something to feed that factory. Howard Bogart and Bob Norman did a very good job. They built a calculator with MOS chips. And because it was a MOS, it was much smaller. The only other electronic calculator that was out at that time was from Friden; they had a calculator made with DTL. It was three times larger. We hired an industrial designer to do the design and it looked great. It was small, silent and beyond our production technology.

Laws: So this was built in house as an applications exercise not with a particular customer?

Ferguson: Well, we built it in-house, yeah, as a selling point for MOS – "We can do with this for you." But we were very desperate. I mean we were just eating money.

Law: So Howard Bogart was the designer of the calculator?

Ferguson: He was not the only one but he was certainly a principal designer.

Laws: This was when, in 1963?

Ferguson: Yeah, 63 and '64. But we had just an empty factory and a lot of promises. So we went everywhere we could, the TTL for Litton, for example.

Laws: About how many gates on those MOS chips? Do you remember, Phil?? One-hundred gates on a chip was a lot in those days.

Ferguson: A whole lot...When we starting designing our computer, I froze the number of gates on a chip at not more than 20.. We designed and build a few calculators and tried to use them as selling tools for MOS, and if anybody was interested they could buy the computer. One of the companies we showed our calculator to was Victor Comptometer.

Victor was impressed but said they needed some changes and additions. We said to bring it on; we would have agreed to anything by then. We signed a contract with Victor and they started giving us cash.

Laws: So the first demonstration model that Howard came out with, was that 30 chips?

Ferguson: The first thing we built and put in a case was 30 chips with no more than 20 devices per chip.

Laws: And you showed this to Victor and they said, "That's nice but we'd like all this other stuff"?

Ferguson: Yeah, and their marketing was, well, they had to have this and they had to have that. And we never said, "Hey, guys, you're getting past our ability to build these things."

Laws: Right, the old creeping elegance problem.

Ferguson: I had a memorable meeting with the president of Victor. Victor had made electro-mechanical calculators forever. They built the Norton bomb site during World War II because they had all this gear and wheel experience. I remember going back there one time while we were getting in bed with them and their CEO gave me a tour of their factory where they had all these punches, presses, and what have you. And he says, "You guys in electronics will never be able to compete with our cost structure for this stuff." I said, "We're either going to wipe you out or we're going to go nowhere." But their thought was that even if there's an electronic calculator it did not threaten their machines. It would be at a price point well above the electromechanical machines. It was interesting how fixed his idea was about the place for electromechanical calculators.

Laws: A very conventional misunderstanding of what a new technology can do for business.

Ferguson: Just like the minicomputers we were talking about.

Laws: Right. And your role at this time, Phil? You were V.P. of operations essentially?

Ferguson: Yeah, I was V.P. of the semiconductor division. The money started flowing out and Pyle National was still a pretty small company. They invested $5 million in us and we were going through it like crazy. And so, Art Lowell got more and more crossways with Bill Croft. And Bill kept saying, "You know, I know this is a wonderful thing but we can't afford it." But he hung in there like a champion.

Bill Croft, the Pyle National CEO, called me up one Sunday night and told me that he was on the Elgin Watch board with the Philco CEO. The Philco guy wondered if Croft had any interest in selling GMe to Ford Motor Co., the parent of Philco Corp. He said "these people from Philco are talking about buying GME but they're only willing to pay $10 million. And you're worth 1,000 times that."

I said “Bill, I’ll be right back there, don’t make any decisions or make or answer any phone calls until I get there”. So I jumped on an airplane and went to the Howard Johnson’s at O’Hare in the middle of the night and, at a 2:00 a.m. meeting said, “Bill, I think you ought to consider this offer from Ford because you don’t have enough money to fix what’s wrong with GMe.”

Laws: By this time, you were CEO?

Ferguson: Yeah, Bill Croft had simply fallen out with Art Lowell and put me in as CEO. He had fired Art a few months before Ford contacted us.

Laws: And they’d invested a total of 5 million?

Ferguson: Pyle invested a total of $5 million. And we didn’t have the classical venture capital arrangement of 80 percent equity for the investors and 20 percent equity for the operators. Our deal with Pyle gave us debt financing ,rather than equity financing,. Pyle still took 80% of the equity.

Laws: But you did a lot of unique things though, Phil.

Ferguson: Well, we did but we were doing it out of desperation. I mean, necessity really is the mother of invention. You just see that fab eating you alive and eating your parent company alive.

Laws: So the wafer size technology at that time was one and a half inch wafers maybe?

Ferguson: One and a half.

Laws: And you were putting between 20 and 150 transistors on a chip. What lithography, 10 micron?

Ferguson: Ten microns. We could make the world supply of RTL, high yielding, everything good, but no market.

Laws: You introduced what was essentially the first commercial MOS integrated circuit?

Ferguson: There’s always been a question about whether we did or GI. GI hired several people from the valley and took them back to the GI factory in New York, including Wanlass. So, there’s always been an argument of who put out the first one. The market for discrete MOS transistors was nothing spectacular. It was only when you put them in big bunches and combined them on a small chip that they became very interesting economically.

Laws: What other projects did the company get involved in? Did you do any MOS chips for NSA?

Ferguson: As I said, NSA was one of the early customers.. Maybe we made a 19-stage shift register at Fairchild. I'm not sure. Fairchild records might show it. But anyway, they had a great interest in shift registers. They could stick a bunch of data in with only (some of it) being significant and bury the Russians in, garbage. So they had a specialized long-term interest in it and very complex circuits. So anyways, the stuff we could make, we couldn't sell. And the stuff we could sell, we couldn't make. Other than that, things were fine. And no money.

Laws: I think GME did some pretty interesting things in early automatic mask layout.

Ferguson: Yeah, when you get these very complicated circuits, you also get pushed into a lot of complicated automatic testing. We also had a need for many more leads on packages and back in those days, there weren't any packing companies that offered what we needed.. So we had to develop them on our own. And we did poorly.

Laws: And your own place and route software?

Ferguson: Basically, all done by people at GME or by somebody who knew more than we did in a particular area.

Laws: And you probably had to make your own masks?

Ferguson: Oh, by that time, there a company called Something Craft. It was a little company around here that was making masks that we started buying from because we had far too many disciplines for a small company. We farmed them out as quick as we could to reduce the amount of stuff we had to do. One such supplier was something Craft.

Laws: Dynacraft?

Ferguson: Yes, Dynacraft. They made 14-lead templates for packages. And they started making masks, as I recall.

Laws: I understand you had an interesting falling out with Bob Norman.

Ferguson: You know, I'd write the story of GME except it'd have to be classed as fiction because nobody would ever believe it.

Laws: So Bob Norman at this time was vice president of engineering. You were CEO.

Ferguson: Yes I was. When I took the CEO job I felt like the captain of the Titanic just as the lookout yelled "Ice".

After we sold GMe to Ford I felt really guilty about it; something about a pig in a poke. So after the deal got done on paper, I went back to Dearborn because their plan was to pay us off in cash. I went back to tell them, “Hey, guys, if you pay all these guys off in cash, they’re gone, you know. They’ll go to the next stock option plan. You really shouldn’t buy them out. You have to keep them on the hook with stock. Well, I talked to a bunch of people but without success. During this trip, I went to lunch in the Ford executive dining room in Dearborn, Ford. I’m always very nervous around linen napkins, which they had there. When I was at lunch, one of the vice presidents was laughing about that how morning they had written off a $10 million investment in a rubber factory in Spain and how funny it was that that it didn’t work out. They were writing off $10 million as if it was nothing. So I thought, well, you know, 10 million here, 10 million there, it’s not that much. Thereafter I shut my mouth.

I went back another time shortly after the purchase to try to talk to them and they responded that “One time, Ford bought less than 100 percent of something and it didn’t work out. So if we buy your company, we’ll buy 100 percent of nothing.” So I thought, “Well, I tried.”

Laws: They didn’t understand the importance of the stock ownership?

Ferguson: Eastern or Western thing. They thought capital was king and people were nothing. One time Blll Croft, the Pyle CEO came out to visit us over a weekend. We were were going to go the beach that weekend and invited Bill go go along. We all showed up in our swimming suits and ran around the beach, playing grab ass with our butts hanging out. Bill came with us but he was dressed in a sharp, completely starched shirt that you think it would cut his head off, dark blue suit, shined shoes. And he took one step into the sand in Santa Cruz and just stood there looking amazed. We ran around and did our thing. I remember sitting there and looking at him thinking, well, Kipling was right, “East is East and West is West and never the twain shall meet.” And there he was, the Eastern establishment standing on that beach worried about getting sand in his goddamn shoes. I always thought that it was very funny.

. And so I went back there one time and presented the MOS story to R.J. Miller and Henry Ford. One of our guys had made this toy intersection with little toy cars. He showed what one chip could manage as far as all the electronics of an intersection, you know, all red and green and all this stuff which of course, would come on this one little chip. Very impressive.

Laws: We got onto this track when we were talking about Bob Norman. So you went back, you got the $10 million for the company.

Ferguson: We got a check for $10 million. I walked over to the Bank of America there on Arques Avenue (in Sunnyvale) and walked into the manager, who I knew, and said, “We got one check in here for $10 million. There’ll never be another check deposited to our account and there’ll be a lot of checks drawn on it. Get ready.” He says, “I can do that.”

And then we set up tables and started handing out checks, jujst like payday in the Army.. And what was so bizarre was that both Bob Norman and Howard Bobb were thinking about starting new companies and they knew who they wanted to go with them. Norman and Bobb were trying to get them their boys some transition money by taking bigger pieces of the Ford pie; it was so complicated. But each of us

ended up writing personal checks to each guy. Because I didn't have any dog in the fight. So I said, "Well, why are you guys giving this person more money?" Well, we just will. So I took my money I tried to fill in the low spots, my money, because I didn't care. But then you had these guys who had never had, a pot, who suddenly got several hundred thousand dollars, which at that time was real money. And so, all the marriages blew apart seemingly, which shows what was holding them together. They were being held together by economics. And so, Bob Norman, God love him, bought a $90,000 house. It was a big house in Los Altos Hills, moved his house, his wife and his family in and never moved in himself. He left the family. So he became a freelancer on the Silicon Valley stage. And one day, about 2:00 in the afternoon, I was looking around for people. And somebody said, "Well, they all went to one of the watering holes about 11:30." So I called up over there and got Bob on the phone and he was drunk as a skunk. And from the noise in the background, everybody else was too. And I says, "Bob, you've got to get those people back there. You've got married people and all kinds of ugly things going." He says, "Well, I can't." And I says, "Why can't you, Bob?" And he says, "Well, I've got a reservation for 30 seats on the 5:40 to Honolulu." I said, "Why would you do that, Bob?" "Well, we've been having an argument about where you can really taste a good Mai Tai without being in Hawaii or you need to be there.. We're all going, to Hawaii to taste the Mai Tais there." And so I sent a bunch of station wagons over and they loaded all those drunks <laughs> in the back of the pick-ups and brought them back. And when Bob came back, I says "Bob, you and I are history. You're fired." So that's the way Bob Norman left.

Laws: Did he go up to Hawaii with his crew <laughs>?

Ferguson: Well, I think they did. And when he came back, I says "We need to talk." But that was one of the few people I ever fired with relish because I thought we're going to get lawsuits and married women, single women, all kinds, but I never did hear where the best Mai Tai was. That's how Bob disappeared from the scene. And then he ended up and started Nortec, which went a few years and disappeared. Everybody left like I told Ford they were going to. Bobb went to AMI with NSA's blessing.

Laws: So how long did you stay on?

Ferguson: I stayed on for a year. I thought maybe I can see what we can do. But as we deteriorated and lost people -- we had an NSA development project that we lost five group leaders in a month because Howard and then Bob started hiring them away into their company just like we did at Fairchild. That was one of my big regrets, is that I didn't realize what we were doing to Fairchild. Everybody was going out and hiring their buddies. Fairchild was right. They should have sued us.

Laws: Did they threaten you with legal action?

Ferguson: They did. And it went on for a while. And they were trying to stop us hiring, which we should have done on our own. It wasn't an honorable thing to do. We hadn't done anything illegal but they were doing it to stop what we might do. But once they got into it, they had to go on. And so, it went on for maybe six months or what have you. And then they came to us and says, "Hey, we're going to drop this, but we've got to have something. We can't be entirely embarrassed." So we made an agreement that we would promise not to-- basically, technically not to go from San Jose to Oakland by way of Omaha. As a matter of fact, I made that comment to the county news. So we picked something that we couldn't care

less about, promising that so they could walk away with scalp on their sword. So it would turn into nothing and we didn't have any liability or whatever. We hadn't done anything.

Laws: Nothing illegal.

Ferguson: Nothing. It was part of the game where everybody hired everybody else. Shockley always called the Fairchild guys the Traitorous Seven. The Fairchild people always said, "We're heroes." So it's all in the perspective, isn't it?

Laws: When did you eventually leave Philco?

Ferguson: I left after about 18 months since we'd been gutted of people.

Laws: And I think they tried to move something back to the east coast Philco facility.

Ferguson: The people in the Philco semiconductor division, which was making MADTs (Micro Alloy Diffused Transistors) wanted us to go away or be placed under the Philco semiconductor division based at Lansdale, PA.. So finally Philco management said, "Well, why don't we just move GME back there. And so they came and said, "We'll give all you guys good jobs doing the same thing in Pennsylvania." Our people said, "Pennsylvania?" Our packaging guy went back there for three or four months and then he left and came back to California. But it was an unmitigated disaster, probably caused, at least in part, by my incompetence. You do what you can. But we made so many ghastly mistakes.

Laws: What do you think were the big mistakes?

Ferguson: Making RTL rather than adopting a product (DTL) that was selling. And that was strictly based on Bob Norman's unreasoning allegiance to RTL. Five years later at lunch, I said "When you get through selling RTL, let me know." He's still doing it. Fifty years later, he's still preaching to RTL.

Laws: So RTL was one. What was next?

Ferguson: Our spending rate. We could make our bipolar circuits but we couldn't sell them and we couldn't find enough markets for them and NSA was always about to place a huge order but never did. That forced us into MOS which we really didn't understand and couldn't make. It's a gradual retreat until you get to oblivion. So I think not having a product line that would sell initially when we set out because we went from an empty building to RTL circuits coming out in about six weeks. That's how fast we improved that building.

Laws: So you had to buy your equipment, and get it running …

Ferguson: The equipment was relatively simple then and we knew the processes so we were able to go went directly to production. But it was all very sad. We had this state of the art factory with no demand for its output. There weren't any markets for it. So had we done DTL as our first product line, wewould have been a real company which we never were. We were a money pit.

Laws: And a legend. So after you closed down Philco you essentially closed down the facility here then?

Ferguson: I didn't stay for it. I left and somebody else closed it down.

Laws: This was about '66, '67 timeframe?

Ferguson: Art Lowell insisted that Bob, Howard and I have separate buildings. He thought for us to feel independent we needed separate buildings, all three of those tilt-ups down there off Kifer where National is now., which ran the cost up tremendously. And I probably ought to mention that back in those days there was a tremendous amount of drinking going on and Art Lowell being a marine knew a little something about drinking. When Art built his office which was gorgeous, he spent $55,000 on his office and it was a cathouse for all practical purposes. The lighting was low, there was a wet bar with all these beautiful mahogany sliding doors and he had this thing about he never wanted to sit down because a doer stood up. So he had this podium he sat at all day. I always remember the look Bill Croft's face, the CEO from Pyle National, when he came in and looked at this industrial cathouse and it was Art Lowell's office. We had all those undertones with all this kind of stuff. But we were doing some very interesting (technical) things. It was enough to attract people up to come look at us. Guys from Northrop came up one morning and sat down in Art's office and Art started serving them booze about nine o'clock. We finally decided at lunch to go out and have some lunch, so one of the Northrop guys walked out for somebody to pick him up in a car and fell down on the concrete and he busted his head open before noon, dead drunk, and so we loaded him in a car and took him to El Camino Hospital. They patched him up. We took him to San Jose Airport and he went back to Northrop. We never heard from them again. But that's the kind of thing that literally went on. It was a different world.

Laws: I arrived in the Valley in '68 and the Wagon Wheel, of course, was the big place to meet then. Did you visit the Wagon Wheel at all?

Ferguson: I drank a little Scotch there but what I remember about the Wagon Wheel that they had very high bar stools and you had to be careful after you had been there a while because if you fell off you could really hurt yourself. So I was always tried to get a chair at a table so I wasn't in any danger. The Wheel was where the most efficient technology transfer in the world took place. I mean, you could go in there and soon somebody from some other company would offer "Let me buy you another drink." And pretty soon, whatever state secrets you knew was everybody's property. It was a fun and funny place. I don't know if it is still there. At one time they had all this strange stuff embedded in the roof, bottles and--

Laws: Yes, they had all kinds of wheels embedded.

Ferguson: I thought they had other stuff.

Laws: I know they had wagons on the roof, too.

Ferguson: I knew there was something on the roof. It may have been my alcoholic delusion but I remember something up there that looked, kind of, odd to be on a roof.

Laws: We have a section of the bar in the exhibit downstairs.

Ferguson: Well, I lived five miles away from the Mountain View plant and it was perfect for me because I could stop at the Wagon Wheel after work and then there was a four mile run to my house. There used to be a restaurant called Sabellas on the corner of Bernardo and El Camino. A nice restaurant because they served free snacks there during happy hour. So we'd go from the Wagon Wheel to Sabellas, eat snacks there and then drink some more and roll home. Why my wife never divorced me I'll never know because most nights I came home in some state of disrepair. It was really fun.

Laws: In those days it was alcohol and these days it's cocaine I guess.

Ferguson: I guess so. Alcohol was more fun.

Laws: So you left Philco. You have a bit of money in your pocket. What did you do next?

Ferguson: I, kind of, had a problem. I thought I'd probably been neglecting my children because of my alcoholic haze and various other reasons and so, since I had a few bucks that I had never had before, I I just said, "Well, I'm going to spend some time (with my family)". I probably made that decision because I was from a family that I always used to think was really smart but was really squirrelly. So I thought "I wonder if I can keep the brains but get them headed down a saner path".

Laws: There were four?

Ferguson: There were four, two boys and two girls. The only decent product planning I ever did. Two boys first and then two girls. When we sold GMe our children (our youngest wasn't here yet) were just starting school.. Our school district, Cupertino Union School District, used to be rated number one or number two in the state and that's why we moved there. After I started consulting, I became President of the local Little League and a Little League coach and a Bobby Sox coach and PTA President and all that kind of good stuff for some years.

Laws: A professional dad.

Ferguson: Professional dad. Well, I got poorer and poorer but it was a good investment. Finally I had to make some money and so I startedconsulting. I did a lot of consulting work for the World Bank, particularly in setting up the first semiconductor fab in South Korea.

Laws: How did you get involved with that?

Ferguson: They tracked me down. They were looking for a semiconductor guy. The concept was that the South Korean government realized that their industry would never go into the fab business because it's too expensive, too complicated and they didn't have any faith in their ability to pull it off. "Face" was very important. And so the Korean government put together this plan with the World Bank to have the Bank lend Korea 30 million dollars and the Korean government put in 30 million dollars to build a working fab, not an R&D, not a lab but a working factory and demonstrate that they could do semiconductor manufacturing successfully They were looking for a semiconductor guy, a process guy, and somebody said, "Well, you ought to call Ferguson". So they called me and I went to work for them for several years while we built this factory in South Korea. I won't burden you with it but that's a story in itself.

Laws: It's a good story because the outcome's changed the industry.

Ferguson: Well, we had to build a factory somewhere and normally you would have thought a sophisticated factory like this would be built around Seoul or where all the support stuff was but the Korean President at that time was Chung Hee Park, who was later assassinated by the head of the Korean CIA.. He was from this little town called Gumi which is Korean for "tail of the turtle". The name was apparently picked because the valley the village was in is shaped like a turtle's tail. It was a little farming village but el presidente said, "We're putting it there." So on one of my early trips I went down there and I said, "What are you guys going to do about tile for the floor of the factory?" The answer was "What's floor tile?" I mean, they literally were a farming community and had zero capability to do any of this stuff. So we went to a very ugly place, very hot in the summer, very cold in the winter. But we pressed on and it's now become the electronics center of South Korea.

Laws: Gumi.

Ferguson: Gumi. that's G-U-M-I, a village then but now with Samsung, Gold Star and all the other big electronics companies having major plants there. But when we got there, there was nothing but farms.

Laws: When did you start to do this?

Ferguson: I left GME in 1966, I left the Air Force in '57, TI in '60 and Fairchild in 63-- about every three years. In '66 we sold GMe to Ford and I started consulting. So it must have been about '68, when we cranked up this project for the World Bank.

The World Bank division chief who was the Bank's representative on the Korean semiconductor project was an Egyptian, Magdi Iskander, who held a PhD from Stanford University. He and I became very close

over the years and we stayed in contact after the project has ben completed. Twenty years after the project began, Magdi called me one day to say that he had gotten a very flowery and impressive document from the Korean government commemorating the start of the very successful semiconductor project. I said, “Where’s mine”? He said, “You didn’t get one” I am still upset about that. .

Laws: How long did it take to build the plant with all the difficulties in getting skilled people?

Ferguson: About a year. We hired a guy from Motorola, Ned Dougherty, who moved to Gume with his family to build the factory. He had been in the Facilities group at Motorola Semiconductor in Phoenix. He was the one that really made the Korean plant happen. He was a wonderful guy with a wonderful, supportive family..

Laws: Ed Daugherty?

Ferguson: Ned Dougherty. He had been in the Marines and they taught him to speak Japanese. When he went to South Korea he started speaking Japanese and the Koreans got agitated and said, “We don’t speak that language.” He was a very bright guy. Crazy as a loon but very bright. So it took maybe a year to build the plant because, you know, there was a funny thing in South Korea that they wouldn’t use their mechanized equipment. They had it but they’d rather use picks and shovels. I remember going into one room in our concrete-frame factory one time and seeing an empty cement bag sticking out the ceiling.. They carried all this stuff in wheelbarrows, all the concrete to build this factory. But the damn thing worked, thanks to Ned Dougherty. And we could make devices successfully. That lab established the level of confidence that the industry needed. And as the proof came in, the big companies all piled into the semiconductor business.

Fortunately, we built a large manufacturing plant in which we installed the pilot line. That way when the World Bank project ended and Gold Star bought the factory, they had a full-fledged, high volume manufacturing plant. We also built separate plants to generate liquid hydrogen and another to make masks.

Laws: How much time did you spend in Korea?

Ferguson: I was there, I think, 25 times. At times I would spend several weeks on a visit. I spent a lot of time there.

Laws: Over how many years?

Ferguson: Over, maybe, three years.

Laws: So this would be early ‘70s when you finished this project?

Ferguson: Yes. Of course, I was just looking for income but it was a very interesting project, very interesting people. World Bank's got some wonderful folks, very smart. So I did that kind of stuff and I just did whatever else came down the road.

Laws: What other interesting projects did you come across?

Ferguson: Oh, I spent a lot of time on small projects; I always worked my consulting jobs around my obligation to things relating to our children. I did some patent work for TRW. They were planning on going into the semiconductor business and wondered how many of Bell Labs patents they would need to license. I did a very elaborate review to Bell's patents, i.e., which were useful and powerful and which were not. I concluded that out of the hundreds of Bell patents only five appeared to be fundamental. So I stumbled through most of the rest of my career until I finally got to a point where no one ever called. I ultimately decided "Well, I am 70 years old", so I guess I'm retiring. I never had the stomach to go out and beg for business.

Ferguson: After I stopped consulting, I started going into places as an interim CEO or interim whatever they'd pay me for. I was at QuickLogic and I was at IMP. QuickLogic want public and I had some founder stock that I was able to sell. QuickLogic is still around, I think.

Laws: I believe so.

Ferguson: They hired a guy from National Semi, Tom Hart, to be CEO and, the last I heard, he still is. At IMP their stock was at two dollars a share forever and a wonderful thing happened to them. They were supplying to one of the early storage device manufacturers – Iomega. The stock of the IMP customer took off and reached impossible levels. One of the TV stock gurus said, "The OEM stock is too high. You can't buy it but I'll tell you one that's just as good because they make the heart of this whole finished product and that's IMP."

Laws: It was the Iomega Zip Drive

Ferguson: So the IMP stock soared for a very brief period -from two dollars to thirty dollars a share and-- well, you were there with me, so you know that story. The CEO, I think he was the founding CEO, decided he had no obligation to IMP so he said "I'm out of here". I think he got, like, five million dollars from the sale of his stock.

Laws: He made a substantial sum of money.

Ferguson: Retired to the wine country. So they brought you, Dave Laws, in as CEO. Dave came in as the Lone Ranger and I came in as Dave's Tonto. You made some money on it, didn't you?

Laws: A little bit, a little bit.

Ferguson: I remember us having lunch one day and you said, "I got these stock options and I'm being wishy-washy." I said, "If I were you I'd keep half of them and let the others go." Was it sixty cents or something like this?

Laws: It was a good price and it worked out very well.

Ferguson: I see I'm getting into David's private affairs. He's getting a little nervous.

Laws: Okay, now your kids. What did your kids end up doing?

Ferguson: We have four children. None of them are in jail right now. One of them is chief operations officer and chief financial officer at a company here called Cenzic which is in the later stages of venture capital funding; they make security software. Doing fine. And the younger girl, she and another woman own a company in LA that makes TV commercials. They have about 10 million dollars a year in sales. It's a very interesting business. Our other two children are MD's, one in Boston, one in Seattle.

Laws: That looks like your fathering paid off, Phil.

Ferguson: The luck of the draw. I maintain that my children worked out so well because of the old mathematic axiom that minus times minus equals plus. We proved it four straight times.

Laws: Congratulations.

Ferguson: Just luck.

Laws: Well, we're sitting here in a museum with a lot of the stuff that you worked on over the years. How does that feel to think that it's now going to be part of history?

Ferguson: You know, I was never emotionally attached to any of this. The only emotional attachment I really had to anything was my kids and flying jets. Everything else is just "whatever".

Laws: Whatever you had to do to feed the family.

Ferguson: You bet, make a buck.

Laws: Any thoughts on encouraging kids going into science today? Would you recommend that your grandchildren pursue this direction?

Ferguson: This may not be politically correct but I'm now weighing whether I should write to my four older grandchildren who are entering college, later high school and tell them I believe this flood of uneducated, unschooled people that's coming in our southern border will continue and it's not just here. The same thing' is happening Europe. So I might say that your education better give you some kind of a license or something that will pull you out of the mass of people who are going to be struggling for a living at very low wages. But if I choose to do that they will probably say, "That old fool, what does he know?" But I will probably do it because it used to be that if you get a general arts education, you can always go and do something. Well, I guess now we better get a license or a union member card or something like that or have something that will pull you out of what appears to me to be a morass of people who will work for subsistence. But I'm always wrong.

Laws: Okay. Well, thank you for spending your time with us, Phil.

Ferguson: I hope I filled in some of the seedier, seamier niches of Silicon Valley. Particularly the guy from Northrop who was the fall-down drunk at lunch time.

Laws: Well, let's hope he never sees this video.

Ferguson: Wasn't his fault. He was ambushed.

Laws: He was being entertained in true Silicon Valley fashion.

Ferguson: Sure as hell was.

Laws: Okay, thanks very much, Phil.

Ferguson: Thank you, sir.

END OF INTERVIEW

