Computer History Museum

Oral History of Tom Rolander

Interviewed by:
David Laws

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Laws: Good morning. It's December the 1st, 2016, and we're at the Computer History Museum in Mountain View, California. I'm David Laws, semiconductor curator at the museum and we're going to be speaking today with Tom Rolander. Tom is a pioneer in the personal computer software area and has a lot of interesting stories to tell us. So let's start right off at the beginning of the story, Tom. Can you tell us where you were born and a little bit about your early life?

Rolander: Well, I was born on the other side of the world in Kiomboi; at that point it was called Tanganyika and its name now is Tanzania. My parents were Lutheran missionaries. They spent ten years in East Africa. My father was headmaster of a teacher training school and my mother taught nutrition. I was born in 1948 and I had lived in Africa that first five years of my life.

Laws: Do you have many memories of the five years?

Rolander: Boy, I tell you the memories of Africa-- I—

Laws: I think you mentioned the smell of Africa.

Rolander: The smell of Africa was one I experienced later on but one of the impacts it had on my life was that where we lived basically anything that creeped or crawled could kill you. As an example, our home was a stone structure and it was built on top of a cistern and that cistern meant-- it was for collecting water for the infrequent and rare rains that we had, a good idea to trap water but it attracted a lot of creatures such as black and green mambas, which are very deadly snakes. We had scorpions and tarantulas and in fact our cribs in the house each leg of our crib was in a can filled with kerosene because of the army ants. So from a very young age-- and I was a very active young boy-- my mother had to sort of train me that anything that could move should not be touched. So to this day I have a pretty big fear of snakes and other things that crawl. What David did allude to regarding the smell of Africa came up when I traveled back to see where I was born; I did that for my 50th birthday in 1998. So I took my son and some of my friends and we flew from San Francisco to Heathrow, Gatwick down to Nairobi. And my father had taken hundreds if not thousands of photos when we were in Africa, great albums that my mother annotated and so forth. At any rate, I was curious about what I would remember at age five, basically just before my sixth birthday, about being in Africa so-- because I certainly remember the photos; I'd seen the albums over and over again. So we got-- the plane landed in Nairobi. They didn't have jetways and whatever, they just opened the doors and brought up the stairways that we were going to walk down. We were pulling things out of the overhead bin, and as we were doing that the smell of Africa came on to the airplane and I knew at that moment that I had been there. It was an acrid smell, burning-- hardwood burning, urine, just earthy smells and I just sat down in the seat and cried. I just knew I'd been there.

Laws: Fascinating story, Tom. You talked about your siblings.

Rolander: Yes. I had a brother. Actually, we had one furlough where we came back to the States and my father did some teaching in St. Paul, Minnesota, and that's where my brother was born. We went back to Africa and then my sister was born about a year before we left Africa. They knew ahead of time that she was going to be a blue baby, that she was Rh negative, and so my mom was actually flown to Nairobi and my sister was born in Nairobi. In fact, my brother and I used to kid my sister at a young age that she had a lot of black blood in her which-- you can tease people as kids -- and my sister was healthy.

Laws: Your parents returned to the States when you were five years old?

Rolander: We came to the States. What happened is my mother got malaria and dysentery. She was very, very ill and so we came back to the States and my father took a parish near Seattle in Auburn for a year to recover for almost two years and then we moved to New York City. My father took a job in Manhattan.

Laws: Do you remember much about those years?

Rolander: Oh, yeah. I was in New York for five years from third grade until eighth grade and we lived in East Orange so my dad commuted by Lackawanna by subway into Manhattan every day. He worked with the Board of World Missions and so he did a lot of traveling around the world during that time, but it was a great place to be in grade school because we had field trips and those field trips were to Staten Island; to history-museum history downtown; we took side trips down to Washington, D.C. So it was a fun place to go to school.

Laws: Do you have memories of school itself? What did you like to study?

Rolander: Well, when you say "memories of school" and I go back to this experience-- the school we were at was right on the border with Newark and the school was more than half black, and I had grown up in Africa where the only white kids I had been around were my brother and sister and so to me it was completely natural. I did not see color in a sense and so it turned out that my best friend at Columbian in grade school was Thelma and when I think about it from hindsight she was probably my bodyguard so she took care of me and were good friends. With that nothing particularly notable about school at that point. When I was in eighth grade my dad took a parish in Seattle, Washington, so we moved to Seattle and that was where I went to-- junior high and high school; I went to Ballard High School, and that was where I got-- I guess identified more of my interests-- academic interests in terms of what area I might head into.

Laws: What were those areas?

Rolander: Well, I was fairly decent at mathematics but abstract mathematics did not really appeal to me and it wasn't until I got to physics, which was in my junior high school-- Ballard was a big school and in fact had two years of high-school physics, two years of high-school chemistry so I really had an advantage there, but that first year of high-school physics we actually took math and used it to do something. It really made an impression on me and it made sense, why we were doing the abstract portion of math, the reason for doing the math; I really enjoyed that.

Laws: Did you have any thoughts about what you would want to study in college and was there anyone who encouraged you in one direction or another?

Rolander: Well, I think at that point because-- I had two years of high-school physics, two years of high-school chemistry and those were the classes I enjoyed the most, I really appreciated the subject, was interested in it and enjoyed the problem solving-- so as a minister's child-- my dad was a prominent Lutheran minister in Seattle so the opportunity was to go to Pacific Lutheran University, which was down in Tacoma. And so my thinking at that point was I so much enjoyed high-school physics and chemistry that maybe I'd want to be a teacher in that subject. One other thing I should bring up is that as a senior in high school I'd always worked. I had had newspaper routes; I worked at JC Penney's in the stockroom and so forth, so I'd had jobs all the way through school because I enjoyed having activities outside of school. And I saw one day a posting for a job as a ramp ape, somebody to gas and oil airplanes down at Lake Union in Seattle. Well, I had an interest in flying that began-- I'm going to back up just a little bit here-- when we left Africa in 1953 to return to the U.S. was the first flight I can remember. It was a East African Airways DC-3, the old Gooney Bird, and it was a flight from Nairobi to Cairo and I recall—

Laws: That's a long flight--

Rolander: --that flight. Just to me-- just watching the countryside go by I was old enough at five to appreciate where I was and what was going on, and I actually still have that airplane ticket and my Facebook home page has a picture of my family in front of that DC-3 as we came back. So at any rate I kept that interest in flying. I built lots of model airplanes and so forth and when I saw that posting on the bulletin board I realized that this was a job I wanted to have. I didn't want anybody else to see that posting. I recall kind of surreptitiously taking that off of the bulletin board and I went right down to Lake Union Air Service. The fellow running it was a Hank Reverman so I went in to him and I said, "I want the job" and I said, "I don't want to get paid. I want to learn how to fly." Hank literally looked at me and said, "You're hired," no payroll taxes, not anything else like that, so what I did-- and this is in the fall of my senior year-- I worked eight hours Saturday and eight hours Sunday gassing and oiling airplanes, it was cleaning them up—

Laws: Now these were float planes?

Rolander: These were float planes, yeah, float planes, seaplanes on Lake Union, and I was working towards my pilot's license so on June 7th of 1966 I soloed a float plane on Lake Union.

Laws: At what age?

Rolander: I was 18 then.

Laws: Eighteen.

Rolander: I was 18 and 3 days later on June 10th I graduated from high school. I can't remember anything about my high-school graduation, virtually nothing about that. I was an honor society student but that didn't make that much of an impression on me. Three days before that I soloed on June 7th and I vividly recall what it felt like to take off from Lake Union, be in sole control of that airplane with only myself to get it back down onto the lake again, and that was a moment that every pilot that you will ever talk to will recall, which is their first solo flight.

Laws: Great story, Tom, and we'll return to flying later on.. So you graduated from high school and where did you go--

Rolander: I went then down to Tacoma to PLU, Pacific Lutheran University. Another thing I should mention is this was a really exciting time because Kennedy had wanted to get to the moon. I recall that when I was in probably in sixth or seventh grade when we were back in East Orange, New Jersey, our family went up to a place called Eagle Rock-- just above the Edison laboratory or studio where he built his equipment-- up to Eagle Rock to watch the Sputnik. And I recall there was just a crowd of people up there and we'd all turned our car lights off and there were no lights, this was a dark place, and we watched this Sputnik go overhead and it just-- there was something compelling about that—

Laws: It made a strong impression on you obviously.

Rolander: It made an impression on me. And of course when I started flying what I realized I wanted to do and what formulated in my mind at that point was to be an astronaut. I wanted more than anything in the world to be an astronaut. I got my pilot's license on September 6th of 1966 so just a few months after I soloed I got my pilot's license so I was just totally at that point focused on flying. I had pictures of every airplane you can imagine, jet fighter, bomber, commercial aircraft, whatever all over the walls of my room, and what I decided I wanted to be is an astronaut. So I started researching what it took to become an astronaut. I discovered some common threads. For one thing, they were all military trained and the most likely way was to be in the Navy because you were flying off aircraft carriers; virtually all of them had degrees in engineering and most of them in aeronautical engineering. I took a look at the curriculum. I

really hadn't examined much about what PLU had. I was taking chemistry and physics classes, discovered they had no engineering program. By the end of that freshman year I had researched the University of Washington and of course they had a huge engineering program, aeronautical, mechanical, civil, etcetera, and their aeronautical program was very big and had funding from of course from Boeing and other sponsors, people that provided money. And so I decided that summer after my freshman year I'd take a couple of engineering classes at the U of W. So I worked full time, took a couple of classes, loved the engineering classes, and by the end of summer I decided to matriculate to the University of Washington into engineering and into aeronautical engineering.

Laws: You worked your way through college?

Rolander: I worked my way through college. In fact, I describe myself I joke myself as a slow learner because it actually took me ten years to finish my bachelor's and my master's. Seven in fact to get my bachelor's, and that was because I had a number of course changes as I worked my way through school. Probably the biggest course change I made was when I got to the University of Washington I not only got into aeronautical engineering; I decided to take another step towards my goal of being an astronaut and so I got into Navy ROTC. So I was now-- this is1968, '69 on campus when the Vietnam War was at its height. Demonstrations and all sorts of things going on that were making me feel a bit uncomfortable. I was in uniform on campus two days a week, Tuesdays and Thursdays, and I was marching with a rifle doing drills so went through that. An event happened that some of my friends may recall, which was the Pueblo Incident. It was a spy ship actually, a U.S. Navy spy ship that was off the coast of North Korea outside of international waters but North Korea had claimed a wider area for their waters. So, I was in ROTC and one day our lieutenant commander, the head of ROTC, Lieutenant Commander Ledbetter, called all the midshipmen into our auditorium. We were all in the auditorium and there were I suspect a hundred or so of us midshipmen in the room. He got up in front of the room and he told us that Commander Bucher had surrendered the Pueblo, his ship. This was the first ship that had been surrendered to an enemy in 150 years or-- I can't remember the exact history of that but he had surrendered his ship and he wanted us to know that Commander Bucher had violated his oath of office and that he surviving this incident should be severely court martialed. And that we on finishing the ROTC program, getting our commission in the Navy, were going to take an oath of office and that he wanted us to be aware that the action that Bucher had taken violated that oath of office. So I'm sitting there and he went through a description of the situation and I'm looking around the room and everybody's kind of listening and he said, "Are there any questions?" and nobody was raising their hand and I raised my hand and he said, "Midshipman Rolander, you had a question." And I said, "Well, it seemed to me-- he had two something like fifty caliber deck guns and he was attacked by gunships. It seemed to me that he saved the lives of his men, and that he didn't have armaments to protect himself." At that point Lieutenant Commander Ledbetter said, "Midshipman Rolander, I'd like to talk with you after class. It's dismissed" so I went to sit down with Lieutenant Commander Ledbetter and he said, "Tom, do you realize how the military operates? There is a chain of command" and he said, "Everybody in our ROTC unit knows that you want to be an astronaut, a Navy fighter pilot." He said, "Do you realize that at some point in time given our situation in Vietnam you're very likely to finish your education here, get trained as a pilot and that in the chain of command you may be ordered to drop bombs over North Vietnam?" And that was-- I

guess I'll call it an epiphany. It had never occurred to me that I would be in such a situation. Flying Cessnas was great and even aerobatics; I'd been flying aerobatics to that point; Citabrias was fun-- it had to be an ultimate flying experience as a pilot to fly jets and jet fighters. And I remember getting home that evening, looking at the four walls of my room at home and seeing all these pictures and noticing literally for the first time that there were bombs <laughs> underneath the wings of these aircraft and that really brought me to a real soul-searching point. So what happened is I went back in a subsequent week to have another meeting with Lieutenant Commander Ledbetter and he asked me, "Tom, have you heard of the American Friends Service Committee?" I said, "Who's that?" and he said, "Well, it's a Quaker organization and based upon the conversations we've had I don't think that you're a peace activist that feels like we can go just lay down our arms and everybody'll stop fighting." , I expressed to him, that there are bad people, that I am thankful that we have police, that we have a military that will protect us, but I said, "I'm realizing I'm uncomfortable with being in that chain of command." 'What Ledbetter had impressed on me in my conversations is that the time to make a decision is as early as possible because the later you make any decision-- he said, "I don't care what it is, about a relationship, of who you're going marry, about your job, about in this case the military, the later you defer your decision the less choice you have about that decision." And he said, "Right now you can choose to stay in ROTC or not but" he said "if you choose to stay and go through the military training the government is going to spend a million dollars training you how to fly that fighter and shoot and drop bombs and you would be violating your oath of office to have gone through that and chosen not to do that." So I had these conversations with Ledbetter.

Laws: That's usually sensitive for a military officer.

Rolander: So in fact I met the Quakers, went through that, and I realized that I was a conscientious objector, that what I chose is this is the country I choose to live in, I respect the people that are willing to make the choice because I realize there are bad people and that we have to take arms whether it's police or military to defend our self, and so he was really good in terms of bringing that out to me. I had never heard of being a conscientious objector so the Quakers helped me with some of the paperwork getting started on that. I went back to Lieutenant Commander Ledbetter and he actually was probably the reason I was able to get my status as a conscientious objector so he presented or spoke on my behalf to my draft board. The last time my draft board in Ballard had granted a person conscientious-objector status was in the Korean War so it had been some time and I recall vividly going to that hearing on my status. It of course had several former military members, one in particular the stereotypical butch cut who wanted to know how I would defend my family if somebody broke into my house and attacked my wife and so forth, but at any rate I went through that process and I think it was largely Ledbetter's letter of support where he said, "I believe this person of his own conscience is not willing to take the life of another" and I got my conscientious-objector classification.

Laws: Interesting.

Rolander: There was one other thing that happened during this process. Of course, I was in aeronautical engineering and I got out of that as I was getting out of ROTC. I took a look around aerospace and decided that so much of aerospace was focused on military, on missiles and rockets and other things like that. I realized wow, if I'm not going to fly these planes and drop bombs was I going to be willing to design the airplanes that were doing that, and this brought up for me a lot of ethical issues; where do you draw lines. I mean we as a society pay our taxes and we can voice our opinion through voting and other processes like that but where do you draw lines. Do you stop paying taxes because some of that money is going to fund the Vietnam War, so these were a lot of the struggles I was going through in my own mind so I realized that I couldn't stay in aeronautical engineering. So this began my pattern of-- at that point I'd changed majors twice already from chemistry and physics to teaching to aeronautical engineering so I decided well, let's try something else and I said, "Well, how about mechanical engineering?" I liked engineering so I actually went and spent a couple quarters in mechanical. It turned out that I never could understand refrigeration, still can't, Carnot cycle; how do you actually cool something down. That just baffled me. At any rate, mechanical didn't really hit me. I looked at civil engineering, not so much roads or highways, bridges or whatever, buildings, but at that point it was the early stages of water and air resources, air pollution and water pollution, and that struck me as something where I could take engineering and do some good, some societal good, and so I actually transferred into civil engineering. And when I was in civil engineering I had got to a point where-- this is when I was going through my conscientious-objector classification. Well, I had a quarter of internship and when I looked for an intern program I found the Puget Sound Air Pollution Control Agency so I went down there and volunteered as part of my school program for a quarter and began working with the engineering team there. It was fun; I enjoyed being there. Well, at the same time I was going through my draft hearings, getting that approval, and these are coincidences that happened-- the EPA passed a set of laws which required government agencies to now record emissions from companies so they had to record emissions, record reductions in emissions and so forth, and this was mandated and had to be done on a computer, couldn't be done by hand. As an intern I was part of their engineering team. The director of engineering looked around the room and said, "Who has computer experience?" I'd had one FORTRAN class so I became the go-to person and I was the one assigned now to computerize this process of recording emissions and emission sources and so forth that had just started. I got my approval from the draft board to get my CO position. Well, what happens then is you get your number; this was back during the lottery days. My brother got something like 357 so he was out. Mine was I think 40 or 43-- I can't remember, some lower number-- so it was clear I was going to get, quote, drafted, so I went down to the induction center with all the guys that were getting inducted into the army. I was a conscientious objector and went through the physical and all of that and sure enough my number was up; I was going to have to get what was called alternate service, an alternate service job. Well, most of those jobs ended up being at VA hospitals so in particular Seattle has a VA hospital just south of the main downtown area and that was where most of the conscientious objectors went; they went to spend two years emptying bedpans. Well, that wasn't exactly a thrilling thing for me and I went back to the air pollution agency and said, "Would it be possible-- do you have any funding that could get me a job?" and well, they had a very small amount of funding, in fact less than you get paid as a orderly or whatever it was called at the VA hospital. So I had a letter offering me a job at a very low salary from the Air Pollution Control Agency and I took that to the draft board and said, "I have skills that could be used here," my-- the engineering manager became an advocate of mine, and sure enough I got a job as an air pollution engineer so I preferred that to bedpans

but that was part of my transition. So, I was then working full time as a associate engineer at the air pollution agency doing this FORTRAN programming. My school was now part time; I was doing ten, twelve hours per quarter—

Laws: Okay. Now this was still bachelor's you were working for?

Rolander: I was working on my bachelor's. I was working on my civil engineering degree. In fact I had a great situation. They couldn't afford to actually buy a computer at the agency so they rented time from a civil engineering firm that was right in downtown Seattle. They were using it in their operation eight to five so I basically had from five in the afternoon until eight in the morning and weekends. Well, it turned out it was an IBM 1130 -- what I call my first personal computer. It was a hands-on computer and where we rented these machines they had two 1130s back to back and Calcomp plotters, printers and the rest in there. So what I did is on one of those computers I did my work and it took minutes and sometimes longer to compile programs and to run reports and print out stuff. So on one computer I kept focusing on my work that I was doing for the air pollution agency. On the other computer, because it was just sitting there and we had rented the whole facility, I had a chance to experiment and learn, to take my curiosity about computers. The first thing that struck me is if anybody's worked with an IBM 1130 they had an IPL card. The first card that went through the card reader had programmed instructions; those programmed instructions loaded in the rest of the cards and went on to compile your program or whatever you were doing. Well, I just got fascinated about what this one card could do. So here were the 80 columns, the 12 rows, how was this done, so that got me all the way from FORTRAN down into machine language, down into machine instructions, so I started writing programs that could do that. The first program I wrote was one for a card reader punch. And the first program I wrote was one that-- or the first IPL card I wrote was the one that would pull in the rest of the cards and punch every hole of every column in that card, just kind of entertainment, so the whole unit kind of jumped up and down. Anyway, it was just kind of for my own entertainment.   I had a Calcomp plotter and one of the things I had to do is atmospheric diffusion modeling and then print out plots-- contour plots of where the projected plume was in the land on the ground and these Calcomp plots took forever. The plotters were very slow and occupied the whole machine so I thought there ought to be some way to do that while I was doing something else, and so I actually wrote a program to do spooling of the plots. So I wrote software to take the output of the plot, put it in a file and then I wrote programs that ran in the background while I was doing other things like compiles and other operations that would then take that file, read from it and run the Calcomp plots.

Laws: Was this all self-taught?

Rolander: This was completely self-taught, all self-taught, because I was a voracious reader of IBM manuals, I read every manual I could find on how the 1130 worked, its instruction set, its codes, how to do all of that, so I was really self-taught through that. I did finish my civil engineering degree through that process in '72.

Laws: Good. So bachelor's in '72--

Rolander: Bachelor's in '72 in civil engineering and that took me across to finishing my CO position. So at that point I started looking around. In fact, I've got one other story I've got to relate from the air pollution agency. I shared an office with another engineer who was hired and he was actually a meteorologist and he was retired out of the air force, came out of the air force, and he had been also a programmer so they had two of us working together. He had been up on the NORAD line, way up in Alaska, and that's where he was programming, and so what happened with him is he'd program-- write his programs, submit his decks and his turnaround was like a week, it was just an enormous amount of time, so he just-- he hand-compiled his programs over and over and over again; because the turnaround was so bad he was really careful with that. And the ironic thing: This guy that was the most careful, slow, methodical programmer I ever had seen. He had a poster over his desk and the poster said "It would take a thousand accountants a hundred years to make the mistakes I have made today" and that has stayed with me for now it's over fifty years ago that-- or roughly fifty years ago that you have to be careful. If you've made an error in your program, computers can make an amazing number of mistakes in a very short period of time on your behalf so I always enjoyed that, but at any rate I was so into computers then that I had a friend of mine that mentioned to me that he'd seen a programming job-- just a pure computer programming job up at Fluke, which was an electronics voltmeter [manufacturer]-- primarily voltmeters, timing-- frequency synthesizers, other equipment like that that near Seattle. And so, I applied for a job up there and got a job in test equipment. So I left my job at the air pollution agency. I had already progressed from my bachelor's degree and began a master's program in civil engineering but I had these two sides; the one side was heading off to kind of do good in water and air resources, in that area, and the other was just my driven interest in being involved with computers. So, I started work at Fluke and I decided that I wanted to transfer from the civil engineering graduate program into an electrical engineering graduate program. That turned out to be a bigger hurdle than I had imagined.

Laws: There was no computer science program?

Rolander: There was no computer science program, yeah—

Laws: Okay, so electrical engineering--

Rolander: --at that time, yeah. Because this is back in '72 so I mean we're talking about the advent of the [Intel] 4004 -- there was really no computer science program at that time-- or at least that I was aware of, -- so electrical is where I went. At that point the 4004 was out, I wanted to start working on these computer chips, and the place to do that was in electrical engineering, but it turned out the chairman of the EE department was not so keen on bringing somebody in to get a master's in EE without having gone through traditional EE curriculum. So I spent about a year and a half taking a whole slew of undergraduate electrical engineering classes, studies in subjects like amplifiers and Ohm's law and a lot of these things. I just wanted ones and zeroes but I had to take these classes and thankfully I've never

really had to use that; I got into software. So I proceeded with my master's in electrical engineering and one of my major projects was my thesis, which really became something that had an influence on me and ultimately was to connect me later with Intel. Now at this time-- this is now in the early '70s, '73, '74-- I had left-- actually later left Fluke in '75-- HP was doing a fabulous job of providing educational benefits to engineers. HP would offer a benefit such as paying for your tuition for a graduate degree in electrical engineering so then the rest of the companies in the industry whether it was Tektronix or Fluke or Motorola they all had to follow suit because they were pulling from an engineering pool. So basically through this process Fluke paid for my graduate school in EE, they paid for my time in class; they paid for books; they also provided their facility for me to put my thesis system together. And I go back to complimenting HP for their foresight and what they offered to engineers because I worked a lot more than 40 hours a week plus going on to school because this was an incredible opportunity to have. And one of my good friends and colleagues, Jim Peckol, who is a professor now at the University of Washington, he and I commuted together, carpooled down to our EE classes, and he's been a friend since that time, My thesis was focused on connecting microprocessors-- writing software, building my own computer, as at that point in time you couldn't actually go down-- this predates the Altair and all the premade machines or constructed machines. What you could do is you could go buy a microprocessor chip for-- and I think the first one I bought was maybe $360; it was a small fortune for that. I remember buying my first VT100, my first character terminal, which was a thousand dollars for that, but at any rate I built my very first computer. I designed the circuits, wire wrapped the machine. I wanted to learn a lot of things as I was going through this process; this was after all a master's thesis so I also did a 4k static RAM board. I designed the board, taped it up myself, and of course because I was at Fluke and this was part of the graduate program they manufactured the boards for me, provided me with the chips, and my thesis was called "MOBIUS," which is a multi-operator basic interactive user system. We go out of our way to make acronyms that do something. At any rate, so I had-- I started with an 8008 but the 8080 came on during the time I was working on my thesis. The 8008 was outdated-- it had the eight-level deep stack and it was just really not a really powerful machine. I loved the 8080 so what I did is I actually made a dual processor system in my thesis. The 8008 I had as my terminal processor; I had it connected to four UARTs so it was connected to serial terminals. Then I had a shared memory and my 8080 was my main processing unit so it ran a basic interpreter so I actually wrote a minimal basic interpreter, a language; I wrote that in PL/M and that was what I had-- so basically the shared memory-- I had a message passing machine between the front end which did the communication with the UARTs through the terminals and then the BASIC and the back end and I could run multiple BASIC programs at that time and that was in my thesis.

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Laws: Were you familiar with Gary Kildall at that time?

Rolander: Good question. - Just as I was making the transition from civil engineering into EE, I was spending a lot of time in the computer science lab and just as I finished my bachelor's-- this is in the summer of 1972 just when the 4004 I believe was out if I got the dates correct on that-- I was in the computer science lab one night. It was late, -- certainly after midnight, probably one or two in the morning-

- and in came a kid, a fellow who looked like student, reddish hair. He was in cutoffs, I remember the strings hanging down from the cutoffs, and he had a leather briefcase and he brought it into the lab-- this was a Sigma 5 lab I think it was-- and he opened the briefcase and he pulled over an ASR-33, a teletype, plugged it into this, and it had a series of LED lights and buttons on it, PROM programmer, and it was a 4004 monitor. I just became enamored of this. I wanted to know where he got it, what it was for, how I could get one and so forth. This turned out to be Gary Kildall and Gary was infectious in his enthusiasm for this machine, for what it could do. He was hired by Intel to actually develop the monitor for for the 4004 and build that machine. Gary at that point was down at the Naval Postgraduate School [in Monterey, CA] and one of his other projects after the 4004 at Intel was to write the PL/M language, write the compiler for that, which he wrote in FORTRAN, so I used the PL/M language in my master's--

Laws: Okay. An interesting connection.

Rolander: --in my master's thesis.

Laws: Yeah.

Rolander: So that was the initial connection that I had with Gary.

Laws: So you graduated with your master's in--

Rolander: I finished it-- the work in '75. I had to go back up to defend my degree-- it was actually in 1976. I recall with some fondness defending my thesis; that was fun. A group of professors including Professor Gilford, who was my main adviser, and of course at that point I knew a lot more about microprocessors than any of the faculty did so I had an advantage on that, but I remember after defending, and it had gone well, Professor Gilford took me to the faculty lounge for lunch. And we had a great lunch conversation and as we were wrapping up that conversation he looked at me and he said, "Rolander, as you look on into your future" he said "as an electrical engineer you will only truly be happy when there are no moving parts bigger than an electron." He said, "Printers will be the bane of your existence" and that was in 1976-- early '76 and that was true, very, very true, and that's 40 years ago.

Laws: And they still are.

Rolander: Still are. <laughs>

Laws: Okay. So you've defended your thesis. You're now a master's graduate. What did you decide to do for a career?

Rolander: Okay. So I was at Fluke and so my first job at Fluke was in test equipment-- automatic test equipment. We were doing multilayer boards in our products and one of the big problems we had is if you fully load a board and find you've got a short in the board later, later after you've loaded the board, you've expended a lot of effort, time and money in that. So, one of my first jobs at Fluke was a bare board tester. We had a bed of nails basically and I wrote the software to sit there and verify that there were no shorts, that all the paths were in fact correct and that there were no shorts on the board. Most of that program was on RSTS on PDP-11s, and it was in BASIC, I was just much more interested in getting back, because of the experience I had with my thesis, to work on the 8080 - working on processors. So at that point I got recruited as the software project lead, software project manager for Fluke's first microprocessor-based instrument. It was the 8500. It was a 10 part per million, 1,000 reading per second instrument, and it had an 8080 processor in it. I actually worked with the engineer designing the processor unit, the memory and so forth of that, and I did some of the last hardware I've designed. I did their serial interface board and worked on the IEEE488, so I got involved with some hardware part of that design, but most of it was software. So when you think about it, here was the instrument, and we were now going to do everything we could do in that instrument with the processor, with software. That meant de-bouncing the front panel keyboard. so As you pushed a button you'd get an on/off, on/off cycle till it dampened that oscillation and stayed in one state, so it was de-bouncing the switches. It used seven-segment LED displays. For normal mode rejection in the instrument we were synced to the line frequency, so we had line frequency events that gave me interrupts and I used those to light up the LEDs so the LEDs were multiplexed. They were just strobed as we went through that, so we did the strobing for the display. When we did our Ohm's we actually did Ohm's law inside the instrument, so we would force a current and measure a voltage drop. And our A to D in that unit was R squared A to D, recirculating remainder R to D. So we would basically make a measurement, then we would take-- actually, we would generate a precise voltage that we knew, then we would take the difference between that and the voltage coming in and then approximate again. So it was recirculating. We'd take the remainder part until we got down to our 10 part per million reading on that. That was just a lot of fun. That got me connected with Intel, so I spent a lot of time talking with Intel engineers as we were designing and putting the processor in and had other questions and things that I worked with Intel on.

Laws: And you eventually ended up at Intel.

Rolander: Eventually ended up at Intel. So I was finishing my master's and I got recruited by Intel. So there was through word of mouth a contact that I'd had through Intel. There was Nick Nichols who was head of the application department under the microcomputer systems division, so it was Dr. Nick Nichols who reported to Dr. Bill Davidow who reported to I think it was Dr. Noyce at that point. So I'm looking up this series of Ph.D.'s up above me and wondering if I shouldn't maybe continue on <laughs> for a Ph.D. But any rate, I got recruited down to Intel, and my first job at Intel related a little bit to my hardware, that at Intel was called the Multibus, which was their bus. It was used in the Intellect, their program development machine. It was used in their single board computers. It had not had a specification written for it. In other words, the timing, the interrupt control, all of that was not really specified, and so I got the thankless job of trying to arbitrate between different groups of engineers in terms of the actual specification for the Multibus, so that was among one of my first projects at Intel. The next project got me more in the direction

of where I ended up, and that is Intel decided that they wanted to have a real-time multitasking executive for their processor so that it could be used in process control kinds of applications. So there was a team put together, a team of three. It included Ken Burgett, who was one of the software managers. He had designed the ISIS operating system for the development system, and myself. So, I was brought in because my background was more hardware to do the device driver portion of it, the device interface, the interrupt controller, you know, the UART programing, and the like. So, the three of us were the team that designed and built RMX-80.

Rolander: Any rate, so one of my fun things as an application engineer was to put together demos of the system, and I remember there was an NCC, a National Computer Conference that was down in Houston, and it was in August of all times and all places and whatever, just crazy to me. I just remember the heat. Any rate, my job was to come up with something that demonstrated how an RMX-80 might be used. So I thought about this for a while, and what I came up with was I built basically just some plastic boxes and a lightbulb in the box. And I had a hole with a grommet in it and a thermometer in there, and I put a thermistor inside the box and I had three of these that were sitting on the table. Then I took the output and went through an A to D that went into the single board computer. And then I wrote the software in PL/M that had a little control panel that allowed you to have a set point, a high and low set point. So the light would simply turn on to raise the temperature in that box and when it got to the upper limit of the set point it would turn off the light. The light would stay off till it got to the lower one. And this was just a simple demonstration of a process controller, and so the purpose was to demonstrate the utility of a single board computer like the SBC-80 and to demonstrate RMX-80 as software tool that could enable you to do this in real time, in a real time interrupts. So that was a fun project, I enjoyed that one.

Laws: And you were at Intel for a couple of years

Rolander: I was at Intel for a couple years, and it was a great time. There was Bob Garrow there, there was Terry Opdendyk. Dave House was there, Jim Lally. It was an incredible time to be there. I really enjoyed the comradery, the experience, and everything going on there. One thing that had happened is that Intel's stock options had been very generous, and so what had happened is the engineers I was working with were vesting-- you know, each time they vested a year's worth of options they were cashing out, and in the case of many of them that I was working with the options they were vesting and cashing out were the same as their salary. So they'd come to the point where they were out of options and were being offered new options that weren't quite as big and generous as what they had, so they were looking at taking significant decreases in salary. Well, at that point I'd been working with Ken Burgett for some time, and Ken had the idea, "Well, Tom, we ought to go out and start a consulting company and see what we can do." So, I thought about this for a while and decided that, well, Ken was a pretty sharp guy, and up to that point I'd worked at fairly large either government agencies or in fairly large companies. Never really thought about being an entrepreneur, heading out on our own, so Ken talked me into it. And so we left Intel and actually got a contract with National Semiconductor, to design the operating system for their single board computer, something you might say competitive to RMX-80, and the system was called Starplex. So Ken and I were very careful, especially after getting a meeting with [Roger] Borovoy, who

was the attorney for Intel as we exited Intel, that we were not taking any software with us from Intel, that in fact what we were taking was our knowledge, what was between our ears. So we did Starplex for National, and that was a fun project. And we also did some terminal emulation and software, because at that point, you know, we were getting smart terminals, intelligent terminals. And there was a company, Beehive, that was in Utah.

Laws: Utah, yes.

Rolander: Yeah, in Utah. And so they hired us to do their software. One funny story I recall about that was that we developed their terminal emulator for several different functions, and at the end of our project it was in PROMs and then they had put it into metal masked ROMs. And we were having a final meeting with the engineering management at Beehive, and I recall the manager saying that he expected us to continue to support these units that they were shipping. And of course the software at that point was all in ROM. And I recall Ken just sort of looking at the guy quizzically and saying, "What do you expect us to do with code in ROM, salute it?"

<laughter>

Rolander: So any rate, not much you could do about code in ROM at that time. After a few of those projects--that was about a year and a half--Ken decided to move to Arizona, down to Scottsdale, Arizona. And I didn't want to go to Arizona. I had been in California now and just loved it. Heat drove me crazy, so I decided that that was not something I wanted to do. Well, Gary Kildall had been in touch with me numerous times since I had finished my master's to come down to Intel. In fact, I connected with him at Intel when he was doing further PL/M development and additional consulting, and he would keep asking me, "Tom, you ought to come down to Pacific Grove and work with me. We could so some software." In fact, after Ken and I finished Starplex Gary had called me, and so I brought Ken down and we talked to Gary about doing a multitasking system for Gary. That didn't quite pan out. Ken and I had other work. And so any rate, when Ken moved to Scottsdale, I said, well, okay, it's time actually call Gary. And I'd never been to Pacific Grove. I'd at that point been in California for several years. Most of what I'd seen was--

Laws: Highway 101.

Rolander: Yeah, Highway 101 and offices, you know, writing code, so I'd never really seen much of the ocean or certainly had never been down to Monterey and Pacific Grove, so I called Gary and said, "Yeah, why don't I come down and take a look." And I said, "Besides that, if I decide not to come down or to take the job, will you just leave me alone?" He said, "Not a problem, but just come down." So it happened to be a Friday afternoon and it was one of those Chamber of Commerce days, just beautiful. It was before the aquarium was built and so there was actually not the Rec [reation] Trail. It was still part of the railroad tracks. But Gary had directed me when he gave me instructions on how to get to the office to come down

to where the aquarium is and then drive along the beach to Lovers Point, gorgeous views, and then turn up three blocks to the office, which was at 801 Lighthouse at the corner of Willow and Lighthouse. And so I came up to Gary's office, and just blown away with the view. And Gary had the master bedroom on the second floor of this Victorian. And I walked in the office. He had a big desk with a couple of computers on it. And I looked over and on the side of his desk there was a model airplane. And so as I'm walking into the office and we're shaking hands saying, "Hi," and I said, "So, Gary, what's with the Cherokee 180?" And he looked at me and said, "Huh, are you a pilot?" And I said, "Of course." You know, to look at a model of an airplane like that, there are lots of different models. There are Cherokees 140, 180s, 235s. It could've been any one of them.. I knew it was a Cherokee 180, so he knew that I knew something about flying. He said, "Well, tell me about it." And I said, "Well, you know, I got my license back in high school and I've been flying for," you know, at that point 12 years or whatever, 13 years, active pilot. And he said, "Are you current in type?" And I said, "Yes." And he said, "Wow, I got my instrument rating last month." He had just got his instrument rating. Now, one of the requirements of being an instrument rated pilot is that within every six months you have to do six approaches-- basically, six hours of under the hood or instrument flying time, and so it's a difficult thing to do. You have to hire an instructor to come along with you or you have to have somebody that you know, and that person, then, is going to sit in as a safety pilot. They sit in the copilot's seat. They obviously don't have a hood on or anything so they're able to watch for traffic and monitor what's going on, make sure the pilot under the hood doesn't put the airplane in a bad situation. Well, Gary said he had just got his instrument rating and he said, "Why don't we continue our conversation-- let's go out to the airport." So <laughs> we hadn't been maybe five minutes in Gary's office and we went down and got in his Porsche, drove out to the airport, pulled his Cherokee 180 out of the hangar. He put on a hood, I sat in the seat next to him, and he did several approaches. We came back. We went out for dinner, shared a bottle of wine at dinner, and it was a done deal.

Laws: <laughs>

Rolander: I came back shortly after that to start work with Gary, but that began years and years and years of flying together.

Laws: Sure. Back up a little bit here now. You married--

Rolander: Yes.

Laws: --when you were in Seattle?

Rolander: Yeah, I married when I was in Seattle. That was back in the end of '69. I had brought my wife-- my second son was born the month before I joined Intel, so I actually had a home up in Seattle. I had at that point a daughter that was 3, 3-1/2, and a son that was a year old or just-- I'm sorry, a month old, and so I was getting moved down to Intel. So I came down to Intel and we had a house up in Alderwood

Manor near where Fluke was located, so I came down and spent the first few months at Intel alone and made some trips back up before I brought my wife, Cindy, at that point, and son, David, and daughter, Kari, down, so I moved them down to California, so we came down at that time. Later on, and this is a little bit of a digression here in the story, and that is that I had started working with Ken Burgett. Well, Ken was into the metaphysical and I had had a traditional Lutheran upbringing, a missionary's son, minister's son, and hadn't really explored, hadn't really thought about my beliefs. These were beliefs that I had in effect in a culture I had inherited. I hadn't really thought much about it. Well, when I was at Intel one of the things I learned about Ken was that he was very interested in metaphysical and something beyond just engineering and the mathematical world and whatever, that he was a voracious reader of books like "Seth Speaks" and whatever, and, then, he had been involved with a religious group called the Family of Man, which was in San Jose. Well, I got curious about this. If I was going to become a business partner of this guy I wanted to make sure that he had all his marbles and was all there, and so I had gone from my traditional Lutheran experience to go try out this Family of Man. Well, there was one weekend where Ken and his wife June happened to be out of town. I figured this was a good time for me to go explore and find out what this is. So I come to this building in Willow Glen, and it's got rainbows painted around the whole outside of it. I was probably hugged a dozen times before I got in and sat down. There was a requisite number of guitars up front and other things going on, and this was quite an experience to me. So I came in and I felt I was very obvious as a stranger in there, and so a lot of singing going on and at one point a blonde woman got up in the front, intense blue eyes, looked at the audience, and I felt like she was looking at me directly and talking to me. She says, "This morning I'd like you to suspend your disbelief because I'm going to talk about a little experiment that we're going to conduct here, a mental experiment and exercise, so I want you to try this on for size. So, remember, you're going to suspend your disbelief. Just be open to this for a little bit." She said, "Okay, let's imagine that we have a couple and they're on vacation. They're traveling up the coast, spending some time sightseeing and staying at hotels, eating out, just a wonderful time. They're deeply in love. They're having a great time. One evening they get to a hotel, they check in, and no sooner have they checked in and got stuff in their room they start fighting. They start arguing with each other. Well, this is a little strange. They've been so good at this." She said, "Well, let's suppose for a moment the night before there was a couple in there that was arguing and fighting. Is it possible that something they did, that argument could've somehow permeated the walls and been-- there was something, energy..." she called it energy. And she went on to say, "Well, you know, years ago, there has always been a magnetic field around the earth. We couldn't measure it thousands of years ago. It was discovered. It didn't mean there wasn't a magnetic field, so who's to say that at some point in time we can't measure this energy?" Any rate, I thought, wow. Okay, I'm being asked to actually sit in this situation and think about something and not repeat creeds and be part of dogma and whatever, and so I thought, Ken, this is pretty interesting stuff, so that actually opened me into that. Just to wrap up that part of the story, my wife, Cindy, got very involved in that metaphysical movement and the Family of Man, and the teacher, this Marsha Mossman, moved back east. She wanted Cindy to be with her. So Cindy-- At that point we were living in San Jose. I was commuting down to Digital Research in Pacific Grove.

Laws: Okay.

Rolander: And so one evening I'd come home from the commute and Cindy said, "I want to move to Washington, D.C.," because Marsha had chosen to be there for the 1980 election. That was the Reagan election. She wanted to be there for the focus of the energy of the country and so forth. So I'm digressing here, but, anyway, that brought my wife out. So, I went to Gary and said, "I'm going to move with Cindy. I moved her to California. She was willing. She wants to move to D.C. I'm going to D.C." Gary was upset for a little bit. He came back into my office a couple of hours later and said, "Tom, you're the hardest working. I can depend on you. Why don't you just take a computer with you? We'll fly you back here at our expense every few weeks and you can continue on." So we went back to Washington, D.C.

Laws: Okay.

Rolander: So Washington, D.C. We then moved on down to Florida, and then part of that story is that this Marsha, the woman that led the group, her husband was sort of my best friend at that point, and a lot of Frisbee throwing. He was kind of a house husband and that. So in Florida, my wife, Cindy, was spending a lot of time with the Family of Man. She was one of their leaders now of that, so a lot of classes and whatever. Well, one evening Cindy and John came in and said, "It's in the energy for us to be together, and you'll be okay with the kids," and they left.

Laws: Wow.

Rolander: So at that point I'm living in Florida. I've got this job in Pacific Grove and I'm trying to figure out--

Laws: And a child.

Rolander: And a five- and an eight-year-old, and what am I going to do? So, the next day I called my parents in Seattle and said, "Mom and Dad, could I bring Kari and David up to stay with you for a couple of weeks while I figure out what's going to happen?" So I brought them up there and I came down to California to talk with Gary and he said, "Tom, come here. You need to be here, live here in Pacific Grove. Great place to raise your kids," and so forth. So at that point I flew back to Florida, loaded up a U-Haul truck and brought that truck out to Pacific Grove, moved into an apartment. And at that time Gary had a twin-engine airplane, an Aerostar, great airplane. So, we got in the airplane and we flew up to Seattle and picked up Kari and David, my son and daughter, flew them back down to Monterey. So at that point Gary said, "Tom I'll have you run engineering." So at that point I had a team of about 15, so I was vice president. I was running engineering and a single dad with a five- and an eight-year-old, and that was a handful. And I met Lori, my wife now of 35-- we've been together 35 years. I met her at the office. I don't know where else I would've met a woman.

Rolander: But any rate, she has been wonderful and made most of my career possible.

Laws: That's a great story, Tom. <laughs>

Rolander: Yeah so...

Laws: Now, what did you do as vice president of engineering?

Rolander: Okay, so when I joined Gary, what he wanted was a multitasking [version of CP/M]

Laws: So this would've been about 1980?

Rolander: This was end of '78, early '79, '79. And what Gary wanted, because he saw the potential, even with this microprocessor, this 8080, that it could do more than just one thing at a time. He clearly understood multitasking and if nothing else print spooling. You know, background printing was an issue. And he saw opportunities with companies like Siemens that needed a multitasking operating system, and so he recruited me to do MP/M, which is a multiprogramming monitor.

Laws: Okay, and by this time, then, CP/M was in the mainstream for small business computers?

Rolander: CP/M was in the mainstream. We were phenomenally profitable. We were making a lot of money. We were the go-to company for everybody that was shipping microcomputer systems. And they would all--

Laws: Right, and now you could see the opportunity for a--multitasking version of CP/M,

Rolander: And so this was the multitasking version of CP/M. At that point, these computers were still relatively expensive, and so the idea of putting a couple of terminals on them to do more-- you know, imagine word processing. You know, word processing doesn't take a lot of CPU time, and so putting a couple of those terminals on one computer was the objective. Now, with the 8080 we're limited to 64K, so you had a small amount of memory that you could actually deal with, and so I had to construct an operating system that fit within 16K that was fully multitasking that included the file system and the whole operating system. And what was designed at that point in terms of hardware was Altos Computer, Dave Jackson, was one of our first customers with that. They would take the upper 48K memory and bank switch it, so you had software control to toggle different 48K segments, so each user would have a different 48K but share the common 16K underneath. So I did MP/M 1.0, and that was probably the most fun I've had in my life because I did the entire operating system.

Laws: Just by yourself?

Rolander: Myself. No other engineer. I wrote the utilities, the file transfer, copy, program, the print utilities. I wrote-- the debugger I ported, brought the debugger over, and I wrote all the documentation for it, so that was just a huge amount of fun.

Laws: What kind of machine would you be working on to create that?

Rolander: At that point I believe I had a Godbout. I used a CompuPro, a CompuPro system. It was S100 based. I remember my first hard drive, I think it was five megabytes or something <laughs> like that, so these were small machines. In fact, one other story about when I was commuting from San Jose down to Digital Research I would come down Monday, spend Monday night, come back Tuesday, go down Thursday, come back Friday. So on the nights I was down there I had a camp cot that I would fold out in my office in a bedroom that was up in this Victorian, and what I would do is I set it up so that it would beep when it finished a compile, because at that point compiles could take half an hour. Actually, a full build of all the utilities in the operating system could take even a couple hours. And so, basically, I was kind of working 24/7 on the projects at that time. So, MP/M 1.0 finished, went out, and of course immediately followed with the second version because there were a lot of requirements for additional functionality, additional utilities with that. And I led that team and also began work on what Gary saw as the next step, which was a network operating system, so I began work on what we called CP/NET. It needed to deal with everything from token rings to Ethernet, and so the idea was, basically, what CP/M did is it separated the hardware from the application, so the operating system, then, became this layer that obscured the hardware so that it didn't matter what the capacity or size or speed or whatever your disc drive unit was or how your display was implemented or whatever. Your application sat on top of that, so it made it possible for any application to run on any piece of hardware. So, that was core to Gary's design, and so, of course, with MP/M, with the multitasking, the whole interrupt architecture, timers, all of that had to be dealt with in the same way, and this was part of what Gary schooled me in. And, then, again, as we got to networking it was doing networking, so you could have a remote drive. You could map a file system on another computer to be a drive on your computer, and that had to be done in a way that was hardware independent, whether it was token ring or Ethernet or whatever that technology was, so that was a big part of my schooling from Gary.

Laws: How would you work with Gary? I mean were you in the next room and you'd be in and out all day or would you just see him once a week or...

Rolander: Most of my time with Gary was actually either out talking and jogging, having dinner, or flying was the majority of our time. But what happened is at early stages I think it was a relationship we developed that I really appreciated and one that I've relied on in my own management style, and that is I like to work with people where they have a known skill set, where they're competent in an area. Okay, imagine a couple of people with well-defined skill sets. Well, when you put this team together there's

always going to be overlap. There's always going to be decisions that a person will make that will affect somebody else's work. What Gary taught me is that when a decision I made would affect some other team member's work, that was the time to get together with a meeting. But most of the decisions that were in my own domain for what I was designing--maybe it was the message passing machine within my own real time kernel--there was no reason for me to call meetings together and all the rest of that. So we would spend time discussing architecture. That's another thing I learned from Gary is that when you design software you have to know ultimately not just this generation of what you're building but where this can go so that you're thinking multiple steps ahead, because, as he expressed it to me, early on decisions are arbitrary, you know, almost a coin toss whether you go this way or that way. But if you have an architecture in mind, a view of where you want to be ultimately, where this can go in the next generation of systems, these are not arbitrary decisions. So a lot of our time together especially early on was-- flying was a big part of that. We were together at Digital Research until-- well, one other story I have to say about Digital. So I became vice president of engineering, and really the reason I became vice president was that Gary gave me a choice. He said, "Tom, you're either going to help me hire your boss to run engineering or you're going to be the VP of running engineering." I figured, how hard can it be? I'll run engineering. So I did take over engineering, and that was shortly after I had moved back to Pacific Grove. So I managed engineering until it got to be 150.

Laws: Wow.

Rolander: And at that point I had people reporting to me who had people reporting to them. I was three layers away from the people actually doing the engineering. I was fine managing when I was managing people that were doing the coding. I was still pretty okay when I had people that were managing the programmers reporting to me. When I got one more layer in there I was now working on spreadsheets and business meetings and all sorts, so I just was losing touch technically, and that was very frustrating to me. So I had an experience in the summer of '83. I was running a $28 million business unit, and I got up one morning, put on my suit, my coat and tie, was headed down to the office, and I realized for the first day in my life I did not want to go to work. And I literally sat down kitchen table and cried for a bit. You know, I'd loved newspaper routes. I worked at the post office for years, Penney's, you know, whatever. I always enjoyed my work, and I didn't want to go to work that day. So I took off my suit-- didn't call the office, took off my suit, put on sweatpants and a shirt, walked down-- in Pacific Grove everybody knows the town to Ron's Liquor Store. I picked up a six-pack of beer and put that in my backpack, walked down to Asilomar Beach, and I sat on Asilomar Beach for the whole day, one beer at a time, very slowly, thinking about what was I going to do. Well, that next morning I went into the office. And at that point Gary was chairman of the board and John Rowley was the CEO. So, I went in to Gary's office and I said, "Gary, I need to talk to you and John." I went in and I said, "I quit." And they looked at me and said, "You can't quit. You've got this business unit. You've got 150 engineers in your department. We need you. You can't quit." And I said, "Yes, I'm not happy. I need to find a job where I'm writing code. I've got lots of vacation time I haven't taken, so I'm going to take the vacation right now--this is my notice--and I'm going to go down to my office and start packing up my things." So with that I left that room and went down to my office and in fact started packing up my books and my things that I was taking with me. A couple hours later John Rowley and Gary came in the office. They looked at me and they said, "We have an offer for

you, an idea." And I said, "Okay, I'm open." And John looked at me and said, "We'd like to offer you the position of VP of research and development, the CTO of Digital Research." And I paused for a moment and I said, "Will I have any direct reports?" And John looked at Gary, Gary looked and John, and they looked back at me and they said, "No." I said, "I'll take the job." So that was kind of the end of my-- you know. By then I'd learned that I'm very comfortable leading small teams. I've done several startups since Digital Research time, and I love leading a small team, but there's a point that you know in your gut that it's more about management than about the technology working, so I left that. And, actually, I was in that role, I then shared a corner of Gary's office and the two of us were doing R&D projects. And we started working with a big laser disc project, and that was when Gary heard about compact disc, about CD-ROM. Well, Digital was-- if you recall back in '83, '84, Microsoft had really taken over the OEM market. You know, they had the IBM standard through PC-DOS and then MS-DOS, and so Digital's business was shrinking and shrinking. And Gary and I were in the R&D portion looking at new opportunities, new areas. And one thing Gary was really good at is seeing new technology, and a lot of times that technology is in the form of games or entertainment and things like that. Well, he'd heard about CDs, compact discs for music, and so he got a hold of a compact disc drive. And I remember the day he got the drive. It came in from Japan. I think it came in as a toaster or microwave or something because there was no import. They couldn't export--

Laws: Criteria <laughs> for it.

Rolander: --for bringing it into the U.S. So any rate, Gary had this and he said, "Tom, Tom," you know, we put music on there. He had earbuds with a splitter and he took me out. We would run together on occasion down through the woods in Pebble Beach, and so we went out and did this run, both of us listening to his choice of music, but it was amazing how this device was able to play music. It was this little sheet of what looked like plastic and replicated that sound so well. And Gary looked at me and he said, "Tom, you realize this is digital storage. This is not an analog medium. This is ones and zeros here with error recovery, error handling, but it's ones and zeros. So we can put digital data on this disc." So Gary went to the next board meeting and he proposed that in R&D we'd develop something for optical disc and go do this, and the board said no. So Gary, his counter to that was, "I would like this clearly not to become a conflict of interest, so I want a written statement from the board that I can proceed with this separately on my own," and in fact obtained that. And just a few months after that I resigned from Digital Research and joined Gary. And initially it was called Activenture, but we changed the name to KnowledgeSet after Activision sued us, because it was too close. But any rate, we became KnowledgeSet, and our focus then was to make a disc with the encyclopedia on it. So we got a license from Grolier to take their encyclopedia and put it on disc, and this was in June of '85 at the Consumer Electronics Show in Chicago, so we produced the very first CD, commercial CD you could buy literally in the world, was the Grolier Encyclopedia. That was just another example of Gary looking ahead, seeing an opportunity, seeing what I call a paradigm shift, and these paradigm shifts, these big changes for how we deal with information, this was moving information from essentially paper, from print, that source, into an electronic-- or at that point optical, but ultimately into an electronic form, and today of course into the cloud.

Laws: Okay, I'd like to come back, Tom, but we can't go on from here without talking about a paradigm shift that Gary missed, which was--

Rolander: Okay, the internet. Are you talking about the internet?
[Note: the reason I thought of the internet was that it was a technical opportunity which Gary missed because it came after he passed away. I did not think of IBM because that was a missed business opportunity. Gary excelled at technical opportunities and not business opportunities.]

Laws: No, I'm thinking about the IBM PC, which--

Rolander: Oh, the IBM, okay, yeah, IBM PC, ah, thank you.

Laws: --I know it is something you don't like to dwell on--

Rolander: Oh, yeah, yeah, right.

Laws: --but I think we need to get some of that story.

Rolander: Okay.

Laws: What do you know about the interaction between Gary and IBM and what really happened back then when he made decisions that changed the direction of his company?

Rolander: Right, because Gary had so much vision in terms of technology, and really his Achilles heel was in terms of business, actually being a businessman. And ultimately, as the story now has played out, he ran up against one of the most aggressive and possibly ruthless businessmen of our time, which was Bill Gates, a very successful businessman.

Laws: Now, he'd known Bill for some time.

Rolander: He had known Bill for some--

Laws: They'd even talked about merging their companies at one point, I think.

Rolander: Yeah, yes. In fact, it has to go back a little bit earlier to when Gary first got to know Bill, and that is back when he was at the University of Washington, one of the jobs he had was working with a timeshare company. If you recall, timeshare companies with teletypes and other mechanisms you'd go in and you'd pay for a certain amount of time that you were on the system, and much like today you had a username and a password, and you would go in and get access to the system and be billed based upon how much time you had on the system. Well, in the process of doing this, Gary happened to notice that there was a lot of usage of a couple of accounts that he couldn't quite figure out, and he had noticed that there were some people's accounts where their account was used but they had no record of using it, so he knew that somebody somehow had accessed these other accounts.

Laws: And this was at University of Washington?

Rolander: He was at the University of Washington. This is when he was going through his master's and Ph.D. there, and he had a part-time job working with a timeshare. He discovered that some very clever students, they were actually high school students at the time, had figured out that they could go in and with their program look at memory that was outside of their program space, and in fact they could go pull a bunch of that out. And so my recollection, my understanding of this from Gary was that what they had done is they'd gone through memory and found things that looked like user names and passwords and had then been able to use those for additional access on a computer. Well, it turned out when Gary researched this and went all the way down finding out, it turned out to be Bill, so that was his first encounter with Bill. The other thing here that affected Bill and that played a part later on had to do with IBM. UW had their old 7094 mainframes, and they were getting ready to upgrade. And at that point the candidates were the IBM 360, the CDC 6400, and the Burroughs B5500. Those were the three major players in that. And I think it was Odegaard, who was the head of the University of Washington at that point, made a rare decision, and that is they now had a computer science department. And he went to the computer science department and said, "I need you to help me decide what computer we should select from these choices out there." So this came to the computer science department and Gary became part of the team to help decide what computer they should get: IBM 360, CDC 6400, or Burroughs B5500. So what the computer science students did is they put together test decks, boxes of punch cards, okay, running mathematical analysis, compiling, statistical programs, all sorts of things. They put together a full suite. Then Gary and his team went off to each of the sites, Burroughs, IBM, and Control Data, and ran their tests. Came back from their tests, and it's probably no surprise to any of us in the industry, the CDC 6400 just wiped out the IBM 360 and the Burroughs B5500. And so their team came back, they went to Odegaard and said, "This is it. This is the machine you should buy." Well, there were always jokes, probably rumors that IBM had already put a 360 on a railroad car getting ready to ship out to the U of W. Their approach was very much one of a heavy-handed sales process top down, and in fact they had-- the board of directors at the University of Washington, many of them had been wined and dined by IBM and so forth, and Gary essentially became indignant. I mean IBM really fought the CDC purchase from the U of W to buy the CDC. So, IBM at that point did not impress him because it was not a superior machine to CDC, so technically it had failed. And then the business aspect of that dealing really bothered him. So that is a little bit of background. All right, so now we fast forward to 1980, I guess the end of '80, not quite getting to '81 yet but the end of '80. At that point the way the story began is that IBM had decided to build

a PC, which is remarkable, and make it essentially an open system. And so this is the group that was in Boca Raton. Well, they needed an operating system for that, and the primary pairing that was sort of in common use at that point in time was Microsoft BASIC on an Apple II, for example, running on top of a CP/M card, which was running the CP/M operating system. But at any rate, it was that combination of BASIC and CP/M. Well, IBM went to meet with Bill up in Seattle and discovered that Bill didn't own CP/M--they assumed he had BASIC and he had CP/M--and so he couldn't sell them CP/M but he had BASIC. At that point, much to Bill's credit, he called Gary and said, "Hey, I've got a customer, potential customer of yours that you ought to treat well. I can't tell you who it is but they're going to get in touch with you." Well, the reason Bill and Gary had had that relationship is that they had at one point in time-- because Bill was connected with Altair Computer down in Arizona, I guess it was Albuquerque--

Laws: Yes, right.

Rolander: --and, Bill's parents were up in Seattle; and Gary's parents were also in Seattle. But Gary and Bill had talked about even the possibility of moving Microsoft in to Pacific Grove where Digital Research had started, which was an odd kind of combination. But any rate, shortly after Bill had called Gary, Gary did get a call, and the call was from IBM, and they were on the west coast. They wanted to come down, two days later, and meet with Gary. And Gary said-- I believe that was going to be on a Thursday, and Gary said, "Well, I have a meeting that morning at CompuPro up in Oakland, and so I have a meeting in the morning but late morning I'll be back down and I can meet with you, so why don't you come out and we'll meet?" Well, so that was set up. So that Thursday morning, I was with Gary, we flew up to Oakland. We had a delivery and a conversation and stuff to do with Bill Godbout there, and that meeting ended and we flew back down to Monterey. Well, in that ensuing time IBM had come to our Victorian and met all the people, and we were casually dressed, jeans and whatever, met the people in the office. And Gary's wife Dorothy was the office manager. She was the businessperson there. Well, IBM came in and they presented what was a one direction, a unidirectional nondisclosure agreement. So basically it was to say that anything that IBM said, the fact that they'd been there could not be revealed. That was all secret. And the flipside of that was that anything that Digital Research told IBM they would regard as public domain. It was all public information. Well, that really irritated Dorothy. She was from what I understand unwilling to-- we had an attorney at that point, a fellow, Gerry Davis, who had done our copyright on our software, was unwilling to spend the $60 or $80 or whatever it was an hour to have him come be in that meeting, so just ended up having the IBM people stew while Gary and I got back down to the meeting. So we sat in the meeting and Gary just said, "Oh, go ahead. We'll sign that." Well, I could tell you what was going on in the back of Gary's mind was, this is IBM. You know, I don't know what this is, but it can't be that important ultimately because they're not just technical leaders and whatever, so he was like, "Whatever, we'll go ahead and sign it." He said, "We'll sign the agreement." So, we sat down with them, and they were developing the new IBM PC, and they were going to license an operating system for that. They wanted to name it PC-DOS and they wanted a fully paid up license for that system. Well, that right away presented two problems for us at Digital Research. The first one is that everybody had to call it CP/M. That was a requirement. You couldn't name it by your company name or your product. It was important to us to have it all called CP/M so that you would know if your program ran on CP/M, whether it was a CompuPro machine or an Alto or an HP or whatever, so that was off the table. "No, we won't do that." Number two,

we didn't offer anybody a fully paid up license. We were an OEM business, and our pricing was structured on how many prepaid copies you were going to pay royalties on. So if you wanted 1,000 copies the price was here. If you wanted 10,000 it lowered and 100,000 it got even lower, and that was our business model. And Gary's concern was that if we offered a fully paid up license for this that we'd have to offer it to all of our customers, and our business, we were successful. We owned the market. And so, basically we said to IBM, "If you want to license CP/M you're going to have to call it CP/M and you're going to have to pay our royalty scheme. Decide how many units you want to buy." So it was an amicable meeting. I was brought in the meeting to talk for a bit about our multitasking because we at that point were working on MP/M-86, which ultimately became Concurrent DOS or Concurrent 86. We looked at the 8086 processor and said this obviously is something that shouldn't be single tasking, single user, whatever. You needed to have a multitasking operating system, so we had put our big team, our A team on multitasking because we thought that was the future of 16-bit processor. So we presented that to IBM. We basically pitched them that you ought to use MP/M-86, not a single tasking operating system for your computer, for your entre. All right, so the meeting ended and the next day--this is a random event--Gary and his wife Dorothy and their kids were going to I think it was the Bahamas or I don't remember where it was, but it was someplace offshore from Florida, and so they were taking a flight from San Francisco to Miami. Well, it turned out when they got to the airport and checked in, and they were in business class, apparently, they were on the same flight as the team from IBM, and apparently they had an amicable conversation. They agreed to follow up with other meetings, so Gary didn't think anything of it other-- he was assuming IBM was going to come back to him with an agreement. They were going to decide how many copies they were going to purchase or whatever of CP/M. So Gary was on vacation then, IBM had gone back, and we hadn't heard anything for a period of time. Well, about a month later we heard from one of our consultants who had heard rumors--the industry is fairly small--that Bill had connected with Seattle Computer Products, their operating system called QDOS, and had acquired a license for that, and that IBM was going to use QDOS as PC-DOS, that Bill had licensed that. Well, so what happened next is Gary called IBM, and what he told IBM was that "We're aware of QDOS, and in fact we have our attorney preparing a lawsuit because we believe they have violated our copyright with CP/M, you know, copying our operating system, our API interface, and we are in the process of putting legal action together to sue them." And so IBM's response was, "Whoa, whoa, whoa, wait a minute. Let's meet and talk about this." So it was probably another week or two later that Gary and Gerry Davis, our attorney, and myself, we went back to Boca Raton to meet with IBM. We sat down with IBM and IBM said, "Okay, what we've decided to do is we're not going to bundle an operating system on the PC, so what we're going to do is we're going to ship the PC," and then if you recall back to the days when we had these silk boxes with the little three ring binders that went in with the software, that, "The operating system purchase will be separate from the PC itself." And at that point the UCSD P-System was another one of the competitors in the operating system space. So, IBM told us, "What we're going to do is we're going to offer CP/M-86, we're going to offer PC-DOS, and we're going to offer the UCSD P-System over here, and we'll let the customer decide what package they want to purchase, so it will not be bundled with the computer. And so what IBM will do is we'll buy..." I don't remember the number of copies, 100,000 or whatever it was, "We're going to follow your procedure. We're going to call it CP/M. We're going to pay you up front royalties on X number of copies, and, in fact, we're even going to hire your engineering team to write the BIOS, to write the physical I/O System. In fact, I ended up being the team leader for writing the BIOS on the IBM PC. So Gary and I are kind of looking at each other. "Well, great, that sounds good to us." And

they said, "Well, there's one condition of proceeding with this agreement, and that is that you can't sue us." And I don't remember the full details of the wording, but it was either explicit or it was certainly implied, "You can't sue Microsoft, either, for this PC-DOS, so you can't do that. We'll do business with you, and a condition of that business is you're not going to sue for this." Well, we said we needed to discuss this, so the meeting broke and we came back in to meet the next day. Well, that evening talking with Gary, we're looking at going with IBM in personal computers

Laws: <laughs>

Rolander: How could this giant company get out there and- besides, Gary had such a deep-rooted dislike basically for IBM, almost wishing their failure, <laughs> in a sense, and his take of it was, you know, let's take our money and run. They're going to pay us for 100,000 copies or whatever that was. It was a fairly good amount of money to do this project, and that's guaranteed for us whether IBM makes it or doesn't make it, so Gary was not inclined to fight it. He decided, "Well, let's go ahead with it." So we agreed and we got a contract with IBM. And I remember not too many weeks after that we had a delivery from IBM, their PC, it came in. It was under lock and key with a key in/key out room. It was chained to a desk. And I remember the first time I looked at that first PC and my reaction was, this is crap. You know, it just was not impressive. I mean we'd seen the other computers, the 16-bit machines that were being developed by IBM's competitors and they were, to be frank, quite a bit better a machine than that. We just really were not appreciative of the importance of having IBM on the label, on the brand. So any rate, we went ahead, we delivered on schedule with the documentation, the BIOS, and the IBM PC rolls out. That was at January '81 or...

Laws: It was '81, yeah.

Rolander: Yeah, something around that time. So we got the notice about the rolling out and all the rest of that, and so as Gary and I were want to do, we flew up to San Jose and took a cab over to the IBM store, and we came in the store, and sure enough there was the IBM PC sitting there, and here were the three boxes of the operating system. And we looked at this and the IBM PC-DOS was priced at $40, and then over here was CP/M and it was priced at I'm pretty sure it was $260. It was more than $200 above PC-DOS, and I don't even remember what the UCSD P-System was. But we looked at that and I've never had my face slapped in my life, but I know what it would feel like to have my face slapped. It was such an unexpected thing. I mean we had totally assumed that this was going to be a level playing field, that PC-DOS was going to be priced the same as CP/M, the same as the UCSD P-System, and that we were going to let the market, the users decide which one, which clearly it wasn't. And Gary described that day later on in his memoirs as kind of the day innocence was gone.

Laws: Loss of innocence, right.

Rolander: Loss of innocence. It was gone that day. So that was a very rude awakening in that time.

Laws: Sure. Interesting story, Tom. Thank you for telling it.

Rolander: Yeah.

Laws: So over the next few years, Digital Research brought out multitasking, they brought out concurrent, they brought out networking--

Rolander: And they brought DR-DOS. Gary's last big coding project was something called DR Logo. It's a Logo language. In fact, prior to that probably one of the most impressive programming jobs he ever did was PL/1 for the eight-bit processor, which was just phenomenal.

Laws: And PL/1 was a programming language--

Rolander: A programming language, yeah, yeah--

Laws: --for the eight-bit processor.

Rolander: --a widespread commercial programming language and Gary was part of the PL/1 committees that were out there. I mean Gary's passion really was the end compilers. His Ph.D. thesis was on global flow analysis. His thesis is still referenced in theses to this day in terms of how he did code optimization, Gary was an engineer's engineer. In fact, I could make another comment about watching him in action in doing his designs. Back in the early days when I was first working with Gary, we had this fanfold printer paper, big sheets, and Gary was a huge fan of that because he would draw out the most incredible diagrams. One regret I have is that I never kept any of those. But he would do beautiful drawings of his design, his data structures, the complete flow of data through whether it was a compiler, and how he would do parsing and so forth. Back to the KnowledgeSet days when we built inverted indexes for database, before he would write a line of code he would sit there and just have these sheets that would go sometimes 10 or 12 feet, you know, the full width of a printer and would draw all of those diagrams out, so he really did that, and then he would write the code. He debugged all his own code. And when you get that first run, and this is something that for anybody that's written software or designed hardware or whatever, it's hard to explain to somebody that hasn't experienced it. But the first time you see something running-- and Gary would call me. It could be two in the morning. It drove Lori, my wife, crazy that he would call and just have to have me there, so I'd throw on some jeans and a sweatshirt, and I'd come down to wherever Gary was, either home working or at the office, to see the first prompt, whatever it was on the screen to run. But he had that enthusiasm about building things, which was really fun to work with.

Laws: Good. So back to KnowledgeSet, so you did the Grolier.

Rolander: We did the Grolier Encyclopedia, and we felt that the encyclopedia was the best example we could think to use to demonstrate the capability. Gary did a great job in the design of how to do that. So, we thought about, what are we going to do with this information? It wasn't simply putting it on the disc to allow you to go manually through as you would in the hard copy. Here's something that's electronic, so we ought to be able to add more value to it. How are we going to do that? So one of the things Gary did-- the most obvious thing was a full index, an inverted index for a full text search. Basically, this meant you went through and you created a dictionary of all the unique words in the encyclopedia. You threw out what we call stop words: And, the, if, for. No reason to note where they were. Then you'd take all of the other words and you'd index them, so you knew every location of every occurrence of every one of those words so that you can now do a search, something that's obvious to everybody now, as if you were doing a Google search. This was not obvious back in the mid-eighties, that it was something you could do with an encyclopedia. Going even beyond that, one of the things that I think Gary did was great about the design is he had references and citations. Okay, so if you can imagine an encyclopedia a subject that might be on, I don't know, discovery of America, okay, would have references obviously to Columbus and maybe to Leif Erikson or whoever else you want to give credit to, but that article would have in its body information that in effect pointed to another article, so that would be a citation. So from an article, this one on early days of American colonies, for example, would have a citation of discovery of America, off to Columbus, and, likewise, from Columbus it would come back to discovery of America. So you would have the notion of what other articles referenced your article coming in--that's the funnel in--and then going out what other articles did you reference? So from that you could actually create a locus of information, so you could analyze connections between articles. So the relevancy of articles would depend on the number of connections between those articles.

Laws: Sounds familiar. <laughs>

Rolander: So those would come up higher in searches, and this was years before we had the Google search and so forth, so that was all done with that encyclopedia. Now, once we had the encyclopedia done, we assumed we could take this and go off to other companies that had books, legal books, law books, medical books, whatever, and they would see the obvious use of this, that you could now have this searchable, accessible. You didn't have this wall of books and so forth. And that was a tough job because it ended up being more of an education job to what this could do, more of a sales and marketing kind of a job than technology. The technology was done. It was demonstrable. It worked, but it took much more than that to get it out. So, what happened, I think Gary began to lose some interest in this because there was this slow spiral that was taking place. The early CD-ROM drives, were close to $1,000, and the first discs were hundreds and hundreds of dollars, so people wouldn't make more drives without more software, more applications to run on them, more media. And, likewise, people wouldn't want to generate information for CD, the media, if there weren't more drives, so it took a long time to get that going. So during the interim, we contracted-- we did phone directories for Pac-Bell, experimental phone directories. That was one of the projects we did. We did a prototype for Hallmark Cards. The idea was producing a

kiosk which had all these pre-stored images and things you combined together to make a card, for example. And we also got contacted by Banta. Banta at that point was the second largest printer in the country. R. R. Donnelly was the biggest print company. Banta was second biggest. They were the biggest printer of U.S. stamps, for example, so a big print company. They were approaching their centennial, their 100th year anniversary, and their chairman of the board decided, what was his legacy? Where was print going to be in 100 years? So he hired a consultant, a fellow by the name of Bob Dehlendorf, to go and research this to find out ideas on what print might be. Well, he happened to read about our encyclopedia and he came out to meet with us. And the end of that was that actually Banta came and acquired KnowledgeSet, so we sold our company to them. Now, during that process we had contacts-- this is interesting because it was back to IBM -- with I believe it was the RS/6000 one of their minicomputers, they made a decision at some corporate level that their entitlement (what goes along with a computer when you buy a computer) was going to be done now on CD rather than on paper because it was so much cheaper to do it on a CD and it was searchable and accessible and all of that. So as far as I'm aware, the very first computer in the world that was ever shipped with the entitlement on CD was IBM for the RS/6000, and so we had a contract with IBM that went on for quite a number of years to provide their documentation for publication in the optical form. So when we got acquired by Banta, Gary was out of it. He was no longer interested in it, and he left. He had moved. He had bought a home down in Austin, Texas, and so I'd lost a fair amount of connection with Gary at that point.

Laws: Didn't you do a whole bunch of manuals for Boeing, for example, as well, and others?

Rolander: Oh, yes, good point. Yeah, Gary and I, of course both having a passion for aircraft, we got in touch with a company, Sundstrand, which was one of the suppliers to Boeing, and they'd heard about us with optical disc, and they were thinking that, wow, we might be able to work something out to get manuals, aircraft manuals, because those manuals, it's just a huge amount of paper, and it was either accessed in paper or in microfiche. And when you've got an airplane sitting on the ground and you've got a mechanic that needs to find information quickly to get that plane back again, this was an obvious market. So Sundstrand connected us with Boeing and with British Airways, and we had a project to do maintenance manuals for the Boeing 757 and 767, so this was to take essentially the typesetting tapes for the manuals, which included the graphics and the text and put that into a CD-ROM. So we had to basically write the software that displayed the graphics, because these were not just fixed images. We brought them in as vector graphics so they could be scaled depending on the size of display you had, and bring in the text so we could reformat that again for the different size of display that you had. This was a fantastic project. I really enjoyed it. I ended up making roughly a dozen trips to Heathrow during this process because our test site was a Boeing 757 out of Heathrow, but that was a lot of fun. Really enjoyed that connection with flying.

Laws: How many folks did you have in those days, Tom?

Rolander: Yeah, at the company?

Laws: At KnowledgeSet.

Rolander: I think at our peak we were still a very small company. We were probably no more than 15, so the company was originally Gary and I, the two that started the company. We brought a couple more people in, some that came from Digital Research, but it was not a huge company.

Laws: So you were back into managing a company again?

Rolander: No, not back into managing, no.

Laws: <laughs>

Rolander: And when we got acquired, when KnowledgeSet got acquired, they chose to move the company up to Sunnyvale, and so I did a bit of commuting up to Sunnyvale. I'd had an employment contract that went on for a couple of years. I kept an engineering role, but they'd moved the company and the people up to Sunnyvale. And after my employment contract was done I left that.

Laws: Okay, so what did you do next?

Rolander: Next I went to start a company called PGSoft. PG stood for Pacific Grove. We joked, calling it Pretty Good Software or PG, Parental Guidance or whatever, but it was PG Software. And this company started with a gentleman who was an engineer at Digital Research years ago, Lee Lorenzen. And Lee was living in Pacific Grove, and at that point I was at a bit of a loose end trying to figure out what was next, and I started talking to Lee about starting a business. This was a rare opportunity because we didn't have a business concept in mind. This was the classic case where you get a bus and you recruit people to get on the bus, and then you decide where the bus is going. I think as an engineer that was really an incredible experience. —When started out there were three of us in the company, Dave Brown, another engineer from Digital Research, and we sat down and independently went through a bunch of ideas, thoughts that we had about potential products. Now, our background was in operating systems, so where we tended to go was utility programs that required an in-depth knowledge of an operating system, so sort of the layer between typical applications like word processing and spreadsheets and the operating system itself, software that operated at that level. During that time one of the things that we thought about was that what we were continually doing was running out of storage on our computers. We were filling our discs. So we realized that there were other cheaper forms of storage such as magnetic tape, and you could get a gigabyte of tape for much cheaper than a gigabyte of hard disc. That was a no-brainer. And so, what we did is we came up with a product idea that had to do with taking data from the hard disc and backing it up to tape storage but making it look like it still existed on your hard disc so that when you were going to need to access a file we would actually put up a prompt, say load this tape. It would stream the file back off of tape and then it would be on disc at that point. Well, we put together a demonstration of

that system, a prototype, and we were at a data show that was in San Jose. And 3M was there, and 3M produced of course a great deal of that tape. Well, our prototype got their interest, and so that led us to a couple of years of a very good contractual relationship with 3M to produce a product called Tape-It, and it was kind of a play on the Post-It, which of course 3M was famous for. But the idea of Tape-It was that what we did is we made their tape drive into what looked like a disc drive, and this ties back to the CD-ROM. At this point virtually all computers had CD-ROM drives and we knew the CD-ROM interface very well, so the operating system was set up to talk to a CD media. What we did is we made the tape drive look like a CD-ROM, so it was very easy to add to the system. And we did some very lucrative contracts with 3M, so we worked on utilities and built utilities. One other utility we had was called Gimme Space, and this was a problem where people would have the C drive and then they would add another hard drive, D and E, and now they're trying to keep track of what drive the various files were on. But we had a technology called Alias, which enabled us to have a directory entry that actually pointed somewhere else so that we could actually put a file on a different drive than the C drive but make everything look like it was on the C drive, so this was a utility we did and it was quite a successful utility. We also did a program that had a fun name--it was a little controversial--but a product called Save Butt, and this came from a-- I'm trying to remember the cartoonist now [Gary Larson creator of Far Side], but one of the typical newspaper cartoons was a picture and it showed a picture of a key and it said "Save Butt" on the key cap. And the purpose of the key that was computers will be truly useful when they have this key. The idea was if you've just deleted a file it would bring the file back or whatever it is you've done, so it was Save Butt. So what we did is we did versioning. So, again, we're software that's between the operating system and other applications, so when a Word document would get edited and closed we would have save the previous copy and now archive the new one, and so basically it was versioning, it was transparent versioning that we did for that, and that was the save button. That led us to the next thing, which was actually the end, then, of PGSoft, and that was that the internet was upon us, and we were trying to figure out, how we could exploit the internet with our utilities.   We got the idea for something we called the iFolder. The idea of the iFolder was that anything you edited on your computer, on your desktop, in any of your folders, would be replicated transparently without you dragging it up to a server, and if you had another computer, like you had your computer at home and your desktop at the office, that it would be transparently synchronized down so that when you got home all your files are there. This is of course known today as Carbonite and any number of products. So we put together a prototype with that and we thought, well, who are our customers for this? Where could we possibly get this? Well, we had contacts at Novell that went back all the way to the early Digital Research days. In fact, Drew Major was the chief architect at Novell, and he had been somebody I'd talked to when I was designing CP/NET because he was an early user of CP/NET, and then he went off and he designed NetWare, which was the main core product for Novell, so I'd had a relationship with Drew for a long time. So I made contact with Drew about our prototype so we got an invitation to come and present this at Novell. The meeting we presented at included Eric Schmidt. Eric Schmidt at that point was CEO of Novell. So we came in to make this presentation. Drew's there. Eric's there. I'm making this with Gary Gysin, who I'd promoted to be CEO. I don't like being CEO, as you've heard about my approach to management, so I stayed as CTO. But we came in and made this presentation to the team, so we gave the demo, described it, did our little PowerPoint. We finished the demonstration. This is just approaching the very peak of the dot com boom, so this is the end of '99 coming into early 2000. And I recall at the end of that meeting Eric Schmidt stood up and he looked around the room, and in a Jean-Luc Picard fashion, well, he said, "Gentlemen, this is

software that we need. I think it'll promote the use of servers," because the Cloud, the server-- it wasn't called the Cloud then, but, "Our servers will become more in demand because people will have their software transparently backed up and so forth. We need this product. And we can either acquire this company or we can build it ourselves. My preference is that we buy this company." And then as I was alluding, Jean-Luc Picard, he said, "Make it so." I swear he said, "Make it so."

Laws: <laughs>

Rolander: Any rate, he left the room and we were acquired within 60 days, so it was a very quick acquisition. That was the good news. The sad part of that story is that it was stock and cash. We got the vast majority in stock. The stock went from roughly 35 up to 43 in the next month and a half, and then something around April it started its precipitous drop, and by the time the stock came out of escrow for us to exercise and sell the stock, it was down under $4, so that made quite a drop.

Laws: Ten times factor under what your expectations were.

Rolander: Yeah, Novell was severely punished with the dot com bust, other companies not so badly. But great experience with Novell. They really promoted it with NetWare, I believe it was NetWare 6, it was built in. It was one of their flagship items for the product. I got a lot of travel speaking and other things with Novell and had a good relationship with them, but at the end of two years, again, an employment contract, I was ready to head out for something else then.

Laws: Interesting story, Tom. So from PGSoft to Novell, what did you do next?

Rolander: After Novell I was back to talking with Lee again. You know, what was next? And one of the things I had learned is that it's great to have a passion for what you're working on, to believe in it. I think the best software is oftentimes produced by people that need the software, that are actually going to use that software. Well, at this time my father had been diagnosed with early stages of dementia, Alzheimer's, and I really knew nothing about Alzheimer's and dementia itself, so I'd gone out and done the requisite amount of searching and trying to learn about it. I learned about the various different stages and how much burden it was going to place upon the caregivers, and I was very concerned about my mom. And my mom and dad at that point had moved into a retirement home, a large apartment complex in downtown Seattle that had both independent living and assisted living. And so I got interested in what I could do to help out mom, because I lived in California, my brother is in New York, my sister is in Connecticut. What could I do with that? So my mom was just getting involved with computers, with the internet, with doing email and so forth. And I was familiar with VNC, products that do remote screen sharing, and there was an open source product that worked. The difficulty was that you couldn't get through a firewall. My parents' apartment building had a firewall. I even tried. I went to the IT manager at

their apartment and said, "Would you poke a hole, port 5900, through your firewall to my parents' IP," and of course he wouldn't do that. I don't blame him for that. But any rate--

Laws: <laughs>

Rolander: --I became his nemesis with time. So I went out and looked for other software. There was software that was available. There was TeamViewer that was available for personal use but very expensive for private use. Or, actually, TeamViewer wasn't quite out yet, and I'm failing to remember the name of the other software, but these software products that could go through a firewall were charged, and they were charged on the order of as much as $20 a month. And when you start computing your number of endpoints, one in Seattle, one in California, one in Connecticut, and one in New York, you're looking at a lot of money to do this connection. And so what I did is just as a trial I signed up for the trial mode, connected with my parents, got into the machine, and now I was able to help my mom so that, for example, I could set up a webcam so that I could visit with mom and dad, or that I could show a photo album to my dad. So I got to thinking about this and realized that, well, here's VNC, which is open source software, and what could I create as a software layer to enable that to go through a firewall? And so that became the basis for my next company, which was CrossLoop, and what I did is I developed a piece of software that operated as essentially a proxy. So on one side it would look like a server if you roll it to a client, and then the reverse. And so what I did is I was able to get through firewalls by doing UDP hole punching. So I'd go out to an outside source, relay information, and then go to connect the two parties together. And so I was able to use VNC as an open source product without changing one line of code with my wrapper code to connect between the two of those. So here we had technology, and so my interest in doing this was to develop software that I could use, not pay a fortune for, that I could then use with my parents. So this put me on the track of spending a couple days a week visiting with my parents. My dad at that point in time, he had crystal clear memories of his years in college, his professor's names, but for the life of me he couldn't remember what he had for breakfast or who he may have visited with the day before, but his long-term memory was phenomenal and this did a lot for I guess his morale, that he still had those cells that were working. And my mom would need to have her hair done but she didn't trust leaving dad in the apartment without somebody watching him as she went off to the salon. So with this I would have dad, I would have my webcam so I could see that he wasn't leaving <laughs> the room, and I would do that. My dad was definitely a Luddite. He was terrified by computers. I never got him to be able to use a mouse. He couldn't move the mouse without looking at it. So he'd look up at the screen and see where the mouse form was. He'd look down and try to estimate how far to move it. He'd move his hand, then he'd look up at the screen. He just could not. <laughs>

Laws: Interesting.

Rolander: So he was approaching 90. And any rate, I forgave him for that, but I had great experiences as an engineer developing a technology that I was debugging and working on with my mom and dad, so I really enjoyed that. The issue became one of, okay, do we sell this as a product? You know, what is the

business model here? How do we expand this? And so what CrossLoop became, what our idea was is to use this software to create a marketplace for services. Okay, eBay was products. People would go on and list their products. People would come on, you know, whether they were bidding on it or whatever they would buy the products. Well, we thought that there ought to be the same opportunity in services, to be able to do this, so somebody that would do tax returns or somebody that would do other kinds of accounting, or maybe it's just IT support to your home. And so what we did is we saw this screen sharing as the tool, the enabling tool, to be able to put together a group of IT people or others that we would then offer as services out to end users and that we would get, just as eBay does, a little cut of their business. And so that led us into getting some funding for this, so we actually raised two rounds of funding. First round of funding was from El Dorado. Second one was Venrock. And any rate, we raised $12 million for this business. The business was ultimately not successful. I have not seen anybody yet that's solved this problem of trying to create a marketplace for services. I think a major part of it had to do with the trust factor, of giving somebody access that you don't know into your computer and so forth, but the technology was successful. We actually had 12 million users of our software, so I got involved with scaling at the back end, of being able to handle fairly high loads and all sorts of issues to do with keeping up the 24/7, 365 operation, so that was a lot of fun when I did that.

Laws: So the company eventually was dissolved?

Rolander: The company-- what happened is there was an asset purchase, asset sale, and that went on to AVG, AntiVirus Group acquired the company, acquired the IP for that, and they used the underlying software in their IT support, so they acquired that. And so, I'm thinking about what am I going to do next?

Laws: And you're still in Pacific Grove all this time.

Rolander: I'm in Pacific Grove trying to figure out what I'm going to do next with this. Of course, I was taken with the smartphones, the droids, the iPhones and whatever, and I've always been an avid photographer, taken far too many pictures, more quantity than quality. Any rate, I got intrigued with an idea. I thought, well, maybe I'll make a try at an iPhone app. I was seeing a lot of the selfies and seeing how you get group pictures. I thought, well, why couldn't I take one camera and use it as a remote trigger for another so that what I'd do is I'd set up a camera one place and then have people over here, and then I'd be in the audience with the people and I could then trigger it from that point. And what I did is I had license to the underlying technology, the peer-to-peer underpinnings that were used by CrossLoop. I'd mentioned this technology that was proxy-like. I called it the VIP Tunnel, so it was a virtual IP tunnel between two peers so that I could run software that would make it look like a VPN, essentially, that looked like it was on the same network, the same application it'd run over there. So I still had a license to that software. That was something I had retained as CrossLoop was being formed. And so I used that software to actually be able to connect two mobile devices together as well as a mobile to a desktop. And so I had put a prototype together and was getting ready to throw this out there for 99 cents to see if I could make a go of that software. Well, at that time I got contacted by a gentleman by the name of Ko

Nishimura. Ko is a weekender in Pacific Grove, the town I live in, and he contacted me through a mutual friend. I'd had coffee every couple of months with Ko and become acquainted to him, and our common acquaintance had mentioned to him that I was starting another company, so I'd finished with CrossLoop and I was starting another company. So, one Saturday afternoon I was working away on my application and I got a call from Ko and he said, "I'd like to talk to you. I have an opportunity that you might be interested in."

Laws: Back up a second. Ko was the …

Rolander: From Solectron, yeah.

Laws: Right, he was CEO or founder of Solectron--

Rolander: Yes, I should-- yeah, let me back up. The way I'd gotten to know Ko is Ko was-- well, he'd worked at IBM for a number of years and then he was recruited by Solectron as their CEO, and he took them from I believe $80 million up to something close to $16 billion, so he'd really taken the company up.

Laws: Basically, a contract assembly operation<overlapping conversation>--

Rolander: Contract assembly, a lot of it overseas.

Laws: Sure.

Rolander: Lots of assembly boards, you know, motherboards of a unit.

Laws: Right, so he was already a very successful businessman--

Rolander: Very successful businessman.

Laws: --trying to solicit your attention.

Rolander: He had a Ph.D. from Stanford in materials, essentially semiconductor physics. He is the only U.S. CEO to receive two Malcolm Baldrige Awards.

Laws: Quality award, yes.

Rolander: The Malcolm Baldrige Award.

Laws: Yes.

Rolander: He had one from Clinton, I believe, and I don't remember which president he had the other one from. But any rate, he's the only U.S. CEO to receive two of those, so very good at his job. After he retired and left Solectron, he went to work at the Santa Fe Institute, which is a think tank, basically, and at that operation he got interested in worldwide water usage and in fact became focused on what he saw as potential water wars that were going to come down the road before very long, because we have a lot of water on the planet but very little that's potable water. We have a population that's increasing exponentially, and so he became intrigued with that problem. Well, he reconnected with a former boss of his at Lockheed. He had out of college worked at Lockheed, and there was a gentleman by the name of Sam Araki who was chairman of the board and president of Lockheed's space and missile division. And Sam was retired, and the two of them got together and they had roots in farming way back in their youth, connections a lot through the Japanese community and farming. And Sam also had a connection with space through Lockheed and was aware that a lot of the space lab research had been done on growing food, because if you're going to have astronauts go to other planets you were going to have to have them be able to grow food en route. They couldn't take it all with them, so he was aware of that research. And, actually, I think a lot of that research is becoming declassified, but that's where a lot of the research was done about red and blue, those areas of the spectrum that plants need. Well, any rate, Ko had called me and said could we have breakfast the next morning and I said sure. So we came in to Toasties Restaurant in Pacific Grove and sat down. He had with him spreadsheets on the business that he was putting together and he said, "Tom, I've put a business together that is growing in soil indoors. It's a vertical farm. And we already are getting our first customers that are restaurants, and we need somebody to come in and do IT, front end and back end IT, somebody-- essentially a CIO of the company. I'd like to see if you're interested in that." I said, "Wow, well," I said, "First of all, I've never put a seed in the ground."

Laws: <laughs>

Rolander: I may have in kindergarten or first grade or whatever, you know, had one of those things where you, I don't know, take an avocado pit or whatever and try something, but I said, "I don't garden. In fact, I strongly dislike yardwork, so that's a little bit of my background. But I am intrigued with growing food and doing this in an urban area." So he said, "Well, why don't you come up and take a look at our operation? How about tomorrow? How about Monday?" So I said, "Sure." So I drove up there Monday, I drove up to Campbell, and I came over to this warehouse, opened the door in the warehouse, and Ko brought me in and introduced me to the COO and CTO of the company and had them walk me around. Well, I came in and here's this magenta color, these shelves stacked one on top of the other with beautiful looking produce, produce I had no idea what they were, herbs and all sorts of leafy greens that they were growing. So I was first of all just fascinated with the fact that they were growing something that was edible, doing that. And the fact that they needed clearly to be able to produce order entry system,

they had to have forecasting for what to grow, they had to have tracking of produce through their operation principally for safety concerns, so food safety would be a number one requirement so you could go from seed lot all the way to the customer that it went to, so tracking that whole process. And by the end of having a tour there and then having lunch with Sam and Ko I was totally smitten. Well, I was at that point faced with 80 miles of commute from Pacific Grove, so what I did is I drove-- this is reverse of what I'd done to Digital Research some 30 years prior. I drove up to Ecopia on Monday morning, worked there Monday/Tuesday, and then Tuesday drove back home to Pacific Grove, Wednesday worked down there [in PG], and then did the same thing Thursday/Friday, went back and forth, and just was totally taken with this business. Now, one thing I should explain, I've been I guess what you might call a serial entrepreneur, started five different businesses, but more than a serial entrepreneur I regard myself as what I call a paradigm shift seeker. A paradigm shift occurs when things are completely changed in terms of how something is done, how it's executed. The first example, the first paradigm shift I encountered was actually back in my days at Fluke, and this was all of Fluke's instruments until I worked on the 8500 they were single purpose machines. They were built with discrete components. You couldn't change anything about them. They were designed as a fixed unit. The paradigm shift that occurred there is with microprocessors, not computers I'm talking about but microprocessors and software that now enabled a machine to be repurposed or enhanced or whatever with software in that machine and, of course, VLSI and other technologies that enabled that to be scaled and made cost effective. That was a big paradigm shift. The second paradigm shift was personal computers. People don't realize these days that the very first personal computers were incredibly primitive, just very poor quality machines, hard to get anything done with them, and yet they were very expensive machines. And so it took a while before this market built up, the costs came down, the performance of the processors, amount of memory and storage and whatever increased to make them what they are today, but that was a second big paradigm shift, because now instead of having a typewriter, okay, you had now a computer, personal computer, which could not only do the function of the typewriter but also your spreadsheets and other operations like that, so that was the second. The third paradigm shift I've been involved in was essentially electronic publishing, moving from paper as the medium of storage to optical and now to the cloud for storage, another big shift. And so, what I came quickly to realize was that food, the need to feed our planet is a major problem that we're going to face as a society, and certainly within our children's lifetime and our grandchildren's lifetime they'll be facing this, because right now we have, well, six billion people on the planet. We're going to be up to nine billion by the year I think it's 2050, and we have no more arable land, and limited water resources, so we're going to have to come up with solutions to be able to feed more of the planet. And that was part of the theme of Ecopia, developing technology to enable us to grow indoors so that we could move towards feeding the planet. More of that strategy was that, Salinas Valley is the salad bowl of the country. Seventy percent of the leafy greens consumed in our country are grown right there. Well, if you think about it, the average head of lettuce travels close to 2,000 miles, 1800 miles, and that average head of lettuce takes about 70 gallons of water to grow. And you've all seen the sprinklers out in the field. They're now moving to drip irrigation and other things. The problem with drip irrigation is if you lay down all that pipe and you harvest the lettuce, you've got to pull all that up and put it down again, so there's a lot of cost effective issues even though drip irrigation may be more effective from a water point of view. But any rate, these issues of water usage, of transport, of carbon footprint are big issues, so there are a lot of motivations to move that growing closer to the point where the produce is consumed, to the cities, in particular. So I'm just totally all in now with agriculture. I think one of the things as a paradigm

shift seeker that I look for are really two things. It's going to be a paradigm shift. It's a candidate if people do not believe it's a good financial solution, if there's a business in there, it's not a business solution, and if they believe that it's not technically possible. So those two things are almost always at the beginning of every single paradigm shift, and so when I see that that's something I'm greatly interested in and I'm just really taken with, where farming is going.

Laws: And how did Ecopia work out?

Rolander: What happened with Ecopia is Ecopia was funded by Ko. As somebody that's done several startups, when I've started up a company, my focus is getting to the point where I'm no longer hemorrhaging, where I've now covered my expenses. That is the all-consuming focus. My focus when I start a business is getting to that point. Unfortunately, Ecopia was much more of a research project, Ko coming from large companies came in with a management style of a large company, lots of meetings and lots of experiments, so we weren't really focused on how to reduce costs, how to generate more income from our products and so forth. It was more of a research project. What happened is investors were brought in, and as you might gather, investors do have that requirement. They have to make sure that there's focus on reducing the costs, so that it is a profitable business. And the investors were brought in in two phases. The first phase was upfront, and then on meeting certain milestones the second part of the investment was to be made, and that second goal was not achieved, and so actually Ecopia was shut down.

Laws: So [what happened to] the intellectual property?

Rolander: I believe that some of the IP may have been purchased by Ko later on, but the IP would basically be focused in on the method of growing, you know. I believe there was one patent that was applied for, which had to do with the gravity system for taking these fairly large trays of soil that were growing leafy greens, and so these rack systems were-- I believe a patent was made for those.

Laws: And the software was climate control, feeding fertilizer and then all the tracking?

Rolander: Yeah, the software I did for example, was creating and printing barcodes that went on the trays. Planting schedules were produced as barcode labels, waterproof labels were put on plant stakes, and so they were put in a tray that would identify what product was to be seeded in that tray.

Laws: Right, right.

Rolander: And so each of these operations was done with a Motorola barcode gun. We had RFID tags on the trays so that we could find and locate any of the trays, so all of the product was tracked through

the operation. From a software point of view, the forecasting was probably the most fascinating part of that, because here you have a fixed number of locations on the floor where you can hold product, okay? Now, your product has different amount of days of germination. Some would germinate in a couple days; some would take six or seven days to germinate. Then each product, whether it was amaranth, cilantro, fennel, basil, whatever these herbs were, each tray would produce a different amount of product, a different number of clamshells. Some, like agretti would produce maybe barely one clamshell per tray. Some other ones would produce maybe a-- red-veined sorrel may produce 2 or 2-1/2 clamshells, so you got a different amount of yield for each one of those trays. Then each one of these products had a different harvest window. So from the time you planted it, germinated it, until it got to the size that was appropriate for sale would take anywhere from maybe 18 or 19 days out to 50 or 60 days. So now you have what amounts to a linear algebra problem, multiple constraint problem, where you're trying to constrain your sales-- your sales wants to do forecast, so you may be coming up to Valentine's Day and you know that red-veined sorrel is very popular for Valentine's Day because it's used as a garnish and it's in salads, so you want more of that product. Well, you can't just simply say I want more trays of red-veined sorrel. You have to then reduce some other product that you have, and then you have the issue of when to plant that product because of your harvest window. So these were fascinating computing problems to me, and that was my focus for software development.

Laws: Okay, so technically Ecopia could be described as a success. You could grow it and you could harvest it and -you could track it.

Rolander: Yeah, but it was an operations issue Cost was really the problem with the business. Ecopia had roughly 100 customers, the high end restaurants. I jokingly described it as if you could put a $12 to $14 salad on your menu that looked absolutely gorgeous that differentiated your restaurants from other ones you were a great customer of Ecopia's.

Laws: <laughs> So you're still a believer in the technology and the opportunity and the need in the long term for this kind of capability.

Rolander: A believer. Most indoor farming that's done now in urban areas is hydroponic, and I come from essentially a soil background here. You know, we had soil. And everything grows in soil, so it's not a question of whether you can grow it or not. Hydroponic, there's actually a fairly limited number of greens that will grow well hydroponically. Another part of hydroponic solution is that typically it's a continuous water system, okay, so if you get any kind of infestation or problem it goes systemic, whereas in the soil tray system everything is a single tray, and so you've isolated yourself down to a smaller part. Now, one thing that I faced when I began to write software at Ecopia is I don't write software that already exists. I don't write another spreadsheet or another word processor. They're overdone, well done, don't need any more features, don't need to write those. And so I had an assumption that I could find software that I could license and integrate together into their farm operation. When I started researching that, sure, there is farm software, but the best way I can describe it is traditional farm software is batch mode. By batch

mode I mean you plot, you plant a five-acre field with kale. Then 90 days later you come back and you harvest that five-acre field, so in a year you get a few crops, a few plantings that you get going year-round, and you have crop rotation of course because of the chemicals and the soil and nutrients and so forth. Well, when you think about what happens with indoor farming, this is a continuous process. You plant every day, seven days a week. You harvest seven days a week. It's a continuous process, not a batch mode. So there was some greenhouse software that was similar and close but not a lot that was there, so that's basically where I'm headed right now. I have a consulting company, AgSoft Consulting, and am putting together software whose focus is largely on food safety, because you have this requirement now, an actual real requirement, health requirement, government requirement, to track all the way from your seeds all the way to the customer. So you have to know when that product is planted, who touched it, when it was watered, and all the way to who it was sold to so if there is an event, a food event of some kind, a customer of some restaurant or some produce, you're able to track back to where that came from, and so that's an area that I'm currently working in.

Laws: So this is an ongoing story of our intrepid serial entrepreneur here, Tom.

Rolander: <laughs>

Laws: I understand you received a reward from the University of Washington at some point for all these different areas you've been involved in?

Rolander: Inventions and what I did.

Laws: Tell me a little bit about that.

Rolander: Yeah, well, I had mentioned earlier a connection I have, a professor, Dr. Jim Peckol at the University of Washington. Well, this whole process began kind of subtly because I got invited to speak to their alumni-- it's called a Distinguished Alumni Speaker Series, and so Jim invited me to come up and talk about my career to my fellow graduates, alumni and students and faculty, so I thought that would be a great opportunity. So I went up to the University of Washington and gave an hour talk, and it was probably 100-something people, maybe 150, and about equal quantity of faculty and students and alumni and so forth. I really enjoyed giving the talk. Well, a week after the talk I got a phone call from Leung Tsang, who is the chairman of the EE department. He said, "Tom, I really enjoyed your speech last week. Would you be willing to give the commencement address for electrical engineering this June?" Well, I was taken aback, so I was stunned for a little bit there. And Leung comes back and he says, "Oh, you don't have to answer me right now, but please by the end of the week let me know because we need to have our commencement speaker lined up." So I thought about it a little bit further and decided, wow, this would be a great honor to go back to my own university, electrical engineering, and give a

commencement address, so I agreed to do that. Turned out that that 12-minute speech took me probably 150 hours to write.

Laws: <laughs>

Rolander: Among other things, I discovered that they don't have a back-up commencement speaker. You're it.

Laws: <laughs>

Rolander: And because you're it you can go up to the University of Washington on a visit. I'd frequent visits to my mom and I would come in and I got tours to meet post-docs, professors. They opened the doors to anything I was interested in learning about doing, and I had a great time giving that address, which was a lot of fun to do. Any rate, so a couple years after that, this was in 2014, I got a notice from the University of Washington that I had been selected for their Diamond Award for Entrepreneurial Excellence. Now, this is from the college of engineering, so they have 10 different schools in the college of engineering, and by my rough calculations, since I graduated there was a pool of about 35,000 engineers that were eligible for this. But at any rate, they give out a number of awards from the whole college across all of the different schools, and so they have awards for academic, for teaching awards. They had one for social benefits, social service to people, and I got the Entrepreneurial Excellence Award, which was quite an honor. So they did a video where they interviewed a number of my colleagues over the years and a very nice banquet where I was presented with, I don't know, maybe a 15- or 20-pound piece of crystal with this award.

Laws: <laughs>

Rolander: So I was quite pleased, quite pleased to receive that.

Laws: We're getting towards the end here, Tom. There's a couple of other things I'd like to touch on, certainly your involvement with the Big Sur International Marathon.

Rolander: Oh, okay.

Laws: And I'd also like you to tell me the story of your repeat of your solo flight.

Rolander: Okay, all right.

Laws: So which one should we go first? Let's talk about the flight.

Rolander: Let's do the flight.

Laws: So you decided after 50 years, after graduating as a solo pilot that you wanted to redo that experience.

Rolander: Yeah, so I soloed on June 7th of 1966, and I think if you asked any pilot in the world what day did they solo, when did they solo, they will give you the month, day, year. You know, this is something that we all know. We remember our solos. So I've been an active pilot for many, many years, going back from my seaplane days. I've owned four different aircraft, been part of aircraft construction in the garage on a number of projects, owned six passenger airplanes where we took the family of six of us, four kids, so like the station wagon. So we would fly to Calgary, Canada, to go see Banff and Lake Louise in the family station wagon. And of course, we were doing it at 150 knots, which was nice, more fun than driving, more fun for me, certainly. I got very involved in aerobatics, done many years of aerobatics, and formation flying, really enjoying flying with other aircraft. Any rate, in the back of my mind I've been looking for kind of a bookend and recognized and heard from the FAA that they have what they call a Master Pilot Award. Master Pilot Award is given to pilots that have flown for 50 consecutive years without accident, injury to themselves or other persons, so basically they regard it as 50 consecutive years of safe flying. So I started thinking about this. Probably five, ten years ago I was aware of it, and I started thinking about how would I bookend my flying. On June 7th, 1966, I had soloed on a float plane. Well, I hadn't flown a float plane at this point for over 40 years. It'd been a long time. I'd been in wheel planes and other kinds of planes. So I made a decision a couple years ago that what I wanted to do is I wanted to solo a float plane on June 7th, 2016, which was this last June, so that was my scheme. That was my plan. I sold my last airplane about a year and a half ago and I started renting airplanes, so I flew some aerobatic airplanes and just local scenic flights that I would take, and I started my research to see how I was going to be able to arrange to get current so I could solo. So, basically, I have a seaplane license and a wheel plane license, but you have to be signed off by an FAA licensed designee to be able to fly solo. And, actually, what you learn about flying is that the control of flying is really done by the insurance companies. Whatever the FAA says is one thing, but the insurance companies are the real true controllers of whether you can fly an aircraft or not. So any rate, I ran into some problems. I had begun over a year ago to try and locate a place in Seattle where I could actually rent a seaplane, get instruction, and actually solo that. And I ran into three different operators that I went to where that was just not possible, so I was beginning to think this was not going to be able to happen. Well, I found a flight school with kind of a kindred spirit, James Young, a guy who I could tell from when I explained to him my interest in soloing on this June 7th, he got excited about being part of this. And so he was able to get a special-- it's not a dispensation but whatever, exclusion or whatever from his insurance policy we had to pay extra for, by the way, so that I could in fact be legal and insured to fly that aircraft. That brought me to the point of needing to go back to get current again. Well, I found out the difference between being 68 years old and being 18 years old when I started flying float planes. So what I did is I set up an entire week. I flew up to Seattle on June 7th and I set up a whole week for me to take two lessons a day and get back to the

point where on June 7th I could do this solo. Well, I got there and some of the things that I'd completely forgotten about float planes. First of all, when you're on the water you have no brakes. You can't stop. There's no reverse, so all you can do is go forward. Second, you have--in this case it was a Cessna 172-- a 38-foot wingspan, so this moving vehicle that can't be stopped has a 38-foot wingspan, and that's as wide as this room here, so that's a problem. Then you get to the third one, which is an airplane is sitting on a frictionless surface, water, okay? Well, think of how a wind vane works. A wind vane wants to turn into the wind, so when you're in an airplane on the water that plane wants to turn into the wind, so that's very difficult, in other words, to turn out of the wind, so that's a problem. And then you get to issues of agility. I was a lot more-- I was not only fearless, fearless because I didn't understand all the potential problems as an 18-year-old, so I'm asking all the what if. You know, what are all the problems? I'm looking at those. So then you get to the agility issue. Well, if you think about how you launch a float plane, you've got this plane with a pontoon, a float, up against the dock. And in my case there was another plane parked in front of that, so you can't go forward. So what you end up doing is you get out of the airplane, you go to the back to the tail, and you pivot that plane around--

Laws: <laughs>

Rolander: --okay, away from the other aircraft, okay? Well, now you have another problem because at the back end of the float there's a rudder called a water rudder. This is a very fragile piece of metal that you actually pull onto the wing once you are ready to take off, but it sits in the water. Okay, well, you can't pull the plane all the way around to a 90 because you'll bend this thing off, so as you're pulling through the 45-degree angle, you have to push the plane away from the dock, keep it rotating, and now you're jumping on a six-inch wide float at the back of the airplane, taking several steps up, opening the door, getting into the cockpit--and, remember, the engine is not started--start the engine and then move forward. Any rate, my first two nights up in Seattle were sleepless. I just sat there, sleepless in Seattle. I just was terrified by this. I couldn't believe what I'd done at 18, what I was trying to do now, and was I possibly going to be able to do it on June 7th. And the instructor I had had a terrific sense of humor. He was big in what he called Plan B. He said, "Tom, you've flown for 50 years. You must be good at Plan B. That means always having an escape route." He said, "Before you do anything-- and it's more critical probably here on this float plane because of all the elements you can't control, the wind, the fact that the plane wants to weather vane. You can't stop it. You have to be really ahead in Plan B." And so any rate, he was really good, really helped me through that process, and in fact on June 7th I went back. His plane was based in Lake Washington. I had flown solo from Lake Union. And so there's this small, little beach at the very south end of Lake Union, and so we flew over to that beach. I beached the airplane.

Laws: <laughs>

Rolander: He got out of the airplane, turned it around, and I went out and took my solo flight. So I took off from Lake Union, went up over the ship canal out to Lake Washington, did a little circuit of part of Lake

Washington back over the University of Washington, saluting my campus, came back down in around Lake Union then down-- you know, a downwind base, came in and landed on Lake Union, and it was--

Laws: Great story, Tom.

Rolander: --it was a very emotional experience for me--

Laws: I can believe it. I can believe it.

Rolander: --to, yeah, have that goal and go through that.

Laws: Another activity you've been very determined at is long distance running.

Rolander: Yeah, okay.

Laws: And you've run in every marathon, I believe, at Big Sur--

Rolander: Every Big Sur.

Laws: --since day one? And you started running with Gary?

Rolander: Actually, my very first running was in high school. As a freshman I ran the mile, and then as a sophomore I ran cross country, and I got a letter, and that was at I guess 17 or 16 or whatever I was at that time. And I got a job, so from then on I was working and then went on to other jobs. So when I went to work with Gary he was a frequent jogger, so a couple days a week he'd go out and I quite often went out with him. He usually liked to have music on and I was preferring my own thoughts. But any rate, that was a fun thing to do. And when we traveled we would oftentimes get up early before a flight, and we found it was a good way to wake ourselves up and become alert, was to get out and get running, so I did a little bit of that. But in 1986 I was 38 years old, or coming up to January 1st of 1986 I was 38 years old. I was over 200 pounds, and I had that one sort of moment, that epiphany when you look at the mirror and you go, oh, my God. This is not going to end well. And I said I've got to do something about this. What can I do? And I thought about it and remembered that I'd been a runner. What I liked about running is it didn't take a team. All it took was a pair of shoes and some determination to do that, and so I decided that on January 1st, 1986, I was going to start running. And I mean that first day I started to run I literally-- well, I couldn't run more than 50 yards or whatever, so what I ended up doing, I learned this technique, I would pick a mailbox and I would run all the way to that mailbox. And then I'd stop and I'd say, okay, I'm going to now walk until I get to that telephone pole. <laughs> And by the time I got there I'd pick my next

place, my next destination, and that's basically how I started running, and it was all early in the morning in the dark because I didn't want anybody to see me while I was struggling through this. Other thing that I did that very first January in '86 is since I was 21 roughly I'd had one or two beers at dinner every night, and I was kind of wondering, you know, what is an alcoholic? Do they have a beer every night? Am I dependent on this? I like beer. I thought I be okay with that. I said, okay, I'm going to go without beer. So I went that month of January no beer, no alcohol, and I've done that now actually for 31 years. It's kind of my cleansing month. I still know I'm in control. I can always lose five to ten pounds during that time and so forth. But any rate, I started running. By the end of the month I got up to about seven or eight miles. I just kept running. I enjoyed it. One of the challenges of running is most people treat it as punishment. I mean those of us that remember PE days, physical education back in our junior high and high school days we were punished by going out and doing laps around the track. Well, it's hard to get over that stigma. But, anyway, I got to the point where I realized I was outside, and the benefits for me as an engineer were that I got time to do some free association. I got a chance to get away from the immediate problem I was on. I've done without question the best problem solving of my life actually getting away out alone just running and thinking about that, so got into that. Well, coming up to that April, I learned on a Friday night there was an event in Pacific Grove, a quilt show preview party, and I was actually bartending for that that evening - helping out pouring wine, and several of my friends came up, three of them, and they said, "Are you running Sunday?" And I said, "What's Sunday?" And they said, "The Big Sur Marathon." I said, "Wow. Is that 26 miles?" And I said, "Wow, how are you guys doing that? I can't imagine running that far." And they said, "Well, we've seen you run a few times. What have you done?" I said, "Twelve miles." And one of the gentlemen, Ed Bredthauer, says, "Oh, you can do a marathon. Sign up for it. Sign up tomorrow." So that was a Friday night. so I thought about that Friday night, went in Saturday afternoon, and what Ed told me to do--he gave me the coaching--he said, "Run to every aid station," they're early on every two miles and then about every mile and even closer, and he said, "Every time you get to an aid station grab some Gatorade, some water, and walk for two minutes, then run to the next aid station." He said, "What it is it's about a dozen two-mile runs, you know, so it's not a big deal." So I thought, okay, well, what the hell? I'll give it a try. So I went in at about ten minutes to five--they close registration at five--signed up for the Big Sur Marathon, went out the next morning. They took us by bus from Carmel down to Pfeiffer Park 26 miles south of Carmel, let us out of the bus, and at seven o'clock they fired a pistol, a gun, and we all took off running Highway One up and down and up and down back to Carmel. Well, I followed my friend's advice. I did a walk/run, and I finished that on as high a high as my solo flight, just for pure personal, not relationship, wife, kids being born or whatever, just purely personal. The two in my life were first solo flight and finishing that first marathon. I was absolutely hooked. And I just said, "Oh, wow. I love this." I've done a lot of ultra-marathons. I realized shortly after that that my real goal was-- I'm a goal-oriented person, as you could tell from my flying and whatever. I wanted to have a goal, so I decided, okay, I want to be running a marathon when I'm 80 years old, so I actually did a little program on my computer, which counted the number of days until I was 80. And, in fact, right now on my iPhone sitting in my pocket, there's now an iPhone app, which is days until, and it's got the number of days. And I think it's now 4,100-something days. I can't remember when it was, but that's my next goal, which is running the Big Sur Marathon on my 80th. So I ran the next year. I started training right away, ran the second year, ran an hour and a half faster than I had the first year, and I have now run all 31 of the Big Sur Marathons, not missed one, and all 14 of the half-marathons. In fact, I've run 134 total marathons. I've also been very active in the organization at Big Sur. I got recruited it'll be 20 years ago

this spring to do the website, to be the webmaster for the marathon. So when they recruited me, they asked me to do IT and the website, and I said, "Well, I'll do it under one condition." It's pro bono. It's free. "I'll do it under one condition. I get to race on race day. I don't want to miss being at the race," and I said okay, so fast forward a little bit. I've been on the board for a number of years. Previous few years I was vice-chairman, and in the end of September this last fall, I was voted chairman of the board, so I'm now chairman of the Big Sur Marathon. And it's a great volunteer organization. We're a nonprofit, $3 million a year budget, and we do a lot of good for our community. So we put on world class events that benefit our community and promote health and fitness.

Laws: And you can't turn up at five o'clock on a Friday afternoon anymore and sign up. It's very selective.

Rolander: Our Big Sur Marathon, it's what's called a bucket list. We have sold out for years and years and years. We finally had to go to a lottery system. But the chief runner at Runner's World, which is the largest running magazine in the world, made a statement some years ago, and he said, "If you only have one marathon to run in your life, Big Sur should be it." Even our half-marathon, which we had two weeks ago had runners from 48 states and 23 countries, our marathon always has runners from all 50 states and usually 40 or sometimes 50 countries.

Laws: It's a unique experience.

Rolander: Yeah, it's a beautiful event.

Laws: One more thought, Tom. If you're going to be giving advice to a young entrepreneur coming up today, what would you tell them to do?

Rolander: First thing that comes to my mind in terms of what I'd suggest for a future entrepreneur is find something that you have a passion to solve. I've described three characteristics of what I think it takes to be an entrepreneur. The first one is to be curious. You know, don't take things at face value. Try to understand why things work or why they don't work, because it's that kind of thought process that will open up opportunities for you, ideas about where you can be an entrepreneur, so curiosity is really an important characteristic, I think, and I've seen that in all the entrepreneurs that I personally know. Second one is persistence. It takes a lot of discipline, it takes a lot of drive, because you get a lot of, "No, no, no, no, no, no," "Screw you," "No, no, no," finally a, "Yes," you know, so it takes a lot of determination to do that. And then the last aspect is passion that plays across all those. So, you know, if your passion is making money, I don't know. I know more people that have been happy with their career and their lives that have actually built something that they're passionate about, and I rarely see that in terms of worldly goods or whatever. It is more along the satisfaction of the creation, the creative process, of building

something that you see actually work, and the real test of that is that people pay for it. Whether they pay thousands or hundreds is a different issue. <laughs>

Laws: Sure, sure.

Rolander: It depends upon the kind of problem that it's solving, but mostly it is to find a problem that you're passionate about. And so to encourage entrepreneurs it is to just keep that curiosity alive. Gary really recognized that toys were an excellent way of getting ideas. You know, the first personal computers were toys, absolutely toys, and that CD audio player, the first one from Sony, the Discman, was kind of a toy and exploring those kind of things. So today toys I guess are ranging from drones to these new skateboards and devices like that are areas that are possible.

Laws: Good. Well, thanks very much for your time, Tom.

Rolander: Thank you.

END OF THE INTERVIEW