
# Oral History of Gene P. Carter

Interviewed by:
Douglas Fairbairn

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**Douglas Fairbairn:** All right. It's September 29, 2014. We're at the Computer History Museum in Mountain View, California. My name is Doug Fairbairn, and we're here to interview Gene Carter, who has basically sort of been through it all when it comes to Silicon Valley, from the early days of buying components, to helping market components, to microprocessors, and onto the world of personal computers, and even activities after that.

So Gene has seen a lot in terms of the building and evolution of Silicon Valley, and we're happy to have him here, get his story behind-the-scenes activities of what went on in his experience. So welcome, Gene. Thanks for coming.

**Gene P. Carter:** Thank you.

**Fairbairn:** So Gene, looks like you were actually born in Wisconsin. Is that right?

**Carter:** No, South Dakota.

**Fairbairn:** South Dakota, OK. So tell me a little bit about your early family life, brothers, sisters. Just sort of set the scene in terms of where you were growing up and what it was like.

**Carter:** Well, I was born in Huron, South Dakota and lived there until I was 10 years old. Growing up, my mother wanted me to have some kind of music capability, so I took tap dancing lessons, which I hated, and convinced her that I'd take piano lessons if I could quit tap dancing. I started when I was about eight and subsequently ended up playing professionally in a dance band when I was 15. Music was my first love.

**Fairbairn:** What were you playing in the dance band?

**Carter:** Piano. So music was my first love. But it's the old story. There's one in 1,000 that make it big, and I wasn't going to be one. So I was going to be the thousandth one. So I decided that probably music was not my forte. But I did very well at it during high school and after high school, through college.

**Fairbairn:** Did you have brothers and sisters?

  

**Carter:** I have a little sister seven years younger than me that was also born in Huron before we moved to Saint Joseph, Missouri in 1944. My dad got transferred to the Armour plant in St. Joseph, Missouri as Master Mechanic.

**Fairbairn:** So were there any other sort of guidance from your parents about what they wanted you to do, or what they expected of you?

**Carter:** Well, unfortunately my dad did not have an opportunity to get an education. He didn't get through the seventh grade, but he was a real stickler on education. And obviously, running the mechanical gang for a meat packing plant, he was not stupid.

But he said, you will go to school. And I said, I don't want to go to school. And he said, you will go to school and you will pay for it, because he couldn't afford to. I went one semester and dropped out.

**Fairbairn:** So growing up, besides music, was there any particular skill or interest in high school or whatever? Any teachers that steered you in a particular direction?

**Carter:** Probably as I think back about that question, the one thing that I really enjoyed was math. And I had two very good lady teachers that knew how to get the concepts of geometry and algebra across. I always liked math and always did well in math. The other subjects bored me. Music, wood shop, and math were my fortes.

**Fairbairn:** So you got out of high school. You went to school, to college or something for a few months, or what happened coming out of high school?

**Carter:** As I said, my dad told me that I would go to school. So I went to school for one semester at the local junior college, and ran up against Engineering, Physics, Chemistry, and Calculus all in the same quarter, plus a girlfriend and playing in a dance band three nights a week. So something had to give, and it was school.

**Fairbairn:** So you dropped out. What happened after that?

**Carter:** Well, after a bit I was really still interested in electronics. You remember that in 1952 electronics and television were very new – We had a little 12-inch set. I enrolled in a correspondence school in Kansas City called Radio Electronics Television School, RETS. It was a correspondence course in repairing television sets and radios and I really enjoyed that.

  

**Fairbairn:** Vacuum tubes and tuning transformers and so forth, right?

**Carter:** 6SN7s and all that good stuff, you know. I learned how to use a scope and how to realign an IF strip. In those days, you didn't throw out the TV, you repaired it.

**Fairbairn:** So did you make money doing that at any point?

**Carter:** No. I think I got paid $8 a day. But it was an experience. It was a good experience for me.

And in the meantime I got married and was working at Armour in the Industrial Engineering Department doing time and motion studies. And during that period of time, in 1956, I was drafted. It was right after the Korean War. [Dates don't match Korean War period]

When I was a junior in high school, the local Air National Guard unit got called up to the Korean War. And I realized that I didn't want to be a soldier. With the Air Guard gone, the only choice was the Naval Reserves. About 50 or 60 of my classmates joined at the same time.

**Fairbairn:** Who had the same concern.

**Carter:** Yes. Somehow or another my draft number came up after being in the Reserves for five years and I went on active duty.

**Fairbairn:** So were you out on a ship?

**Carter:** I was on a troop transport. I made 15 trips to Korea in 22 months. So we spent a lot of time at sea. I was a Third Class Electricians mate and made Second Class before I got out.

While I was there I ran into a friend who was a similar crazy kid that I was in high school. And in talking to him, we came to the conclusion that we both wanted to go to engineering school. And he was going to go to Milwaukee School of Engineering since he was from Wisconsin, and suggested I go with him.

So the next year he got out and got married, and I went up to his wedding and went to Milwaukee to see the school and decided that that would probably be a very good place to go. So I enrolled at Milwaukee School of Engineering in 1958.

**Fairbairn:** To study electronics.

  

**Carter:** To study electronics.

**Fairbairn:** Did you have any particular goal in mind in terms of what you wanted to be, or is it just electronics was an interesting space?

**Carter:** No, I was interested in communications electronics and the design of electronic equipment. And during that time, again, I was playing in a dance band while I was going to school. That was our source of income.

**Fairbairn:** And making a pretty good income at that.

**Carter:** Wasn't too bad. But one of the band members was going to Marquette, and he was telling me about a thing called semiconductors, and I said, what's a semiconductor? And he says, well, it'll replace a vacuum tube, except it doesn't use any power. And I said, are you talking about perpetual motion? No, it's real.

So I started to get more information, and I found that there was a class offered at MSOE on semiconductor theory. It turned out that it was a book on germanium diodes-- not even transistors, or silicon-- germanium diodes, taught by an instructor who had never seen one or had any idea about them. But it was enough for me to get interested in it. And as a result of that, we went on from there.

**Fairbairn:** So you got out in a relatively short period of time. Your goal was not to go to a four-year college, and you got out in much less than that.

**Carter:** Yes, I got out in 15 months. I doubled up on courses and got out in three quarters. So I was able to get out. And when I got out of school, I was the class respondent. I set up the interviews for companies that were coming in to interview the prospective engineers.

And the first people in was the Atomic Energy Commission, Sandia Corporation in Albuquerque, New Mexico, because it took about three to six months to get a security clearance. So I signed up to go see what kind of questions they ask. I had never been through an interview or had no idea what kind of questions they ask. And in the process, they told me that they couldn't tell me what I'd be doing, but I'd be working in electronics, because it was all classified. And they only accepted the top 10% of a class, and I qualified for that.

So a month later, I got an invitation to go to Albuquerque to interview. And the day I left Milwaukee, it was in February, it was 13 below zero and there was three feet of snow on the ground. And I got to

  

Albuquerque about midnight, and it was cold, 20 degrees, but not 13 below. The next morning I got up. The sun was shining. It was beautiful out. It was 20 degrees, but by noon it was 55.

And in the interview, I couldn't get inside, but I was on the outside of the fence talking to prospective engineers that would hire me. And they offered me a job if I could pass the security clearance. And the job paid about $150 more than any other job that I'd found at the time. And they had five weeks of vacation. And the sun shined 360 days a year.

So having lived in Milwaukee and Missouri and South Dakota all my life, that sounded like a pretty nice deal. So I accepted the job.

**Fairbairn:** So did any of your classmates come to work at the same place, or were you the only one?

**Carter:** I was the only one.

**Fairbairn:** So just briefly, what kind of work were you involved in there? And how did that eventually lead to your next position at Fairchild? Well,

**Carter:** I was working in what was called the Component Development Group. Our job was to define military grade components for the next generation of weapons. We did the design--

**Fairbairn:** Atomic weapons.

**Carter:** Atomic weapons, yes. It subsequently turned into more than atomic weapons. But that was the intent. In 1960, that was the intent, was to find the next generation of bomb, which was not going to be vacuum tubes.

So we were doing some testing, and transistors started to come out, and they got interested in transistors. And being a research organization, Fairchild, Signetics, Motorola, Texas instruments, Westinghouse, everybody that was in the semiconductor business would come to our place and say, we've got the next great thing.

Most of the engineers that I worked with when I first got there were in their late 50s, early 60s, and they had worked on the weapon themselves. And they were just waiting to retire. And when they talked about semiconductors they said, oh, no, I don't know anything about semiconductors. I don't want to know anything about semiconductors. And I said, I'll do it. I'm interested.

  

So since it was a minor job, they gave it to me. And I did radiation-hardening studies on transistors, 2N918, which is like a $50 part, and we were buying them 100 at a time to do evaluations, radiation studies on them, and test them.

**Fairbairn:** What was the state of the industry at the time? Were they able to supply the kind of parts you were looking for?

**Carter:** Yes, but they didn't meet the radiation standards. I mean, there were different designs for radiation hardening than for a typical part. But it was a beginning, and we were able to-- we let a contract with Motorola to build a radiation hardened device.

To my knowledge, I don't know if they ever got to it or not, because in the process of trying to build a radiation hardened transistor, integrated circuits came about, the Series 51 and the 930 Logic series started showing up. And we became interested in building or testing ICs.

That resulted in my-- there's another story here, that in that process, one of the jobs that I was given, one of the designs I was given, was to build a detonator for a 3 and 1/2-inch mortar shell. It was Doppler effect. And it had to fit on a 3 and 1/2-inch printed circuit card. So I had to go learn about Boolean Logic and Venn Diagrams and all those things, and try to reduce that down to a circuit that would fit on the board.

**Fairbairn:** 3 and 1/2-inch diameter thing that would fit inside the shell.

**Carter:** Right. And it was a 21-gate array, gates and flops, that I ended up designing. And about that time, Westinghouse, Newport Beach, California, came in. And they said, we've got a new process for dual layer metal, and we can reduce the size of components, and are you interested?

Matter of fact, I do have something. So we gave them the logic design, and they worked on it for a year.

**Fairbairn:** Tried to build a custom chip to do that.

**Carter:** Trying to build a custom ship with those 21 gates on it. And their biggest problem, which I suspect they're still having some difficulty today-- or they did, I know, for years and years and years-- was the temperature differential between aluminum, and they tried gold and oxide, and it would craze if it wasn't put down properly.

  

So they spent a year trying to make one. And they built one that worked, brought it to me, and I said, OK, now I need 100 to test. They said, oh no. We built one. That's all we need to build. They didn't want any more of it.

And then about that time, we were doing temperature testing and what we call shake, rattle, and roll, you know, the military specs for ICs. And I wrote the contract for a Fairchild 4000 integrated circuit tester and placed the contract with Fairchild Semiconductors Systems Group out here.

And in the process of doing that, I was looking to do something else because I wasn't happy with the progression that I was getting at Sandia as far as work was concerned. And so I came out to Mountain View to check on the Fairchild 4000 tester. And one of the engineers said, while you're out there, would you go over to Fairchild Semiconductor and negotiate the spec for new µA702, which is an operational amplifier. I said, I don't know anything about operational amplifiers. You don't have to. Just make sure it'll meet military specs.

So after I got through at Fairchild Systems, I went over to Semiconductor and was introduced to Jack Gifford, who was the Linear Marketing Manager.

**Fairbairn:** What year is this now?

**Carter:** This was in 1968, late 1968. So when we got through talking about the specs, Jack asked me if I'd like to go to dinner, and I said, sure. And his wife Rhodine was also staying in Dinah's Shack down on El Camino, and he said, would you mind if she went along? I said no. I didn't care. I was going to get a free meal out of it.

**Fairbairn:** She was there because Jack had just recently moved into this position himself, right?

**Carter:** Yes, that's right. Jack had just moved up from LA. He'd been a salesman in LA and had been made Marketing Manager for Linear Circuits in Mountain View. So we went out for dinner and he said, how would you like a job?

And I said, as a matter of fact I'm looking for a job. But I'm not interested in linear because I don't know anything about it. I'm interested in MOS because I've been reading about it in the IEEE spectrum-- been reading about this new technology called MOS that's supposed to be low power, and you'll be able to put a lot of parts on a chip. And it sounds really interesting.

  

And he says, well, I'll tell you what. There's one commercially available MOS device at Fairchild. Because R&D had been working on MOS for some years under Noyce and Andy Grove and Frank Wanlass. There was a whole crew of them there, Leslie Vadász.

So he says, you can market that product if you come to work for me. And he offered me about $200 more than I was making, which was more money than there was in the whole world in those days. Only to find out that that was all taken up by the cost of living in California.

So I accepted the job and came to Fairchild in March of '66.

**Fairbairn:** So was your wife happy to be moving from--

**Carter:** No. Matter of fact, I had to convince her that we would come to California for five years maximum to make our fame and fortune, whatever that might be, and then we'd go back to Albuquerque. And she cried for three days when we left Albuquerque. She cried the first three days out. So obviously we're still here.

**Fairbairn:** So it was '66 when you left Sandia and moved on to Fairchild. So coming to Silicon Valley at the time-- it wasn't called Silicon Valley-- was there a sense that this was a new, exciting, vibrant place to be? Or what was the feeling about coming here, besides this seemed like a good job? Or was there any notion of gee, this is a place that--

**Carter:** It was very-- it was exciting for several reasons. One was because this was a new part of the semiconductor industry. And remember, 1964, '65 is when the transistor really started to be for real. So '66, it was just starting to grow, and integrated circuits were just coming in. And the planar process was just getting done.

So there was a lot of excitement at Fairchild, I'm sure as there was at TI and Motorola also, but there was a lot of excitement at Fairchild. And then R&D was working on the next generation of MOS devices. So that kind of helped me understand more about the next generation of products.

Also, when I joined Fairchild I told Jack, I said, I want to know-- I want to learn the whole process. So I went through-- over a period of months I went through ingot pulling, and in those days they were pulling an ingot an inch in diameter. And if we had a little earthquake or something, they started all over.

It was in the basement of the Whisman Road building. I saw how they cut it. I went through all the design areas, went through R&D, got to know all the R&D guys, the Intel group clan, if you will.

  

So there was a lot of excitement. And then, I want to say 1967 or 68, when they began to realize that microprocessors were coming about, they came up with the concept of custom MOS devices and bipolar devices that were called Micromatrix and Micromosaic was the MOS devices.

And I coined the phrase-- in fact, I learned about patents and trademarks and all that stuff-- but mosaic was a word that I coined. MOS Array Integrated Circuit. That's where the name came from.

**Fairbairn:** That's great to know. I don't think we even recorded that in the direct history of that particular product.

**Carter:** It was trademarked. Or it was a registered trademark. Whether it still is any more, I don't know.

**Fairbairn:** So were you Marketing Manager for that product as well?

**Carter:** Yes. Yes. In fact, it was kind of interesting as an aside. I was giving seminars around the country on Micromosaic, on what we could design, the kinds of things we could do. And I was down at Hughes Aircraft in Southern California, and I had about 40, 50 people in the audience.

And one brash young engineer in front gets up and he says, what do you do at Fairchild? And I said, I'm in marketing. He says, I'm not going to sit here and listen to a marketing guy talk. If you're not an engineer, I'm not interested.

I said, well, my job is marketing. I am an engineer. Well, I don't know if I'm interested or not. I said, I'll tell you what. You sit down, and if you get tired, and you don't think I'm giving you any information, you raise your hand. I'll stop right there and it'll be done.

Well, that shut him up. I've learned how to deal with crowds. And when I got through with the presentation, he came up and he said, “that was incredible. Would you do it again for our executives? “ And they brought in about 15 upper management, and I gave the same seminar again on MOS and what it would do, and what you were able to do with it. So kind of made me feel good about that--

**Fairbairn:** You won him over.

**Carter:** He was going to throw me out, and I won him over, yeah.

  

**Fairbairn:** That's great. So while at Fairchild, you were originally marketing for this communications switch device, right?

**Carter:** Yes.

**Fairbairn:** And eventually moved on to--well, through the custom, semi custom micro mosaic program, and then on to microprocessors, is that right?

**Carter:** Yes. As time went on, they brought in Jerry Larkin out of the field. And he took over memory devices, and they put the MOS stuff under him, the micro mosaic and the micro matrix. He had all of that, the memory and the custom bipolar and custom MOS.

I left the Linear group and went to work for him as a Marketing Engineer on those products.

**Fairbairn:** So what were your observations about Fairchild at that point? Obviously, people were spinning out. It was a couple years after you joined the Intel folks spun out, but I think national spun out before then. Tell me about the feeling at Fairchild, and what was working, what wasn't, and what sort of led to this multiple spinouts.

**Carter:** Well, I think there were factions within the company that had-- like Shriner's group with the micro matrix and the micro mosaic design, custom design work. There was a lot of interest in that because of the evolution. And we were going from SSI, or standard single function, to MSI. And then we were going to LSI, and during that same period learning what size packages, what form factors of packages, and that affected Shriner's group. And I know you've interviewed several of those fellows, so you know their story.

So there was a lot of interest. And I think there were groups of people that thought they could do a better job on their own. And you see large companies become very disorganized. They don't stay focused on a function. And I think that these groups stayed focused on the functions.

For example, they brought in Lee Boysel from IBM to build a computer, a microprocessor. And he brought in a group of guys that were helping him design a 4-bit slice of a 16-bit computer. So he built a 4-bit slice that you put four of them together or two of them together and create an 8- or a 16-bit computer.

And that was all four-phase MOS logic. And I don't know if you recall, but he took that whole group and went to a company called Four-Phase. And they built, I think, the first Sabre computer for American Airlines. I think that was their big computer.

  

They subsequently got bought out by Motorola. And I was devastated that they didn't take me with them. They took  Cloyd Marvin instead. And I was devastated, because I really wanted to go with that group.

**Fairbairn:** So were there any of the other spinouts that particularly-- like when Intel, when Noyce and Moore left, was that a big thing within the company?

**Carter:** It was a big thing. And that happened after I left, because they-- I left in March of '69, and I don't think--

**Fairbairn:** I think they left in '68, it sounds like it's--

**Carter:** Oh yeah, you're right. You're right, it was. Because they left before Hogan came in, and Hogan came in-- his group came in shortly thereafter. And I think the same thing happened. You had Andy Grove and Gordon and Bob and Les Vadász . Those guys had a concept for a memory chip. And Fairchild was trying to build a core memory-- and not doing a very good job of it, you know, where they used a little core and wire around it. And Intel decided they were going to try that, and that was their first product, and it didn't work so well. And they got into the 1103, the random access memory. And they were in that for--

**Fairbairn:** So was Fairchild as a semiconductor company was trying to build core memory?

**Carter:** Yes. That was a back room job. Well, everybody knew we needed more memory. They just hadn't figured out how to do it yet.

**Fairbairn:** And they didn't see that semiconductors were going to get there.

**Carter:** Apparently not. Apparently not.

**Fairbairn:** Interesting.

**Carter:** So all that was going on. And as I was saying, I had cultivated this job for MOS Marketing Manager, and made sure that I was working the peripheries of it, and everything was working. And one of the marketing managers had a friend who was in Florida that wanted to come back to California, and he gave him my job. And that was the straw that broke the camel's back.

So as you said, the Intel group left, and that's when Hogan's Heroes came in and destroyed Fairchild.

  

**Fairbairn:** Was that because they just didn't know what they were doing? I mean, Hogan was from Motorola, right?

**Carter:** Yes.

**Fairbairn:** And was it because they tried to run it as a big company or didn't know the technology?

**Carter:** They tried to run it as a big company. And my feeling, looking back, was they were not visionaries. They were just trying to run a company. They didn't have a vision for what they were trying to do. Intel had a vision for what they were trying to do. National had a vision for what they were trying to do. But I don't think that the Hogan group-- it was a bureaucracy, in my opinion. It was a bureaucracy that kind of fed on itself and didn't feed on what was really vibrant.

So the group that went to National, Charlie and Fred Bialek and Don Valentine and Floyd Kvamme and Pierre Lamond. Those guys had a vision for what they wanted to do and how they wanted to create it, and they made that happen.

So when I found out that I didn't get the job that I had cultivated for two years, I called Don Valentine.

**Fairbairn:** Who was--

**Carter:** He was the Director of Marketing at National. I'd worked two levels below him, but he knew who I was, and I knew him.

I called him, and our interview, typical Don, as he's sitting down he says, so why should I hire you as the MOS Marketing Manager? So I had to "sell" him, quote unquote. And I got the job. And I left Fairchild.

**Fairbairn:** How big was National at the time?

**Carter:** They were $6 million. This was in March of '67-- no, I'm sorry, March of '69. March of '69.

**Fairbairn:** And they had a few hundred employees, or--

**Carter:** Not more than that. Not more than that. I don't remember what my employee number was, but it wasn't a big company.

  

**Fairbairn:** Small company. Six million bucks. And what was their major product at the time?

**Carter:** Series 71. TI knockoff.

**Fairbairn:** 71 was what type of product?

**Carter:** That was a TTL logic line. And then they built DTL. We had a DTL line that was compatible with Signetics. Was not a big line, because that was just kind of a secondary effort. And MOS was-- we had Ken Moyle was running the MOS group. And Dan Izumi was there. He was one of the design engineers. So that was a-- the MOS program there was vibrant. It was going; they had new ideas and new concepts going.

**Fairbairn:** So what was your first job there, coming in there?

**Carter:** I was MOS Marketing Manager. And then about 1972, Pierre Lamond left, and-- no, Don left before that. Don Valentine left to start Sequoia Capital. And Floyd Kvamme, who was the Director of Marketing, was promoted to Don's job. Then Pierre left to join the venture capital group, and Floyd was--

**Fairbairn:** To go to work with Don?

**Carter:** Yes. And then Floyd was promoted to General Manager. And I got the job of Director of Marketing, and I didn't want it. And he says, no, you'll do just fine. So I took the job.

**Fairbairn:** You didn't want it because

**Carter:** I didn't think I was up to it. I didn't think I was up to it. So I did that until that recession that hit the valley, and they laid off 20,000 engineers over at Lockheed.

**Fairbairn:** It was '75, '74?

**Carter:** '75. I believe it was late '75. And we divisionalized National, and I didn't have a job because each division took on their own marketing group.

**Fairbairn:** All these people that used to report to you all of a sudden became their own Directors of Marketing in their division.

  

**Carter:** In their own divisions. So they gave me the job that I wanted, which was the Microprocessor Division. So I was the Marketing Manager for the Microprocessor Group.

**Fairbairn:** So this was '74, '75. So Intel had announced the 4004. And then is 8080 out, or what's--

**Carter:** The 8008. Good story. 4004. And I saw it over-- I was at Intel a couple years ago and I saw the story.

When I first came to National, we had a group headed by Jack Irwin, and we were building a 4-chip set for a business calculator for a company called Busicom in Japan. And this 4-bit processor was for a business calculator. They never could seem to get it to work. All the pieces wouldn't work together. And so the Busicom people got frustrated, and they went to Intel and said, is there something you could do for us?

And that's when Ted Hoff came up with the idea for the 4004. So his 4004 replaced our 4-chip calculator.

**Fairbairn:** But the 4004 was a 4-chip thing, too, right?

**Carter:** It was a 4-bit.

**Fairbairn:** It was 4-bit, but there was multiple chips that went--

**Carter:** No, it was just one chip. He put it all on one chip. The 4004 was all on one chip.

**Fairbairn:** Right. But it required some support circuitry around it. It came with a family of chips.

**Carter:** Right. The family that went with it.

**Fairbairn:** OK, so same Busicom that got Intel started. But what you couldn't get going in your four chips, they were-- a few years later were able to get going in their single chip.

**Carter:** Right. They got them to work together. So getting those four chips to work together just didn't seem to--

**Fairbairn:** Was this a manufacturing problem or a design problem at National?

  

**Carter:** I think it was a design problem. I think it was a design problem. That same chipset was being used by a guy in-- Roberts, Dr. Roberts in Albuquerque-- called MITS. You remember MITS? [MITS was selling calculator kits]

And they built the Altair. [The Altair was built with the 8080 microprocessor] It was a kit. You could buy it through "Popular Electronics." And we were selling them to him. And the poor guy was hand to mouth. The bank would give him enough money to buy them. So he'd call and we'd say, OK, we got four chipsets. Well, he'd get the money released from the bank to pay for them so that he could buy the parts to put them all together.

And when we found that we just couldn't make them work, the salesman says, I'm not telling him that. So I had to get on a plane and go to Albuquerque and explain to Ed Roberts that we couldn't build the parts. It wasn't a matter that we didn't want to. We just couldn't make them work. And he just had a fit.

And he introduced me to his engineers. I want you see my engineers. He was working out of a little house on San Mateo in Albuquerque. And back in the bedroom was monitors, there was cables hanging over top of the curtain rods and all over the floor.

And here are these two guys. And he says, Gene Carter, I want you to meet Bill Gates. He got up, shook my hand, sat down, and kept right on going. And he says, Paul Allen, I want you to meet Gene Carter. He got up, shook my hand, sat down, and kept right on going. They didn't mean anything to me.

But that was the first time that I met Bill Gates and Paul Allen. And they had long hair. They had just come out of Harvard.

**Fairbairn:** They were developing Basic for that computer.

**Carter:** That's right. That's right.

**Fairbairn:** So they had originally tried to build it out of your parts, but then those didn't work, so then they switched to the Intel 8008, is that right? The Altair 8800 was designed from scratch with the Intel 8080 microprocessor]

**Carter:** I don't know. I didn't keep track of it after that. But they--

**Fairbairn:** Because they did sell computers eventually, and must have been--

  

**Carter:** Yeah. They might have done the 8008. But Ed Roberts is a doctor now, a medical doctor. I don't know if you knew that. He moved back to Georgia and he's a medical doctor. [He sold MITS and went to medical school]

**Fairbairn:** You scared him out of the microprocessor business.

**Carter:** Probably did, yeah. Funny stories. It's just funny how you cross paths with people.

**Fairbairn:** Fascinating. So he was using these chips-- I mean, he had a system working.

**Carter:** He had a working system, right.

**Fairbairn:** He just couldn't build reliable parts on a regular basis. Some would work and some wouldn't.

**Carter:** Some worked and some didn't. They just couldn't seem to make them work well. So anyway, that was my relationship with-- before I went over to the microprocessor group.

But National had also built what we called the IMP16, which was a 16-bit processor. Dan Izumi and his group had built this 16-bit processor. And in trying to sell it, Intel were able to kill it because they were going around telling everybody, you know, a 16-bit processor takes twice as much memory to program as an 8-bit processor.

And nobody knew anything about computers. I mean, we're talking about the early stages of computers. They knew nothing about computers. And it was easy to convince somebody that 16 was twice as much as eight, so it took twice as much memory. Forget about the fact that the efficiency of 16-bit computers would reduce the amount of memory needed. It killed the system.

And we sold some. We sold some to Sun Electric, you know, the people that build auto analyzers. They completely automated their system, which had been all electromechanical. And that worked out fairly well.

But again, it was a process fraught with problems. And the MOS process, you know, the oxide crazing and the difficulties of building in the early times of MOS.

**Fairbairn:** So then you moved over to head of the Microprocessor Group at National. So tell me about that experience.

  

**Carter:** Well, we had the 16-bit processor. And then we had an 8-bit. Once the 16-bit ran up against the opposition of the 8008, we built one that we called a SC/MP (Scamp), Simple Cheap Microprocessor.

**Fairbairn:** Yeah, I remember that one.

**Carter:** You remember that?

**Fairbairn:** Yeah, I do.

**Carter:** And SC/MP was an 8-bit processor, worked very well. We sold a lot of them. There was a young engineer who was building products in the design group for us, and he used SC/MP to build an industrial computer.

In the '70s there was an industrial standard, a four by four card that fit in a card rack. And that was an industrial standard if you were building industrial control, computer-managed industrial controls, et cetera. And Steve Leininger-- who subsequently created the TRS 80 for Radio Shack, incidentally-- Steve had built this card frame and had the processor, the memory cards, the interface cards, and the monitor cards and everything, and had written a Basic program called NIBL, National Industrial Basic Language.

**Fairbairn:** So it was an industrial control system programmable with NIBL.

**Carter:** You could put as much memory in it as you want. You just put it in a card cage that was a standard size. And so we were working on that. And the trials and tribulations of our manufacturing left a lot to be desired in the process. And I was not happy working over there with the guy that was running it.

So I came up with the bright idea that we could make a business out of small computers. So Phil Roybal, one of my marketing guys and a good friend and I wrote a business plan. And we presented it to Charlie and the exec staff.

**Fairbairn:** Charlie Sporck, who was the CEO.

**Carter:** Charlie Sporck, right-- he was the CEO-- and to the executive staff that we needed $500,000 and a place to work, and we would build small computers. And at the end of this Charlie said, there's no market for small computers. It's 370-158s and DEC 11s.

  

I said, well, I guess I'm going to take my ball and go home, then. And he said, well, if you really believe in it, why don't you join the marketing group and research? I said, no, I don't want to do that. So I left. And as a result of that, Radio Shack-- the guys had been in to National to see about buying-- they wanted to buy a handful of chips for 100 bucks that they could build a microprocessor with. And I'd taken Steve in to talk to them and explain to them why you couldn't get a handful of chips for 100 bucks.

They hired him, and his wife was a geology major at Berkeley. And he says, well, my wife wants to work in the oilfields. And they said, if you come down here and work for us, we'll find her a job. So that's how he ended up down there.

**Fairbairn:** Down in Texas.

**Carter:** Down in Texas. Yeah, in Fort Worth, that's right. Radio Shack was in Fort Worth, that's right. So there was-- at National there was a lot of things going on. There was a lot of activity, a lot of interest.

Let me circle back. Because on the bipolar side of it, the problems that they were having were communications problems with DEC and the small minicomputers. And our Applications Manager, Dale Mrazek, had been noodling with all this. And he came up with a concept that would eliminate the problems.

It was called Tri-State Logic. It has a high state, a low state, and an infinite state. And he built a PDP 8 out of these parts. He made all the different parts, the up down counters, and all the interface pieces, and built it-- you know, the PDP-8, I think, was on two 16-inch cards. And he built it on a 12 x 12 card, reduced it down. Much like Wozniak did. If you read Woz's book, his idea was minimal, the smaller the parts count the better.

So when he got it done, he got the first part done, I was going out to DEC and Data General to talk to them about an MOS keyboard encoder. And Dale said, you know, I've got this part that I've just designed. There's somebody out there that needs it at DEC. And so he explained to me how it worked, and it was a DM8094, which is a Tri-State gate.

So I'm talking to the guy, the engineer-- and I'm sorry, I don't know who he was now-- but I was talking to this guy about the keyboard encoder and how they were using it and problems they were having with it. And being a good marketing guy, I said, is there anything else that you've got that we might be able to help you with?

And he says, oh man, and he reaches back behind and he pulls this big D size print out. And he says, see all these lines? Those are bus lines. And see all these lines? These are all input lines. And he says,

  

on the end of these buses, we got a monitor one place, we got a printer someplace else, we got a fax machine someplace else. And they're all over the building. And if somebody turns one of them off, it shuts down the whole data bus.

And I said, “you're the guy I'm looking for,” I swear to God. I reached into my briefcase and pulled out this design. And I said, OK, here's this thing. Let me show you how it works. And I told him about how the gate worked.

He looked at it and he says, wow. Picked up the phone and he calls the purchasing agent and he says, hey, I want to order 100,000-- what did you call them things? I said DM8094s. I want 100,000 DM 8094s ordered now. What do you mean “how much they are?” What the hell do I care? All I want to know is I want them, now.

**Fairbairn:** Had you made any yet?

**Carter:** We'd made a few. I mean, you talk about fate. That's a marketing guy's dream, isn't it, to find somebody that needs what you have?

**Fairbairn:** You had an order in place and you hadn't even gotten back to the company yet.

**Carter:** No.

**Fairbairn:** Did you guys accept the order?

**Carter:** Of course we did.

**Fairbairn:** Did you deliver the order?

**Carter:** We delivered the order. Yes, sir. We did deliver the order. And Dale has a patent on Tri-State Logic. And so we started doing seminars around the country on Tri-State Logic, on how it worked and what it would do for you. And a little company down in Texas called Texas Instruments followed us around the country telling all these people, if you use that, you're going to destroy your system because it's going to burn it up,

  

And guess what? Three years later they “invented” this new technology called three-state logic. And the reason it was three-state logic was we trademarked Tri-State Logic and they couldn't use the name. So same story as our calculator.

**Fairbairn:** But in the meanwhile, you actually did make some money on your Tri-State Logic product.

**Carter:** They still are. I mean, that's the standard of the industry now.

**Fairbairn:** So you mentioned the calculator. I think you have a story about the calculators.

**Carter:** Oh, the calculator. When I was Director of Marketing, each year we had to do a business plan. And I had linear, digital, MOS, hybrids, transistors. I had five marketing managers. And Charlie would-- he wanted the plan. So I used to get a piece of butcher paper, draw lines on it. And you'd put the DMA 80-94, and you'd put down the volume by quarters and the average selling price by volume.

And you'd put it all together, and down in the bottom right-hand corner, after spending two or three nights all night long, you'd find out that the plan was for $450 million. And I'd take it in to Charlie, I said, OK, here's the plan, Charlie. He said, not big enough. Do it again.

**Fairbairn:** This was before the day of spreadsheets, right?

**Carter:** What?

**Fairbairn:** Digital spreadsheets.

**Carter:** Not big enough. Well, how big do you want it? I'll tell you when you get there. So I'd go home, get another piece of butcher paper, draw all the lines on it, put all that stuff back in. It all had to be done manually. There were no printers in those days to do that.

**Fairbairn:** Start putting in bigger numbers.

**Carter:** Put in bigger numbers, and try to figure, project, you know, how many you're going to sell at 100,000 and how many you're going to sell at 10,000. And he'd finally say that's OK.

So I went through that for three years. And one of the design engineers came in one day and said, you know, I figured out how to put a calculator on a chip. What would you like to see in a calculator?

  

Oh, man. I said, the calculator I use is a Commodore. And it uses a peanut battery, which is about a half a double A battery. And I said, at 2 o'clock in the morning the battery would die, and I never had brains enough to buy two of them. I'd just buy one. And you couldn't find them anyplace.

So I said, here's what I want. Eight-digit, floating point, runs on a nine-volt battery. Well, in those days MOS ran on plus 5 and minus 12, so that was 17 volts. And engineer said, we can't run on nine volts. And I said well, then I don't want it.

So a couple months later he came back and he said, I figured out how to do it. I can put a voltage doubler on the chip. We're using CMOS, and we'll put a voltage doubler on the chip. However, we can't do eight digits because the LED digits were a buck and a quarter apiece. And I'd told him that it had to sell for under $40. And eight digits times a buck and a quarter's 10 bucks cost right there. That's half of it. And we can't do floating point because it takes up 25% more chip area, and the chip is too expensive. We'll give you six-digit fixed point.

I said OK, six digits, fixed point. But it has to sell for under $40. So we came to an agreement. And when the manufacturing manager found out we were doing it, he had a hissy fit and tried to get it thrown out.

And so I went to Charlie and I said, Charlie, I'll quit my job--

**Fairbairn:** Because he didn't think he could make it.

**Carter:** He didn't think he could make it. He thought it was too complex. It was a big chip. It was almost a quarter of an inch on its side, which in those days was a big chip.

And so I went to Charlie and I said, Charlie, I'll tell you what. I'll quit my job, and I'll sell these, but I want 5% commission on every one I sell. And I don't know if you know Charlie Sporck, but he always smoked a cigar. He looked at me and he says-- and he's very good at pounding his fist or pounding his hand-- he said, you better ass be right. Now get back to work.

So we built the chip, and we sold the product for $39.50. And within 18 months they were $4 giveaways at banks. And as a result of that, they started a division called Novus, and Novus built calculators. And then they ended up building LED wrist watches. You know, you had to push a button because it was a red screen. You had to push a button to see the time.

**Fairbairn:** LEDs took too much power.

  

**Carter:** That's right. That's right. So that was another great, I think a step forward. That's why I say, the innovation-- I think so many times people miss the vision. And I think as a company gets bigger, they miss the vision because they're so focused on making it bigger.

If you look at IBM and HP and all these larger companies, they're successful, but all the new startups are offshoots. They're people who have left there because they don't have the foresight to visualize what they're doing. And you can argue with me over that, but I've seen so many little splinter groups split off and become big companies with technology that was there. They just didn't take advantage of it.

**Fairbairn:** So what finally brought your National career to an end?

**Carter:** Well, what brought it to an end was when I made the presentation to Charlie and the exec staff of making small computers, and he suggested that there was no market for small computers, that I could go to work in the marketing group and research it more if I wanted to. I said no, I'm gonna take my ball and go home.

So I took that business plan. I went home and did nothing. I thought, well, I can live without working for awhile. I was 43. I don't have to work. And within three months I was stark raving mad. I don't sit well. I'm not an easy sitter. I got to be moving all the time.

**Fairbairn:** So what year was that when you left National?

**Carter:** 1976. I left in the fall of 1976. So I took the business plan, and knowing Don Valentine as I had from Fairchild and from National, and he was at Sequoia Capital, I took my business plan and I went over to Sequoia and told him what I wanted to do. He says, well, what do you want to do?

I said, I want to sell computers. I'm not an engineer. I'm tired of marketing, and I want to sell computers. And I think there's a market out there for small computers. And I've got a business plan here designed by Steve Leininger, who's now at Radio Shack, did the TRS 80. And all I need is some funding, and tell me how I go about getting it funded.

And he says, well, do you know what your friends Markkula and Scott are doing? And I said, no.

**Fairbairn:** You had worked with them at National.

  

**Carter:** Mike Scott and Mike Markkula and I shared an 8 by 12 cubicle at Fairchild for three years. And then Mike Scott worked for me for four years at National as the Hybrid Marketing Manager before he became the Manufacturing Manager for hybrids.

And those two had-- well, Don said, I had these two scruffy-looking kids show up in my office last November, and they wanted money for their computer. And he says, I called Markkula, who had left Intel because he'd been passed over for the Director of Marketing job, or VP of Marketing, so he left. And he says, I sent Markkula over there to check them out and he never came back.

**Fairbairn:** So Don hadn't put money into Apple at this point.

**Carter:** No. And he says, he hasn't come back. So he said, you might want to go see what they're doing before you decide you want to start another company. So I went over to see what they were doing on Bandley Drive in Cupertino.

**Fairbairn:** So they had a real office at this point.

**Carter:** They had a 20 by 60 foot cubicle, you know, an office space in the office complex there, right behind Target now on Stevens Creek. And I mean, he gave me a tour of the place. And this was order of magnitude better than what I was going to do. So I said, I'd really like to join. And I said, I'm interested in selling computers. He says, well, we don't need any marketing guys. We've got two marketing guys already. We don't need any more.

I said, no, I don't want to market. I want to sell. I'm tired of building marketing plans that the field ignores. So I will be in the field. You tell me what you want done, and I'll do it your way. If it doesn't, work it's your fault, not mine.

And so I went home and I wrote up a little plan, and I took it back to him and I said OK, here's what I want. I want a percentage of the company. And I want to be Vice President of Sales. And he says, I didn't give the president that much. I'm not giving it to the sales guy. And I said, well--

**Fairbairn:** What did you ask for? What percentage did you ask for?

**Carter:** I asked for 10% and he offered me two. And I said, no way. He says, OK. He wadded it up and threw it in the trash can. So I went home and I was sitting there having lunch with my wife, and I said, I really want to do this. I really want to do this. If it doesn't work, I'll go find another job, but this is really something I want to do.

  

So I got back in the car, drove over there, reached in the trash bag, straightened it all out and laid it on his desk.

**Fairbairn:** Same day.

**Carter:** Got a deal. Yeah, it was within an hour. I said, you got a deal. So he says, well, I can't hire you because we don't have any money. So I said OK, but I want the job. You can have the job.

So I showed up every day. I worked every day, sometimes weekends, until the 5th of August. And we shipped 50 systems on the 5th of August.

**Fairbairn:** 50 which?

**Carter:** Apple IIs. So that was in April that I made the deal with him. So I worked from April to August for nothing.

**Fairbairn:** '76.

**Carter:** '77. So I worked for nothing, which was fine. And when I got hired, I got $30,000 a year plus 2% of the company. So the $30,000 was just enough to pay the mortgage.

**Fairbairn:** But the 2% was worth a little more than that.

**Carter:** Well, eventually it was. But we weren't really sure there for awhile.

**Fairbairn:** So what was it like? What was the environment like, and what was your experience with working with Jobs and Wozniak and so forth?

**Carter:** Startup companies have their own vibrance. If you work in a bureaucratic company and you say, oh, I'm going to do this, and they say, no, that's not your job, that's my job. You stay away from that.

Boy, in a startup company, you want to do something, do it. There's more than you could ever possibly get done. So you do whatever you have to do to make it work. And to me that was the exciting part of it.

  

And you were working-- I say one of the reasons that I feel that Apple was so successful is because of the vision of the people. Jobs had a vision for what he wanted. He wanted to build a personal computer. That was his word always, personal computer was his. He wanted to build-- regardless of what you thought of him, he believed that he wanted to build a computer.

Woz wanted to build the ultimate computer so that all the engineers knew how good he was. Mike Scott wanted to build the best, low cost, highest quality manufacturing line ever built.

And then Mike Markkula wanted to be the best marketing guy there was and prove to Andy Grove that he made a mistake by passing him over. Now he may not admit that, but that's the way I read it, because I've heard his innuendos over the years. And I love the guy. He's still a dear friend of mine.

**Fairbairn:** So what employee number were you when you joined?

**Carter:** 14.

**Fairbairn:** So you were working out of this 1,200 square-foot building.

**Carter:** Yeah.

**Fairbairn:** And so during the time from February to August, whatever you were there, what were you doing? Whose doors were you knocking on, who were you trying to sell to? What was that experience like?

**Carter:** Well, at the time, in those days we had Byte shops. And there was a group of stores called Team Electronics that went across the northern part of the country, which were like Radio Shack. They were kind of an all-electronics-- they sold components, hardware, phones, all those things.

And when I started, that was my sales outlet. We had zero software, had no program capability. Mike Markkula had written a checkbook program in Basic. That was our program.

**Fairbairn:** Well, you didn't have a machine until August, you said.

**Carter:** No, well, they had a machine that worked. We didn't have any to ship. But they had workable machines. We just didn't have anything to ship, because we were waiting. They had trouble with the case,

  

because you remember the case was a molded case and it warped and Jobs wouldn't accept a warped lid.

**Fairbairn:** So that was the limiting factor in terms of getting the product to market, not the electronics, but the case.

**Carter:** Right. Right. The case was a problem at the end, the end of that start. So what we hit again, as we talked about at lunchtime, fate. This was an era where I used to tell the story when I was out selling for Apple, I said, you know, the world's first computer was called ENIAC because there's only one guy in the world knew how to program it.

And then there become, people got interested in it and they wanted a computer. So we needed tens of computers. And even IBM, Tom Watson, said there wasn't any need for more than 10 or 15 computers in the world. So they built mainframes and they added peripherals to them.

And then you had hundreds of people that wanted computers. So they built a mini computer called the PDP-8. And then they wanted thousands of them. So we networked them so that you could work off of a mini-mainframe.

And now we have the personal computer, where everybody wants a computer on their desk. That's what the Apple II is. It's your personal computer. And that was the pitch that I gave to people to recognize that.

And so all of those engineers who had always wanted a computer of their own were buying the Apple. They were programming it in programming language or in Basic, and they were programming their own applications. And that was the first year, that's what we had to sell.

**Fairbairn:** So you were selling through retail--

**Carter:** Retail outlets, yes. Retail dealers.

**Fairbairn:** Did you try to sell overseas? What was the--

**Carter:** We had a guy that took the Apple II and converted it to the TV standard in Europe.

**Fairbairn:** Oh yeah, the 50 hertz and 50 scan line frequency.

  

**Carter:** Right. And he sold Europe. So for the first year, I was the only sales guy, first nine months. So I handled all the Far East, I went to Japan several times. I was all over the country. I was on the road probably three weeks every month, out there pushing and selling, trying to. And that was an exciting time to try to push that along.

But in the meantime, more people started to open up stores. And as time went on, we had ComputerLand and BusinessLand. And we had a lot of good dealers that sold audio equipment, so they had at least access to techies, things of that nature.

So our biggest push, though, at the beginning was training these 20 Team Electronics dealers and the Byte shops around the country. They were the biggest movers.

But that was in '77. When I left in '84, I had about 2,700 dealers. So it grew from a handful to 2,700 in a matter of seven years.

**Fairbairn:** So you there were up through the introduction of the Mac.

**Carter:** That was the last thing I did, was introduce the Mac, yeah, in March.

**Fairbairn:** So in between that we had the Apple III.

**Carter:** Had the Apple III.

**Fairbairn:** So tell me about the evolution there, and what were the driving forces. What were the mistakes made?

**Carter:** The Apple II was-- well, we started out with a 40-column card. We only had half-- 40-column display. We got the 80-column card that we could put in it so that you get a full display. And then there were some limitations on memory, eventually.

And it's interesting to think that most of the systems ran on 4K of memory. Today we got megabytes. The first Mac we talk about a little bit later, but we wrote a program, integrated package like Microsoft Office, that ran on a 128K Mac. Had spreadsheet, database, word processing, communications, all in 128K. And now it's megabytes. But I got sidetracked there.

  

**Fairbairn:** Well, we were talking about the evolution. The Apple II was obviously a big success. And then I guess the IIe and-- what was it like internally? What were the pressures? Was it obvious what the next generation was? The Apple III was not such a great seller. What happened there?

**Carter:** Well, the Apple II, it just evolved into the Apple IIe, and they evolved into a little better design, little faster design, adding more memory. And then we built a portable, which was semi portable.

**Fairbairn:** Luggable.

**Carter:** Yeah, it was luggable. That's right. That's what we called, the luggable. And then we had the toilet seat, which was kind of a round-- if you remember it was a notebook computer about so big around.

And we needed to get into the business market, because the Apple Ii wasn't powerful enough to handle the business market, handle accounting software and things of that nature. So they started to design the Apple III, which had a 10 keypad on it. It was going to have hard drive capability, which the Apple II didn't have, neither the 10-key keypad nor the hard drive. And it needed to be more powerful.

So we started on the Apple III. And the big mistake with the Apple III-- the machine was fine, but there was a computer conference every year in Anaheim. And they rushed it to get there so we could introduce it at the meeting. Our engineering VP was a bureaucrat. Every Monday morning he met with his engineers and says, how you coming? They said fine.

Well, my engineering, I still was interested. I'd go back and see these guys, they'd say oh, man, we got problems with the hardware, the operating system doesn't work. We'd get to the staff meeting and I'd say, how can you say it's fine? Your engineers are telling you that it's not working.

Well, we introduced it anyway. And all of a sudden we're having failures in the field. And it was because the contacts on the memory cards, they didn't use bifurcated contacts, if you know what they are. And so they'd turn it on, it wouldn't work. So the solution to it was, lift it three inches off the table and drop it, and it would reseat the board. Everything would work fine until it'd corrode again.

So that was a disaster. And we had to bring them back and retrofit them all. And that wasn't up to Apple's quality, and we got hurt by that pretty bad.

**Fairbairn:** Now was Wozniak still involved in the engineering at that point, or was he gone?

  

**Carter:** He was still working on the Apple II. He wasn't working on the Apple III. They had another group of guys that come in, and Woz was working on the Apple II, upgrades to the Apple II.

So that was a blemish, and unfortunate. But in fact, when we came out with the Mac-- well, just get to Mac.

The Lisa was the next one. And the Lisa, in my mind, the Lisa was a success in its own right because, if you remember, we got the idea-- Jobs happened to hear that to Xerox PARC was working on a computer that used-- what do you call it?

**Fairbairn:** Windows and a mouse.

**Carter:** Yeah, used the-- slipped my mind. Anyway, programming capabilities, and it was called the Star computer. And they were like $50,000 units. And had the GUI, graphical user interface and all that stuff.

And so he had heard about, and he went over to see it and got all excited about it and said, we'd like to license it. And they said well, we'll let you license it, but we want our Xerox printer stores to become Apple dealers. And he said, done.

So he comes back and he says, Carter, put on the Xerox stores. Well, wait a minute. Why do they-- Just put them on, because we're going to get something out of this. So I put on all the Xerox stores, which they didn't cause any problem at all, because people just stood there and held the door open.

**Fairbairn:** They couldn't sell anything.

**Carter:** They didn't sell anything. If you wanted to buy it, they'd take your money. So that wasn't an issue. So we got that over and started working on Lisa. And it was a super secret deal. We “bet the farm” on it. You know, we said, this is do or die. Cost us a lot of money, and it was all subsidized by the Apple II, because that was the only thing we had to sell.

**Fairbairn:** The Apple III was out but not doing well at this point.

**Carter:** Wasn't doing well at all. Apple II was-- in fact, that was a sore spot with Woz, that the Apple III wasn't doing well and we were ignoring the Apple II. And he was upset. That's why he left, because they weren't taking care of his baby like he thought they should.

  

So we worked on Lisa. And because of the power, being able to use hierarchical memory and to be able to multitask at the same time required a lot more capability than was available at the time. One of the problems was the disk drive. 140K was the biggest floppy you could buy, 5 and 1/4-inch floppy.

And so they came up with a design, a new hardware design for a 640K floppy. But it required faster revolutions and a different head, and it generated more heat. As a result the grease that they used on it melted. It wasn't the right-- and it melted and caused problems.

That was one of the downfalls of Lisa, is that they couldn't get that hard drive. It was running too fast and too hot.

**Fairbairn:** It was a floppy or a hard drive?

**Carter:** I'm sorry. A floppy. The hard drive was a 5-megabyte, if you can imagine. It was a box like this, 5-megabyte drive.

But it sold for $10,000. I had one month to train the field. That's kind of like asking a Volkswagen salesman to sell a Mercedes Benz. Have no concept. And it's really easy for them to say, why would I pay $10,000 for that when I can buy one of these for $2,500, or for $1,200, rather.

**Fairbairn:** The Apple II was like $1,200, yeah.

**Carter:** Apple II was $1,200, and that was $10,000. So we had an issue with the floppy. And that was-- it just, it didn't fly.

**Fairbairn:** Between the technical problems and the cost.

**Carter:** Yeah. The technical costs, and it was too far advanced for the sales. You can blame us for it, I don't know. We just didn't-- it was ahead of its time. But I contend that we never would have gotten to the Mac. We went from a $50,000 computer to a $10,000 computer, found out where we'd made the mistakes, and got to a $2,500 computer.

So when I hear people, I usually bristle if somebody says, oh, the Lisa was a failure. No, it wasn't. It was a step that didn't succeed, but it certainly was an evolutionary point to the success of the Macintosh. And the Macintosh has been around 30 years now, and it's still Macintosh. And it still does what Macintosh does. And it still does exactly what Lisa did.

  

But the whole idea was Mac was going to be the workstation for the Lisa, which would have been the central processor. That would have been the mainframe, if you will, of the network.

**Fairbairn:** So were you involved in helping sort of spec out these? Or was this sort of engineering and Jobs-driven, and this is what we think we need to do?

**Carter:** Well, I didn't get too involved with Lisa because that was all quiet. And I got to go over and see what was going on and get excited about it, but I didn't have too much of an input. But when the Macintosh came along, that was Jobs' bit. He wanted to run the Lisa division. And he was 23, 24 years old and brash. No people skills. And we said, the exec staff said, Steve, you're not up to it. You're not ready for that yet. And so that made him mad, so he went over to the skunkworks, which was Jeff Raskin's process of building the Macintosh, and took over. He just moved in and took over, which was a good thing. But that's what happened.

**Fairbairn:** Right. That's how he operates.

**Carter:** He took it over, and he would come to staff meetings and tell us about the machine. This is going to be the business machine for the small business. Keypad, no 10 keypad.

I said wait a minute, you gotta have a 10 keypad. No, you don't. It just costs money. That's extra. But if this is going to be a business machine, people need a 10 keypad. You're not going to put numbers in up here. No, we're not.

I said, OK. I guess I can start a business, then. I'm going to start a company building 10 keypads for the Macintosh. So that became a joke.

Then one time he shows up and I said, well, where's the hard drive connect? We don't need any hard drive because we got 640K of memory on the floppy. We don't need it. We don't need it.

It's a business application. You've gotta have it. OK, I guess I can build a hard drive, too. So that became the standing joke. What are you going to build next, Carter?

And so then they were rushing it again, and I said, we are not putting out a product that's not ready to go. We are not going to do this again. We've gone through it with the Apple III. We're not going to do it again.

So I have a painting on my wall at home. It's original that Regis McKenna's designers did. And do you remember Orson Welles used to have a commercial for wine that says, we will not release--

  

**Fairbairn:** No wine before its time.

**Carter:** Right. This is Orson Welles, and it says, we will announce no Macintosh before its time. And he presented it to me one day at the staff meeting. So that's a good memory for me. It hangs on my wall at home.

It was a challenging time, exciting time. But then we brought in John Sculley, and the whole demeanor of the company changed. Kind of like when the Motorola group came into Fairchild and everything changed. And it wasn't the same. So I took my ball and went home.

**Fairbairn:** So were you involved in any way with the famous advertisement, a Super Bowl ad for announcing the Macintosh? Were you privy to that? And what did you think about it before it actually aired?

**Carter:** I was privy to that, and we were privy to that. And everybody in the exec staff said, you are out of your mind. You're putting a red flag in front of a bull. There ain't no way. No, cancel that. Chiat Day, you know, had gotten-- cancel that Super Bowl article. Well, he came back and said he couldn't, which I think Jay [Chiat] never tried to get rid of them.

So it did run, and fortunately for us, 25, 30 years later, it's still the number one Super Bowl ad.

**Fairbairn:** All right. It's the only one that everybody still knows, right? At least it was alive at the time.

**Carter:** It was an incredible ad, but we had heart failure. When you wave the flag in front of IBM, oh my God, are you kidding me? So fortunately we did, they did.

**Fairbairn:** And that was just Jobs and Chiat Day. Was that--

**Carter:** Yeah. Yeah. So that worked out, fortunately.

**Fairbairn:** So how long did you stay on after the-- you left when?

**Carter:** March of '84.

**Fairbairn:** So right when the Mac was starting to roll out.

  

**Carter:** Yes. And I stayed around in a non-exec role. And another fellow by the name of Bob Rogers, who had been a computer store owner and had worked for me for three years inside managing the computer stores, and Ron Rohner, who's a fella that I hired to do market research and work on distribution processes and things, and I, got the exec staff to allow us to build a store.

At the time, in 1984, one of our problems was that all of our best dealers-- we'd been out there for four years and had cultivated a good organization of dealers. Well, IBM "invented" the PC in 1983. We were out there in '77, or 1981, sorry. So we'd been out there for four years.

So they came in to all of our good dealers, they picked out the good dealers and said, how'd you like to handle the IBM line? Oh, yeah. I'll tell you what. You buy 10 computers from us and we'll make you a dealer.

What does that do to a guy whose net worth is $25,000? His money's all locked up in IBM equipment, which-- I mean, it was a smart move on their part. They locked him up.

So the dealer, now he gets the IBM machine. Somebody comes in and said, you know, I've heard about this Apple II. I'd like to buy one. Can I tell you about the IBM machine over here? We got a new IBM machine. It's really something. You know, if IBM's in the business, it's got to be a good machine.

So they're funneling them off to IBM, and the Apple's suffering. And they picked off our best dealers, which like I say, I give them credit. They were smart enough to do it. And I said, we've got to have our own store.

**Fairbairn:** That was going to one of my questions is, had the idea of creating your own store come up in the time that you were there?

**Carter:** That's how it came up. And one of the things that I said, you know, if you worked in construction and you worked on an asphalt machine, where would you go to buy your work shoes? Red Wing. Only place I know that you can go to buy industrial grade shoes, Red Wing.

So if we want somebody to buy an Apple computer, we need our own store. They can come to our store. So Bob Rogers and I and Ron Rohner put together-- we put a 3,000 square-foot store together in a warehouse because we didn't want our dealers to know that we were going to compete against them.

So we put it in a warehouse. We built a complete store; transaction, the whole accounting system, the walls, the displays. And the idea was to put a major store, like in Chicago, that had training, repair,

  

service, a certain amount of inventory, and a display area. And then have satellite stores in Cleveland, Toledo, etc, that would work from that store. But this would be the hub store.

So we put that all together and made a presentation to the exec staff. And Sculley says, I don't have time to be worrying about that right now. I said, that's not your job. That's my job. I'll run the stores. No, I'm not interested. So that was the end of my tenure there. It was on May 11, 1984. I remember it because it was my 50th birthday.

**Fairbairn:** So it was on this whole issue of stores. That was sort of the last straw. You said there were other issues and so forth, but that was the first time it had been put before the executive staff. When did Apple open its first store?

**Carter:** Oh, gosh. Probably 2001, 2002, something like that. Because it was after Jobs came back, and he came back in '99. So it was probably 2001 or 2002.

**Fairbairn:** So 17 years later your vision finally came to be.

**Carter:** You know, in hindsight, I'd like to get credit for it. But in, hindsight we had the Macintosh. What they have now is they've got the iPads and the iPods and the Macintosh and the notebooks. They've got a full complement.

I think we could have made it work, but not a success. I mean, 50% of their business goes through that store. So I think we could have made it work, and I would have loved to have done it. It would've been--that would've been a blast. That would've been fun. But so goes life in the big city.

**Fairbairn:** Would've been hard to make it the phenom that it was when it came about.

**Carter:** No question. No question. And Jobs, his attention to detail. I mean, the floor marble is from Italy, and it has to be a certain color and it has to look a certain way. He could be a real pain.

But when I think back, the first time I ran up against that, we were shipping those first systems in August and we had the six-color decal. The first ones we got in, they didn't do a good registration, so in between each color line there was just a little bit of overlap on the colors. So you had a black line between the red and yellow for example.

**Fairbairn:** In the Apple logo?

  

**Carter:** In the Apple logo. And he went ballistic. No, they're not going. They're not going. Nobody'll even notice it. They're not going. So we held up delivery of the machine for another two weeks while they redid them right. He was not about to let them go out.

And so in those days I thought, you're out of your mind. Now I realize that that was his-- he was a perfectionist. Not always to your satisfaction, but he was a perfectionist. And I have to say that Jeff Raskin said yeah, he's a visionary. He's being drug screaming and kicking towards a new idea, only to call it his own.

I brought him back from the Consumer Electronics Show. Sony had come out with a new 3 and 1/2 inch-drive enclosed, like the new floppies are. I said, this is what we need, because the 5 and 1/4 was taking up too much space in the Mac. And this is what we need. And he said, nah.

I said, well, it's 640K on a board. And it's smaller, it'll fit in-- nah.

Three months later he said, I found the perfect floppy, the floppy that I'd brought in. So he was the visionary.

**Fairbairn:** Sometimes it took awhile for it to dawn.

**Carter:** Yeah. But he was a marketing man's dream, though, because he came up with ideas. Being in marketing, the engineers would say, what do your customers want? Since they don't know what they can get, they have no idea.

He recognized, he was able to recognize what people wanted. I mean, when he came out with the iPod, it was instantaneous. Why didn't Sony do that? Sony didn't have the vision for music. I mean, they had the market for the Walkman.

**Fairbairn:** Tape-driven.

**Carter:** Both the tape and the DVD. And they should have had that market. They didn't have it because they didn't see the vision. Again, big corporation with no vision. And I think that's what bureaucracy does to a large corporation.

**Fairbairn:** All right. So '84. It's now 2014. We got 30 years?

  

**Carter:** 30 years.

**Fairbairn:** So you walked out of Apple 50th birthday. What was the next thing on your mind?

**Carter:** Well, about two months later a friend of mine-- it took me awhile to get over the fact that I didn't have a briefcase whenever I left the house. What'd I do with my briefcase? Oh, that's right. I'm not working.

A friend of mine and a fella that worked for me, Don Williams, came over and he says, I bought the code to AppleWorks, which was the integrated software package for the Apple II. Which that's another one we should go back to. We'll get back to it in just a second.

VisiCalc, remember VisiCalc? And his neighbor was the guy that wrote AppleWorks. And he didn't want to convert it to the Mac. And Don says, you know, you've got to convert to the Mac. He says, I don't want to.

So Don bought the code for 500 bucks, and he came to me and he says, I want you to run the business. I'll do engineering, you do the marketing and business side of it. And we're going to start a company called Productivity Software. And we're going to write the Mac version of AppleWorks.

So that's what I did. And we had five engineers that did the design. They converted AppleWorks into Works. And then we got all through, got it done, and Don and I decided-- it was our own money-- that it wasn't a big enough product that we needed to start our own sales organization and our own manufacturing. We'd be better off if we could find somebody to distribute it for us.

So he took off and went to the east coast to check on-- I forget who it was now, one of the software companies back there. In the meantime Gates found out that we were shopping it. And he got a hold of Don and said, don't do anything until you talk to me.

So Don talked to Bill Gates, and Gates agreed to market it. And we got a percentage. We got so much per unit sold as a royalty. We got a 20% royalty, which was pretty rich for royalties. And they distributed it for us. We did all the bug fixes, we did all the manuals and did all the upgrades and all that stuff. All they did was print them,

So I did that from '85 to '89.

**Fairbairn:** What did Microsoft sell it as?

  

**Carter:** It was called Microsoft Works. And what the problem was, was that Works had spreadsheet, database, word processing, and-- not PowerPoint, we had a display presentation thing-- for $295. And Microsoft Word was $295. Excel was $295. PowerPoint was $295.

And we said, Works does 95% of what 95% of the people want. You know, they get so complex that people can't even use it. So we had what we thought was the package for most people. And we were doing very well. We sold almost $100 million a year at wholesale. Yeah. And so it was a very lucrative business. And Gates said, I want to buy the company. I said, we're not interested in selling.

So one day-- I kept ignoring him and he sent to Jon Shirley down talk to me. He said, the man wants to buy the company. I said, we don't want to sell it. He said well, he's going to be insistent. I said, well, sorry. We like it the way it is. It's doing fine. We got engineers busy, and we're upgrading it, and it's the most successful product on the Macintosh.

So a couple weeks later Gates called me, and I went up to see him, and he says, I want to buy the company. I said, Bill, we don't want to sell it. We're happy with the way it is. And he says, either I buy it or I find a way around it.

I said, sit still. And I said, what does that mean? And he says, just what I said. So we sold out to him. Because Don and I decided, you know, it was going to be us against them. And we could litigate for $10 million. It would cost us $12 million to litigate. I mean, it was all copyrighted software. We sold out to him. So I guess it was the time.

So yeah, I know Bill Gates.

**Fairbairn:** Did he remember your first meeting in Albuquerque? Probably not.

**Carter:** Probably not. So anyway, that kept me busy for five years. And then a group of guys came to me, and they needed-- they said marketing help, but I found out it was spelled M-O-N-E-Y. They had a patentable sealed lead acid battery that was in a flat cell. And sealed lead acid-- batteries are round because the anode and the cathode has to touch the electrolyte, so that way as it expands and contracts it stays together.

And they had come up with a way of making a flat cell. We had cell that was 2 and 1/2 inches wide, four inches long, and 3/10 of an inch thick. And it was a 5 ampere-hour cell, rechargeable. And these engineers over in Scotts Valley had come up with it, and they needed some money and they needed marketing. So I ran that for three or four years. I say I ran it. I worked with it for three or four years.

  

And our biggest customer was IBM, because they used it-- you have to have keep-alive power on the memory cards and in the data units. And when they put the round cells in there, they have to take up a card slot, every other card slot. Well, this was only 3/10 of an inch thick, so they fit right on the card and they didn't lose a card slot. And they liked our quality and everything.

The problem was, it was a semiconductor processing technology. I mean, you had to build thousands of them at a time on a production line. And we built maybe 200,000 or 300,000 a year. And we got caught with-- nickel metal hydride came in just about that time. And we were getting 20 watt hours per pound, where normal sealed lead acid was getting about 12. And nickel metal hydride was getting about 25, so that hurt us.

And then when you start hearing about lithium and it's what, 50, 60 watt hours per pound. Put us out of business. And that was the end of that. We were in the wrong place at the wrong time. Just like I was in the right place at the right time sometimes, that was one I was not in the right place. It was a good technology, it was workable, it was quality.

**Fairbairn:** You just never know when the next thing's gonna come along and kill it.

**Carter:** Don't know when it's going to kill it.

**Fairbairn:** Well, before you get on, you said to come back to VisiCalc, and so I don't want to lose that one.

**Carter:** Oh, VisiCalc. When the guys came in, Bricklin came in with this VisiCalc to display it, I was probably one of few at the company that realized what it was. I says, oh my god. You can create a spreadsheet. I'm thinking back to my National days when I had to do it all manually.

**Fairbairn:** Butcher paper, right.

**Carter:** I can put it in here and all I have to do is change a couple of numbers. I thought-- I literally thought I'd died and gone to heaven. That was the greatest thing.

**Fairbairn:** You were willing to go back and be an accountant for that, right?

**Carter:** Oh my god, It was unbelievable. I guess I'm showing too much excitement.

  

**Fairbairn:** You're still getting excited about it.

**Carter:** Yeah. I mean, it was just an incredible invention. And that's what really made the Apple II what it is. I mean, I think that's what made the personal computer what it is. Remember, we had spreadsheets and we had database programs. There's no database programs anymore because you use a spreadsheet. Does the same thing.

**Fairbairn:** Well, I was-- so that was the first time you'd seen it. And that really was a huge boon to the Apple II and actually got into business. Even without the Apple III you got into business clients with it, right?

**Carter:** Yeah. No question about it.

**Fairbairn:** So I had been at Xerox PARC in the 70s, '72 to '80. And we had developed all these other things on the personal computer and the Alto at the time. And nobody ever dreamed of doing a spreadsheet. Course, they were all engineers, not--

**Carter:** What do you need them for, right?

**Fairbairn:** Yeah, what do you need them for, right? Well, it turned out we could use it also. But I'm curious as to, it's such a powerful application that everybody uses on a personal computer, right? But it took a long time before it was developed relative to all the other computer PC software at the time.

I'm just curious if you had any insight. Had anybody talked about that? Had you ever heard of that idea before they sat down and showed it to you?

**Carter:** I had not. I had not heard, I had not heard anything about that. And I don't think the rest of people got as excited as I did, because of what I had gone through at National with that butcher paper. I mean, the guys would look at it and say, yeah, that's pretty interesting. But my god, I could--

**Fairbairn:** So what happened? What did you do? They had developed it on the Apple II, is that correct?

**Carter:** Yes. Oh, yeah.

**Fairbairn:** And they had done that-- that was before the IBM PC came out.

  

**Carter:** Yes. It was before the IBM PC. It must've been, what, '79 or '80. Might have been 1980. The PC wasn't out yet, because Lotus 123 is the--

**Fairbairn:** That became the standard on the PC.

**Carter:** That became the standard on that machine I think, to kind of answer your question, the old story if you don't know where you're going, any road will take you there. I think nobody had any idea of what the spreadsheet-- OK, that's a nice program. I just don't think it occurred to them

Like you say, engineers, you didn't have any need for it. But there were engineers that learned real quick how--

**Fairbairn:** Yeah, I mean people found all sorts of uses.

**Carter:** Yeah

**Fairbairn:** So they came and demonstrated. There was nothing you needed to do. They were going to sell this product, and they just wanted to show it to you to get some support or whatever.

**Carter:** And boy oh boy, that was--

**Fairbairn:** So did Apple take any proactive action in order to promote that, or did it just-- it just happened?

**Carter:** No, we advertised in conjunction with them, and went out. And our salespeople did seminars on how to use it and what to do with it. So we helped them with it.

**Fairbairn:** Did you have any conversations with them as to why they had done it or what gave them the idea, or how did they--

**Carter:** I didn't. No. I don't know--

**Fairbairn:** You just showed it and you immediately know that it was a winner.

**Carter:** I knew it was good.

  

**Fairbairn:** So let's pick up things there. I don't know how much you want to talk about what's happened since then, or if there's anything in particular. Or is there anything that we missed in the previous things, like the VisiCalc story?

**Carter:** VisiCalc, yeah. I don't want to miss that.

**Fairbairn:** Well, I'm glad we got the Apple store story, because it's interesting that it was-- and you had done exactly what Jobs did 15 years later, that is, build one in a warehouse, right?

**Carter:** Yes.

**Fairbairn:** Do you know whatever happened to that? They disassembled it? I mean, you'd built it.

**Carter:** Well, they just disassembled it. Because I left, and Bob Rogers left.

**Fairbairn:** Where was that?

**Carter:** It was down off of Orchard Parkway someplace. I can't remember where it was now. But we had a big warehouse that we built in there.

**Fairbairn:** And 15 years later Jobs did the same thing, built another model store in some warehouse someplace.

**Carter:** Probably. Probably.

**Fairbairn:** Yeah, that's what I've heard, is that they had fine-tuned everything.

**Carter:** Well, it was state-of-the-art stuff at the time. I mean, there weren't any stores-- ComputerLand was the closest thing to a-- they were a computer store, there's no doubt. But part of Computer Land's problem was that they operated as a distributor. They were a franchise. So they operated as a distributor. And they didn't always do the best by their dealers, nor by us either, for that matter.

So that's why I terminated them, because they wouldn't service the product, and they were undercutting the other dealers. And so I said, you know, you've got to service the product. Because they'd sell it to you at 30% off, and then tell you, don't bring it back in here for service. Take it over to him. And then he'd complain to me that he was servicing their parts, because you were required to service what you sold.

  

So I terminated them. And that was a big issue with John Sculley. Why did you terminate them? And I explained to him. He didn't think that was such a good idea. But they were disrupting the--

**Fairbairn:** They couldn't-- yeah, they were disrupting the chain.

**Carter:** Yeah, exactly.

**Fairbairn:** So are there other things you want to cover? Other business ventures and so forth since--

**Carter:** Might be of interest, the Aldus story.

**Fairbairn:** OK. Well, let's get into that. So are we rolling here?

**Carter:** The Aldus story. I was--

**Fairbairn:** So let's set the context here. So the battery company, which was called--

**Carter:** Portable Energy Products.

**Fairbairn:** So you decided to close that down. The new technology kind of overwhelmed what you had to offer. And so what was your next business venture after that?

**Carter:** That was '92. So that was pretty much the end of my business ventures, '92.

**Fairbairn:** So the portable electronic thing was that? So what about the Aldus? What was that?

**Carter:** The Aldus. Aldus was, when I quit Apple in 1984, one of my neighbors belonged to a venture capital-- today we call them Band of Angels. They had money and they were investing.

And he came over one day and he says, would you be interested in coming into one of our meetings? We have somebody coming down with software that runs on a Macintosh, and none of us know anything about the Macintosh, and we'd like to have you come and see what you think.

  

So I said, sure. I wasn't doing anything else. So I went to the meeting, and Paul Brainerd was there with his software for Aldus, PageMaker, and demonstrated it. And I thought, oh my god, I see this, Macintosh.

Because on the Macintosh we had the-- what do you call them?

**Fairbairn:** Fonts.

**Carter:** The fonts, all the different kinds of fonts. I forget what you call them now, but all the different fonts we had capabilities. And this was an opportunity for page layout. You could actually lay out a page of a newspaper, put pictures in and all that, which was very innovative at the time.

And it turned out that Paul had worked for a newspaper and he'd done all this hot type. And he, again, trying to figure out how to do it easier, do it better. And he came up with this concept. And with the laser writer and the Macintosh, that's what he needed.

**Fairbairn:** Perfect combination.

**Carter:** So we came in, I came in and I looked at it and I said, oh my god, this is a great deal. I said, you guys gotta invest. And they said, well, if you want to, you can invest with us if you want to.

Well, unfortunately I only put 25 grand in it. I should have put 200, but I put 25 grand in it. And obviously it's been a very successful investment.

**Fairbairn:** That was then sold later to--

**Carter:** That was sold later to Adobe when Paul decided that he didn't want to run it anymore, and we couldn't find-- I was on the board. They invited me to be on the board. And I joined the board and enjoyed that relationship. And when he decided that he wanted to step back from day to day, we couldn't find anybody to replace him to his satisfaction.

So the board suggested that maybe we ought to sell the company. And he said he'd been talking to John and Charles about a relationship and that he could probably--

**Fairbairn:** John Warnock and Chuck Geschke.

**Carter:** Yeah, right. You might know them from--

  

**Fairbairn:** Oh yeah, definitely.

**Carter:** Were they there when you were there?

**Fairbairn:** Oh, you bet. They were just guys down the hall.

**Carter:** Yeah, OK. Well, anyway, Chuck and John. And they agreed to buy it, and we got two board seats, so they asked me to be on the board, and Paul. So I was on the Adobe board until 1999. And that's when I got off that board.

Now during that same time, '85, I invested in a company called Chips and Technologies.

**Fairbairn:** Oh, yes. Gordy Campbell.

**Carter:** Gordy Campbell. They built all the peripheral chips around the 8080s and the microprocessor chips. And as Intel kept integrating the keyboard encoder and the memory controller and everything, they all a sudden realized that they were out in front of an 800-pound gorilla.

And we tried to figure out how we could reconfigure the company. And it was evident that it was going to cost us well over $100 million to try to reconfigure into a different design concept. And Jim Stafford says, well, you know, I was at a meeting with Les Vadász at a conference one day, and Les says, you know, we ought to buy you. And I said, talk to him.

So they bought us. And that was another good investment, and a fun one, because my background was semiconductors. And that was--

**Fairbairn:** It had a great run for awhile. All of these-- some other new thing, new technology, new integration levels and so forth. It's hard to keep ahead of all of these things.

**Carter:** And you know, now after having been out of the business for 30 years, it's so far away from me now that I don't even try to keep up. So that's been-- that's about, I guess--

**Fairbairn:** Wraps things up.

**Carter:** That wraps things up. Just as I was writing and thinking about this to see what we've seen, it's kind of like from the turn of the century to 1950, what we saw in airplanes and cars. And I've seen a

  

similar thing in the high tech world, or the semiconductor world, how we've evolved from a single transistor to millions of transistors on a chip in a microprocessor.

What's next? Everybody asks me. I say I have no idea. I don't know where we're going. Because a lot of the stuff we're building now has little or no intrinsic value in my mind. I mean, it's a next step. But you know, how many games can a kid play? And what is it doing to their interaction with the other kids their own age? We need something meaningful, the next generation of meaningful things.

**Fairbairn:** Yeah, I think there's a lot of-- I've heard some conversations among venture capitalists and so forth about the similar kind of story, is that it's generating money and new incomes. But we need a new fundamental platform, a new fundamental breakthrough to really launch things in another direction.

**Carter:** Like, who would've thought-- I don't know about you-- but I think, who would've thought, when I heard about Facebook, I said are you kidding me? Who wants to know that I got up this morning and brushed my teeth, and I'm going to go have breakfast and I'm going to have bacon and eggs. Who cares? And look what it's doing.

**Fairbairn:** Billion people are signed up to do something.

**Carter:** Yeah. Yeah. So I'm sure that we'll find something new. Let's hope it's for peaceful reasons and not for something else.

**Fairbairn:** All right, Gene. Thanks very much for spending a couple of hours with us. It's been very insightful to learn about some of the inner workings of these companies that you've played a major role in. So thanks very much for joining us.

**Carter:** Thank you for having me. And I've said, I think there's a lot of behind-the-scenes things that don't get told that are as interesting as the stuff that does get told.

**Fairbairn:** The visible things are told many times. And the behind-the-scenes things are often as meaningful but don't get out, so it's a great opportunity. I

**Carter:** Always think back that two of the most incredible engineers that I've ever had the pleasure working with is Dale Mrazek and Steve Wozniak. And they're the ideal “mothers of invention”. If they can't do it, it can't be done. You know, necessity is the mother of invention.

**Fairbairn:** So Dale, was he also at Apple?

  

**Carter:** No, he was at National. He was at Signetics and then he came to National and he spent his time there. But Dale was a great communications-- fact, we started a company building the same stuff that 3Com did at the same time.

**Fairbairn:** Ethernet controllers?

**Carter:** Ethernet controllers. And it was called Tigan Communications. And it was Dale and I and two engineers, and that's about the time that 3Com came out. And they had funding and we didn't.

We had a contract with the Minnesota-- what was it called, MECC. Minnesota Educational Computer Consortium. We had a contract with them, and we're selling some systems to them, but we didn't have enough-- could have been partly my fault, because I didn't want to work that hard again.

**Fairbairn:** What year was this?

**Carter:** That was '86, '87.

**Fairbairn:** So one of the things you did after Apple.

**Carter:** Yeah. Yeah. And I was doing that along the same time I was doing Works, and Works was more exciting than that was.

**Fairbairn:** And making more money.

**Carter:** And making more money, yeah.

**Fairbairn:** Magic of software.

**Carter:** We just kind of got run over. 3Com had more funding, and they did the job.

**Fairbairn:** All right. Well, thank you again. It's been very interesting. Thank you.

**Carter:** Thank you.

  

END OF INTERVIEW

  