



## **Oral History of Brian L. Halla**

Interviewed by:  
Douglas Fairbairn

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**Douglas Fairbairn:** We're here with Brian Halla. We're doing an oral history. I'm Doug Fairbairn and we're here at the Computer History Museum in Mountain View, California. So, welcome, Brian.

**Brian Halla:** Happy Valentine's Day.

**Fairbairn:** Delighted to have you with us. Yes, happy Valentine's Day. And so, we want to explore your sort of history and contributions and ideas and connections and stories from your career in the software and semiconductor industries, and in order to lay the groundwork for that, we'd like to actually step back to where you grew up, where you were born, what kind of family environment you grew up in. So, if you'd just sort of take us back to that time and tell us a little bit about your family life and how that sort of launched you in your career.

**Halla:** Let me ask you this. Are you going to be part of the transcripts, or should I repeat the question?

**Fairbairn:** No, I'm all part of the transcripts, so...

**Halla:** You are?

**Fairbairn:** Yep. My question will be that...

**Halla:** Good. So I don't need to repeat the...

**Fairbairn:** No. It's just a conversation.

**Halla:** So, I was born in Springfield, Illinois, in 1946 and moved out of town a year old and we moved to Fort Dodge, Iowa, where my dad was a resident FBI agent.

**Fairbairn:** Oh, my.

**Halla:** And so, I grew up there.

**Fairbairn:** Fort Dodge, Iowa.

**Halla:** Yeah, Fort Dodge, Iowa, 14 years of Fort Dodge, and my dad got transferred to Omaha. And so, my high school time was in Omaha and then off to the University of Nebraska for my degree.

**Fairbairn:** So, before you went to the University of Nebraska, what were the influencers? How did you take Middle America and find your way into a technology career?

**Halla:** Well, for one thing, we ask all of our engineers—there's a shortage of people excited about math and science these days, and so at National we ask all of our engineers, "What got you into engineering? What got you excited about it?" and almost—well, a significant percentage of the people answered "my first Heathkit" or "my first transistor-radio kit." And it was kind of the same with me. It was the first toy car that had headlights that actually lit up, so that kind of—in the back of my mind, I was a gadget kind of guy. Having said that, I wanted to be a pilot all of my life, and I...

**Fairbairn:** Is that like a jet pilot or a...

**Halla:** Yeah. This was during the- it was my senior year at college, and I got accepted into pilot training at Lackland Air Force Base, and a recruiter from Control Data came around and I didn't know anything about Control Data except that they were obviously a very big military contractor. And he promised me a draft deferment. Of course, I was the first guy in the history of Control Data to get drafted, but nevertheless, the thing that really moved me along in my career was time spent in college. My girlfriend's brother, who's now my brother-in-law, got me a job at an engineering company, and it was a grunt job, where I would take the populations of little towns in Iowa and South Dakota, Missouri, Nebraska and plot the population to either grow or to decline over the next 15 to 20 years. And I'd have my constant of if it had grown seven-tenths of a percent over the last ten years that it's sort of going to grow the next ten, or vice-versa; it was going to shrink. So, I had to crank out these numbers and then we put them in a Font Number 10 "orator" typewriter, but it was tedious. It would take me days to do one chart. And so, I had audited a Fortran course in college in the EE school. Nobody did computers. In fact, the whole university only had one computer. It was an IBM 360. And we had somebody come back from industry and he's talking to this whole group of seniors in engineering, and he said, "I know all of you are excited about aerospace," because that was the thing at the time, "but some of you ought to try computers. It's going to be a big deal." And so, I audited this Fortran class, never got a program to run with less than 250 errors, but I knew that this could do something for me. So, instead of me cranking out these numbers, I spent time writing a computer program. This little engineering company, Hoskins & Associates Consulting, they had an IBM 1132, and so I wrote a Fortran program to do all of these numbers and format them and print them out on a computer printout that was..

**Fairbairn:** A line printer.

**Halla:** A line printer. And all of a sudden, when these planners—the company would take to the city council in Pella, Iowa. The fact that the numbers came out of a computer made them gospel and the people would accept the plan. They'd accept that such-and-such a city was going to die, so there's no reason to put in a water tower; and such-and-such a city was going to thrive, so we should put in a four-inch water pipe from a tank on a hillside and all this kind of stuff. Anyway, it not only took me out of grunt status but they kind of made me part of the team when we'd go out on these sales pitches, and I realized then the power of, well, the computer and productivity, my productivity, because I could crank out these numbers, change the constants, get a new run. And of course I owe a lot to the guy that was running the computer, because he helped me with do loops and things like that and showed me how to get a binary out of source. And so, as an electrical engineer, my first job with Control Data was the software systems analyst, not an [electrical] engineering job, nothing to do with hardware. In fact, my first interview at the end of the day, he says, "So, what do you think?" and I said, "I think I'm still going to be a pilot." And he said, "Well, what didn't you like?" And I said, "I must be more of a people person," or something, but he says- I said, "It was just kind of all these jobs were kind of lonely. I'm in the auditorium sticking a probe in the back of a mainframe into ferrite-core magnets, and he says, "Do you want to be an application engineer?" He said, "You can wear a suit but you can talk to people and you can still be technical." And I said, "Sounds great." And he said, "Software or hardware?" It was the first time in my life I'd heard the term "software." I had no idea what it was, but I'd just spent a day looking at hardware, and so I realized I didn't want to do that, and so I said software. He says, "Name your spot in the world," and in Nebraska it had been 45 days with a wind-chill index of subzero, no sun or anything, so cold. So I said California immediately. "La Hoya or Palo Alto?" And I'd never heard either name, but Palo Alto sounded kind of neat and I said Palo Alto. And it turns out that they had a software-development group in Palo Alto, so I got to grow in the software world and became the manager of the development system when my boss got drafted (after I got drafted).

**Fairbairn:** So we're sort of jumping ahead. So, you went to the University of Nebraska. Was there anything in your high school? Was there a teacher or whatever that sort of inspired you or—and you were going not to get an engineering degree at the University...

**Halla:** Yes, I was.

**Fairbairn:** You were. And...

**Halla:** I was pretty mercenary about it. I remember Time magazine came out my senior year in high school and it listed all the starting salaries of college graduates, and I went down the right-hand column to the largest number and I read over and it was electrical engineering. So, I did want to do that, but I'd say an influence that was very positive was a football coach at West Side, my high school in Omaha. He got a bunch of us into a room. He was also a math teacher, and he told us not to be afraid of calculus when we find ourselves faced with it, because in those days they didn't teach calculus in high school, only in college. And it was like hitting a brick wall, my first calculus class, and that's when most of the people

would drop out of engineering. And later it became Chem 6 that would get most everybody, but I think he was influential for that reason. But in the category of doing it as opposed to studying it, I think this job at Hoskins Engineering was the most important thing in getting me started in my career and this job that my brother-in-law, Dennis, got me.

**Fairbairn:** So, your parents were technical or not? Your father was an FBI agent, so...

**Halla:** My father was FBI. My mother was a homemaker.

**Fairbairn:** Homemaker. So, did they try to steer you one way or another, or they just wanted you to go to college? Was that a high priority?

**Halla:** It was a very high cost. While I was going to college, at any given time I had five different jobs almost always. I had 13 different jobs by the time I graduated, but still I'd have to go and tap my dad, and as an FBI agent with 5 kids that was tough for him, but he'd always somehow come up with the money, books or tuition or something, where I hadn't saved enough and he had to help me out, and he always did. But, no, their aspirations for me, I think, never came out if they had any, other than someday they'd like to have grandchildren.

**Fairbairn:** So, you got this job at Hoskins and then you spoke about throwing the dart for Palo Alto. When did you give up your idea of being a pilot? That sort of recede or..

**Halla:** I didn't. I canceled the invitation to go to Lackland Air Force Base and they were pretty upset about that, obviously, but I still decided to be a pilot, and so the first thing I did when I got out here was got my pilot's license.

**Fairbairn:** Just different kind of airplane.

**Halla:** It was a Cessna, and I did my studying for flight school like I did my studying in college: Namely, I crammed for everything. So, as a physical pilot, I was never prepared for the things that came along. And my very first solo, away from the pattern I spun the airplane and I dropped from 3,100 feet down to about 1,100 feet in a couple of seconds. And it wasn't until I let go of the wheel—because I knew I was going to die—that the plane flew itself out. And so I called in five-mile final to the tower and they said, "We don't have you but continue on, cleared to land." And so then I called in two-mile final. He said, "Still don't have you in sight," because I'm down at 1,100 feet and they're looking for me up at 5,000. "I still don't have you in sight. Cleared to land. Continue on." So I now come over Eastridge shopping center and they have taxied another plane out in front of me. And so I flew over that plane and I figured I'd broken the plane,

because the artificial horizon was upside-down and jammed into the instrument, because I'd been upside..

**Fairbairn:** That's fun. This is Reid-Hillview Airport, right?

**Halla:** Yeah. So, I skidded the airplane all the rest of the way around in the pattern and I came in and I tied it up, and my instructor said, "So, how'd it go out there?" and I said fine. And he said, "Well, I noticed you turned in a chit on the artificial horizon. What happened?" And I said, "Well, I kind of"—then he said, "You spiraled the airplane?" I said, "No, I"—he said, "Wait a second. Come to my office." And he pulls me into the office and he says, "You spun that F-ing airplane?" He says, "Don't you ever tell anybody you spun that plane. I'll lose my job." And I said, "It's okay. I quit. I'm done." And he and my wife in the next three months talked me into going back and finishing my license, and I was a great physical pilot, but things like coming back from Half Moon Bay I lost my radio, and I thought, "What is it you do when you lose a radio?" I knew you had to communicate with the tower and green light was good but red light was bad and you had to somehow get their attention. Anyway, I just landed the airplane, taxied and tied it up. But the worst was I had about 100 hours and our neighbors had their first baby, and he was my best friend, and he says, "Brian, could you take us up at night and fly us over San Francisco?" This was before terminal control area, so you could fly over San Francisco. And it's nighttime and I took he, my wife, his wife and their little baby and took them up over San Francisco to see the lights. And it was cold in the cockpit and I just had sweat streaming down my face, because I was so terrified that I could potentially end their entire family. And so, I tied up that airplane and I never flew again after that. But it was nice to have met that challenge anyway.

**Fairbairn:** My brother a couple years before was one of those flight instructors at Reid-Hillview.

**Halla:** Really? No kidding. Which FBO?

**Fairbairn:** I forget what the name—there was a woman there.

**Halla:** Aerotrends. No. Amelia Reid.

**Fairbairn:** Amelia Reid. And he had started flying when he was 16, and so then he came up to go to San Jose State and was teaching flying. They had a flying club there and so forth, but anyway.

**Halla:** No kidding.

**Fairbairn:** So you never ran across him. He was a couple years ahead of you, so..

**Halla:** Did you fly?

**Fairbairn:** No, I've never flown, but...

**Halla:** There was this story about Amelia Reid. When San Francisco had nude beaches, these two instructors took a plane and flew into a fence close to the people.

**Fairbairn:** Looking outside too much, huh? Back to software. So you got your flying career out of your system and you're back at Control Data and decided applications engineering was the path to meeting with people and that sort of thing. Pick it up there and tell me what happened.

**Halla:** The job I had at Control Data was—it was field application engineer, but it was a group that were pulled in to Sunnyvale from all over the world, because they decided to close the local office function down and centralize it and make everything be phones and air travel. And it was a really fun gig. I had no idea what I was doing when people would call up and say, "My mainframe hung and I got an RBT overflow error flashing on the screen. What do I do?" And this would be somebody like Chrysler. They were trying to run payroll. And so, I'd end up flying out for machine time at 2 o'clock in the morning to try to recreate the hang and then dump the 600,000 octal words into a printout and go get on a telephone with one of the experts. And I did a lot of traveling, a lot of that kind of thing, and after you'd solve a problem that was unique to a certain type of computer, then all of a sudden you look like the hero, because you'd already—so they'd say, "I don't know, record block table overflow? What do I do?" and I'd say, "Go look at the CMR and see if you got a disk over"—but, anyway, so...

**Fairbairn:** So you also learned about business urgency in those kinds of situations, right?

**Halla:** No kidding, because their mainframe is down, they're down, and you're the guy that's supposed to ride in on a white horse and fix it immediately. But I had a boss there that was so influential in the way he managed me. One time my boss was traveling. He was my boss's boss's boss. My boss was traveling and he says, "Brian, where's your status? Where's Joe's status report?" I said, "Joe's in Chicago." He says, "No." He says, "You're taking over for Joe while he's gone. You write the status report." I said, "I didn't know I was supposed to that," and he says, "Remember this the rest of your career. You are 100 percent responsible for anything you're remotely involved in." And when I got to Intel, which was in '75, that's the way everybody acted. Everybody was focused on that stock price, because it was moving every day, and it was electric. People were bouncing off walls, by contrast at Control Data was more like a government shop and two-martini lunches and mañana, but, man, at Intel it was electric. It was..

**Fairbairn:** So you were at Control Data. Did you move up there, or how did that transition you to the next position?

**Halla:** My boss at Control Data went to start a paella restaurant, so I got a battlefield promotion. And I had a great group of people, and one of the guys...

**Fairbairn:** In the same function in the field engineering?

**Halla:** Yeah, field support. And one of the guys in my group and I were friends, and he came to me and he said, "I just interviewed for this job at Intel, a little company called Intel." And he said, "I don't want it, but you might." And he handed me a Time magazine article with a picture of a chip, a micro-controller chip, and so I went and did the interview and he got rid of his boss and I got a job at Intel as a software guy, because the whole company..

**Fairbairn:** One of their first software guys, right?

**Halla:** Yeah. In fact...

**Fairbairn:** Sounds like Time magazine was important for you.

**Halla:** Yeah, it was.

**Fairbairn:** It sort of got you into engineering and then got you into Intel, right?

**Halla:** <coughs> Excuse me. And what was amazing to me— this company was small enough then that the first thing that happened to me the first week is I got to have lunch with Noyce and Grove and Moore, just me sitting there...

**Fairbairn:** So how many people there at the company, 50 people or less?

**Halla:** That's tough. I think it was over 100, because they were in the big building down on Kifer and Central Expressway, but...

**Fairbairn:** And this was 19...

**Halla:** 1975.

**Fairbairn:** '75.



**Halla:** And that year, if I remember correctly, the stock split three for two, two for one and five for four.

**Fairbairn:** All in one year?

**Halla:** And people...

**Fairbairn:** Sounds like everybody was keeping track.

**Halla:** People were selling options on their options. It was incredible, but you really learned that what you did there made a difference. They had a software manager named Terry Opdendyk and they had a software consultant by the name of Gary Kildall, and I was assigned to be Gary's interface as a software guy. And that's...

**Fairbairn:** So, you told us earlier off-tape about- don't necessarily go into all the stories, but sort of how did Gary Kildall get linked in with Intel, and why was he in that position?

**Halla:** Gary was teaching at the Monterey Naval Graduate School. He was teaching software, and so he understood about compilers and everything else and he saw this chip come out from Intel called the 4004, and so remotely he wrote a MiniBasic for it and then brought it to Intel, and Intel arranged to resell it. And then he wrote a high-level language for the processor for the 8080, the successor for the 4040, then 4004. And so, Intel now had a PLM high-level language, and so Gary was very important to the company and Gary also wrote the first disk-based operating system called CPM, which advanced systems like IBM's data-checker systems, or their point-of-sale systems would use CPM. And Gary went to sell that operating system when he heard about the IBM PC to IBM, and, anyway, he was competing with Bill Gates for that socket and Bill Gates won by giving IBM control over the source code.

**Fairbairn:** So, did Intel really appreciate the value and importance of software at that point in terms of selling their chips, because they were a chip company and it often takes a while for them to figure out that software and support is a critical piece of that. Where were they in that?

**Halla:** Bill Davidow was the guy. He got it, and he ran the Microcomputer Group, it was called. I think it was Microcomputer Group, which included the development systems, and it was Bill Davidow that hired me, but just the architecture of the X86 itself would tell you that, no, they designed a processor to be a micro-coded machine that would be coded by engineers and not programmed by software people. Motorola, by contrast, designed their microprocessors to be programmed by UNIX programmers coming down from the mini-computer world.

**Fairbairn:** But Intel by this time—by the time you arrived, they appreciated the value of the software, so they weren't seeing that as a major part of their business, but a net major part of supporting their business in terms of selling chips.

**Halla:** One of the most important people there was Terry Opdendyk, who was the head of the software program. But software is important, because in order to write code for the microprocessor in the early days everything was done on a national time-sharing system, GE or—and so that was the only way you could write code for any of the chips, and so software is a big deal but it was all on mainframes and some on development systems themselves, where we'd configure the switches in the front panel and read in a paper tape to boot it. And that started the blue-box business.

**Fairbairn:** So, continue on. You were hired into Intel to do this software-development work, so...

**Halla:** It was software marketing.

**Fairbairn:** Software marketing. And so, take me on from there.

**Halla:** So, I wrote data sheets and I would talk to customers and I'd solve problems over the phone and entertain the field application engineers. And one of my most important jobs was I was a product manager of our first floppy-disk operating system and floppy-disk-based disk system, which used eight-inch floppies. And this was literally one of the very first desktop machines that had floppy disks. And so, I was getting ready to launch it and I did a competitive analysis on what else was out there and the only thing I saw that had any viability at all was this thing called the MITS Altair 8800 out of Albuquerque, and they had a young consultant working for them by the name Bill Gates. And Jim Lally, who was my boss, very influential within Intel's direction, a smart guy, he decided that Intel ought to look at the personal-computer business. And so we went up to a meeting in Oakland, a presentation from Altair, and we're in the back of the room looking over a sea of Cub Scout hats and hobbyists, and the speaker comes out and he says, "We're no longer interested in hobbyists. We're going to go into industrial. We're going to put gold leads on these boards and they'll be prohibitively expensive," and Lally and I got up and walked out and he says, "There's no way. We're not going to do this." And so, the development system never became the desktop PC. Having said that, if I could tell one little story that's...

**Fairbairn:** Please do. Those are valuable.

**Halla:** So, as I grew within Intel, I grew on the marketing side and acquired marketing of the X86 as well. And we had a guy by the name of Steve Morse, who was the architect of the 286, and as a development-system guy, the biggest problem we had was you could sell a disk, a PLM or Basic or whatever, but anybody could copy it. There's no way to protect it. And so, we tried to come up with all kinds of schemes, and pretty soon I came up with an idea and I started a folder called "Big" and I—everybody'd say, "What's

Big?” and I’d say, “I can’t tell you, but it’s going to be big.” And I went around to the software developers and I said, “If we could do a processor that was a decrypting processor so that you could encrypt your software, would that be interesting?” And everybody said, “Yes, of course.” So, I got Steve Morse to do an encrypting 286. The whole idea was that I was going to propose that we would sell the vanilla 286 to all the clones, all the PCAT clones, and we would go into the PC business with a proprietary encrypting 286 that we would only make available to IBM. So now there’d be 2 companies that made 286s that could protect software and 198 companies that couldn’t protect the software, so we’d be the official second source for the PC. And so I kept collecting information from the software developers and whatnot and I finally got a meeting with Ed Gelbach and I said, “Ed, this is big.” I said, “We can go into the PC business.” He says, “My gosh, this is big.” So the next thing that happens is the whole executive staff for Intel and the board of directors is down at the Grand Hotel going through the National Computer Conference. Remember that before it became COMDEX?

**Fairbairn:** Yeah.

**Halla:** And I get a call in the morning and it’s from Gelbach and he says, “Brian, bring Big and meet Les Vadez at our booth.” And so, I get my folder and I make a bunch of copies of the presentation and I go down and all the Intel gang are sitting in this suite at the Grand Hotel and I’m sitting in there with Gordon Moore and Art Rock and all these people and we’re waiting for Andy to finish taking a shower or whatever he was doing, and Gordon’s talking about someday people will have satellite antennas on their roof and they’ll be the size of the dish, he said. Now, it was fascinating. So, Grove comes out, sits down and Ed Gelbach says, “Brian, you’re on.” And so I presented the whole program, the decrypted microprocessor, and they all said, “This is big.” And Les Vadasz says, “We got to do it. We’ll do it in a small building with a light bulb hanging from the ceiling. You know what I mean? Off campus, so nobody knows we’re doing it. Brian, you can’t be the head of this, you know.” I said, “I understand.” “But you can be a marketing guy.”

**Fairbairn:** To develop a whole PC that was around this 86 processor, the 286 processor.

**Halla:** And do it in secret, because we didn’t want to lose all of our clone customers, because they could all go to AMD, our second source for the—so, my finest moment, and I fly back and I’m just..

**Fairbairn:** You just changed the course of the company.

**Halla:** A couple weeks go by, and at that show, the National Computer Conference, TI at the time was in one of the PC companies and they announced \$100 million loss, which would be chump change today but it was big money in those days, and they threw everything but the kitchen sink into this loss, the Speak-and-Spell that was losing money, but they said it was primarily because of the PC. So, the executive staff of Intel decided it was too risky to go into the PC business, too big a chance, too volatile. So Andy came around to my office and he said, “It was a great idea but we’re not going to do it. Are you

okay with that?" And the way he let me down was I still felt like a million dollars. Now, in retrospect, would that've been the right thing to do? Probably not, because Intel was so successful as a chip supplier, thanks to Andy, but, anyway, that was...

**Fairbairn:** Well, was that ever presented to IBM as an option?

**Halla:** No. Certainly the decrypting processor was very, very interesting but not Intel being your second source. Everybody loved the decrypting processor.

**Fairbairn:** So, you're in this software-marketing, product-marketing-type position. So, pick things up, and so what were the...

**Halla:** So, everybody that became a general manager at Intel was from engineering or from finance. I was a "marketeer," and I explained this to Andy, because I obviously wanted to grow into general management. And I don't think Andy had ever realized this, but he said I was right, and so somehow they made me the general manager of a group called Market Development, and my job was to find places for Intel's chips outside of the socket in a PC, the CPU socket in a PC. That was my job. My group quickly grew. We had three basic projects that we were doing. One was a high-speed engine for a laser printer. One was a network using the power lines, and one was a PC on a credit card. And I bought the name from a company that went bankrupt on the East Coast. The name was going to be Wild Card. And we kind of did this under the radar. It was literally a card the size of a credit card. It had a 100-pin connector on the edge. We used a Faraday combo chip from the PC chips that—they had put it all into a thing called the 2010A, and Intel at the time was allocating all of their CMOS to the ramp-up of the 386, so we had to go to OKI to get a CMOS supply of 8088s. That was going to be the CPU. We had a math coprocessor socket on it, and we got this thing designed and developed. Noyce loved it, because we used flip-chip technology for all the chips and then globbed them with epoxy instead of having packaging. We had it built by a company called Fuji-something in Iwaki, Japan. They were the manufacturer.

**Fairbairn:** What year was this?

**Halla:** This was 1980—probably '86.

**Fairbairn:** So you'd been at Intel 11 years, so you were a longtime employee by then.

**Halla:** I was there 14 years altogether. So, anyway, Andy Grove was on sabbatical. That's key from this thing. Everybody in the company was enthralled with this Wild Card and we started getting it designed in. We got it designed into a laptop in Korea. We got it designed into a videotape-dispensing machine at 7-Eleven, all over the place. And so, I get the spot for the upcoming MOMAR [ph?], which is a monthly

management review, and MOMAR is when you present to the executive staff. Andy had just gotten back from his sabbatical, and, again, Noyce had one of these Wild Cards in his pocket. Gordon Moore loved it so much he came and became our lab godfather watching over all the stuff we were doing. And so I'm up there and this is going to be the proudest moment in my life. First, I do a demo of the high-speed laser printer and then I do a demo turning on a light in the back of the room using a power light. Now it's time for the Wild Card and I start presenting what it is and the target market, and now everybody can use a PC as a programmer for this card. And so I pass out the cards and I see the card making its way to Andy, who's sitting right in the middle row, right in the middle of the middle row, and Noyce is on one side and Gordon's on the other side. And the card makes its way to Andy and Andy looks at it while I'm talking, and I try not to stare at him, but he looks at it. Pretty soon he looks up at me and he says, "What is this shit?" I said, "Excuse me. That's the Wild Card, Andy." "What is this shit?" I said, "Well, it's a PC on a credit card." "What do we have in this shit?" And he was right. OKI supplied the CPUs. The board itself was built in Iwaki, Japan, and we had nothing in it except marketing. Only Andy was smart enough to realize it—not smart enough. That's not fair, but...

**Fairbairn:** Had the perspective.

**Halla:** Had the perspective. And that's the kind of thing that Andy did over and over and over. And he [Noyce] covers the one in his pocket and bends over the other way <laughs>. It was, I mean, went from being the biggest day of my life to my life is a failure. And I...

**Fairbairn:** So, you succeeded in marketing, it's just the...

**Halla:** ...yeah, the marketing went okay.

**Fairbairn:** ...it was a good idea. Just didn't serve the interests of the company, huh?

**Halla:** So, from then on Andy said "You got to come back into the mainstream and help me market the 386. And I'm tired of these fooling around with these toys." And I didn't. I elected not to go back and do a regional manager's job. And I kept doing this thing and we were still doing some valuable technology. And then after a year and a half or so, I decided to leave the company when LSI came to me a fabulous offer. Now, actually took me six months to accept the offer, but.

**Fairbairn:** So, what year was that when?

**Halla:** That was 1988.

**Fairbairn:** And so, Wilf came to you or who?

**Halla:** No. No, his HR guy came after me and I had my first interview with Wilf and they were looking for, he had just signed the MIPS and the SPARC license. And he wanted to get into the microprocessor business. You know how in those days everybody was unhappy with the business they were in.

**Fairbairn:** Yeah, absolutely.

**Halla:** So, he wanted to become a MIPS and a SPARC supplier. And so, it was between myself and another candidate as to who got this job and I somehow came out on top. And got a job as, I think I started out as a senior vice president at LSI from a director at Intel. And they gave me enough stock that I...

**Fairbairn:** So, they found you through the grapevine. You didn't know the people at the LSI before that.

**Halla:** ...didn't know anybody. I knew that Wilf Corrigan had the reputation as a tyrant. And so I met with him first. And he after talking to me and at the time we were having problems with pickers picking chips and causing silicon dust to get on the processors and this first time he'd heard of silicon dust I think. And so, that was interesting to him. We talked about the solution and all this stuff and he says "Come on, you got to come with me." And so, we go out of his office and across the way and he opens the door and on George Wells and a couple guys. George Wells was, I think, he was the president at the time. And I remember thinking "Well, this is rude." But, so I took that job and all of the people, so many people wanted to come with me. And I didn't recruit any of them, but the guy who came up with the Wild Card idea, this is one of these unknown heroes. His name is Dirk Smitts. Do you remember Dirk Smitts, Jeff?

**Katz:** I do.

**Halla:** Dirk was...

**Fairbairn:** This is Jeff Katz who just joined the discussion on the side. Go ahead.

**Halla:** ...a brilliant individual. He's Mensa. But, he was a management challenge. I loved him. He forced you to listen to him think. And one time during a one on one he was talking away and I put one of those little pocket recorders on the table and I just sat there and listened to him for about 10 minutes and then I played it back and I made him listen to it. Said "Dirk, a good marketing guy does as much listening as he does talking." But anyway, Dirk's idea, he believed that if we could do a Wild Card we could put a whole PC on a credit card that we could put one on a chip. A whole PC on a chip. And that was our

quest and we get to LSI and he comes with me and he's the marketing manager for the MIPS division. And there were five other suppliers for MIPS. There was Sony, there was Performance Semiconductor, there was, anyway, five suppliers. Siemens was a supplier. And he says, "Hey, Brian, why are we doing, there's only one socket for the MIPS and processor and it's the Silicon Graphics workstation. So, why are we competing with these other four guys for one socket when the price, we're all scrambling to be the first and then the price is when the second comes out." He says "Brian, what I'd like to do is redo the MIPS 3000 as a core. And then we can combine them with all of LSI's cells and do systems on a chip." Now, I always became the system on a chip guy, that was my reputation, was because of Dirk. All I did is I supported what he was trying to do. Anyway, so he redesigned the MIPS processor as a core. We never told Wilf that we were doing that. We're still selling the standard product. But, along comes a request from a Japanese company named Sony and very mysterious. They liked the core, we call the program CoreWare. They liked the core ware idea. They wanted us to quote on what suspiciously looked like a video game. And we could have all of the chips except the graphics processor. They're going to give that to Toshiba because they didn't want to have one company own all that. And so, we proposed CoreWare. And we got the design and there's a lot of stories underneath. Our execution was perfect. We did four or five generations of the processor. Sony went from being nowhere in the video game business behind Nintendo and Sega to dominating.

**Fairbairn:** This is the PS2?

**Halla:** PlayStation 1.

**Fairbairn:** PlayStation 1.

**Halla:** Yeah. And we were also on the PS2.

**Fairbairn:** PlayStation.

**Halla:** The net net is that design took LSI's stock from four and seven-eighths to one hundred and twenty-six and was the best performing stock in the New York Stock Exchange two years in a row.

**Fairbairn:** Anyway, so let's get back to you're time at LSI, but actually I wanted to talk about the transition from Intel to LSI. You were director at Intel. You must have had some significant responsibility there at Intel and made quite a name. They were going to move you over to LSI in the senior VP type position. So, was there any significant difference in terms of the management challenge or the level of responsibility and so forth between those two positions? Was the LSI position a major step up or was that more of similar to the responsibilities you had previously?

**Halla:** Well, if you recall in those days there was Intel and then there was everybody else.

**Fairbairn:** Mm-hmm.

**Halla:** So, you were at the place if you're at Intel. So, to go to a company like LSI Logic was a step down even if you were the CEO in those days. You thought about it.

**Fairbairn:** You were a proper Intel employee.

**Halla:** Yeah. And I think I had some pretty good references high up within Intel. And I don't want to mention their names because that would be violation of their fiduciary responsibility, but Corrigan had a lot of friends in the management team at Intel. And so, I got the recommendation. I think it was because of the some of the innovative stuff we had done with Wild Card and what not. And I gave a decent sales pitch.

**Fairbairn:** So, it was the breadth of the responsibility at the LSI position significantly different or was it in terms of numbers of people?

**Halla:** Yeah.

**Fairbairn:** Breadth of operation?

**Halla:** Brian, here's your four employees, get us in the microprocessor business.

**Fairbairn:** Okay. So, it was a start up internally.

**Halla:** Yeah.

**Fairbairn:** To get going. And the vision there was to get into the microprocessor business, not to be a core.

**Halla:** Not the systems on a chip, right.

**Fairbairn:** Not to be a system on a chip. Okay.



**Halla:** Right and just to give you an idea, at Intel I had a tradition of we would have bets with management and we had a bet with Dave House one time that if we could do \$35,000,000.00 in a quarter that he and all the executive staff would have to dress up in tuxedos and serve us apple cider and steak and lobster, white gloves and all the stuff. And they'd always do it. We'd always win the contest because we had ways of generating revenue when we needed to. But, I think the last one was a beach party that Andy Grove let us do where we could actually drink beer on site and we had my kids pool with sand all around it. We threw Dave House in the pool as part of the entertainment. But, no, I had five guys. So, this tradition of the tuxedos I took it to LSI with me and the first thanks at the end of the year event was myself and one other guy wearing tuxedos and serving these five people, three or four people. But, just to give you an idea the group grew so fast at LSI that the last one that we had was at the Red Lion Inn and we took the double ballroom.

**Fairbairn:** Oh, wow.

**Halla:** And we had, must have been 1,000 people, but with the ice carvings and we had the USC band come in and play and so, we grew pretty rapidly because of Wilf's support that the ASIC business wasn't all that.

**Fairbairn:** Wasn't doing what it was supposed to do.

**Halla:** It wasn't doing what it was supposed to do. Well, even so, Wilf was a pioneer and I think he just believed in microprocessors because Intel, with the success of Intel was the example. Could you ever knock out an x86 with a MIPS or Spark? No, not necessarily.

**Fairbairn:** So, before you go on there, I actually wanted to step back. Something just occurred to me. You had the opportunity to work closely with three icons of Intel, Andy Grove and Gordon Moore and Robert Noyce. Tell me about each one. Let's start with Robert Noyce. What were the things that struck you about him and what do you think his major contribution in terms of leadership at Intel was?

**Halla:** Oh, man. Noyce will always be known as the transistor guy, the inventor of the integrated circuit and all this stuff, but he was somebody that everybody wanted to please and yet, you never really got a chance to do anything except answer his questions about you. And I don't know, I've never known that many people, but I try to adopt that trait and show as much interest in people that work for me as he showed in me and people around me. So, he was a wonderful guy. Gordon was the grandfather that everybody always wanted to have. Gordon took Dave House and myself and a couple of other guys out on his boat, a diesel with twin screws. We went out to the Farallons and we're all having fun fishing and a big wave came along and I went flying across the deck into Dave House who dumped all of his tackle over the side. And it was a \$400.00 or \$500.00 fishing reel. And Gordon said "No problem, no problem. We got another downstairs." And he goes down and he fixes up Dave's tackle and on the way home

Gordon cleans all the fish, hands them back to us and takes our picture with the fish we caught. And then we're driving down 280 on the way home and I get pulled over by a highway patrolman for speeding. And we had been drinking beer and wine on the...

**Fairbairn:** Yeah, I can imagine.

**Halla:** ...and Dave House is sitting here [on the passenger side] and the highway patrolman comes around to his side and as soon as I lowered the window he smelled Dave's breath and so he says to me "Get out of the car." And so, he's having me do this thing, count your fingers and I hadn't drunk very much at all. And I said "Why are you doing this?" So embarrassing standing on 280 roadside. "Why are you doing this to me?" He says "Because your buddy smelled like booze." I said "Why aren't you doing it to him?" He says "Because you were driving." And Gordon drives by. And I thought "I'm screwed." And the next day I get a little happy note from Gordon saying "Thanks for clearing the road for me." Sweetest guy in the world. Andy was the nuts and bolts of that organization. Never spent an erg dreaming. It was all execution. And you had to respect Andy for that. I mean, the fact that he shut down my Wild Card program was fine. That was the right thing to do and what I had done wrong is not incorporating his thoughts into it before we started out. Can you give me capacity inside of Intel, I won't take very much, but I'd like it to be an Intel product. That's why I did it outside of the system. The other thing about Andy is the people that called him names and thought he was, I'll use the word asshole, he wasn't. He was just intense about problem solving. And people that felt like they'd been attacked by Andy, if you really looked at it, Andy was attacking the problem not the people. But, the people would try to emulate Andy, this includes a lot of upper management people at Intel, they became assholes because they would attack the people. But, the nuance of Andy Grove was that he was ruthless in attacking problems. And if you came to appreciate that about him then you had to just appreciate him as a man. And I just thoroughly enjoyed working for him. And I remember when I went to LSI and we were talking about putting a system on a chip and I said "Someday the CPU on a PC will be \$25.00 and this PC will sell for under \$1,000.00." And Wilf calls me at home at night and he says "Brian, you're in the "Investor's Business Daily" or some magazine and there's a quote in here from Andy Grove saying 'I refuse to discuss the fantasies of Brian Halla.'" <laughs>. And he says "This is it, Brian, we've made it, this is the big time." But, that's the kind of stuff that Andy would do all the time. So, the three of them were just even as a gestalt were just unbelievable as a team. And you just kind of wonder how it was that they all came together and there's...

**Fairbairn:** Each one quite different, but each...

**Halla:** ...so different, yeah.

**Fairbairn:** ...complementary and appreciating the values and strengths of each one.

**Halla:** Yeah. And but, not necessarily did they appreciate the styles of each other. I remember we had an offsite meeting of upper management and somebody, we're walking across the street with Gordon, and somebody "Wow, it's really kind of sedate in there and kind of low key and casual." And Gordon says "Yeah, for a pleasurable change." So, he didn't like all the yelling and screaming you could tell. By the way, there was one offsite meeting, I think it was the same one I'm talking about, Les Vadasz was giving his pep talk and to 150 people in the room, Jeff might have been there. And Vadasz finishing off his speech and he says "And now everybody we're going to go out there and grab the bull by the balls and run with it." <laughs> And then, are you kidding me? "Did he just say that?" He was a master at those things.

**Fairbairn:** All right. So, we're going to get back to LSI now, appreciate the side light there. I think it's important to sort of get the perspective on these three gentlemen. You had taken what was a standard product business in the MIPS processor and then turned it into a core business and you'd won this Sony design which rocketed the stock price from the single digits to the triple digits and so pick up the story then. What evolved after that and sort of what were the major highlights?

**Halla:** Well, that's when I got to be known as the "system on a chip" guy. And so they started putting me in front of the cameras for the investor relations meetings.

**Fairbairn:** This is the future.

**Halla:** Yeah.

**Fairbairn:** This is how it's all going to go. This is how we make money.

**Halla:** Yeah, yeah, yeah. And in those days you could say this is what we're looking at and you could pop the stock. And now nobody's going to pay-you-well-in-advance-for-a-job-well-done. But, so I was kind of the front guy giving the vision all the time and they liked the vision. But, that was a pretty heady time. Also, Sun Microsystems was important in there. Now, the system on a chip we called it CoreWare. I had a guy working for me who ran the apps group. And his name was Jen-Hsun Huang. And long before we announced the CoreWare business, Jen-Hsun had already taken the graphics core and made a graphics engine for Silicon Graphics that was their value added. And so, I took note of this kid that was super, super sharp and, as you know, he went off and started Nvidia. And was very successful doing that. But...

**Fairbairn:** That was his easy to recognize his brilliance at that point.

**Halla:** ...oh, he was unbelievable. And I remember when he said "Brian, I'm going to go with a couple buddies from Sun and we're going to start this graphics company." And I said "Jen-Hsun, you can't, Jen-Hsun, you can't. I'll promise you anything," I said, "I'll tell you what, I'll give you more stock than you'll ever be worth at Nvidia." And so, Jen-Hsun's pretty much dug in and we were good friends and I called Wilf and I said "Wilf, I'll never ask you for anything in your life except a job, but I need to have you help me talk Jen-Hsun out of going, he's the best I got." Wilf says "Sure, Brian, bring him over." So, I go over. We walk into Wilf's office. Wilf says "So, Jen-Hsun, I hear you're leaving the company." Jen-Hsun says "Yeah, I'm going to go start this graphics company." "So, do you need any investors?" <laughs>. And I think...

**Fairbairn:** That is the last favor that Wilf did for you <laughs>?

**Halla:** ...I think he actually invested in that company. Anyway, that was, so.

**Fairbairn:** So, the CoreWare business grew to how big, what was the size of the?

**Halla:** I can't remember. I don't think it was that big. It was just kind of the hood ornament of LSI from that point on.

**Fairbairn:** Right. And you took in other processors as well; I mean, the MIPS was only one, right?

**Halla:** We had the SPARC as well.

**Fairbairn:** SPARC.

**Halla:** SPARC was interesting. While I was still at Intel trying to figure out for the six months whether or not to go to LSI, one of the guys that worked for me at Intel, Syd Gerity, went over to Sun. He had a PhD in procurement or in materials and he went over to Sun to be a purchasing guy. So, I called up Syd and I say, "Syd, how's the relationship between Sun and this LSI company?" And he says "It's pretty big, but they're losing ground to Fujitsu who's the other SPARC maker." And I said "Why?" And he says "Well, Fujitsu will do 168 hour burn in and you guys won't do that. And there's things like that." And I said "I tell you what, if I take the job at LSI let's make a pact to make each other look good." Hell of a purchasing guy at Sun who's going to make you look good. Then, I'll do anything for him. We grew the business with Sun from \$5,000,000 to \$200,000,000 a year.

**Fairbairn:** Wow. That was big one.

**Halla:** So, that was one of the things that helped bump the stock and it was never anything unethical or illegal, it's just things like Brian, you guys really need to do longer burn in if you want to be competitive. And never did he give us a premium on the price. I just knew when he was saying "Here's what you need to do to be a good supplier to Sun." And that was...

**Fairbairn:** Listen to your customer.

**Halla:** ...pretty important help.

**Fairbairn:** So, how did things evolve in LSI and then you were going to end up at National at some point. Tell me, lead me through that story.

**Halla:** Yeah. So, I grew pretty well within LSI and became the executive vice president. I didn't know it until after I left, but I was the number two guy. It was one of Wilf's board members that called me and told me that. Wilf never told me that. In fact, in the eight years of working for Wilf I gave a pitch to his board and he says "Brian, wait in my office." And he comes out at their break and taps me on the shoulder. He says "That went pretty well, Brian." That was the only positive thing he ever said to me in eight years. Even though I loved him, I knew when he was appreciative. But, anyway, so things went pretty well and he gave me more stock and now we're getting into more and more systems on a chip kind of things and we found out that virtually everything needed analog because digital anybody could do, but the analog front end stuff, things like Ethernet and SCSI and all this, a very select few. We had one guy in the group that was an analog guy and we could hardly ever find him because he was his daughter's volleyball coach. So, we had at the time there was a req [requisition] freeze. And there were 35 reqs open for analog engineers and the word was that if we could find anybody in analog that we could hire him even during the req freeze. We realized the importance of analog. So, I get a call from a headhunter from Heidrick and Struggles. "Brian, I'm working on the biggest search in the valley. It's the CEO of National Semiconductor." And I said "Okay, I'll take the job." <laughs> And he says "Well, shouldn't we have lunch or something?" And so we got a lunch and he's telling me about it and I said "Well, I'll take the job." Because I knew it was an analog company and I knew analog was the future. And he says "Well, don't you want to know what the package is?" And I said "As long as it's fair I'll take the job." And so, I go to the interview and it's up at Tracey O'Rourke's company, Varian, and my slot is seven o'clock at night. It's the whole board. And the receptionist asked me to sign in which, of course, I didn't do. But, I opened the book and I'm looking at all the other people signed in before me.

**Fairbairn:** All the other candidates.

**Halla:** And they're all, and I'm not going to tell you who they were, but they were very well known people. All manufacturing types, they were all cut out in the image of Charlie Sporck.

**Fairbairn:** Now, you were not taking over Charlie Sporck, you were taking over for?

**Halla:** Gil Amelio who had left to go to Apple.

**Fairbairn:** Mm-hmm.

**Halla:** So, I said "Well, this whole interview is a waste. They want to hire a manufacturing guy." So, I was pretty brash in the interview. And in talking about systems on a chip, I said "What happened to the x86 core that you guys were working on?" Charlie said "We buried it, six feet under. It's dead, it's buried." And I said "Well, dig it up because it's the key to the future." <laughs> And so, of all the candidates that bid for the job, including the presidents, I scored the highest in the interview and on Ed McCracken's matrix, I got a 72 <laughs> and got the job. But, it was just my belief that analog was the future. But, also the first thing we did when I got there was we bought a little x86 company, Cyrix.

**Fairbairn:** Oh, yeah, I remember that.

**Halla:** And we said "We'll just go ahead and put a PC on a chip." And we paid \$500M for it. It was a decent run, but Intel took the Pentium at that time was in a cartridge. It was in a cartridge so that none of the other patents that the competitors had were valid because this was now a system. And they took the SRAM out of the cartridge and sold the naked Pentium as a thing called a Celeron and I said "It's a Pentium in nose glasses." But so, they then kept the price of the Pentium up here and sold the Celeron against our Cyrix at the \$25.00, but you had to buy the server chips from Intel because we didn't have anything like that.

**Fairbairn:** Package deal.

**Halla:** So, they knocked us over pretty easily I would say over a couple of years. We got a lot of designs and a lot sub \$1,000.00 PCs which was our goal, but I remember when we finally got out of it I was quoted in the "Wall Street Journal" as saying "Competing against Intel is like beating your head against the wall. It feels so good when you quit." So, our stock went up 12 points when we announced we were selling Cyrix. And I get a call from Otellini and he says "Brian, this is the wall calling." <laughs>. He says "I'd like to buy your design group in Austin, Texas." And anyway, so...

**Fairbairn:** So, you went into National, what were your top priorities other than getting into the x86 business, what were the things that you needed to get rid of, what were the things you wanted to emphasize, how did you want to reshape the company or not walking into that job?

**Halla:** Well, I knew that where the National was going was analog, more and more analog and they had, I don't know, 700 of the top analog engineers in the world. I knew where they'd been and that was the discretos and the family logic and stuff that I didn't know anything about. It was old commodities. And so, the first day on the job I asked the CFO, how healthy the company would be if we got rid of all that stuff? And he said "There's about \$700M of that stuff."

**Fairbairn:** Out of what was the total?

**Halla:** We're probably a \$3 billion company at that time. I'm not real sure, but it was somewhere in there.

**Fairbairn:** Maybe 20 percent or something.

**Halla:** Yeah, 20, 25 percent. So, I said to the CFO, I said "Let's flush it." Meaning shut it down. And he said "I think I can sell it." And so, I spent until seven o'clock that night looking at his business plan to sell these two businesses. We spun them out into two blocks and gave them to two different banks and weeks later the VP or the director of North American sales came into my office and he said "You know, trying to convince our customers that buying from three suppliers instead of one isn't working." And he said "What if we took the name Fairchild and we put the two businesses back together," and we sold it as Fairchild. Because National had bought Fairchild and owned the name. I said "Keith, that was so f-ing brilliant that I wish I'd have thought of it myself." And so we did that and that was worth a huge premium both emotional and capital. We kept 18 percent of the new Fairchild and I became the chairman of Fairchild.

**Fairbairn:** Just to be clear, this was not the old Fairchild that you were spinning out, this was just some other collection of low...

**Halla:** It was the name.

**Fairbairn:** ...end, it was just the name...

**Halla:** Fairchild.

**Fairbairn:** ...on the low end products that National still had kicking around.

**Halla:** Yeah, and National had an office of the president that I shut down the first week. And so, we had three presidents that all thought they should have my job and they were all eventually going to go. But, one of them was Kirk Pond who was good manufacturing guy. And he was the one that spun the

Fairchild out and he did a great job rebuilding it as an analog company, buying various little companies out there and getting Fairchild in the analog business. As the chairman of Fairchild, I was getting ready to go to work one morning and watching the TV, CNBC, and here's Kirk Pond being interviewed on CNBC and he says "We're going to go in the analog business and we're going to knock over National Semiconductor."

**Fairbairn:** I was going to ask you this sounds like a competitive thing.

**Halla:** I said, I picked up the phone and I called my secretary because I was running late that day and I said "When I get in to work remind me to send a letter of resignation to Fairchild." But, I'm really happy with the fact that they were able to rebuild that company and it's up and running. And hopefully some day...

**Fairbairn:** Now, did they become major competitors of National in the analog business?

**Halla:** ...no, no.

**Fairbairn:** Different portions of the business.

**Halla:** Different portions. Typically, very low end stuff, at least in the early days. To be honest with you, I don't know what they're doing now. But, never did they take a big chunk of National's business.

**Fairbairn:** Okay. So, you wanted to spin out the lower end stuff. What were some of the other initiatives or strategies that you thought were important to sort of get National?

**Halla:** Wow, wow, okay. There's some other things that I did shut down. Air brake, not air brake, air bag controllers, decelerometers, pacemakers, anything where somebody could die.

**Fairbairn:** Everything that had medical liability kind of stuff.

**Halla:** Yup. I shut it down. In those days I thought I shut things down. But, and we called them the "walking dead."

**Fairbairn:** Yeah, have to keep supplying them, right?



**Halla:** They'd just somehow, three years later, somebody calls in and said their airbag didn't deploy because EPROM in Colorado froze or whatever. So, you're constantly trying to kill these things that never wanted to die. But, at the time National was the power management leader. And what I mean by that is that anything that was mobile wanted to use National chips. Both Epson and Nokia came to National to change the displays from green and black on cell phones to color, but retain the battery life. So, we did that. We had a lot of different circuits in the cell phone. Now, they still do, I assume. So, anything that could save battery power was big for us. Anything that radios, battery management, the, I forget what it's called in a phone that sends the actual message out. And obviously, mobile was a big thing. Nokia was the biggest customer they had. Motorola was a very big customer, anybody in the mobile business. Eriksson was one of their largest customers.

**Fairbairn:** Okay. So, take me through the rest of the story with National and how did things unfold there?

**Halla:** Okay. Cyrix was probably my biggest faux pas because if I believed in the reason I went to National I should have...

**Fairbairn:** The analog.

**Halla:** ...have forgot about systems on a chip stuff. It just was too obvious that the world needed a sub \$1,000.00 PC. But, so after we shut that down we did focus on analog. We rebuild the organization, we gave it priority. One of the things we did, it turns out in the industry, and this was one of the things that the industry has to get over, is the way technology was built on Moore's Law if something was created 30 megahertz you try to make it run at 60 megahertz instead of if a PC was good what else could you do? And so, I launched a program called \$100M idea where I said "Anybody that can come up with an idea that turns into \$100M chip product line, we'll give you \$1M." And I said "But I want you to approach from solving problems not just making better widgets that we already make." And so, I said "Maria, the coffee lady will be able to be eligible for this program." So, at the same time we were and I was trying to be an example of this, so I submitted some ideas because they were all public that everybody could see them. At the same time we helped Cal Tech and USC and the University of Santa Cruz get up a grant to do chips on the back of retinas in the eye for people with macular degeneration or going blind, as long as the nerves behind the retina were still intact, they could let people see and so they got the grant and we're having a brainstorming session and the first they said is, "You know, one of the problems of putting a chip on a retina is it forms a cookie cutter pattern and does more damage than good." And so one of our guys that had always been my go to guy even at LSI, Mohan Yager Yegnashankaran said well, "I can backgrind the die so the die is actually flexible so we can attach it to the retina with surface tension." "Brilliant," they said. They said, "But the other problem we have is if you embed a chip inside the eyeball, the body has no way of draining off the heat so if you ever get an infection, the body surrounds it with fluid to cool it down; can't do

that if the chip's in the eyeball." And so I said, "Well why don't we do a Peltier heat pump and take the heat off inductively." "Brilliant," they said. <Laughs> So I went back to my office, first time anybody had ever said anything I said was brilliant, and I wrote it up and got a patent on it and these people came by a couple years later with their BBC footage of people they'd done these transplants on and it's miraculous, some of the people that they have—somebody that was born blind that could shoot 10 free throws in a row and other people that had never been able—or had macular degeneration, lost their eyesight, could now see things, see figures and they showed—rolled out the plan that someday they could get 80/20 vision back for somebody that was blind or macular degeneration. Anyway, so that was one of my patents and we also worked with a company called Given Industries that did a pill that you could swallow that would do endoscopy.

**Fairbairn:** Hmm. That's a camera.

**Halla:** Have you heard of this? Camera. It shoots four pictures a second, and it's literally a pill; it's \$450 dollars if you have it done at your doc's and it shoots these four pictures a second, puts them in a hard disk on your belt and then some technician goes through all these pictures and looks for anything suspicious. And so we were having...

**Fairbairn:** Now do you try to retrieve it if it passes through?

**Halla:** No, I used to talk about it in speeches; I'd say National is giving it battery life all the way from launch pad to splash down.

**Fairbairn:** <Laughs>

**Halla:** And I'd always say, "Yes, it's disposable." And so we were doing power management for this thing, proposing for this thing and one of the things they said was, you know to get longer battery life was really tough without changing the form factor of the pill. And I said, "Well why don't we put a temperature sensor on the outside of the capsule, back grind it so that it can fit and only take pictures where the temperature is elevated, because that would be an indication of an infection." And so that's another patent that I got <laughs>. But the best patent that's still in the pipeline but it's still active is when I told the employees to just come up with problems and we'll solve them with technology and so one of the things that irritates me is you're walking down the airport concourse and somebody said, "Hey, what's happening?" And you spin around hoping that you're going to recognize this person that's just said that to you and you see that you're eavesdropping on half a conversation. So I said, "You know that's irritating; I hate that." Why can't we cancel the voice the same way as we cancel the noise in a car, because we have noise cancellation circuits and since everything runs so fast, you can generate a reverse sine wave that

quickly cancels out the noise. So we mocked it up and unfortunately we could do it, but it would give you about 20 seconds of battery life. <Laughs> So we said, "Well since we're already making the device that cancels the ambient noise like in a bar, the clink of glasses, why not give the guy feedback when he's talking on the phone, that if he talks too loud, it starts crackling," and so that one's still in the pipe and that's a pretty good one, but that makes him talk low enough on the phone...

**Fairbairn:** Yeah it would be nice if people would lower their voices on the phone.

**Halla:** Yeah.

**Fairbairn:** So National eventually was.... So tell me how you wound things up with National and sort of how things—you know what you've been doing since then.

**Halla:** Okay. Part of a Board's duties are to do succession planning, so we'd had an annual succession planning at National and I always said, "Donnie Macleod is the guy." And Donnie Macleod was all his life, finance and so I promoted him to the COO and then eventually to President and I'd say, "Donnie Macleod's the guy, Donnie Macleod's...." And they'd always say, "Yeah, he's probably the guy, but we should do an outside search," and so one succession planning and I'm starting to think, "Yeah I'm getting close here; nobody should be at a company longer than 14 years," and it was my 14<sup>th</sup> anniversary and Steve Appleton was on my Board, the CEO of Micron said, "You know what, Donnie's got to be getting impatient; how many years have you been promising him this job?" And I said, "You're right; I better go talk to him." I went and sat down and I said, "Donnie, you know you're going to be the CEO." He says, "No, I'm not." He says, "I'll give you two more years, and I'm out of here." I said, "Donnie, that's the wrong answer." <Laughs> I said, "Donnie, if you leave here, I'm stuck." And so I said, "I just want you to go home and think about it." And Donnie Macleod is a superstar, absolute superstar. He comes in the next day with a full presentation about how we do the transition and what my responsibilities are versus his and I was "Mr. Outside Guy," he's "Mr. Inside Guy" and so we presented that to the Board and... that was an interesting process but Donnie eventually became the CEO and I was the Chairman for another year or so and... <laughs> but it was more the thing that, you know, it's—if you're comfortable in what you're doing it's difficult to make a big change, but I knew it had to be made and so I would have to give Donnie credit for me finally making that move. So the activities now I'm involved in is I've invested in a couple of small startups; one is very interesting. It was brought to me by an ex-Intel companero and it was golf clubs that have a swing analyzer on the—

**Fairbairn:** Oh yeah.

**Halla:** It's a company called Mobiplex and I got in early enough to get a pretty significant piece of the company for not very much. Another one is...

**Fairbairn:** So that gives you speed and acceleration and angles and other things?

**Halla:** If you're coming outside to in, or inside to out, the club hit speed, the angle of attack, the smash factor, which is your club hit speed versus ball speed and it's done by a group of guys from India that are just super talented in what would you call that, motion detection?

**Fairbairn:** Mm-hm.

**Halla:** And it's really quite clever and I'm trying to push them to actually embed this inside the shaft and then sell it to True Temper and some of these shaft makers so that every club has that in there and you can enable it if you want to, but you don't have to, so it's not PGA illegal.

**Fairbairn:** Mm-hm.

**Halla:** And that's kind of fun; it's gotten a lot of attention now, a lot of sales during Christmas. The other start up is a super antioxidant company.

**Fairbairn:** That's pretty different.

**Halla:** Yeah, my trainer told me, he swore by this stuff and he says, "It's unbelievable how fast you can recover from a workout." So I went over to get some of this stuff and <laughs> while I was in there, I couldn't help but notice that the people that were walking in and out of the store are incredibly cut athletes, and <laughs> so after I brought my package I was driving home and I turned around and went back and I said, "Do you guys need any investors?" And so I ended up investing in the company and one of my best friends, his daughter is a "what do you call it?" an Ironman.

**Fairbairn:** Oh yeah.

**Halla:** And she took five years off to have a couple of kids and at 33, she goes back into being the Ironman.

**Fairbairn:** What's the name of this company?

**Halla:** ProAnox; P-R-O-A-N-O-X, and they're right next door to Forbes Mill over in Los Gatos and so she—I asked her to start using ProAnox supplements and see if they help. Her very first Ironman was the Wisconsin Ironman; she won it and when they interviewed her, she swore by these ProAnox and she said, “It used to be after an Ironman event that it’d take me five or six days to get back in shape.”

**Fairbairn:** Recover, yeah.

**Halla:** Recover. She said, “Now I feel like I could go do another one this afternoon.” So she’s now one of the professionals...

**Fairbairn:** Spokespersons?

**Halla:** Yeah spokesperson and we have a bunch of others that are really <laughs> outstanding athletes; the number one bicyclist; a female bicyclist, the world and the Olympics, several of the athletes are ProAnox people and all the testimonies are on the web site.

**Fairbairn:** Interesting.

**Halla:** So that’s kind of fun and then I’m on the Cisco Board which is <laughs> about 20 meetings a year <laughs>.

**Fairbairn:** Pretty intense, huh?

**Halla:** It’s intense, and you know it’s such a huge company but it was interesting. And Chambers is so influential with so many people but he went to Obama with the same thing that we’ve been asking, you know, for forever. This company has \$40 billion dollars in cash overseas; only about \$8M here. And so the natural thing would be bring the cash back, invest it in the United States, build factories here, hire people here and it’s not the plan; they’re not going to let us do that. So fundamentally I think the Administration thinks that companies that haven’t paid US taxes on profits made in foreign lands are gaming the system.

**Fairbairn:** Mm-hm.

**Halla:** And I think that’s a big mistake; I think they should have a re-patriation that maybe it’s 5 percent tax, or 10 percent tax, but to not even consider it I think is just moving manufacturing and hiring and everything off shore. And Cisco has to do all of it’s M and A quite frankly off shore

because of the cash they have...

**Fairbairn:** Because that's where the money is, huh?

**Halla:** Yeah cash they have here is used for dividends and... US expenses. So... anyway, we'll see what happens as we go forward.

**Fairbairn:** So in maybe this is a good time to shift gears and you'd mentioned off camera in a previous conversation that Gary Kildall was somebody you had gotten acquainted with but I guess back at Intel and that he had made a number of contributions for which he was not recognized or appreciated and I think that, you know, one of the goals of these oral histories is to, you know, uncover unsung heroes and you know, events and situations that may not be widely known, so it seems like a good chance to maybe give you a few moments to tell us about that and what you're...

**Halla:** Because I was one of the new software guys at Intel, one of my jobs was to interface with Gary Kildall who had written the first mini Basic for the 4040 microprocessor, actually the 4004 I think, wasn't it? And then the first high level programming language for the 8008 and 8080 and when I first met him, he was offering to give us CPM, which was the operating system he had developed at Digital Research in exchange for, actually he developed in a little shack in his backyard, in exchange for one of our development systems and we gave him the development system but didn't accept the CPM and the CPM...

**Fairbairn:** And he was willing to give you license to the operating system to distribute and...?

**Halla:** We didn't pursue it.

**Fairbairn:** <Laughs>

**Halla:** I don't know what he was—he just wanted to get a development system.

**Fairbairn:** He just wanted a development system.

**Halla:** Just wanted a development system.

**Fairbairn:** That was the only thing on his table.

**Halla:** And I went down there, my wife and I went down there and we really enjoyed him and Gary and I became fast friends and as you know the story, the CPM eventually got ripped off by Seattle Software which was bought by Bill Gates and Bill Gates won the IBM PC after Kildall had already won it by agreeing to give IBM the source code to DOS and so IBM created OS2 which went basically nowhere and DOS became the standard. Gary I would say was if he was disappointed, it never came out in subsequent conversations; he just thought it was interesting and the—he would correct the stories. People would say he went out and was flying that day; he was a pilot and he stiffed the IBM people that were there to close the contract and that wasn't true he said. In fact, he flew back with them on the airplane to Boca Raton because he was going on a cruise or something but so...

**Fairbairn:** But they fundamentally didn't agree because he didn't want to give them the source code at the time.

**Halla:** That's right. That's right. Okay so here's the string of accomplishments and this is why I think Gary Kildall is the unsung hero of computer software and innovation in Silicon Valley. The second thing that Gary did is when RCA came out with the LaserDisc, the big platter that they distribute movies on, Gary believed you could actually store digital data on that and the innovation he did created the whole CD ROM industry.

**Fairbairn:** Did he actually develop a system using it as a data storage mechanism.

**Halla:** Yeah; and the software to load the data onto the disk and store there and that created the CD ROM industry which Bill Gates again started the CD ROM conference, an annual conference but held in Redmond, and Kildall thought that was amusing but not devastating by any means. Another time when we did the Wildcard at Intel, Kildall loved it and he was one of the first guys to ever get one of those brick phones from Motorola I remember him tapping on the window outside of my office and he said, "Look outside your window," and I look up and he's talking to me on a phone. And that was a big deal in those days; you know, nobody had a phone like that, without a carry case. And so when we came out of the Wildcard, he said, someday phones are going to be as smart as the PC and he built a phone with the Wildcard in it. But the one that was exciting, I was at his house one time, he said, "You got to come down in the basement, see this." And he took me down in the basement, showed me this Vax 11/780 that he had running in his basement and he was so proud of it and he said, "I figured out a way to have a computer generate animation," and he said, "Watch this. And he runs a demo of a Coke bottle that starts real slowly and starts spinning and so as maybe several months went by, he lost interest in this and he sold his setup to a little company called Pixar. So it's like, you know, you can go on and on.

**Fairbairn:** Started all these fundamental technologies, huh?

**Halla:** He could see two years down the road and around the corner and he was there with the idea.

**Fairbairn:** And he could implement it; I mean he was actually creating stuff.

**Halla:** Yeah; he was an inventor, but just a wonderful human being and in fact, he also had a limousine company when he was in Digital Research and he said, so when his customers would fly in from Japan and what not, he'd have a limo pick him up <laughs> and he said, but he was too ethical to do this, he says, "You know what I should do? I should have a microphone in the limo, so <laughs> as they're driving in, and talking strategy..."

**Fairbairn:** He'd know what they were <laughs>.

**Halla:** I'd know everything they were talking about, and then as they're going back to the airport, I could eavesdrop on everything that they thought of me.

**Fairbairn:** <Laughs>

**Halla:** But he was a very ethical guy and didn't do that, he just <inaudible>.

<overlapping conversation>

**Fairbairn:** So how did he eventually make money? He had all these wonderful things, but he...

**Halla:** Well he made a lot of money with CPM; I mean IBM designed it into their point of sale systems and CPM was the standard operating system for all systems before there was a PC.

**Fairbairn:** I see, okay.

**Halla:** Anyway, PC was interesting. It was when IBM was going to do the PC-AT, they gave three of us advanced access to the advertising campaign and the launch and they were Bill Maxey, Paul Otellini, and myself. Were you there, Jeff?

**Jeff:** I was there, I wasn't in that room.



**Halla:** Okay but they invited us down to Boca Raton.

**Fairbairn:** Mm-hm.

**Halla:** And they're getting ready to launch the PC-AT, and we're at a Holiday Inn in Boca Raton. We go to the conference room; phone rings in the conference room. We answer it. The meeting's been moved to such and such place. We go to such and such a place, we go in the conference room, the phone rings again. The meeting is across town at the Holiday Inn such and such. So we go across to the third and we get there as they're going around, you know, checking the room... I mean it was that high level and high secret.

**Fairbairn:** Wow! <Laughs>

**Halla:** And basically they showed us how they were going to launch this thing with the—remember the Charlie Chaplin.

**Fairbairn:** Oh yeah.

**Halla:** Back in his chair and his hat's up and the only thing that was color in it was a red rose and so we were supposed to go back and run ads that were consistent so that they could make the 286 look like it was a powerful machine and so I was with the development system group at the time, I went back and ran an ad that says, "Intel development systems help big and small companies get to market fast," and it was just the picture of a corner of a PC with a red rose.

**Fairbairn:** <Laughs>

**Halla:** Because they wouldn't let us use any of the actual.

**Fairbairn:** Right; yeah, yeah, yeah.

**Halla:** And I forget how we dealt with the rest of it but so I need to tell you another story that involves Jeff Katz. The Microsystems Marketing Steering Committee and Andy Grove appointed us four marketing guys to be the committee that kept our chip in the socket of a PC as we were going from the 286 forward and most of the management at Intel, possible exception, Terry Opendyk or some of those people thought that the 286 was all there ever needed to be; we'd just make it faster and smaller and it was even at Intel, we all thought it was the ugliest architecture there was, because it was segmented architecture; you couldn't program it like a UNIX machine,

you had to index it but we had it; we had that socket and we were going full speed ahead. But Andy created this group to make sure we kept the socket and the two Godfathers were Jack Carson and Bill Davidow and Jeff Miller calls an emergency meeting of the MMSC and we all get in this conference room at four o'clock in the afternoon and Jeff's standing up there and the paper's shaking and he says, "It's called Redwood and it's 32 bits," and it was the Motorola 68020. And so Carson and Davidow said, "You guys stay in this conference room and don't come out until you've figured out what you're going to do." And so we invented the 386, the 486 and a 586 in that room and the 386 was going to be able to play segmented software as well as have a flat architecture and then Andy gave all the compute power and the corporation to Gene Hill and said, "Get us a die photo; all we have to have is the die photo," and that'll convince people we're going to have a 32 bit architecture for the PC and when that first die photo came out, we all scrambled up to de Young Museum and had a big party. Everybody had business cards with one of the die on the card.

**Fairbairn:** Die <laughs>.

**Halla:** And...

**Fairbairn:** It didn't work by then but...

**Halla:** Oh gosh; it wasn't close to working but it was a brilliant response to what could have shut down Intel's story forever, because that 68020 was clearly a superior architecture. I mean because they saw—Motorola saw the future programmers of a six—of a processor coming from the programming world; they'd be UNIX programmers whereas Intel and tell me if I'm way off base. Intel thought that microprocessors would still be microcoded by electrical engineers.

**Fairbairn:** Hmm.

**Halla:** That was the mentality that existed, I think or at least that's what I felt at Intel and but those were the headiest kind of moments you could possibly have when everything hangs in the balance and then I can't remember why we started Crush 85, but I got to be the Godfather of Crush 85.

**Fairbairn:** Mm-hm.

**Halla:** And everybody on the executive staff got depositioned and the depositions would go... did you get deposed at the...? <Laughs> The deposition would go, "Do you guys, do you know Brian Halla? What does he have against the Japanese," because there'd be TWX in the emails—not

emails in those days but TWX where I'd say, you know, "The V series from NEC is deficient in this and that and this and that." Anyway, those were the days, my friend.

**Fairbairn:** Alright, well...

**Halla:** You've got to do one of these by the way?

**Fairbairn:** Well someday I will.

**Halla:** Kofer talked about you as a god. <Laughs>

**Fairbairn:** <Laughs> Well like you there are—sometimes I get credit or blame for things I was not directly responsible for but I'm happy to associate with myself with the right people at the right time and it help steer the ship in the right direction hopefully.

**Halla:** Before we conclude, let me just look at my notes and see if...

**Fairbairn:** Yeah, please do that. I had one sort of final question.

**Halla:** Okay.

**Fairbairn:** That is, you know, both of us have sort of lived through similar kind of generations; we were born about the time the transistor was invented and kind of ridden that wave of semiconductor technology and later software technology, you know, over this—over our careers. What—where do you think the exciting trends of the future and for somebody going into college looking to get a degree today, what's your advice to I don't know you have kids or people that would ask you, you know, what's the equivalent thing to be focused on today?

**Halla:** Well, you know, people say, "Oh the semiconductor industry's matured," and we clearly don't have the attention on it. I remember my son in law teaches an advanced Physics class at Los Gatos High at the time and he had me come in and do a speech and I put my iPhone up and twisted it and I said, "Does anybody know how this happens?" And you've never seen so many blank faces. These are advanced Physics students. And finally one kid says, "That's done with on chip MEMS with gyros that run the accelerometers from analog devices." And I said, "I want to keep an eye on you; you're going to be an employee." But what came home was that kids are so infatuated with the capability, none of them care how it happens, they all just take it for granted. But having said that, the future truly is in technology and here's why: One day I'm in my

office and my patent lawyer comes in and he says, "You would not believe the presentation that's being given to the engineers down in building 13." And I said, "What is it?" And he says, "It's Professor Majumdar from Berkeley who's a mechanical engineer, Majumdar... mechanical engineering professor at Berkeley and he's talking about DNA molecules." And I said, "What?" I said, "I've got to see this white paper," so they brought me the white paper. And he starts out with, "Forty years ago, all technology was at the level of an aircraft carrier. And at 20 years ago, technology moved down to the size of a bread basket and then 10 years ago to the size of a microprocessor;" and he says, "now we're at nanotech, sub-nanometer," and he said, "all of a sudden everything changes because now all the sciences merge together because we're all doing the same thing; we're all just pushing atoms around." And so medical and engineering and physics and biophysics and all of these things with all innovate off of each other's experience and patents will be generated off of the sum total and the combination of patents that exist in all the sciences, because we're all doing the same thing. So how he got there was he then talked about mems technology being used at MIT to put a small motor on a watch that's more efficient than batteries and it's a hydrocarbon turbine and they hadn't been able to get it to run successfully over a long period of time, but that you could actually put a motor on a chip and then he went into DNA molecules and how a DNA molecule is actually very much like a motor. It has gears and all these things and he says, "Someday there'll be DNA molecules on chips that you don't even think about; you take for granted." So if you think of where we've come in our career; we've started out with everything Intel did was on time sharing mainframes, GE or some of those guys, that was how softwares developed; so that was a machine to lots of men and then you had the PC and you had man to machine and then you had man to a lot of machines and now we have machine to machine for the sake of man. So if you think of where that takes you, there'll be incredible technology that knows where we're coming and knows from big data analytics because all that data is now in the cloud and exists, they'll know what you like and what you don't like, and they'll have solved the privacy problems and you won't have to carry around a phone. You know, we're going to—if people had to keep carrying around a phone, in a couple of years, everybody's going to look like...

**Fairbairn:** Have to work on neck problems, huh? <Laughs>

**Halla:** Yeah <laughs>. So I think the technology will continue to become transparent and taken for granted, but now because of this combination of all the sciences, we're in a position to do fabulous things; some of the things we're working on at National is MRI probes or things that you stick in a brain to look at a tumor, they are inefficient because of the noise on a cable.

**Fairbairn:** Mmm.

**Halla:** But we've—we had analog circuits where we could get 90,000 die on a wafer and so now you can embed the chip right in the needle that sticks and things like I said we were—National's

always been a leader in temp sensors because we have temp sensors that can detect a thousandth of a degree change. So one of our guys worked with Eli Lilly to put a matrix of temp sensors, 256 of them on a surface like this and use it to detect heart blockage. Why? Because if you're out in your backyard and watering and you have a spray nozzle, there's actually a temperature elevation at that nozzle where the water is compressed. Same thing with blockage in the heart; there's actually an increase in temperature so if there's blockage, you can get a picture of it without invasive, without running the tube up your thing, just using temp sensors. And these electric cars; when the batteries die, you're going to have to spend \$30,000 dollars to replace them all. That could be solved. Batteries die because of acceleration; we're letting them all run to nothing. But by combining super capacitors with batteries, you can trickle charge the capacitor which has an infinite number of life cycles and you can accelerate off of the capacitor and never go back to the battery for things that damage it and dramatically extend the—so all kinds of things. We were working with Lawrence Berkeley Labs. It turns out that cancer cells have a different fluid mass than healthy cells, so they can actually see cancer cells by using sonar to make the cells vibrate and the cancer cells would vibrate differently.

**Fairbairn:** Oh they have a different frequency than the normal cells.

**Halla:** Yeah and before he went off to be our Department of Energy Chairman; I guess he's resigned, Steve Chu; he's working with our guys to come up with a zapper, a cell zapper that's 1,000 amps over 1,000 volts times one ten thousandth of a second, so when you saw these cells wobbling, you could zap them with something that was clearly strong enough to kill them but not long enough in intensity to do damage.

**Fairbairn:** Mm-hm.

**Halla:** But you think about it, there's all these opportunities for medical and silicon and all the sciences to work together to do amazing things that will be taken for granted.

**Fairbairn:** Hmm. Great insights.

**Halla:** Yeah.

**Fairbairn:** Great insights.

**Halla:** My thoughts.

**Fairbairn:** Okay yeah take a look at your questions and see if there's anything else that probably didn't cover everything but...

**Halla:** No; and you know what? You asked me what I would tell somebody young.

**Fairbairn:** Yes.

**Halla:** That it's really a great feeling and a great thing to work for a living. We just went through an election where we found out that half the people don't believe that, but I tell you every day I drive by Home Depot and I see all these Hispanics out there trying to get hired to do manual labor and I'm inspired every time I see them; I'm just—I think, you know, these people don't have access to food stamps, a lot of them and they just want to work.

**Fairbairn:** They want to work, yeah.

**Halla:** And so working is a good thing and working hard is an even better thing for new employees in a job, I would say what I learned at Intel which is it does work when you are worried about the health of the company more than the health of your group or you and in those early days at Intel, we all focused on the stock price, intently <laughs> and everything we did, we wanted to make the stock price better and I think a lot of that comes with a small company.

**Fairbairn:** Yeah.

**Halla:** And the other thing I would say is, as a manager you should know that all your people, even if they're working for you, they're working for themselves. So their jobs need to somehow line up pretty well with what their personal interests are and so you spend time trying to find out what's important to somebody and if they say, "Eventually I want to be in finance," then let them have some exposure to finance. And the third thing is, no matter who you're working for, if they ask you to do something you think is unethical or it's just not right, you don't have to do it and eventually that person will get found out but don't do it because you work for them; you don't have that kind of responsibility.

**Fairbairn:** Don't get dragged down with them.

**Halla:** Yeah; right. But anyway. I just... I've had the most wonderful career, not because of anything I did, but it was always like somehow being in <laughs> exactly the right place <laughs> at exactly the right time. I mean to be able to work on machines that actually put a man in space

and then him walk on the surface of the moon and in those days we thought those machines <laughs> were incredibly complex.

**Fairbairn:** Yeah.

**Halla:** That was just exciting and then Intel for 14 years, people never stopped bouncing off walls or just being high energy, so anyway...

**Fairbairn:** Alright; well thank you for spending a couple hours with us and telling your story and I really appreciate it and think it was a great interview. Thank you very much.

**Halla:** My pleasure; thank you.

END OF INTERVIEW