VLSI Technology Oral History Panel

Jack Balletto, Douglas Fairbairn, Dan Floyd, Ken Goldman, Ron Kasper, and Gunnar Wetlesen

Moderated by:
Geri Hadley and Paula Jones

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Hadley: We're gathered here today to do an oral history on the founding years of VLSI Technology which was founded in 1980.

Balletto: Seventy-nine.

Hadley: Okay. It was founded in 1979 and we have the founders here and two of the earliest key employees, executive employees. And we're going to be discussing the founding years, the VC challenges, and early sales and businesses and setting up our fabs and we have quite a few things to cover. And let me just quickly introduce myself. I'm Geri Hadley. I was employee number 28 and ran marketing and corporate communications for the first 5.5 years. And sitting with me is Paula Jones also is going to be one of the co-interviewers. And Paula…

Jones: Hello. I took over Geri's job when she left for the next four years.

Hadley: And we'd like to get started and have each of the founders-- actually, let me say one more thing. VLSI was one of two startups in that period of time, LSI Logic and VLSI and they both were in a new area which ultimately became known as ASIC, application specific integrated circuits or semicustom. And they had different approaches to solving this but both came out of the gate doing pretty well. At VLSI we really did a lot of the things that set the stage for how integrated circuits are designed today. So it's an important interview and important history to be captured. And to better understand the semiconductor industry and systems and how they all came together. At this point, we would like to start with the introductions of the founder and we'll start with Gunnar Wetlesen on the far right.

Wetlesen: I thought I'd be last. Well, my background in semiconductors began with American Microsystems and I was there for approximately six years. And that was when I got to know my colleague Dan Floyd and we became part of the founding team of a company called Synertek and that's where we got to know Jack Balletto. So there's the connection that VLSI was the third semiconductor company that I was involved with. And my role was always in technology with a lot of that focused on the things related to memory development because that was so central to pushing our technology ahead in all of those companies. And since the VLSI I've been an under achiever. So I'll pass the mike.

Floyd: I'm Dan Floyd. Gunnar set the history back to AMI. But the three of us Gunnar, myself and Jack were together at Synertek along with Ron. And we grew that company very successfully and ended up selling it to Honeywell in 1978. And I left Synertek right after that. And Jack and Gunnar stayed for another three months or so?

Balletto: I would say about a year.

Floyd: About a year. And one day I got a phone call saying they were interested started another company so we all got together, again, to start VLSI. And we started work on that in 1979, I believe, early '79. And that was a challenging time because there was no money available and every venture capitalist said they were never going to ever fund another semiconductor company because they weren't needed. And so we were the icebreaking company for new funding of semiconductor companies. And right after we got funded there must have been ten within a couple of years. So we just opened the floodgates. VLSI, I had the memory products group which was ROMs and other types of products like that. And after we went public at VLSI in 1983 I ended up leaving there. Two startups in a row were a little bit too much. And after that I got involved in just some minor little products and turnarounds on other companies that were in trouble. And a whole series of bed and breakfast inns along the coast of California which is a little bit different. At VLSI we had all of these highly skilled technical people, Ph.D.'s and software development and everything else. And I got on the bed and breakfast business and it was minimum wage people.

Balletto: Well, you had the surf shop, remember that in Santa Cruz.

Floyd: Oh yeah. I forgot the surf shop.

Balletto: You better let Doug have a turn before it leads to surfing.

Floyd: But anyway, I did a lot of miscellaneous things and after we sold the inns I moved to Montana. So I'm living up there now.

Fairbairn: Okay. I'm Doug Fairbairn and I was not part of the first part of the group that came together. I joined them in the mid fundraising activity. My background was that Xerox Palo Alto Research Center where I was doing mainly systems engineering initially and I got involved with Carver Mead and Lynn Conway, in the development of the Mead/Conway IC or VLSI design methodology. And based on my background in that and systems I decided it was time to start a magazine so I got Xerox to help start a magazine called Lambda. In the process of doing the first issue I interviewed these three guys Jack, Gunnar, and Dan who were starting a new company that was dealing with the custom IC issues that we wanted the magazine to focus on. And so I did that in November of '79 and ended up joining them a couple of months later in January. So I then subsequently took on the responsibilities for design automation tools, eventually all of the ASIC design and the ASIC business. I stayed at VLSI for almost 11 years, left in 1990 to start another company Redwood Design Automation which is purely focused on software which was then bought by Cadence in 1994. So Jack, you're next.

Balletto: Yeah. I often wondered what would have happened at Fairchild if we had had Dan and Gunnar because one luxury at Synertek-- and Greg Spadea -- at both Synertek and VLSI was top notch wafer fab. And it's the first time after being in the industry for a long time, ten years before we had a fab area that I could trust. And so at VLSI we always had the lead-- we were like the lead dog among those

Alaskan sleds. We were always equal to or ahead of Intel, as a matter of fact, which makes it a lot easier on all of the design people and so on. So we did Synertek and before that Fairchild. As Dan said we sold Synertek to Honeywell. And by then Ron was over in London for Synertek. So I can't wait to hear some of those stories about Acorn and Arm because they used some of the Synertek products and they used some of the VLSI products. So the two companies in a row kind of helped launch a couple of things there. After Honeywell bought the company I stayed about a year. I went back to Minnesota with Bob Schreiner, the CEO for the first budgeting meeting. Because at Synertek all of the memories, all of the circuits have been designed with timeshare and terminals. And years before, people like Fairchild had IBM360 computers and automatic this and this and that. So we were finally going to get enough money to get our design guys at Synertek a mini computer. So they said, well, no you really can't buy that one because they're a Honeywell spinout and you have to buy one we have, or will have in about a year. So in the taxi on the way to the airport Schreiner was going like, "Well, I think it's probably time to start another one." And this was like death to us. I had all ready been talking to Dan and Gunnar so I'm looking straight ahead at the airport. It's like, I don't know, Bob, it's pretty expensive. So that's what did it for me. Got back and got with the guys, wrote up the plan, a lot of which was just what we were doing at Synertek, you know, customer-owned tooling is what we called it at Synertek, which is basically a foundry. How do you deal with other people's mask sets? So, we went out looking for money. Six months into it, it was obvious that unless we could show them how to design chips we were going to get nowhere with this foundry idea. And thus made it pretty easy to-- and we've been talking to Carver Mead along the way and he singled out Doug as the best cream of the crop out of PARC to come join us as a founder. Then not too far after the funding we had Ron come over early to try to learn what Doug was talking about because I couldn't follow it.

Kasper: I'm Ron Kasper. And I was vice president of sales at VLSI. But previous to that I'll give you a little background, I actually moved from Southern California to Northern California for TI, the systems group to open up their first sales office in Northern California. That wasn't the semiconductor group. That was the systems group. And then I went to work for Electronic Memories and Magnetics. That was my first experience with memories. They even had some solid state semiconductors plus rotating memories. And then I got married and we did about a year's sabbatical travel. And then I ran into this character next to me, Jack, who recruited me into Synertek. And when I went to work for Synertek the next thing I knew I was calling on Atari and two guys that you now know as Steve Wozniak and Steve Jobs. And we did the first design work for Apple, gave them their first line of credit, sold them the first read-only memories, designed in the 6500. And we did the same thing with Atari and I said, hey, this is not bad. At Atari on Friday afternoons they had a cold keg that everybody was invited to come over. And it was an interesting experience the first time we brought Apple into see Bob Schreiner at Synertek, Wozniak and Jobs especially showed up in sandals and Schreiner looked at them and go, "We're going to give these guys credit?"

Balletto: Don't think so.

Kasper: Little did we know. And according to Jack and everything else he did such a great job with those accounts that they had a guy that they had recruited to go to Europe to start European operations for Synertek. I think at the last minute he backed out. And so they said would you like to go and I went why not? So we went to Europe and lived in Europe for three years. Started with virtually no sales and grew it to quite a nice piece of business with the design center starting to do customer design for Synertek that was Honeywell. We were doing thermostats for them. We were doing a lot of business with all Olivetti which became-- Jack and I became very familiar with the Olivetti people which really then influenced how Olivetti came in and financed, helped finance VLSI. And in among all of that I was doing business with a company called Acorn. And Acorn was buying 6500s from Synertek. And when we started VLSI they became part of the group that started the ARM [Advanced RISC Machines] group. And we were part of the ARM group at VLSI along with Apple.

Balletto: Yeah. There are about two ARMs shipped in every smartphone that goes around the planet. If Intel's lucky they get one, probably a half.

Kasper: So when Jack started VLSI I was still in Europe with Synertek and he convinced me to come back. I kept asking him but Jack why do you need a sales guy? What is there to sell? What is there to sell?

Balletto: Smoke.

Kasper: And it was like smoke and mirrors, yes. He said come back. And I met this group and I really liked them but I said, Jack there's nothing to sell. I don't know what I'm going to do here. And low and behold we stared and we started selling the thin man, the stick man that was doing the circuit design, promoting this design technology. And I kept telling Jack, we need something else to really sell. And low and behold that's how the ROMs became part of this, but I'll stop there and let somebody else go on with the story. Good times, though.

Hadley: It seemed like this was a perfect storm at that time because technology and the market changes were all coming together. The computers were coming together, being developed that would help enable designing chips and the technology, the wafer technology and the design technology, it was all merging, finally at that time. And that was one of the reasons why from my perspective, why the company came together and could take off like it did. And could you just tell us a little bit about that?

Balletto: Well, I think you're right in the money. The need for a semiconductor company to be more responsive to its customers was becoming more and more critical. We had a situation with Hewlett-Packard, with HP, who was fighting it out with TI in the scientific calculator world. They were taking turns being number one. Big stakes. And they contracted with AMI to design the next generation. AMI designed them then they couldn't build them. So HP was losing ground like crazy. They come to Synertek we know

you guys used to work at AMI maybe you can figure this out. Again, Dan, Gunnar, Greg, turn the factory upside down to figure out how to make this mass set work which put HP back in the race against TI. Now, TI had their own chip capabilities. So not having a full integrated was pretty obvious. There's more to that story too.

Kasper: Yeah, there is.

Balletto: The next contract to come out of HP, who do they give to? AMI, again.

Kasper: But we got it back.

Balletto: Then Atari, the same thing. Atari had contracted the design of the Pong chip with a consultant shall we say from the mountains. And lucky for us he wasn't a very good designer because a lot of people tried to make yield with that mass set including Intel and so on and it came out junk. So, again, our guys--the last thing you want to do is mess around with your process, but we concluded this was going to be a real big market. So they did it again. And we were the only ones who could make the Pong chip for two years. So we had a free run with those guys, with Atari. And then they used our micro as Ron said. So the need was always. The missing link as we started talking to all of these customers about it, hey we're going to do the same thing. We're going to have a spectacular manufacturing capability. All you've got to do is learn how to design chips and they're all going where do I go? And at that time, as I recall there was a little place in Arizona called Integrated Circuit Engineering, which is real basic. You maybe could do a watch or something like that. It was real basic.

Fairbairn: If they were lucky.

Balletto: Yeah. So we were not going to get funded unless we could have figured out the part two to the puzzle. And so nobody doubted we could and did create and perfect the foundry industry starting way back at Synertek for that matter. And then when Doug and Carver and the Xerox PARC and the Caltech gang came in that really was the other piece that we needed to get funded.

Hadley: That's what opened the doors for you.

Balletto: Absolutely. Yeah.

Floyd: Well, it's an interesting side note on the HP thing the first circuit they brought to us was for a heart monitor. And the heart monitor used to flat line. It would overheat. And every time one would flat line the hospital would go crazy because they thought the patient was dead or dying. And Gunnar and his team

had a technology figured out to make it run real cool, the part run cool. So when his team came up with that and we integrated with their mass set, you know, we fixed their chip problem and all of a sudden, it didn't look like anybody was dying anymore.

<group laughter>

Balletto: It cost them a lot of money to keep those people alive like that.

Floyd: They had to repair each one of those.

Fairbairn: So getting back to trying to put together a team that would justify the financing Carver Mead had said you ought to go talk to these guys, you know, they were down in Los Gatos and Dan, Gunnar and Jack. And it would make a good story for the magazine. And I think he was actually just sort of setting me up to get introduced to them as a potential employee. And so what I was doing at Xerox PARC, you know, fed exactly into the need that they had in terms of being able to generate an army of designers out there. It would prove to take a little while to do that, but in the end we were very successful. I think there was an interesting dynamics there in terms of just that whole startup period, it took what 15 months from when you wrote the business plan. So I think maybe talking a little bit about that would be…

Hadley: And how long before you joined?

Fairbairn: Well, the first business plan I saw the date was September '79. I don't know if you had something before that.

Balletto: Yeah.

Fairbairn: I joined, basically, 4 months later in January of 1980. And we raised the money a year later, December of 1980. So it still took a year to do it. But Jack, why don't you talk about sort of the initial strategy in terms of going after OEMs and that kind of thing.

Balletto: Yeah, you know, a month into it we thought it was all funded. We had a letter of intent with Olivetti, the same Olivetti that we got to know so well at Synertek. And Elserino Piol, the number two man, came over. He smoked those Italian cigars that would put you in the hospital if you sat next to him. So he wrote out a letter of intent, that we're going to do the whole thing. And he goes back to Olivetti. Gee, the ink's barely dry in the business plan and we're all set. He sends back probably a fax, I guess, in those days, that says everything's off, a French company had bought 25 percent of Olivetti while he was gone. Saint Gobain I think it was called. Everything went on hold. Everything goes on hold. So he just bowed

out. And then it took us another year, year-and-a-half to get the funding. We had been turned down twice by Hambrecht & Quist, pretty much everybody.

Hadley: And Sequoia.

Balletto: Sequoia, all of the guys.

Hadley: All of the big ones. Kleiner.

Balletto: Jerry Sanders had that thing like real men have fabs. That was starting to become popular. Foundries will never make any sense. Now, I had met Carver actually at Synertek. And part of the reason that when I had that, we had the bad meeting with Honeywell on the budget I was still at Synertek, I had been meeting with Carver up at Rosatti's [a beer pub in Portola Valley] and chit chatting about just how big do you think this foundry-- how many systems engineers can we really convert? And of course, knowing Carver it was hundreds of thousands, immediately. So I was sold on that. But actually, we didn't get funded until there came a time when Carver who was, I think, the first computer science professor at Caltech working for Ivan Sutherland who started the computer science department at Caltech. So Ivan convinced Dave Evans his old co-founder of Evans and Sutherland Computer Corp at one of the board meetings that Dave Evans should look at what we were talking about to cut the cost of his simulation computers, aircraft simulators pretty much. And Hambrecht's on the board. And Hambrecht's like, "What are you guys talking about?" So he didn't even know his troops at H&Q had turned us down twice. So they convinced Bill. Then Bill got a hold of us and he convinced Kleiner Perkins. So we ended up with Kleiner Perkins, Venrock, H&Q, Advanced Technology Veterans, where Ivan Sutherland was a partner and another one I can't remember. But it took that circuitous route because we told the story but it's like cross eyed, what are you talking about? The industry has to be totally vertically integrated. He can't separate design and fab. They have to be in the same cubical which was in the early days, the sixties and seventies. It was really needed because you were adjusting things on the fly.

Hadley: It was a new concept at the time too.

Fairbairn: Yeah. I think the funding of VLSI convinced me that the stories about venture capitalists being lemmings was really a true story, because it really happened as Jack said. All of the VC's had turned us down and then Dave Evans says okay I'm ready to go. If Dave says it's okay, then Bill Hambrecht says it's okay. If Bill Hambrecht says it's okay then every VC in the world wanted to be a part of the deal.

Balletto: And everybody in the queue like LSI, they were a month behind us. So we got funded, so they got funded. So Daisy got funded. And everybody that was necessary to make this whole disintermediation possible got funded.

Hadley: The VC's started understanding the scope of what was happening.

Balletto: Yeah, once they bought into it they said, well, we better fund everybody because it's hard to tell who the winner is going to be in this new sector. I think half the market is probably traceable to foundry if you add up all of the money.

Fairbairn: But there are some important things that happened even before the funding. I mean there was a year after I joined, before the money came in and so the question is, other than going and talking to potential financiers what are we all doing? And so one of the things that I did was I was continuing to work on this magazine which I had started at Xerox. And I also started teaching a course in VLSI design at Hewlett-Packard and created a set of videotapes on IC design which we subsequently used at VLSI. And, I guess, Dan and Gunnar were off doing other things at that time.

Wetlesen: We had a technology consulting agreement with GE to help them with their new fab that they were building. And that helped keep the lights on so to speak because during that period from '79 until '81 obviously nobody was drawing a salary but we also had all of the expenses of running a startup operation in the sense of trying to do fundraising and flying all over the country. You didn't mention Art Rock [ph?] amongst the guys that we also pitched.

Balletto: Well, the one that really paid off was the contract, the fab contract with Ricoh to help bring up their foundry in Osaka. Earlier, back at Synertek, they were getting stiffed by AMI. Nobody would pay attention to Ricoh so they couldn't get on the priority list to get delivery of anything. So they concluded pretty quick they had to do their own. That's why they almost bankrolled Synertek. And then when they read that we were doing VLSI they got a hold of me and we contracted with them. And ended up just helping them design that fab area in Osaka which proved out to be…

Kasper: And their first customer.

Balletto: And yeah, we'll get into that later. But thank God we did that fab area because otherwise the order Ron got which we'll talk about later, I don't know where we would have built it.

Kasper: Right.

Hadley: In addition to the traditional VC's, VLSI took some very interesting approaches to financing. And there was Bendix and that happened, I believe, in '82 as I recall. And then Olivetti came back in the fold and then GE came to us but that's another story.

Balletto: That was GE Capital.

Hadley: GE Capital.

Balletto: Yeah, Bendix is one of those companies and they were really small. Yeah, they really couldn't get-- nobody would talk to Bendix. Most of their applications were military. It would be like 1,000 pieces. I mean it would be like $1 million a piece but still nobody wanted to do it. So we were talking to them. And they eventually basically co-signed a loan for us to buy the fab equipment, $20 million, $25 million something like that. And QT Wiles was the chairman at that time. And he taught me a trick I had never heard of. So Bendix-- we wanted $3 million besides. And they said we don't want to invest in a small company because small companies sue us. So we've got to figure out some other way to do it. So QT came up with this trick: they buy a CMOS process from us for $3 million. It's the book. And then they still co-signed the loan, which is all we really wanted. We wanted that plus $3 million but we gave them warrants. So with warrants they don't have any liability as long as it's warrants. So Gunnar had to sit with somebody for about a week and type up this big thick CMOS, latest, greatest CMOS process book. So they gave us the three million dollars. I never thought of it, but that's one tick that QT had up his sleeve.

Wetlesen: They also helped support some of Doug's efforts, too, didn't they? Didn't we have a development contract with them?

Balletto: With Bendix? I don't know.

Fairbairn: I remember something, but I don't remember doing any business to them. Olivetti and Evans and Sutherland who had put in 3 million of the initial 10 million wanted to get all of their design engineers trained in VLSI design. So for the first several months when VLSI was just getting started after funding, I commuted to Salt Lake City and taught a series of courses there to get their designers up to speed on how to use the technology and this new foundry that was being built at VLSI.

Hadley: So at VLSI you had to be very creative and clever in your business arrangements. And it wasn't like a traditional semiconductor company that designed standard products and sometimes they worked closely with customers on them but sometimes they didn't. I mean you had a much closer relationship. And often, the relationships were quite different with your customers, some were like partners, some were like customers, some were investor customers. It was a new business model, almost at that time. Is that a correct assessment?

Balletto: I guess it was a lot like the regular. There was a lot of custom business went on back in the sixties and seventies. I mean Intel's micros are mostly derived from custom contracts they had with Datapoint and Busicom. So there was a lot of that. I mean the early days where we insisted Bendix also give us 3 million in cash and all we ever guaranteed them is they could get 10 percent of our fab capacity

if they gave us 6 months' notice. So that's like not giving away too much because 6 months' notice you can ramp up 10 percent any time.

Floyd: There were some interesting relationships along the way though. I'm going to jump ahead to the Ricoh scenario that we went through.

Balletto: Oh, sure.

Floyd: We decided we needed a ROM design; we needed to get a foundry to build them for us because we didn't have a wafer fab area. And Jack happened to have worked for the president of Ricoh.

Balletto: Yeah.

Floyd: And so we knew they had the fab area and we had worked with them before. So we had a meeting with Ricoh. Jack and I went over to Osaka.

Balletto: Yeah.

Floyd: We had this meeting with their technology people and the president of Ricoh trying to hammer out a deal. And we ended up with a technology agreement where they would build wafers for us at certain prices, that kind of thing in the capacity. And we were sitting in an amphitheater. It was a table like this and there was this huge amphitheater just filled with people. There must have been 100 people in this room that were quality people and engineers and just general observers.

Balletto: Ricoh is like the Xerox of Japan. And so what are they doing messing with this little dinky startup.

Floyd: Anyway, we go through this whole agreement. We work it out.

Fairbairn: In front of 100 people.

Floyd: In front of 100 people.

Hadley: Why were there 100…

Balletto: It was more like a food fight when they we were working it out. They're yelling at each other.

Floyd: Well, the end of it though was the finance guy gets up and asks Jack how are you going to pay for this? And Jack said, "Ninety-day terms because we don't have any money." And you could see everybody's jaw just drop.

Balletto: A lot of hissing.

Floyd: Anyway, we argued back and forth for a few minutes and I don't remember what we ended up saying we would do but we got our 90-day terms. And what happened is right at the end of it everybody turned around and the president of Ricoh is sitting way up at the top there and you could hear the eyeballs clicked because they all turned around and looked at him. And he looked at him and did this <nods head> it was yes and he approved the deal.

Balletto: It was like one of those Japanese movies.

Hadley: A Kurosawa set.

Floyd: It was amazing because I'm sitting there and couldn't believe what happened.

Balletto: You see those samurai movies, argh.

Floyd: But the follow-on to that was even more intriguing about what, three months later the Ricoh guy from San Francisco came into your office. And this guy brought a contract, I swear to God it was two inches thick. And he brings it in and wants Jack to sign this contract. And Jack takes a look at it and throws it in the waste basket and says we have a deal. We don't need a contract. And this guy about fell through the floor too. It was so funny to watch them react.

Jones: I have a question. And that is what made you decide to do ROMs in the first place?

Kasper: We needed business. The thin man wasn't getting fat enough quick enough and so not enough revenue was coming in.

Balletto: No, ROMs were always in the first plan.

Kasper: And we needed something to tweak the process.

Balletto: Yeah, drive the process.

Kasper: So that's how the whole concept came about.

Wetlesen: Yeah, I think we can speak to that a little bit that if you look at the family tree, if you will, of technologies and how in the beginning even if you go back far enough, even DRAMs were made with a process that could accommodate logic chips. As time went on there was divergence. And so DRAMs went down a technology path. Static RAMs went down a technology path. And eventually ROMs became EPROMs and things and different technology paths. But the mass programmed ROMs that we were very good at because when you're small, you're agile. One of our things built into the plan too was quick turnaround, right, as kind of an ethic, if you will, part of the company culture and a deliberate way in which to build the manufacturing facility with the capacity that would allow that kind of quick turnaround. The mass programmed ROMs turned out to be a very, very close match to the requirements for the kind of advanced logic chips that could be developed using the suite of design tools which Doug and his merry men were developing. And Greg and Miin Wu, I'm talking about Greg Spadea who headed up our process development technology effort, they built a set of scalable rules so there could be almost a factor of ten reduction in the dimensions all within a common set of design elements. So once the standard cells were developed and modeled and that would be part of the turnkey solution for using the advanced design tools, that that set of cells would go through generations of future products. And Greg had a wonderful background in CMOS which was essential to that.

Fairbairn: So just to reiterate when I joined the company, ROMs were clearly a part of the product line and part of the strategy of the company to do those two things generate early sales and to provide a technology base on which we could build the logic products. And there is no doubt that the work that I was responsible for in terms of developing design tools and educating people in design was a long lead time kind of business. We were developing tools that hadn't been developed before. We were educating people that didn't have any idea about IC design and so forth. And then you have the whole process of actually doing the design itself. So there was clearly-- it was an exciting, tantalizing aspect of the company in terms of what it could eventually be and what could carry it in the long term. But it was clear to everybody from the very beginning that we needed a technology driver and a revenue driver to provide a sort of base level capability. And I think switching to the story of the ROMs and where that early business came from is one of the most interesting parts of the whole thing.

Hadley: Phil Siu played a very big role and his design team in the ROMs, also, and when he did join the company? And where did he come from?

Floyd: They're all ex- Synertek aren't they?

Balletto: Oh yeah, the whole ROM gang was ex- Synertek.

Kasper: They all did ROMs at Synertek. It was all ex- Synertek.

Hadley: They were there by the time I arrived as I recall in late ’81.

Balletto: There’s a story about Phil. Thanksgiving Day of ’81 we all took the day off. We were in the Granger building at the time subleasing. So we’re at home carving the turkey and we get a call from the Santa Clara P.D. they’ve arrested a bunch of Chinese guys that had broken into the Granger building and they’re claiming that they’re working. So I had to go down. There they were. They were our Chinese engineers anyway, probably all of our engineers. These guys just worked. I mean you can’t count the number of hours per day that these guys put in and as a matter of fact they still do. It’s just incredible. But getting all of that done one time certainly saved the day because later-- we kept Ron caged up like a tiger at the zoo. No meat yet, no meat, no meat yet. Okay, now we got it Ron. Once we cut him loose…

Hadley: So the first ROM was designed wasn’t it like late ‘81. I recall a party when we celebrated that.

Balletto: Yeah.

Kasper: I don’t remember that.

Balletto: It could be.

Kasper: I remember just having a two-page data sheet.

Fairbairn: Ron, you were selling ROMs before there was a design.

Kasper: Exactly, even before the design.

Fairbairn: No need to actually have the product before you sell it.

Kasper: We didn’t even have the product. The gentleman that we ended up hiring later on Mac Wilson in a passing conversation mentioned that a company was looking to buy a lot of ROMs and wanted a new supplier and that was Mattel. And Mattel was going to go into the cartridge business, very similar to what Atari was doing. And that’s how this whole ROM business started at VLSI. Should I continue on with the story?

Fairbairn: Yeah, absolutely.

Hadley: Oh yeah.

Kasper: Well, it's an interesting story. So I convinced I believe Phil Siu and his group to come up with a two-page data sheet. And I went down to Mattel and they refused to see me. So I ended up spending all day in the lobby…

Balletto: Well, you were in the wrong building for one thing.

Kasper: Probably the wrong building to start off, but ultimately ended up getting to the right building, getting to know all of the admin people and the receptionist who after the second day when I was there started to feel a little bad for me. And somewhere around two o'clock that following day, the second day I was there, the operations manager was in, she had me sitting out in front of the office where he was residing. And she says, "Okay, Ron, go into the office right now, tell him why you're here." And that's how I went in. He gave me ten minutes. I threw down the data sheet. I said, we're a ROM suppler. We've got exactly the product that you want. And ten days later they came up and visited us.

Hadley: That was quite a story because you were in the Granger building.

Kasper: We used the Granger building. And they thought we were much bigger…

Fairbairn: The Granger building is just a random office building in Silicon Valley. It's nothing…

Kasper: But we were sharing office space. We had what, a couple hundred square feet.

Balletto: Yeah. But it looked like we owned the whole place.

Kasper: We had a cafeteria. And there were a lot of employees, full parking lot. So whenever they arrived they never even saw Granger, they just saw VLSI and they went wow, this is a big company. And they were really impressed.

Fairbairn: When was this?

Kasper: This was…

Balletto: Early '82.

Kasper: Yeah, early ’82. Yeah.

Balletto: So I kept hiding. I didn’t want to have to sit down and tell the truth to this guy. He keeps going, he’s here someplace, I don’t know where he is.

Hadley: Is that when you had the VP of purchasing up?

Balletto: Yeah.

Kasper: That’s when we had the VP of purchasing up, yeah.

Balletto: They had this guy spun around. What was the size of that first order, $18, $19 million, $20 million.

Kasper: I don’t know if that was large but it was at least $10 million. And it became-- it just continued to grow.

Balletto: We shipped $20 million the first year. The first 8 months we shipped $20 million.

Hadley: Which was remarkable. Wasn’t that the fastest growth for a semiconductor company?

Balletto: The ROM wasn’t even a prototype yet, was it Dan?

Floyd: No.

Balletto: And beside that, Mattel had a little real thin cartridge. So he had to invent a new package for the ROM otherwise it wouldn’t fit into the slot.

Hadley: How did that all come together?

Balletto: Well, Dan, Gunnar.

Hadley: Dan.

Floyd: It was Gunnar who was there all of the time.

Wetlesen: I can't speak to the package. You've got to help me here.

Fairbairn: What about the ROM itself? Do you remember anything about the time frame of that?

Wetlesen: Well, Mark Ebel was the chief designer on the 32K which was the first one. And as he said, he made the design, the most robust it could be in terms of operating margins. So therefore it was very high yield and insensitive to what we went on in Ricoh in terms of compatibility with their process and later what our own process technology.

Floyd: I think those are the wafers that you brought back from Ricoh weren't they?

Greg Spadea: <off camera> Yes.

Balletto: Is that right, Greg? You were there.

Greg Spadea: <off camera> <inaudible>.

Fairbairn: So we took an order before the ROMs were designed. Once the ROMs were designed, we put them into a fab that…

Kasper: We were the first customer.

Fairbairn: …we were the first customer of. And we ended up…

Balletto: Invented a package.

Fairbairn: …and invented a package that didn't exist before.

Hadley: Wasn't the slot that it was going into a different size than what you had originally understood.

Balletto: Different than the Atari slot. Yeah, it was like half-height. So we had to invent a way to recess the die and then put polyimide over the top so it wouldn't contaminate.

Fairbairn: So Dan, was your group responsible for the packaging and getting that done?

Floyd: I think a big part of it. I think Gunnar's group, though, came up with the polyimide, right.

Wetlesen: Well, we had some things related to being compatible with that in terms of surface passivation and the way in which the scribe line could be protected so we didn't have migration into the edge of the die. There were a lot of different nooks and crannies to this any time you make a leap like that. I didn't have any direct involvement with the package development. That must have been under Howard [Robinson].

Floyd: That was under Howard.

Balletto: I think he reported to one of you.

Hadley: He what?

Balletto: Anyway, in 9 month's flat, we shipped $20 million worth of product in 9 month's flat from the start to the last shipment.

Kasper: And you did 90-day terms and we were getting paid in 10.

Balletto: Yeah, that flipped the cash flow I think 4 million or $5 million.

Floyd: Ken's good negotiating here. But we did design work in San Jose. We had the wafers built in Japan at Ricoh. And wafers tested in Japan. Shipped them over to Korea where they cut up the wafers, packaged them, tested them and then shipped them out from there. Well, most of the Apple ones went to Singapore. I don't know where the Mattel ones went, I don't remember. Where did we ship Mattel?

Kasper: Mattel, I think the final product was going to the Far East. It was going to Hong Kong, I believe.

Floyd: Yeah, so we had this virtual company. We needed a lot of logistics.

Hadley: A lot of frequent flier miles.

Balletto: Oh yeah.

Floyd: We were sending people all over.

Balletto: Our guys lived on 747s there for about nine months, carrying wafer samples for the customs guy. That's a lot of samples.

Floyd: Ray Mak, Larry Lo, Phil Siu.

Kasper: And Howard.

Floyd: And Howard Robinson.

Hadley: Ron, just brought up Apple. Apple was also an early customer.

Balletto: Yeah. There was a point where we-- we had done a lot of work with Steve [Jobs]. As a matter of fact, when Steve Jobs quit Atari, the first meeting we had was 20 minutes after he quit. He was in my office at Synertek to talk about this new company. He was going to dos it with this buddy Wozniak who was still working at HP. And Al Alcorn had called over to say this young kid was coming over and we should really talk to him because he was pretty smart. I said, you don't have to call me, I mean, we talk to anybody. He says, "Well, you're going to want to-- you're going to tell the secretary at the front desk there because the guy's got the saffron robes and the hair." You couldn't tell the last time he showered. So anyway, we went way back to Steve that far. So then we're off. We hadn't seen him probably in two years or three years. And on the cover of electronic design magazine here's Steve got an interview about Apple and here's the Mead/Conway book on his desk.

Fairbairn: In the photograph.

Balletto: In the photograph on the cover. So I give Steve a call. He said, "You guys doing that?" Absolutely, we are. So that kind of got it going but then we started hiring people from Xerox PARC because Doug knew all of the good engineers over there. So we're kind of taking turns. And then a day comes where Steve calls up and says-- because we kept raising the price for this one chap, a really good one. And Jobs calls up and he says, "You know, if you keep this going we're never going to buy any silicon from you guys ever."

Fairbairn: We had a bidding war over an engineer that Apple was trying to hire and we were trying to hire. And so Jack said we had to give up and let Jobs win that one.

Balletto: The guy never knows he got auctioned off for a bunch of ROMs.

Hadley: So then there were some chips that we were designing for Apple. There was Bagpipe and I know there are some very rich stories around that design.

Fairbairn: Right. So in 1982 when the ROM guys were doing their magic and generating all of this revenue, Jobs put a challenge down to us to design a chip that would integrate all of the random logic in the yet to be announced Macintosh. So this is 1982. The Mac didn't appear until '84, but actually at that time their goal was to announce it in early '83. And so this was in less than a year when he came to us and said, you know, if you guys can design a chip that will integrate with all of this logic we'll put it into the first Macintosh. And it turns out that their real goal was they couldn't meet some of the critical display spec's with their random logic solution. And so they really wanted to have a custom logic solution that would meet these display specs as well as reduce the cost and profile of the machine. And we said, sure, we can do that. And just like Ron said, sure we can do that. Of course, he didn't have the ROMs and we didn't have the tool but we were going to go do it anyway. And so we put together a team combining a couple of engineers from Apple as well as a number of people at VLSI. And as these things go perhaps different than ROMs like they had done before it's bigger and harder and takes longer and the tools are more complicated than you think and so forth. So the chip ended up taking longer to do. And in the process of somewhere along the way it turns out Apple had figured out how to achieve their display performance specifications without this custom chip. So they were thinking okay we really don't need this custom chip. We can do what we need to do. The price reduction issue is not a major piece. So as we were sort of finishing this chip up they had all ready made the decision that no we aren't going to go that way anyway. Well, they didn't tell us that. And we finished the chip. And so the good news, bad news is the chip functionally worked. It did have a performance issue that could have been fixed within a very quick time, a couple of weeks turnaround for mass and a couple of weeks for fab and we probably could have had an operational chip. But by then Apple had decided that they were going to go a standard logic solution. So that was a major blow to all of us. We had invested a huge amount of time and effort, a lot of late nights and weekends to do this. And it was one of those bets that was probably worthwhile. If we had been able to get a custom chip to integrate the first Mac it would have had a huge impact not only on Apple and future generations of Macintosh but also on people designing similar types of machines in the future and the use of custom logic in that. But it didn't work out. They went ahead with their standard solution. The good news is that Apple came back and became a major customer of us for custom chips for a number of different products, their printers, computers and other things along the way. So Apple did end up being a major customer of ours. And there's a famous story about Jobs' interactions with VLSI and some famous sales meeting in which he called our sales force or whoever was in the room some profane names and basically threatened to never do business with us unless we delivered these products on time. And I think we actually figured out how to do all of that and get those products on time. But we certainly got to experience all of the good and the bad of Steve Jobs.

Kasper: We did.

Fairbairn: But we ended up making a lot of money from ROMs and custom chips off of Apple. They were certainly an elite customer of ours for a number of years.

Kasper: Yeah, and in the meantime we designed the ROMs into Coleco which was another game company. I remember flying back with a couple of Cabbage Patch dolls for Valerie, I think.

Hadley: Yeah, it was. I do.

Kasper: And somebody on the airplane knew I had them and it was like man they were going to hold me ransom to get the Cabbage Patch dolls. You couldn't get them anywhere. And we did ROMs for another company that maybe many of you don't remember it, remember Kurzweil and he did the first electronic piano. He did it for Stevie Wonder. I think we had 64 sets of 32K ROMs in that first piano. And we had to deliver them all at exact sets to meet that specification of that. And that was an interesting piece of business also that we got a lot of publicity out of it back in those days.

Balletto: Coleco, I remember jumping ahead a little bit, Ron and I were at Coleco the day we had the IPO.

Kasper: Yeah, they're all celebrating with champagne.

Balletto: We called back in because of rain, thunderstorm. We're at the airport in Hartford which is like an old Quonset Hut from World War II, shattering. You know, you can hear the thunder knocking down the walls. We're on the payphone. Everybody champagne hey, we're out there the plane takes off.

Kasper: A little plane, too.

Balletto: A little plane. We're going to die for sure. It was pointed down for the 45 minutes it took to get Boston but somehow we made it. But I'll never go back to Hartford again.

Kasper: But I did many times.

Balletto: You did. You're good at that.

Fairbairn: So that was 1982. As well as the Apple project there were a number of other companies that we were starting to gage with in terms of teaching VLSI courses, getting people started in custom IC design. And then the ROM business just exploded.

Kasper: When did we start with Olivetti? When did Olivetti come in start designing? That's another interesting story.

Fairbairn: It must have been in ’82 as well.

Balletto: I think we got the contract in ’81 but I think they started the design centers it might have been ’82. The design centers, I think, started in ’82.

Hadley: So at that time I believe it was ’82 we bought our first VAX for doing the design.

Fairbairn: No, we couldn’t do anything in the design tools until we had a VAX. So we actually purchased it as soon as we got funding in December of ‘80, you know, as soon as January of ’81 we were out purchasing a VAX.

Hadley: And what was the first, wasn’t it?

Fairbairn: No, it wasn’t the first VAX.

Hadley: No, but first company to use it for doing design tools?

Fairbairn: It was probably the first one for doing it for design-- for that level of design tools. People had been using it for simulation. So yeah, we had to get a special room built. We had to get it installed. We got all of the-- we were starting to hire engineers. I guess we were doing time sharing work until we could get our own VAX installed. But basically during ’81 we were in the process of developing design tools and teaching design courses and really weren’t generating a lot of revenue other than from the design courses. And selling the videotapes. We were selling the videotapes that we made at Hewlett-Packard. That actually was a nice little side business.

Hadley: Debbie used to manage that.

Fairbairn: Yeah, Debbie Hungerford. And then by 1982 things really got cooking. You know, the ROMs were in production. We were starting to do some serious designs on the design tools. And so the activity really picked up during 1982.

Hadley: Can you tell us more about the design tools because you took a different approach and some of the team that you had I mean Steve Trimberger. and there was a whole bunch of the guys…

Balletto: Different than LSI you mean?

Hadley: Totally different. They were doing ones and zeros still. And you were going into the whole new methodology of design methodology.

Fairbairn: Yeah, we were starting from scratch in terms of developing a whole new family of tools that hadn't been done before that were more well-suited to what had been called the VLSI or Mead/Conway design methodology. And that was a methodology really focused on sort of top down design, architecturally driven design. That is systems engineers envisioning what they really wanted to do from a functional point of view. And then looking for the most efficient ways to map those into silicon circuits as opposed to starting from the bottom's up developing gate level kind of components. So we were developing a lot of parameterized sort of miniature silicon compilers, ROM generators, RAM generators, data path generators, other things that could be used to generate major sections of the lab as well as developing tools that could be used in a more standard cell kind of approach for random logic kinds of things. We were doing place and route tools. We had taken on a huge challenge in terms of having to develop a whole family of tools using a methodology that had never really been tried out before. So it was a challenge. Where LSI Logic and many others were focused in the gate array [ph?] business and using more traditional design methods and traditional design tools and they were quite successful using that path too. It was a quicker start up path. They didn't have to teach people how to do the design, really. They could use the methodology they were familiar with. And so people who really just wanted to integrate random logic that was an effective way to do it. For people who wanted to architecturally driven design and really do fundamentally new stuff, then they wanted to use an approach such as what we did.

Hadley: Wasn't that when you started getting the system designers more involved and actually in the chip design and the system was starting to go on to the chip.

Fairbairn: Right. So that was the whole strategy was to take the-- to teach system designers enough about IC design so that they could actually sort of be tall, thin men as we called them, that is that they could cover this whole spectrum from system design down to physical design. And there were some who could literally span that whole gamut. There were others who could fit better into one part of that or one phase of the design or the other. But it really did have a revolutionary impact on really what was happening in the IC industry. And I think a couple of examples really tell that and think even before VLSI was formed, a well-known entrepreneur named Jim Clark used the design tools we developed at Xerox PARC to generate-- to create the first silicon geometry engine which became the founding chip or the starting chip for Silicon Graphics which is major company in the graphics business. And he used that methodology and that approach to essentially get that company off the ground. The work that was done at Stanford, Berkeley and eventually at ARM in terms of risk processors all of those designs were done using Mead/Conway methodology and Mead/Conway educated people looking at how can we can create a computer architecture which is more efficient and is mappable into silicon in a much more efficient way. So that's just two examples in terms of how this methodology and getting engineers engaged in the whole IC design process fundamentally changed the path of what was happening in the systems business. We got risk computers. We got integrated graphics kinds of technology. A lot of the early telecom companies came to us to start integrating their work. And so there are a lot of these new companies developing very

complex systems that use this technology in one form or another, or use the people who had been educated in that to create the systems which revolutionized the business in the nineties and the twenty-first century.

Hadley: And Lynn Conway was teaching courses…

<clip change at 0:58:36> <Ken Goldman added to the panel on screen left end next to Ron Kasper>

Fairbairn: Okay. So the whole Mead/Conway design methodology had really started at Xerox. It got its name from Lynn Conway and Carver Mead who collaborated to write the book "Introduction to VLSI Systems". That happened in 1978 after Carver had taught a course on VLSI design at Xerox in '76. So we had worked together for a couple of years and eventually decided that we needed a book to kind of help propagate this new approach to IC design. So Carver and Lynn collaborated to do this book. And in order to sort of prove it all out in the fall of '79 Lynn took a leave and went to MIT to teach a course based on this book to students at MIT including some of the professors that were there sat in on the course. And so Lynn is a sort of very exacting person and so she kept perfect lecture notes of every lecture she had. And had her students design chips which were later fabbed to prove the efficacy of the process. And so she came back from this one quarter course at MIT with some working chips a set of lecture notes that told anybody who wanted to teach this course, what you said on what day, a book that was newly printed by McGraw-Hill, I think, and then some videotapes that we had created along the way as well. And it turns out this technology was one that excited a lot of other people. And so first we started with universities nearby such as Stanford and Berkeley. Professors from there would come and sort of pick up this package that Lynn had created and sit with us and sort of get indoctrinated. And then take it back and with these lecture notes and book teach a course on VLSI design. And so within a couple of years Lynn sent this package out to, I think, over 200 universities around the world. And as a result, there were thousands of engineers being educated in the early eighties in this methodology from every significant university in the United States as well as many foreign universities. And through this incredible technology transfer mechanism there was a huge amount of activity and a huge amount of interest that got generated. And VLSI eventually was able to ride that wave. As I said earlier, it took a while to kind of get that going. And so having the ROM business early on to create a basis of revenue was a critical part of VLSI's financial and overall corporate success. So I think we want to sort of move on to the 1982, we were doing the bagpipe chip. We were generating all of this ROM business. And I'm going to turn it back to Jack to kind of sort of tell that…

Balletto: Well, we got funded on December 12 of 1980. And we had insisted on $10 million up front this time having done Synertek 7 years earlier with only $750,000 to go compete with Intel and people like that. That was pretty hard. And so this time we wanted to overkill it and go for the 10 million which we did. And it came in December of '80. And I remember the first board meeting, probably December 13 and I suggested-- I don't think we needed a CFO for quite a while because not much is going to happen for at least a year. So they said, why don't you get one tomorrow, since none of us had really managed that

kind of money before. So we put out the feelers and actually I think it was a friend of Dan's, Alan Gregory, who suggested that a young guy who used to work for him at Fairchild and he kind of lost of track of him but he knew he was over at Memorex, now, a guy named Ken Goldman. So somehow we ended up getting Ken's phone number. And got a hold of him.

Ken Goldman: That was before e-mail and cell phones.

Balletto: Or anything. So we had a keep meeting with Ken, a cup of coffee. In the meeting I was talking about how these startups are so hard. You really can't have people join you if they have any kind of marital problems at all because the stress will just break up a marriage. And why would I want to do that? So he's over there going, I couldn't agree more. He's saying, I can imagine how hard they are. So he invited me to a Christmas party at his house just to show how solid his whole thing. So the wife and I went there, Marny and I went there. Wow, look at this, this is a very happy party, everybody is smiling and good. So that's a checklist we don't have to worry about that for Ken. I find out years later he was living at the Oakwood Apartments the whole time. His whole party must have been hired actors.

Goldman: Nice house wasn't it?

Balletto: It was a nice house.

Hadley: I want to know who's house it was.

Goldman: Well, it doesn't matter because Highway 85 went on top of it.

Balletto: They crushed it.

Goldman: Yeah, they crushed it. It was behind the golf range, driving range.

Kasper: I remember being at a couple of parties there.

Goldman: Oh, you went to a couple of parties?

Kasper: Yes.

Goldman: It turns out it was bulldozed.

Balletto: Yeah, well, lucky for us we didn't go with the checklist.

Kasper: We didn't follow it intently.

Balletto: Yeah, Kenny turned out to be a whiz bang guy as we all know.

Fairbairn: So when did he join?

Balletto: Were you employee number seven or six?

Goldman: I was number seven. We talked, you're right, in December of '80. I joined in March of '81.

Balletto: Had to do the payroll on a touch-tone phone as I recall. We didn't have our computers yet.

Goldman: Well, if you want to go there, yeah, the old days were quite different. We used 17, 18 columns, not spreadsheets even, green paper. That's how we did our accounting. I did all of the accounting. I did the payroll. It was actually very good because the best way to learn is do it yourself. So you did the payroll. You did accounts payable. I did the general ledger. Involved in hiring, not necessarily hiring, but involved in hiring every single employee. You ever talk about the Mark Ebel story?

Balletto: No, I don't know it. I'm not familiar with it.

Goldman: It's a great story.

Fairbairn: Mark Ebel was one of the ROM designers. We mentioned.

<overlapping conversation>

Goldman: A critical guy. He worked for Phil Siu But he was early on and I was involved-- all of the jobs I had one of which was HR, human resources. So Mark we tried to hire from National Semi. So he comes over he says, "I'm all in. Yeah, I accept, I handshake, I sign." He goes back to National, they convince him Mark you can't leave, you've got to stay, you've got to stay. So he calls me up and says, "Sorry, I can't come." I say, Mark, come on, let's try one more time. I come over, we did a little extra, come on Mark and he signs again, "Yeah, man, I'm all in." He goes back there and they convinced him again. So I don't know if you all remember this so he comes back one last time and I said, Mark, we're done with this. Give

me your badge. I took his badge and we were done. He never went back. True story. I took his badge and he never went back and that's how we got Mark Ebel.

Kasper: Threw that in the trash can.

Fairbairn: Without Mark we wouldn't have had the 32K ROM.

<overlapping conversation>

Goldman: He was our number two designer after Phil, right.

Balletto: I think Phil would say he's probably the cream of the crop.

Wetlesen: Well, on the memory side we had Bill Smithson who was the logic design guy. And he not only helped support the development of all of the IO circuits and stuff for the library, the design library but he also did some circuits that were put into production as well. You might be able to help me on that, Ron.

Kasper: If it wasn't for Bill-- we got one of the first circuits that we actually put into production that was a custom circuit was for Williams Electronics in Chicago for the gaming business.

Goldman: We loved those games.

Kasper: We loved those games. Because they were willing to take the risk a little easier than some of the computer companies. And we designed that custom circuit. And Bill Smits was very, very critical to design. And we did that and that thing shipped for many years into Williams for all of their pin ball and arcade games.

Goldman: Well, the truth of any startup is always the very few people that you meet and you need them to get the job done. And so circuit design is just a few good designers so to speak, whether it's Phil or Mark, whether it's a Bill. You don't need a ton of people but you need some very, very good people and that made a lot of difference.

Wetlesen: It's like the old story about if you want to win the high jump you don't want seven guys that can jump one foot, you want one guy who can jump seven feet. And that applies to a great many things in high tech.

Balletto: So when Ron booked that order we did 20 million in ROM deliveries in '82 in 8 or 9 months, how did we keep track of the cash? I think you told me that actually generated cash for us.

Goldman: Well, after we finished paying the commission…

Balletto: Uh-oh, another story we never heard of.

Goldman: Ron always made sure we got that addressed up front.

Kasper: Before you close the books.

Goldman: A lot of people were involved in that. We had two things going for us. One is we were able to get the customers-- well, first of all, we negotiated payment terms so we were dealing with all of these folks in the Far East. And so we agreed to pay them in 90 days. And then the customers were effectively in the Far East as well but we agreed to get letters of credit from them. So they actually paid us on site. So we were getting paid at the time we shipped, which is basically zero days. And we were paying for basically the product in 90 days. So Jack is absolutely right, we were creating working capital every time we shipped. So it was a great capital efficiency story. And I don't know if you covered this but we effectively, the company only had one round of financing when we went public. I mean I guess we'll come back when we go public. We only had really one round of financing that was the original 10 million. Jack alluded to this but the fact that he had 10 million, the good part about that is it gave everybody confidence that we had the funding. So employees come in and could really rest assured that the funding was there, the financing was there, and so forth and didn't have to worry about it. So it gave us a real head start. We had the one round. We then had Bendix come in and Olivetti come in for some equipment financing which really created our fab. But we didn't do any other quote unquote venture round. I mean one venture round, fund A, if you will, and then we can talk about, move on and talk about how we went public.

Balletto: Yeah. Talk about the IPO.

Hadley: Yeah, I think we're ready to go on to the IPO story. It was incredible and we led the way. There hadn't been any IPOs for a while and there's a Bill Hambrecht knowing that this was the right time to push the button. And I think Jack and Ken…

Balletto: Well, Ken can tell that story. We all walked into that meeting.

Goldman: Well, it's interesting how it worked. We went through the customary board presentations, update by all of the folks in the stable in terms of sales and R&D and operations. And so a full board

means you would expect Jack started and so forth. And then we got around to talking to financing and this is the part that probably most don't remember, but I remember well and I don't know what was wrong with me. But I actually was going to Tahoe that night. And I thought the meeting was effectively over. So when I left, Dan you may remember this, when I left we were going to do a private round just to sort of, you know, add some extra dough and whatever to the kitty, so to speak, even though we really didn't need it. So I left, hopped on a plane and headed on to Tahoe. I called Jack and at about seven thirty, eight that night said, Jack, how did the rest of the meeting go? And Jack said, "Oh, well, we made a little change. We're not going to do another private round. We're going to go public. And we're going to be the first ones out in '83." So this was again August '82 and this is an absolutely true story, Bill Hambrecht had this sense that he called it one of the greatest calls ever that the market was poised to turn and we ought to be the first ones out. And so instead of doing a private round we ought to get out and make our name for ourselves and really position ourselves well. And so he did absolutely a 180 on me. And we called Jack and he said, "No we're not going to do a private, we're going to do a public." And so the goal then, it's funny, it's just the same as today. The goal then was to finish off the next two quarters and do the best we could obviously. And then be literally the first ones out. And I think we file something-- I actually still have the great tombstone [ph?], phenomenal tombstone because we filed like January 17, 18. You know, we got our numbers out really, really quickly. Had them reviewed by Ernst & Young was our auditors, and I still actually keep in touch with our audit partner was Sue James [ph?] so I know her very well. So we got our-- we wanted to be first out because one of the goals we had was to get out before LSI Logic and so that we could clearly position ourselves as the leader. And one of the ways of positioning the leader is you be out there first. So our goal was to get out there before LSI. Bill and H&Q were investors in our company. It turns out our great friends Kleiner Perkins they invested in both us and LSI Logic. Now, John Doerr who was involved as an observer, so he was not on our board. And so we wanted to keep all of this confidential so sorry, John, you can't be at our board meetings right now because we didn't want LSI going out before us. And we actually went out, we got filed in January. We went out in February. It was amazing how quickly…

Floyd: Very quickly.

Goldman: In four weeks we were out and public. And it was a great offering. We priced it, as I recall, at 13. And it went up a bit from there. And I always remember this, and it's sort of the way I sometimes tell a story, the way investors think. And I remember being at one of our road show lunches and when you go public you have both general meetings with a number of investors which you may do over lunch or breakfast. And then you have a bunch of one-on-ones with institutions. While we were at this one lunch and the guy leans over to me and says, "VLSI you guys must be better than that company I heard of LSI." And I said, why do you think that? "Well, because you're VLSI and they're LSI." So that gives you some sense sometimes of how much people understand the technology which means you really want to be out there first and get the brand awareness which we did. And so we did it. It was a great job. We got out there. The other thing is you guys are talking about the ROMs and so forth, but here was a company that was started on the basis of really three transformations which always attracted me in terms of a company that's not a "me too" company like so many companies are but really a transformative company. You know, we effectively, as Doug talked about created the VLSI and CAD business. We created the ASIC

business. And we created the foundry business. And so there were really three new businesses that totally emanated from VLSI Tech. And so it wasn't just another one of these "me too" this that. But having said all of that 80 to 90 percent of our revenue was coming in from ROMs, but 80 to 90 percent of the S1 was ASIC's because ASIC sells, ROMs brings the cash in.

Hadley: And we had a whole color section in the brochure.

Goldman: So Doug was the sizzle and the rest of these guys were the meat.

<group laughter>

Wetlesen: The steak.

Goldman: To make an IPO work you need both the beef and the sizzle. And so they both are really required. And we had both and we had a very, very successful road show, actually.

Hadley: Well, that was a very intense time. I remember we worked around the clock. We would work until eleven, twelve o'clock at night, many times during the week. We worked on weekends. I remember one weekend it was raining very hard. It flooded. And we were in the McKay [ph?] building in the only conference room we had at that time. And the water level came up so high, the water table that the floor started flooding. And we had to pick up all of our stuff that was on the floor and keep our feet off the floor because there was water in the conference room. And Dan Case [ph?] was there. And I think Anne Hays was there from LF Rothschild.

Goldman: Yes, LF Rothschild, she's great.

Hadley: And there were several other people. I can't remember. You were in the meeting. And I'm sure Doug was there. And there were quite a few meetings like that that were pretty intense. That was the meeting when Al wouldn't buy sandwiches for us. And we worked all day Saturday. And so Dan Case, he went and ordered the sandwiches so we could eat because we were working…

Fairbairn: Well, some things don't change.

<group laughter>

Hadley: Those were funny days.

Balletto: I don't think we need to go there.

Goldman: But you bring up a good point because how the world and banking has changed. Because the professional that Bill was, I mean he could have argued to be the lead. He did not. He thought his position would be best on the right side of the offering.

Fairbairn: That's on the front page of the offering.

Goldman: So as the lead banker, the book writer. So he suggested a few of us go out and interview bankers. We went to New York, several of us at this table went there. And we interviewed folks like LF Rothschild, like Lehman Brothers, like Morgan Stanley and so forth. And we really did like LF Rothschild a lot. Bill was very fine to-- they were bigger than H&Q. They could have been the lead left. They did a great job. You mentioned Anne Hays and you're right but we had Tommy Unterberg.

Hadley: Was it Tommy Unterberg?

Goldman: Yeah, Tommy, and I remember when Jack and I were with him, I don't know if you remember this Jack, when we cemented a deal with them we had some rice krispies at breakfast with him. So he was-- by the way, that old geezer is still working. He's 80-something and he's still out there working.

Balletto: Jack or Tommy?

Goldman: Tommy Unterberg. Jack, well, that's another story for another day.

Goldman: But Tommy is still out there. But he personally worked on our deal. And some of the other guys Jim Forneau, you remember that name? It was another name.

Balletto: Yeah, I remember Jim.

Goldman: And so I don't remember the resource folks anymore.

Balletto: But, you know, that bubble lasted only about four months. And if you didn't get public in that bubble…

Goldman: It lasted from February to June.

Hadley: And LSI went public.

Goldman: In June. And it pretty much closed out. You know, it's all about timing because the market was up and down and we picked a great time. I always tell people you want to go out before the wave crests. We went out when the wave was just getting going. And so we hit it at an opportune time. We had a great offering. And the world's changed because first of all LF Rothschild doesn't exist and H&Q doesn't exist. But we had probably 60, 70 syndicate folks involved in our offering. Today's it's just not the way. Today, you may have four, five, six people involved, a whole different world. But getting us public really helped us a lot. I think I found that good companies do better when they go public. We did better when we went public. We really executed well. We grew. And as I said the company really was transformative relative to the new industries that we effectively created that hadn't existed before VLSI tech existed.

Hadley: And so overall, how much did we raise on the IPO?

Balletto: Sixty-five. It was $65 [million].

Floyd: Well, the amazing part of that was we went out with a valuation of ten times sales which was really unheard of because a typical company was maybe four times or something like that.

Fairbairn: Yeah, we went out for a valuation of $300 million as I remember. And we did $33 million of revenue that year and not profitable. So those are numbers that wouldn't fly so well now.

Goldman: You'd have a hard time getting through in a million today for a valuation never mind in '82, '83. So no, it was again you need both. The ROMs gave us a base of business that we could say we're a real company. We used that to prove our systems worked, and so our invoicing systems, our collections, our manufacturing. So that was what really drove, got the company up and running because you say ten times sales but you do ten times our ASIC sales or our CAD sales that would have been an awfully small number. So the fact that we had the ROMs drive the ship to be allowed to get to ten times. But the fact of the matter is what people bought into was the ASIC business and the CAD business. That's what got us the hefty <inaudible> valuation.

Balletto: LSI they had only done $5 million in sales the year we did 22. I think they kind of got into our draft and got sucked into the IPO crowd.

Hadley: They thanked VLSI for being first because we did all of the education of the marketplace. They didn't have to explain as much. We'd been the pioneers. So it made it easier for them to do their IPO. One of the other things that I was always…

Goldman: Yeah, they drafted on us.

Hadley: They did draft on us. You're absolutely right.

Balletto: They were only having five million in sales, you're not going to go public.

Hadley: There was one other thing Larry Sonsini was one of the advisors on the IPO and Greg Pickrell was our attorney at Wilson, Sonsini. And interestingly enough Larry was on the board at LSI at the same time. I mean it was an interesting relationship he had with both companies.

Goldman: Larry was on our board, you're right. He was on the cover _____. You're absolutely right. Greg was the partner that was involved directly with us. And he still is actively working as Larry is as well. Larry's as good as ever and as active as ever. And we were actually one of the very few-- so even though he's on the door of his firm, the reality is we were one of very first companies that he was involved in going public. So we were very important to him in terms of helping to establish his career.

Balletto: When we went over to Larry to have him be our lawyer for VLSI they had 13 lawyers in the firm at that time. And we talked him into taking us on. We started out with John Friedenriche. But he had personally made about 50 million selling a company called Qume. I think it was a printer company. You could tell he was not into being a lawyer any more. So we dropped him and went over to Larry. I think it was about 13 lawyers that was it. And Mable used to sit there with her cigarette. You'd call and she'd say, okay, just a minute, put the phone down, smoking away typing. As soon as Larry was off the phone she'd hook you right through. But no automated anything, no voicemail, just Mable, giving her cigarettes.

Hadley: We also had a really strong board. I mean Bill Hambrecht was on the board. Bill Perry was on the board. I was very impressed with the caliber of board we had.

Balletto: Yeah, Dave Evans, a classy guy.

Goldman: There was one more on the board…

Floyd: Well, John Doerr was on the board, also.

Goldman: QT was on.

Balletto: QT certainly.

Goldman: John wasn't on the board. He was an observer.

Floyd: He wasn't on the board?

Goldman: No.

Floyd: He just came to the meetings?

Goldman: He was with LSI Logic and he was an observer. So we only allowed him to be…

Floyd: I know we threw him off.

Goldman: But yeah, we had QT Wiles. But Perry who also is still active working at Stanford, he was phenomenal in terms of advice. Dave Evans too. We had Dave Evans. Sutherland, Bill Perry as you said.

Balletto: Bill Perry was the undersecretary of defense of the country.

Goldman: Bill Hambrecht who is Bill and you don't need to say anymore. And so yeah it was a very-- but Dave really brought the business experience from Evan Sutherland and Bill brought the financing experience, Bill Hambrecht, that is. Bill Perry also I think was also involved in a company's wealth.

<overlapping conversation>

Balletto: He had his own company.

Goldman: No, it was another company. What did they make?

Hadley: ESL.

Goldman: ESL, yes. So he was CEO of ESL. So he was both in government and operating roles. And so you're right, the board was very, very helpful.

Hadley: How did you attract such a strong board?

Balletto: Well, Bill Hambrecht already had Bill Perry as a special consultant to H&Q. Well, they had a separate fund. Hambrecht & Quist Technology Partners, I think, it was called and Bill was one of the partners in that. So they would consult for GE. They'd get $10 million to study what should GE do in the future? It's that big study group out here. So he knew Perry. And QT, of course, was Bill's turnaround guy. They had turned around about 10 or 12 companies. And Bill wouldn't give us the funding, the $10 million, unless we agreed to hire a chairman, who would teach us how to manage the company. And so we tried Don Valentine. He said no. We didn't know that Valentine was doing LSI Logic. And finally, we really had to almost beg QT, right. He really didn't want to do it. He was busy doing Granger. And so we talked him into it, little guy.

Goldman: Squatty guy.

Balletto: Little wide guy.

<group laughter>

Balletto: He scared people to death that guy. And he was great.

Goldman: Well, the company started in his quarters.

Balletto: Yeah.

Kasper: We talked about that.

Hadley: But he was hardly ever around. I mean you never saw him.

Goldman: QT's approach was he was based in Palm Springs. He was based there. And he always had his top three. That's how he ran everything. And so every quarter, all of us would have our top three. And so when he would come to review what we were doing it was always the top three. That's the way he ran things. And there was always the top three for that quarter, and then you start a new quarter. And that was the way he sort of quasi micromanaged the company in terms of what you've got to go do. And then he basically stayed out of our way.

Balletto: He was great on operational things. Like I talked to him about bringing Ron in or any sales person, you know, a year ahead of the schedule, a plan they had just bought off on, bring them in a year ahead of time to kind of get involved especially with Doug and the guys to figure out what's going on. It was about a five-minute chitchat. And he said, yeah, fine, go let's do it. anything like that. But if we used

his office, which I did once by mistake for a photograph for Business Week I think it was. So he could tell that was his office and his secretary said, “Why don’t you use this instead of your thing in the back?” Ballistic, you know, veins popping, who do you think you are? And he had this litany before every chat that got longer and longer.

Goldman: There was a protocol.

Balletto: A protocol.

Goldman: And you always liked protocols.

<group laughter>

Kasper: You broke protocol.

Balletto: My favorite thing.

<group laughter>

Hadley: All of us were in that front little office section in the Granger building. We packed in there in little cubicles. And half the time there weren’t even walls. There were just desks next to each other. I think you had one of those little temporary walls around your office.

Balletto: Yeah, I was the big shot, sure. <laughs>

Hadley: Yeah, you were the president. Anyway, we were all packed in there pretty tightly together. And we overhead every conversation everybody had on the phone.

Balletto: Yeah.

Goldman: Including when I used to do payroll.

<group laughter>

Goldman: Yeah, because one of the things about payroll is when you started it, it was B of A, the system was bill pay? Or it was some other term but, anyway, it was a payroll we did over the phone and you had to sort of put all of the information by touchpad. And if you stopped at any point, you had to start all over again. And so Jack had this tendency to come as I'm in the middle of listening to these commands to try to touch, "Hey, how's it going? How's the quarter going?" Oh, I just lost it all and I had to start all over. So another half-hour goes. Because literally every single person, any change I had to go use a touchtone phone to-- anyway that was our payroll system.

Balletto: That's why we couldn't give you so much stock because it was a touchtone. You were busy.

<group laughter>

Hadley: So a lot of things happened at VLSI that became kind of the norm today. I mean the foundries. Only a few companies have their own fabs now, most use foundries. We were an early foundry.

Balletto: Yeah.

Goldman: Yeah, we had our own. I mean that was really-- that went against the grain.

Hadley: It really did.

Goldman: The fact is we…

Fairbairn: We were a foundry and used other people's foundries.

Goldman: We used other people's until we had our own foundry as well. But we created and we, again, to finance that we used equipment financing and guaranteed by Bendix as I recall. So they came in and they did the guarantee. So it was very cost effective and cheap money. And so that allowed us to build in which we went against the grain because no one goes fabs at this size company. We built the fab and it took us…

Hadley: How much did it cost to build a fab in those days?

Goldman: I'm thinking 20 million.

Balletto: Yeah, 20 or 30.

Floyd: It was 20 million then.

Hadley: And today it costs?

Balletto: Well, three years later they were 300. I remember that because I went to one.

Goldman: Today they're billions.

Fairbairn: Yeah, two, three, four billion.

Goldman: Yeah, it's a B number is all I know.

Wetlesen: We weren't the only ones that built a fab, though. Coming back to LSI for a moment, they didn't have to build a complete fab. And that was one of the advantageous because they only personalized wafers that they purchased from Sony, wasn't it?

Hadley: No, it was Toshiba.

Wetlesen: Toshiba. Okay. So they only had to do the personalization layers.

Fairbairn: Oh, for the gate arrays.

Wetlesen: For their gate arrays so that reduced the size of their fab investment. We, on the other hand, Greg and men supplied the technology. Cliff Roe who was our fab manager in the beginning anyway, they had a big job to bring up an entire factory, an entire fab area that would produce wafers from beginning to end. And the role of a foundry not always with technologies that you would choose to run because sometimes people would come to you with tooling that was all ready pre-designed. And I had a fellow that I worked with back at AMI George Steres. I forget his…

Floyd: Steres.

Wetlesen: Steres, who did the foundry as an interface to the customers and also internally into the factory with our wonderful engineering help Jerry Allison [ph?] who was the internal interface to the fab for the products that had been designed elsewhere. And so we did everything we could as QT described the strategic imperative, fill the factory. And, of course, ROMs were the biggest part of that. Having your own fab area for better or worse it's like having a pet dinosaur. If you don't feed it real often it's going to eat

you alive. You have to figure out a way to run it to a larger percentage of its capacity here or else you have a big negative. And I don't know when we finally started to break even, Ken, as far as…

Goldman: I don't know if we ever did.

<group laughter>

Wetlesen: Well, the problem was keeping up with the technology as Jack mentioned. You know, that every time we got a leg up and then we'd have to recapitalize the company almost to be able to afford the next round of capital investment. And that's where having a high profit margin products under your own label is so key and why Intel has been so successful is because they have that 50 plus percent gross margin. And it's almost impossible when you're running 20 percent or 30 percent gross margin on your products.

Balletto: Well, it took 20 years but TSMC at one point finally hit after they had rubbed out every other foundry in the planet. They're real smart and they're the biggest foundry in the world out of Taiwan. And I think their margins are off the charts, just off the charts.

Fairbairn: Yeah, just reflecting, it reminds me of something relative to the ASIC business. When we entered the ASIC business and our vision was that this was to be a high margin business. You were doing specialized designs for people. And you weren't competing with other people offering exactly the same product. But it turned out to be a much bigger challenge in some ways than we had originally anticipated and required a significantly larger investment than we did. So that was one of the challenges, one of the issues that made it more difficult for VLSI to be profitable in the long-term because as doing ASIC you not only had to have a reasonably state of the art fast turnaround factory, you also every customer wanted some sort of different packaging. So you had to have a broader range of packaging availability than you would otherwise do for standard products. And then there's the need for design tools. And it turned out that the path that VLSI and LSI plowed everybody decided to jump on that path because it looked like the way to go of the future. and so there ended up being quite a bit of-- a lot of competition in the ASIC business for design wins. And so you would end up having to bid lower prices, give away design tools, lower your prices for production in order to win the business. And it turned out to be a more expensive, more capital intensive business because it required unique capabilities, design tools, unique processes, unique packaging, unique testing and other things that a standard product business didn't actually require. So that was a big negative, a big challenge of the ASIC business, one of the things that VLSI and everybody else that was in the ASIC business struggled with.

Kasper: It took a lot of support people to support the customers, that's how the whole independent design center concept started. That's how distribution got involved in it. It took a lot of sales and marketing and technical people in the field to start supporting the customer, to hand hold him through that

design process. So that was another thing that evolved out of VLSI. We started that whole concept of independent design centers to start feeding in designs to our factory because we couldn't do it all by ourselves; another thing that was created at VLSI.

Hadley: Jim Whitman [ph?] set up the design centers, didn't he?

Fairbairn: No, Jim was responsible for some of the training afterwards.

Hadley: And then Warren came in.

Fairbairn: Bill Smithson originally had a role in that. And then other people took that on it. But, yeah, I mean to Ron's point, we were a pioneer and LSI came along quickly as well. In order to properly support the ASIC business you had to have design people that were closer to the customer and to do the training, to do the support, whatever. And so we ended up establishing an international network of design centers, not only doing chip design but also were very early in terms of distributing software development. We established a software development group in France very early on and were a pioneer in that area. But the design center business was definitely one that we took a lead on.

Hadley: Something else that was unique about the company was mainly I think you drove this Doug, we were on e-mail, the whole company every single solitary employee in the company had an e-mail address by probably 1983. And I remember the moment when I realized how important this was is you were in Germany and I needed to reach you really urgently. And I sent you an e-mail and you answered me within about an hour. And it was just-- I was sold right then and there.

Fairbairn: Yeah, I have the pleasure of never having a job that didn't have e-mail. And I started in 1972. And I started at Xerox PARC which was also a pioneer. And so they had e-mail when it was DARPA ARPAnet kind of functionality. So when we started the universities had it. So when we started VLSI, you know, we couldn't-- the engineering people couldn't exist without e-mail. Of course, you had e-mail. That was a given. And so we made sure that the company had it. But yes, we were definitely an early adopter in that respect as well.

Floyd: It was sort of contentious too because it was Doug trying to get this whole building wired for Ethernet. And it cost a lot of money and it could have gone into fab or it could have gone into other things. So nobody was sure what it really did.

Kasper: I do remember that.

Hadley: And now we can't imagine life without it.

Kasper: The wires were pulled through the ceilings.

Hadley: You know, something came along in the eighties also and that was programmable logic. And that started taking away business from companies like VLSI and LSI because companies even though the programmable logic devices were more expensive they could do them in really small lots.

Fairbairn: Yeah, I think they came along really in the late eighties and nineties.

Hadley: It was the late eighties?

Fairbairn: Yeah. Because I specifically remember thinking we would actually have been better served if they had come along earlier because there were a lot of designs that went into customer LSI chips that didn't belong there.

Wetlesen: Right.

Fairbairn: The only reason they did it was because that was the only…

Wetlesen: There was no other solution.

Fairbairn: That was the only solution. If programmable logic had been available earlier LSI, VLSI and all of the other companies who had jumped into the ASIC business would not have been so tempted and the customers wouldn't have required going into that. So we ended up taking a lot of business early on especially that we didn't-- that was not good business, but because we were trying to grow the design base and so forth we did. So I always felt that even though programmable logic was in some ways a competitor, the company would have been better served if, in fact, it had come along sooner because it would have kept us out of a business that we didn't belong in any way.

Wetlesen: And it could have been used for prototyping if you wanted to do high volume and dedicated chips later.

Fairbairn: Yeah.

Hadley: There's something else I remember. We had workstations. What was the company that made the…

Fairbairn: Apollo workstations.

Hadley: Apollo workstations. And we had sales guys taking them out on the road. They'd put them in a van…

Fairbairn: Scary.

Hadley: It was scary. And they were on wheels.

Kasper: And we had to lug them upstairs.

Fairbairn: Not only that, we took them around Europe from one place to another. That was even more exciting. But yes, we were early adopters on workstations, as well, because, of course, key people that had started at Xerox PARC and we had workstations in 1973, '74, so you couldn't exist without a workstation. So as soon as they were commercially available in '82, we told Jack and Ken that we really had to buy a workstation even though they were $50,000 a piece. And so we started with Apollo. I think LSI Logic started with Sun. But, yeah, we were on the cutting edge of the design tools and workstations.

Kasper: We actually sold them for a period of time.

Fairbairn: And that's right. We OEM'd the workstations as part of our design tool business.

Goldman: Anything to make a buck.

Kasper: Anything to make a buck, that's true.

<group laughter>

Kasper: Yeah, if the customer wanted it, we had it for them. I remember.

Goldman: I remember on the OEM I gave you less commission.

<group laughter>

Hadley: You know, one thing that also was special at VLSI was there was a really strong esprit de corps. And I don't remember who started but there were beer parties on Friday nights, hot dogs and beers. And then we had ice cream socials and various things over the years. And how did that all come about?

Fairbairn: I don't remember how it started.

Balletto: Ron drinks too much.

Fairbairn: It must have been the sales guys.

Kasper: It must have been the bells.

Balletto: The cow bell.

Goldman: Oh yeah, the cow bell, yes.

Fairbairn: Actually, the piece of that that I remember and that I'm grateful for and so forth is that given the sort of the state of the engineering world and early product world you had sort of two different groups. You had these guys that were working on software that had the promise of generating revenue but were not actually generating revenue. We were sort of doing sizzle but we weren't doing beef. And we had the guys who had a totally different more traditional IC background who were designing chips on velum and doing digitization and that sort of thing the old way because the tools weren't up and running yet. And so it could easily have evolved into a very split kind of contentious organization where we're generating all of the revenue, what are you guys doing? You know, we're doing this and that. But, in fact, it blossomed into a very collaborative kind of environment, synergistic environment where we realized on the software side and the VLSI design side that we needed the expertise and appreciated the expertise of these experienced IC designers. And they certainly appreciated the fact that the tools they were using were primitive and awful and were looking forward to the day that they didn't have to do designs the way they did it. And so it was a very collaborative kind of effort. And the bagpipe chip, for example, was very much that way. It was a collaboration of people from sort of both sides of the-- engineering people from both sides of the company. And in that existed and that kept on throughout the company. And I think the other milestone that I remember in that regard in I don't know '84, '85 I'm just guessing was when we sat down, you know, when they realized that the place in route tools and everything was good enough. And we sat down this whole team of layout people. You know, we had more traditional layout people. And we said we don't need most of you anymore. And there was a very sort of compressed period in which we took these people and trained them to be IT people, how to support the CAD systems, how to work with the place

and route tools, how to do other things within the company. And some of them left the company and did other things. But it was a very distinct period where we said we need to transition and these people we have, we don't need those nearly that many any more. And it wasn't a contentious period. It was a period which everybody kind of realized, yeah, now's the time, and the tools are now good enough and it's time to make the transition.

Kasper: No, because what I was thinking too is the tools opened up many, many customer's doors even though sometimes we did the design in the old traditional way to get it into production. But we would have never gotten in there if it wasn't for the sizzle with the tools. So it was an interesting period.

Hadley: At that same time, there were the EDA companies, the Daisy's and that's one…

Fairbairn: Daisy, Mentor, Valid.

Hadley: Daisy, Mentor, Valid, right. And they were doing just tools and we were doing tools and foundry and design and on and on. And LSI was in a similar position. And so I'd like to kind of explore that area a little bit.

Fairbairn: Yeah, for a long time they were-- I mean Daisy, I think, was the first and Mentor and Valid were all very much focused on design capture at the schematic capture level and then place and route for printed circuit boards. And so for the first few years there was very little overlap between what they were doing and what we were doing. We were mainly focused on the backend in terms of IC design. And so it was later in that cycle when Cadence and others started coming up and offering place and route tools and so forth that were more user-friendly that it became an issue. And it was a tension within the company for many years in terms of should we stay in the design tool business? There are these companies that are investing their whole operations and focusing on design tools. And so picking the right time eventually the answer was no, we shouldn't be doing our own design tools. Picking the right time to do that and picking the way to transition from that was a point of contention and one that eventually led to my leaving the company I'd say after many of the others had all ready left the company.

Balletto: True.

Fairbairn: But I think it was '88, '89, we at the design tool level decided that it would be better to spinoff the design tools. And we had an agreement with Cadence to do a joint venture with Cadence on the design tool side. And we took that Al Stein who was the CEO at the time and he didn't want to do that. He wanted to continue to hold on to it. And so I had sort of bet my-- that was my strategy. That was what I thought the right thing for the company to do. And so after Stein decided that that wasn't what the company was going to do I subsequently decided to leave the company along with Jim Rowson and we went off and formed another company Redwood Design Automation which was focused on design tools

only. And then meanwhile, the company decided later on to create a subsidiary which was Compass Design Automation to try to create a new separate design automation company which did remarkably well for a while, but eventually it was just too little too late and that operation collapsed.

Hadley: That was one example of something you would have done differently. Are there some other things thinking back?

Balletto: One company did real well. I think it was called Artisan. Didn't that compete with Compass and got in bed with TSMC?

Fairbairn: Yeah, I mean Artisan was doing standard cells and that kind of thing. They were not doing so much of the-- but there were a lot of opportunities and I think if we had done the joint venture with Cadence it would have been a very different story because they were still-- I mean we had a lot more experience in IC design than they did but they just had a lot more resources and more focus. And it's a matter of timing, picking the right thing at the right time. But for a long time we were viewed as a leader and a pioneer in that VLSI design area and we had tremendous design tool capability.

Balletto: Well, you know who loved the company so much and he's still on the board of what got left over after all of these years, Ken. What's it called NXT?

Goldman: You're going down that story. No, it turns out I joined a board, a company called NXP Semiconductor which is about a $4 billion company that was spun out, a semiconductor company that was spun out of Philips. A number of years ago it was spun out and financed by a number of private equity investors. It went public about two years ago and I joined the board at about then. And the interesting part is Philips had bought VLSI Technology. I'm not sure I remember exactly when. But they bought VLSI after some other potential sales that could have gone through didn't go through. So Philips bought it. And it turns out, small world, that for a long while the U.S. headquarters of NXP was on McKay Drive of all things. So what goes around comes around. As I said, I am on the board of NXP Semiconductor and one of its components is the old VLSI Technology we all love.

Balletto: Forty years later, thirty years later.

Goldman: Less than a year ago they got out of the McKay Drive building. They sold it and unfortunately sold it for a loss.

<group laughter> <overlapping conversation>

Hadley: One of the last things I wanted to ask you…

Kasper: Yeah, one of the other things you mentioned, one of the other businesses that we could have been in is the Olivetti group was designing a chip set for the PC and it was basically almost complete. And typical Olivetti every 18 months the management changed and a whole new strategy occurred at Olivetti and they abandoned the project and they left it. And we wanted to finish them off and go into the chip set business with the standard chipset that we had. And we were not allowed to finish it.

Hadley: By whom?

Kasper: By the person who was running the company at the time. He refused to allow us to go into competition.

Goldman: But we did go into chipsets ultimately, right.

Kasper: Ultimately. But the problem is that that design ultimately was taken out of the company-- out the backdoor and it ultimately became chips and technology.

Balletto: Which replaced us as the fastest growing chip company ever.

Kasper: And we could have been in the chipset company. They did get into it but it was…

Balletto: The whole clone business every one of them use the chips.

Goldman: We got into it and I can't think of the name he was running the…

Balletto: John Stockton.

Goldman: No, no, no. It was the guy that ran another company down…

Floyd: Gordy Campbell.

Kasper: I'm sorry?

Goldman: Was it Gordy?

Jones: Doug Bartek.

Jones: Doug Bartek.

Kasper: Wasn't that also down in Arizona?

Balletto: Yeah.

<overlapping conversation>

Kasper: Yeah, Leon Humble, Doug Bartek, John Stockton.

Kasper: But that was a number of years later.

Goldman: It was a very good business for us all the way, the way the standard product business.

Balletto: Yeah, but that one, that was a grand slam.

Floyd: The other big one would have been ARM but…

Balletto: ARM.

Kasper: Oh, the ARM too, yeah.

Goldman: That's probably-- I don't know all of the particulars, maybe Jack does.

Balletto: No, Ron does, he was there.

Goldman: That's probably the biggest missed opportunity. Of all of the things we've talked about it's probably the biggest missed opportunity of VLSI.

Kasper: Well, yeah, because what happened is that VLSI because of our relationship back in the Synertek days with a company called Acorn in the U.K. And we were involved in working with them with processors. They visited us and tried to see what we could do together. And basically VLSI, Acorn and Apple put a team together and it became the ARM group, the funding group for ARM. And what happened is that Apple was going to be the first customer for this new so-called risk based processor. And Steve abandoned it…

Fairbairn: Well, it was going into the Newton. That was the first product.

Kasper: Is that where it was going to <inaudible>? But he decided he wasn't going to go ahead with it. And then, again, our group basically decided to abandon it also. And Acorn then ended up with all of the rights to it which became the funding or the founding of ARM.

Goldman: We also had a chance, I think, to buy the company along the way.

Fairbairn: Yeah, the ARM team within Acorn used VLSI design tools to develop the first ARM chip. And the first chip was fabbed at VLSI in 1985, the first ARM chip. And it worked the first time and that actually the first mass set went into production. And so I actually just recently did a set on the other side and did an oral history interview with the two engineers who had created-- who had architected the ARM chip, Sophie Wilson and Professor Furber.

Goldman: Hermann Hauser?

Fairbairn: No, Herman Hauser was the CEO. No, Steve Ferber and Sophie Wilson were the architects. And then they had a VLSI design team which was using VLSI's design tools that actually created the chip and VLSI was the foundry. And so they were able to spin it out from Acorn because Acorn no longer could-- made sense for them to do it. And VLSI was a part owner of that operation and based on our contribution of the design tools and so forth. I don't think we put money into it but I think the design tools and the fab and so forth that was our contribution. But we had it as a core. And I think we actually sold the first use of the ARM as a core chip was done through VLSI. And, of course, that became the ultimate story of the ARM. And I think we continued to sell it. But we had an opportunity very early on that we did not capitalize on.

Balletto: Yeah, and so today the entire smart phone world has about two ARM-9s or ARM-11s.

Goldman: They're everywhere.

Fairbairn: It's the largest selling processor.

Goldman: I think the company raised like $15 billion or something like that. It is humongous.

Kasper: But VLSI was at the forefront of a lot of these new developments that were reoccurring all simultaneously.

Balletto: PMC Sierra, how about that one, $100 billion market cap?

Hadley: So reflecting back to what the environment was in the seventies and eighties and the growth and all of the startups and how that contributed to not only the growth of Silicon Valley but to technology and actually the world economy, do you think it's possible to recapture that kind of growth again in another industry or something else? Just reflecting on what we were doing then looking forward?

Kasper: Look at the software that's going on now.

Goldman: I'm not sure where you want to go with that but this valley just creates opportunity. And so there are a number of industries that are really going very, very strong right now. And there are all kinds of data in terms of big data. There is a social Internet. There's all kind of mobility opportunities. There's still a thriving-- look what Apple is today. There are just a number of things. This valley reinvents itself every few years to get into the new areas. And so it's never been as strong, in my opinion, as it is right now in terms of a number of different themes going on. So no, there are a number of companies growing very, very rapidly. I mean Facebook, people didn't think about the Facebook, Google and Yahoo! I mean just think of the market capitalizations of those companies.

Balletto: Incredible.

Goldman: The game companies like a Zynga and so forth. So no, there are tremendous opportunities. And the reality is the nice thing and the challenge of the semi industry is virtually every invention emanates from the semiconductor industry. That's the good news. The bad news is it's tough to get good valuations in the semi industry because the margins get beaten down. You don't have the ability to price the products, sometimes for a full value. So while the semi industry, in effect, effectively creates every other technology as we know, it's been hard to capture that value. I remember, actually it's interesting, it didn't actually occur during VLSI but I remember when I went to Cypress. I left VLSI in 1989 and went to go to Cypress Semi because we all felt that the way you make real money at that time was with standard products which is what Cypress did. So I went there in '89. And I remember in '91 VLSI said the next year, this would be '92, the industry would be $300 billion. I always remember this, it would be $300 billion. And actually the semi industry just crossed $300 billion last year. That's a true story. So the

industry is very cyclical. It's extremely cyclical. And it always evolves in terms of winners and losers. And, again, other than a few companies, now most of them are fabless, guys like Broadcom which is doing fabulous work and so forth, ARM which is doing fabulous work. But other than Intel it's hard to find very many semi companies, Samsung would be an example, that have real fabs. Most of them do outsource the manufacturing. Then, again, the fabless companies a few of them make good money. We talked about Xilinx and Actel, not Actel but…

Jones: Altera.

Goldman: Altera. And so there was a few of those. But I'll tell you the industry it's a tough industry to get proper value for all of the hard work you do. And I would just say it's one of those industries where you work awfully hard not to make a lot. Everything has to work right. The design has to work right. The manufacturing has to work right. Sales have to work right. Everything has to work right. And then you might get a decent price from the customer.

Balletto: For a period of time.

Kasper: Yeah, for a year.

Goldman: So it's a very, very, challenging industry. But one point, and obviously I'm coming at it from the finance point, but it's good training ground for finance people because it is so hard. There are so many things you have to worry about. You do worry about being able to interact with some very hardnosed folks. And so it did train a number of qualified CFOs in this value that did come out of the semiconductor industry.

Balletto: Very true.

Floyd: If you really look at what you need to have to get a company to be really successful you have to have tremendous creativity and that people at the top have to be able to take advantage of opportunities. And the worst thing you can ever do in my opinion is put operating people in to run a company as CEO because they don't have the strategic vision. And you look at what we did in the beginning with Jack and Ron and looking at these opportunities and being able to jump right on them. And we never did a lot of planning on how you would do any of this stuff. We just decided we were going to do it. And we knew the opportunity was there, the market was there, and we were going to make it happen one way or another. And if you have operating people running a company they start trying to plan on how you're going to do this. The planning phase usually takes so long you miss the opportunity or they don't realize what the market opportunity really is. And that's the best way to kill a company, in my opinion, is put an operating guy into it.

Balletto: I remember at Atari, we were like this with Atari because we were the only ones who could figure out how to make the Pong chip. And then the next year they decided our micro was far better than Intel. We actually shipped more micros than Intel and Motorola combined up through ’82 or so. But they would invite us to their offsite annual strategy meeting. So we’d be in the other room drinking beer usually. They’d come in and say listen, can you guys double the speed on that RAM? So we’d caucus and okay, they go back. So they’re refining their product plans that they’re going to sell through Sears for the next Christmas based on us being right next door in the next room. And if you can ever get to that level with your customers…

Hadley: So that was the ’82 timeframe you were doing that?

Balletto: No, no this was in ’75, ’76.

Hadley: This was at Synertek?

Balletto: Yeah, Synertek. But the idea being if you get that close to your customer…

Kasper: But reflecting on VLSI if you take a look back at all of the people that were there, the employees, there were some very, very successful people that came out of that company that moved on into other corporations that did very, very well not only for themselves but also for all of the stockholders of those companies that they joined. And I can think of many, many wonderful people that we worked with together there that were quite successful because VLSI was just a phenomenal place for that period of time we were all together. It was an incredible place.

Goldman: Yeah, I’ll add to that. We attracted some very, very good people, a lot of talent. And, again, I come back to as I thought preparing for this and thinking about it I mean it was really a transformative company. And that really was, again, with the VLSI design which was a new concept, we went out to hire the absolute very, very best. It was engineering driven. And so we hired some very good people in design. We had a number of business units which was also a new concept in those days. We had this concept to get big fast and so we grew as fast as we possibly could. We took some risks. We went public as I say-- you know, who thinks now of going public after two years of existence? I mean now it comes to 10, 12, 13 years before they go public. We went after two. And this is a semiconductor company.

Floyd: Well, unless you’re software.

Goldman: Even software companies no one goes public after two years. It was unbelievable. So we did a lot. And we knew that it would take a while for the VLSI business, the ASIC business to catch on. So we got the ROMs and that was fortuitous but we made those breaks occur. And so it was a company-- I

don't remember the exact headcount but, you know, we certainly had well over 1,000 folks and it was very, very energetic. And, again, but the thing I think about is the number of companies and industries that evolved from what we did. And the nice thing about ASIC, you know, I think taken for granted, but you look at what Apple does and all of the great work they do, well guess what, what they use is basically their own custom chips. Now, they do it a lot themselves but that concept originated out of VLSI. That's where they first started. I guess maybe a little bit in Synertek before VLSI. So you see very, very successful companies that really use the basis of VLSI to be successful. So we have a lot to be proud of that the collective team created back then.

Hadley: I think that we've covered quite a bit of the history of the company and thank you for all being here. It's amazing that we gathered all of the founders and the first employees. And it's quite a story and I'm very pleased to see it going into the history of the museum. It's been one of my personal goals to see that ASIC is covered, semiconductors first and then ASIC. And so this is quite exciting.

Balletto: Well, thank you very much.

Goldman: Great to be here.

END OF PANEL SESSION

