Fairchild Oral History Panel: Bipolar Digital Products

Fairchild@50 (Panel Session # 5)

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Bill Welling: From 1961 to 1969 I worked in field sales and in IC product marketing. Mel Phelps preceded me in IC product marketing and went on, when I succeeded him in early '64, to work in Special Products and memory and Fairchild's first ramp into memory products. Cloyd Marvin was in our group, and Bill Baker came later and succeeded in the whole evolution of memory products in one of the most successful and profitable product lines in the Fairchild lineup. John East came to the company right about the time that Hogan's Heroes came in. First of all, I borrowed from Arjun Saxena a comment he made on the Law of the Famous, "The famous are given most, if not all, of the credit, and a large number of others who also made key contributions to the success are largely ignored." This is about most of you and us, so we want to be sure that all of you participate in this. And we want to give time to each of you to give us some of your stories which will add credence, and fun, and humor to this event. Digital circuits; okay, in 1963 I was a salesman at Litton in Los Angeles. Actually they were in Canoga Park in the Data Systems division. They had a program called the Phoenix Missile Program which was a sub [contractor] to Hughes. Our RTL and DTL didn't supply sufficient noise immunity for their needs. Sylvania had just come out with a TTL product line called SUHL, S-U-H-L that was very attractive to them. But we had convinced them that we were the IC kings and that they should go with us. So they were pretty much along the line agreeing to that, but they wanted to do a factory tour. And so we all went up to the factory on Whisman Road. We were going through the factory and going through the line and most of the wire bonding [stations were working on] transistors, but fortunately there were some ICs in these TO5-like cans with eight leads. And Litton said, "Well, I don't see any flat packs here." They asked the line foreman who was giving the tour to see a flat pack, and he opened a drawer and there was this one package in there and it was a solid glass package. It was R&D's first effort to make a flat package. And the leads on 50ml spacings were sort of mangled. So we made some excuses as to this was mainly over in R&D. And then they wanted to see the testing. We went over into a room. It was a room maybe 20 feet squared, 20 feet on each side, and there was a lone piece of test gear in the middle of that room where a lady was trying to stuff eight leads into a socket to test ICs. And we managed to prevail and we managed to get an order for piecework. And the best part about it is that Phoenix Missile Program, was cancelled and we didn't have to deliver because we never would have. I'm just going to run through some historical things here. 1964 Apollo guidance computer using RTL. The 930 series DTL was introduced. A low power RTL for NSA, National Security Agency for use in encryption products. In '64, RTL didn't have any legs, so we did what good marketing people did and, with the support of manufacturing, we transferred the thing to Hong Kong. Put it in a plastic TO-5 or TO-18 type of a can and cut the price to 99 cents, and that gave it a little more traction. And then DTL-- Signetics was giving us a bad time in DTL, so we did again our usual thing. We just made a deep price cut. Chuck Harwood told me later we almost sunk Signetics with that move. In '65 we didn't have a linear circuit group. At that time we still had this one group and we had made the 702 amplifier which was sort of quirky. And the [follow-up device the] 709, which Bob Widlar devised with the help of Dave Talbert's ingenuity, became an instant success selling at some 80-some dollars apiece. We couldn't catch up with [the demand for] that yet. In '65 we started ECL, and some call it CML, Current Mode Logic, as a custom set of circuits for the RCA Spectra 70 computer. In '66, February '66, we cleared the 709 backlog. I think we did about a million bucks in linear circuits that month at 92% gross profit. That, of course, spurred the appetite for a bonus from Widlar and Talbert, which they didn't get. And they subsequently did what they wanted to do [That is leave for a competitor who promised them one]. In '66, early '67, we had an infamous meeting on T-squared. [TTL logic circuits] It was an all-hands meeting, and other people have written about this, Hank Bloom from Applications Engineering and the like, but it was a meeting where everybody had an opinion. R&D had their opinion, applications, manufacturing, etcetera, all had their opinions as to what to do because TI was kicking our butts with their new Series 54, Series 74, TTL. The people in R&D wanted to make it a little better, you know, wanted to do 10^{th} mil, and they couldn't do 10^{th} mil so they maybe 0.15 or two mils. I'm sorry, 2mil. And so in the end manufacturing couldn't make what sales was selling. So the marketing position was, "Just make TI Series 74 and we can sell it," but we didn't. And some of the

people who made that decision went on to places like National where their first products were Series 74 devices. That was how that went. Okay, so Mel's going to come up next here and talk about the early years.

Mel Phelps: I joined Fairchild from Texas Instruments. And that's where I went to take some early training because mine had been [vacuum] tube training up to that point. TI was a very well structured company with beautiful factories and a good organization, but it was quite a different culture. I thought maybe it'd be interesting before we talk about the contrast in products to talk about the environment. It was a company of seven foot tall guys in their Stetsons who had a considerable amount of bravado. They managed by intimidation and occasionally there was an opportunity for advancement. When [I joined] Fairchild basically it was a rag-tag kind of an operation. There was no marketing. There was a terrific field sales [force], but the culture was one in which you learned how to pull up your socks, how to pound the table to get your point across. And with that in mind, I'll walk you through a couple of things. By the time I got there [to TI] , the integrated circuit had just been patented. The first one to come along was in February of '59. Jack Kilby, [inventor of the device] by the way, was one of those tall guys. I remember meeting him in an airport one time and I couldn't find him [at first], but he was the head above all the other heads. So he fit right in at TI. By the way, let me show you what his circuit looked like. Basically a couple of slabs of germanium inter-wired as a hybrid circuit, and yet this thing warranted a patent with the patent office because nobody else had that idea at that point in time. By the way, that was germanium material, if I didn't mention it. A few months later, July of 1960, the monolithic IC --.a slab of silicon using a planar process - had come along and it was clearly superior, but it took a long time to figure that out. This [photo] is not the first pattern for it. This was after it got cleaned up a little bit. It's a top view and a side view. It was a very tough undertaking as you've probably heard from some of the manufacturing people, if you are in one of these other sessions, they told you how difficult it was to produce. I came in from the field after a short time into the first marketing organization working for Bob Graham. Others in the group, include one of the fellows on stage Cloyd Marvin -- a number of names you'd know, Floyd Kvamme and Ben Anixter, Murray Siegel, and so forth. We all had the challenge, first of all, of selling hybrid circuits, multi chip products. It was a logical place to throw this thing called an integrated circuit and let us go struggle with it. These were the problems. We couldn't make it, produce it. As it turns out, after 28 hours of diffusion, you might have one section isolated from another if you've got any kind of yield at all. So we had pretty much vaporware to sell, but we had a hell of a story. And what we did was campaign that around, being careful not to take too many orders, so what we did was hone in on the aerospace military market because, obviously you couldn't sell it to consumers, or commercial or industrial type markets. So we sold it, or we campaigned it I should say. The Phipps and Phelps routine, we kept bumping into each other. Charlie Phipps was selling a latter day version of that thing from TI, and the rest of us were doing the best we could to hold off any sales, but at the same time build up anticipation. I remember, by the time we had saturated the U.S. market with vaporware presentations, Europe got wind of this thing and they were interested in having us visit. The Bob Schultz from applications and I made a trip over there. We were greeted like rock stars. There were flash cameras going off at the airport. You can't believe it. By the time we got to Paris, there was a room probably twice this size full of people with everybody with earphones on getting translations. Nobody ever bought anything, but it was an interesting trip, about three weeks. As it turns out, we had more obstacles. We priced 'em high when we couldn't make 'em. We hoped that we could produce them in order to generate some reliability [data] and, at the same time as Bill had mentioned, we had a terrible choice of logic family - RTL. But in time that all got fixed and we were off and running. Now fast forward a little bit to 1965, by then we actually could make them. Gordon Moore had published his famous paper in *Electronics* magazine about the Moore' Law, and we were looking at commercial and consumer markets at long last. We also were looking at memory. And memory seemed very logical because it was predominantly ferrite core memories at the time - little donuts with wires through them. Semiconductor

memory offered a volume application and a new future. Basically we had what was called the Semiconductor Advanced Memory (SAM) Project which is a chip that ended up looking like this [photo]. In the middle were four 64-bit MOS chips surrounded by bipolar devices. Now this [panel discussion] is a bipolar session I realize, but it was clear to everybody that heat was a problem. Power dissipation was a problem with memory and yield, for sure, and other things such as you would have defective rows and columns, bits missing and so forth. So error detection, error correction, redundant rows and columns, all of that came out of this and it did end up becoming a vehicle that Intel latched onto when they started that company. By this time the first wave was about over. It was about 1968. We sold this operation to Data Products and that was the end of that. Thank you.

Cloyd Marvin: I've got a couple of little stories to tell. I joined Fairchild in 1963 and came from Autonetics where I was designing transitorized systems; analog to digital computers for terrain avoidance work in the aerospace business. I was using Fairchild's specially selected device -- it was an SP2060. I was very critical of what these particular specifications were. They had a salesman down there called John Lambros who was my interface to the rest of Fairchild. I was in Anaheim. And after I interacted with him for a little while, he says, "Well, I'd like you to talk to some people over at Fairchild." And the people turned out to be Mel Phelps. So Mel was the primary guy that brought me to Fairchild. They flew me up and I met Bob Graham and Bob Noyce and the other troops, and I couldn't resist because the primary reason was that I couldn't breathe in L.A. because the smog was so bad. This talk is about two little stories that I'd like to tell you. One is the opportunity lost and the opportunity gained. This takes place in the mid '60s towards the end of this first wave that we talked about. And it really starts with me having come back in from field sales where I was the responsible salesman at IBM in Poughkeepsie. I was approached by some of the upper guys at Fairchild, Noyce was one of them, to come back and take over a product line, and I had come from product marketing before that - that looked like it would be kind of interesting. And that's really where this starts, when I came back from Poughkeepsie. The first place where we can see that there's an opportunity lost is with technology that started back in the 1910s and pretty much carried on just the same way, and that was in the adding machine industry. The companies that you're familiar with are people like Friden, Monroe, SCM and Victor. One of my jobs when I came back from Poughkeepsie was to take over what at that time was called complex arrays, which were gate arrays, large chips and they could be interconnected in different ways. It turned out not to be very practical and then full scale custom projects started out. But my job at that time was to go out to these adder companies and convince them to convert their gadgets into electronic devices. So I went around to a variety of these people in the mid '60s and they didn't see themselves as [electronic] calculator people. They saw themselves as mechanical people, gears and wheels and stuff like that as represented by that earlier photo of the Burroughs machine. I spent a good deal of time going around the country talking to these people. I would try to talk to the president of the division or the company that was involved with these mechanical products and they invariably would bring their chief technologist in. They were usually called chief engineers at that time because they were probably mechanical engineers. My job was to try to convince these people that they ought to take a look at this stuff called logic and consider transferring their machines into this newer technology. Well, I spent a bit of time talking and trying to demonstrate stuff and not one of them found it to be interesting at all because their technology people invariably would say, "That's not the kind of business we're in." But what they really were saying is that we don't know anything about logic so we can't even begin this. They weren't going to fess up to their general manager or their president that they could restructure their engineering department to handle electronic stuff because they really didn't understand it. But it was a huge market [opportunity] for these people, and it turned out that the people who did become interested in these products were the Japanese. I'm sure there are a lot of people here who remember that the Japanese used to come into our company and take photographs of everything and buy very little. And sure enough, they started developing electronic four-function calculators, and they dominated the business in a very short period of time. Our guys had had

full exposure to this but were unable to get out of the trenches where they were stamping machines and gears and levers. The next thing that I'd like to talk about is opportunities won, and this was the foundation of a company called Four Phase Systems which you probably know about. Fairchild was designing in the mid to later '60s, MOS products that by and large couldn't be produced very well. Our manufacturing guys, and Gordon Moore admitted to it last night in this founder's panel, [that we] couldn't make MOS. We had a group of engineering people there that were led by a chap by the name of Lee Boysell who had a single-minded purpose in trying to come up with these very high density things that would allow computers to be built. And we actually spun out in '68 and started Four Phase Systems with the ideas that I had been trying to prosecute with these adder companies and using this stuff really to make complex stuff. So we spun out and design work started in '68 to make a single-chip microprocessor. And, in fact, Four Phase made the first single chip microprocessor. This happens to be a tie clip that I had made up to show people what they look like, and this particular one includes all of the silicon that was in the whole CPU unit. It includes memories, which are the large blocks, and one up in the upper left-hand corner which was called the AL1. And that was the single chip microprocessor, and we came out and started demonstrating that to customers in 1969. At that time, Bob Noyce had been on our board, and when he saw the progress that we were making he said he's got a conflict of interest and he's going to have to resign because Intel was going to go into microprocessors. Well, it turned out we were demonstrating our product in a minicomputer that we'd built in 1969 which turned out to be about a year and a half before Intel came out with a chip that they called a microprocessor. We had a lot of growing to do here because we found out that we couldn't get these things made anywhere, so we had to set up our own fab, which we did. And Four Phase made their own chips after having had some prototypes made by people like Cartesian and Intersil. So this product came out and it represents the state of the art at that time. We were able to prove that it was the first chip because TI, in their rigor to try to prosecute other companies who were infringing on their patents, tried to go after Dell and get Dell to pay royalties on all the computers that they were using. And there was a big lawsuit many years later that resulted from that. We were called as expert witnesses and showed working products and literature that we had in the '69 timeframe. And we were able to show the discovery lawyers that T I had no case for their patents because we were using trade secrets to protect our stuff. We blew them out of the water. So, they were [there] before Intel and even had some patents in it. And so this [Four Phase] was this the first place that a microprocessor was ever produced.

Bill Baker: I'm going to talk about a small segment of the digital bipolar business that I was very involved with. And the issue that I'm going to really want to bring up is this is my narration of and representation of the work of a lot of wonderful people, some of which are here, some of which wish they could be here, and some of which are no longer with us. I just want to thank them personally for the effort that they put into this. I'm going to discuss two very difficult tasks. The initial one was the Illiac IV chip which is the fifth photo on the wall down here from the right hand side. This was 256-bit CML [internal circuit] memory that was shipped for the Iliac system. The Illiac era was the time of 16 and 64 bit memories, ROMs, and some fused-link PROMS. The Illiac project was really taken from TI who was supposed to produce the memory for Burroughs. Well, it turns out there was a group in Palo Alto at R&D, Rex Rice, Wendell Sander, Frank Green, etcetera, that were able to get this contract to build the memory system for Burroughs with this chip. One of the issues was when you look at this function the chip would have been too big for the package. So instead of having a fully binary decoded part, it was a three out of six decoded chip on the perimeter so that the devices and the design rules could fit in the CerDIP [ceramic DIP] package. The chip manufacturing came to Mountain View. Now, typically one of the things that we had to do in our group is, we would take a look at one of the criteria that many were familiar with, is determine how many good die do you get per wafer? Well, in the case when we started this program, it was how many wafers to get a die. So we had our challenges to be able to make it. In addition to that, this chip was also a CML design and ran about, for 256 bits, 1 watt. We didn't have a lot of handlers. We didn't have a lot of very

sophisticated test equipment, so we had a lot of people with burned fingers because these things were quite warm when they went to that particular area. Well, we've worked our way through this project. We've built the chips and shipped them to Burroughs. I happened to be with Rex Rice when we went and presented the first board to a gentleman some of you may know at Burroughs. A guy named Reese Brown was the head of the memory systems. You're laugh! I knew there'd be some that knew Reese. Anyway we walked in with this board that through blood, sweat, and tears had happened. He picked up this memory board that Rex and Wendell and Frank had built up in Palo Alto with all these CerDIP packages on it and bent the board and "whish" all the caps came off the packages. Needless to say, he said, "I don't like the reliability of your package." The last story on this particular era is that we finally built the boards and delivered them. We started in Mountain View building the chips. They went to Palo Alto where they were put into the board. Then to Pennsylvania to build the memory systems. Then they went to Daniel Slotnick at the University of Illinois to build the computer. The project at Illinois ran into the time when they had student uprisings, so they took the Illiac computer after they built it and shipped it to NASA Ames at Mountain View. So I could see that computer going all the way around the country and ending up right here. The next story is about the Isoplanar process. We built the first product, the 4110, which is a 256-bit bipolar memory device. I think there's one person here in the room, maybe others now, Harry Sello who was involved in how the process got named. This is right around the 1970 time frame. We'd shipped the Illiac, basically it was dead-end. We did not have a job, period. We were right in one of the normal depressions I should say a recession, of the industry. What happened was the group in R&D, after Leo Dwork reorganized it, took a group working on an oxide isolated process headed by Doug Peltzer, and merged them into my group at Mountain View. for those of you that don't know, Doug Peltzer was a cartoonist and he had a cartoon person called Mother Flubber. He did a series of cartoons describing how the process worked, we called the process ISOXS at that time. We were able to get an audience with Les Hogan. So Doug went through this thing. Hogan says, "I like it, but I don't like the name. ISOXS sounds like dirty socks to me." Basically it was Isolation Oxide isolation. That's what ISOXS meant. So that's where the name Isoplanar came from - planar because it's Fairchild and Iso because it was an isolation. Some of the [challenging] areas that we got into there were the epi substrates where you had to grow a one and a quarter micron epitaxial layer. We shaved it. The other one is that and we had defects in these very thin epi layers because we had to go through the epi layer to get the isolation. We couldn't figure out how to get rid of defects. We'd break wafers in quarters. We wrote a two on it with a diamond scribe. It turned out that after we did the sertal etch, for those who are familiar with it, we saw no defects. We cleaned it up. That happened. We had over 1,000 washed emitters on this part. We couldn't use common flash apparatus. We had to develop a wire flash process. We had to develop high angle bonders to be able to put this together. We went through the transfer of our process after the Indian uprising in Shiprock over to Southeast Asia. We shipped this product to Control Data, Burroughs, Fujitsu, and the Cray I was built with an ECL version of that part. The internal parts of those transistors, the memory cells were ECL. We had our first big month and we framed a note from Will saying we had our first million dollar month. That was one of the things that we mounted in the area. And our profits rivaled George Wells's comments earlier about the Diode area. In terms of actually gross profit percentage, we were right there with the Diode and today Tom Longo has no idea how we did that. Actually, we're not sure either. We had a contest with our employees and they generated the bipolar patch you saw in the exhibit outside.

East: April 1968 I had maybe four months to go before I got my master's degree, but I was trying to line myself up with a job because I was getting married in a couple of months and I needed a job. I was able to find an opening in Fairchild and drove down there two or three times for interviews and then finally they said, "Well, we want to make you an offer. Come down, we'll do lunch and we'll make you a job offer." So I did drive down there and I met a guy named Jerry Briggs who was in HR and a guy named Gene Flath who was what we called the product manager. He was the big boss in the factory. And they took

me to Chez Yvonne, those of you who were around at the time you know that was the official restaurant, and they gave me an offer. They almost forgot to do that 'cause they were having a good old time at Chez Yvonne, their martinis and what have you. I was just a kid, I didn't know if I should have a martini or not. I think I probably did. But even though I wasn't really in on the conversation, I did have an offer letter. Okay, I'm going to have a job at Fairchild as soon as I finish my master's, which is right after Labor Day. And they said I didn't need to bother to call or keep in touch until right before I was ready to come. I should call them then and they'd fix me up. They both gave me their cards. So with a couple of days to go before I was ready to start, I picked up the phone, and I was a little scared of Gene Flath because he would be my boss and he seemed like kind of a scary guy. So I'll call the HR guy. That can't be so scary. And that was Jerry Briggs. A lady answered the phone who said hello and I asked, "Can I speak to Jerry Briggs, please?" and she said, "There's nobody named Jerry Briggs that works here," which was a little worrisome to me 'cause I had his card there and I asked, "Did I dial the right number?" "Yeah, you did, but there's no Jerry Briggs that works here," and I got into a little debate with her and she finally assured me, "Look, I've been here a month now and there's never been anybody named Jerry Briggs that worked here, so I don't know what you want me to do." Well, luckily I had the business card of the other guy, Gene Flath, so I thought, "I'll let her win this one and I'll call Gene Flath, but I really need to win the next one 'cause I need the job." So I called Gene Flath, got a secretary who answered the phone and I asked for Gene Flath and she said, "I'm sorry. There's no Gene Flath that works here." And I assured her there was and asked if I had the right number and I had the right number. And I kept telling her, "Look, I know there's a Gene Flath that worked there. He offered me a job." She said, "Look, I've been here longer than anybody in the department and there's never been a Gene Flath that worked here in all the time I've been here." It's starting to get really scary. I asked her, "How long have you been there?" She said, "I've been here six weeks now." So I wasn't quite sure where to go, but I thought probably better to fight this in HR. So I called back up, got the first lady, asked "Who is the manager there" and she fixed me up with a guy who said, "I've never heard of you, but there has been a little turn over. Let me go get your folder." He went to get the folder, came back, said, "You don't have a folder and there's no record of us offering you a job and I don't think I can do anything for you." Well, I needed the job and I had the offer letter so I got into kind of a heated debate with him and he said, "All right. You come down on Tuesday," which was the day after Labor Day, "and you bring that offer letter with you and we do have some openings. I'll fix you up with one of them." I'd actually interviewed for a job as an engineer but when I got there and gave him the letter, he said, "I'm going to give you a job as a wafer sort foreman." So that's where I started out and I was glad to get the job actually. And of course, what happened was in between April when all this started and September when I got there, Hogan had come in, brought all his Heroes in, and they fired a whole bunch of people. Those that didn't get fired quit. There'd been total turnover, so nobody knew what was going on. I thought this place it's like out of Twilight Zone. And so to wrap up, and I think I have one second left, to wrap up, I started on a Tuesday, the day after Labor Day, and Friday of that week I was actually trying to get some work done. We were getting zero yield on a wafer program and I rustled up an engineer and got him to start helping me. He worked on it for an hour or so and couldn't figure out what was going wrong. And then he looked at his watch and said, "Hey, it's lunchtime. We're going over to the Heidelberg to have a few beers and so I've got to leave." But I remember my boss needed those wafers sorted and so I asked, "I've got to get this done. When you come back, can you make sure to come in here first and help me get this going?" And he said, "Back? What's back? This is Friday. I don't come back on Friday." So that's when I knew that I had joined a fine company that I was going to like a lot.

Welling: That was great. There are a lot of stories. John has even several more as you saw in the slides, but what we wanted to do is open up the audience and find out if some other people have some stories because we said at the beginning this is a lot about you and your experiences and if you can bring

a little story, credence, humor, etcetera to our meeting. So is there anybody that wants to offer something? Here, please, in front.

Henderson: Dick Henderson. I was the technical guy that went out with the sales guys to try to sell Micrologic to the world. And this was in the days when people designed flip flops by checking and testing every part that went into it and the computer manufacturers didn't believe that a transistor manufacturer could possibly know anything about computers or how they were designed or logic or flip flops or gates or anything else. So the resistance, as I'm sure all you sales guys will agree, was pretty fierce. And that was exemplified for me when I went in with one of the guys, and it's probably someone in the room, I don't know, I don't remember who it was, to Librascope down south. The engineer was pounding his desk. I couldn't quite believe this. He was pounding his desk. "I will never use a flip flop that's designed by anybody other than my department." Well, I hope he had a profitable career after that because, as we all know, nobody designs flip flops anymore out of resistors and transistors.

Welling: Another comment?

Gene Ahmdahl: This really is not entirely about Fairchild, but I started Amdahl Corporation in 1970 and in early 1971, I believe in late January or February, I called on Fairchild to see if they would make a chip for us using an ECL gate array We wanted 100 gates on the chip. We were informed right away that you were not doing anything in ECL, so we went on to other semiconductor companies. One of them we went to was National Semiconductor. They had a big hearing which had about 50 people in the room. We presented what we wanted them to do for us. They listened very attentively. And as soon as they were done, they said, "We have a full plate." They were only there to listen to what we were trying to do. Now, we went to Motorola. Motorola thought we had gotten some breakthrough in interconnection technology, that is software, and so they were willing to make it for us if we'd give 'em the software. We agreed, but they wanted the software before they would do the chip and we wouldn't do it that way. Then we went to Texas Instruments. Texas Instruments listened to us for about 15 minutes and the head of that division called me out and he told me it'll never work. In second place, even if did work, it's in the wrong level of integration - we'll add no value. And thirdly, you'll spend all of your money trying to do it and have nothing to show for it and you'll go belly up. That was my response for all of the major semiconductor companies. But we did have a man we'd worked with before who'd started AMS, Advanced Memory Systems. And they'd completed the design of both a high speed ECL storage chip and a regular FET, or MOS, memory chip of 1,000 bits, I believe. They had not gotten a very big market yet, so they needed the money in order to keep their design team employed. So they made it for us and it came out within 5% of our estimated performance. And that made our company Amdahl Corporation able to compete very successfully with IBM who was struggling to try to get 35 gates on a chip.

Welling: Great, thanks Gene. Someone else?

East: I just want to comment on Gene's story there. If you didn't hear it, the company was AMS - Advanced Memory Systems. It's where I ended up after a while and we actually did manage to make those circuits. They were ECL as I recall, washed emitter, very fast, and it was meeting his demands. This is known as listening to the customer. Gene in those days worked everything out on very large sheets of paper with Laplace Transforms and whatever else his magic was. I remember going into his office at one point. That was the beginning. We were the only semiconductor memory company at the

time. You probably never heard of 'em but they acquired Intersil and changed their name their name to Intersil. That's where I spent nine years after that first stint. So nice to see you again Gene.

Welling: Hank Bloom.

Bloom: The original Micrologic was called Bottle Micrologic because the transistor base had the shape of a bottle, but as they didn't have discrete resistor in the base circuit there was no way those devices could meet any specification whatsoever. Bob Seeds was hired at Fairchild from IBM to put discrete resistors in the base. Then if you controlled the temperature in the test room to about a half a degree, and you controlled the power supply, you could perhaps meet a specification some of the time. Now marketing would sell to military customers and military customers wanted specifications so we had some very lengthy, very ugly, specification negotiations. I remember one with Bill Welling where he climbed all over me for getting out of line. We had one overlooking Moffett Field the day Kennedy was shot and Dave Conway, a really neat salesman from Long Island, was trying to keep peace over the whole thing. And we were getting hot under the collar and then they lowered the flag at Moffat field and we calmed down and we figured out how to get along with it. But it was very dicey trying to meet the military market and trying to get a specification and trying to control a test room to a degree so we could sell parts to some specification.

Welling: Great, thanks Hank. Are there any other comments? While we're waiting for another, can I get the mike over there? Mentioning Dave Conway, Dave was one of our stellar salesmen out there. Dave had a pocket full of cigars for every buyer. I remember there was a milk strike in New York and Davy took it on himself, he went and got milk at a factory and delivered it to the buyers' doorstep. So he always ingratiated himself to every buyer.

Hume: I'm John Hume. I thought Hank Bloom would tell this story and so when I tell it he might have a few corrections. But in the early days of Micrologic, as he pointed out, we just couldn't meet these military specs. People wanted noise immunity measured far beyond what we were [able to supply], and so Fairchild had just a massive amount of reject volume, but not very much in the way of yield that would meet these military specs. So I remember Henry mentioned to me one time that he had a kind of a feel for how much we had in inventory of the rejects and he had very thorough knowledge of what the specs were that we could meet. So I remember he had a meeting with Charlie Sporck and I, you can correct me if I have some details wrong here, but his comment to Charlie Sporck was, "Why don't we sell what we have? Maybe people, if we give 'em the right price, will decide they don't need what they're demanding right now for a much higher price." And Micrologic was selling for in the dollars per gate at the time. So we came out with a sub dollar price per gate. People in marketing probably know this better than I do, but all of a sudden there was a lot of inventory from Fairchild that the market was very interested in. So this Micrologic which had just been a total dog before, all of a sudden was very, very profitable. I knew a number of people at Raytheon and other places where they said, "You guys will just die coming out with this cheap logic. You'll never make it." But it was a very successful venture for Fairchild to come out with this cheap logic.

Welling: We have time for one more comment.

Man 5: Before I came to Fairchild I put in three years in the Navy at NSA. And so when we were talking to the agency about designing the Milliwatt Micrologic family for them, I was the only one that had the top secret crypto clearance, so I was the one who designed the Milliwatt Micrologic that are [known as] the R13 circuits. When the intrusion alarm went off in the secure room, I was only person in the company they could call who had to come and go into the secret room in the middle of the place at Porter Drive. But the R13 family went on for how many millions of devices and years. I know that Ollie North, when he stood up and held up the crypto device, that was full Milliwatt Micrologic and that was quite a few years later.

Welling: What was that called? R13 or something or other?

Man 5: R13 was the group at NSA that placed the contract.

Welling: Right. I visited NSA a number of times and they inspected my badge by an armed Marine guard and there'd be [one at every] corner and intersection. They took me into a lab and they were showing me some of the technology. Then we went out for lunch and the guys ordered a pitcher of martinis and I said, "Oh, my. There's our secrets." I think that just about wraps it up. Thank you.

END OF INTERVIEW

