



Fairchild Oral History Panel: Linear Integrated Circuit Products

Fairchild@50 (Panel Session # 6)

Participants:

Dave Fullagar
Jack Gifford
Garth Wilson

Moderated by:
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Norman Doyle: In July of 1966 I died and I went to heaven, at least that's what it seemed like, I started work at Fairchild Semiconductor in the Consumer Applications Department under Derek Bray. The group included Dave Bingham, Tom Mills, Harry Suzuki, Jay Tucker, Don Smith, Tony Vandersteen, Bob Hood, Andy Adamian, and many others, and we were having the time of our lives. We were replacing vacuum tubes in every conceivable consumer product. We designed Fairchild transistors into color TVs, into stereos, and even into appliances. I actually at one point worked on an 8 track tape player, who remembers those? Even getting up at 5.30 in the morning to spend the first 2 hours of the day at R&D in Palo Alto at Andy Grove's semiconductor physics course, only added to the enjoyment; where else could you listen to Jim Early explaining the Early Effect? Well, later on I moved into consumer Linear IC design under Larry Blazer and now we were replacing those pesky vacuum tubes with integrated circuits. We developed the first monolithic chroma demodulator for color TV and we soon added other TV processing circuits, FM stereo decoders and audio amplifiers to name but a few. But all of this was made possible by the fact that Fairchild by this time was now a leader in Linear. Starting from 1964 with the launching of Bob Widlar's revolutionary op amp, the μ A702, the inspired strategies of Jack Gifford took Widlar's concepts to market and Fairchild rapidly dominated the world of Linear integrated circuits. This was really an era when the incredible was in production and the impossible followed about a month later. Well, Linear went onto become a very solid contributor to the Fairchild revenues and was guided by a succession of division managers including John Husher, John Sussenberger Jim Smaha, George Wells, Doug Sullivan and the late, and sadly missed, Rodney Smith. But the whole thing started with that visionary group of designers and marketers back in the mid '60s without whom it would never have happened, and we're privileged to have three of those people with us here today as speakers. Now each of them will make a brief presentation and then I'll open the meeting up for questions and comments and we're really going to focus mainly on your questions and comments. I think Linear is an exciting subject and I have to believe that there will be plenty of questions and maybe plenty of comments too. Our first speaker is Garth Wilson, Garth graduated from UC Berkeley with a BSEE in 1956, an MSEE in 1958 and a PhD in 1962. He joined Fairchild in 1966 as Linear IC Design Manager at R&D in Palo Alto. In 1969 he co-founded Precision Monolithics with Marv Rudin and he then went onto leading positions at AMD, Intel and Digital Equipment Corporation before retiring in 1995. Please welcome Garth Wilson.

Garth Wilson: Thank you, Norm. You've heard that I ran the design group for the Linear IC in R&D, so let me give you a little bit of background as well as I've been able to understand it about how we came about and what we were chartered to do. We basically started the LIC Group in R&D in mid 1966 when there was already a well established and effective design team cranking out products in Mountain View under the genius leadership of this gentleman here pictured on my right, Bob Widlar. I think what happened was that over the course of working with customers selling the products that we had, the marketing people and the applications people accumulated a list, probably about a 12-page list of product ideas that their customers had proposed that they'd like to see. Since there wasn't the bandwidth to work on them, somebody came up with the idea well let's start an R&D group and let those guys work on that. So when we came on board, we had this laundry list of things to work on that would knock your socks off. As Norm mentioned, Marv Rudin and I started Precision Monolithics two years later in 1968, so our tenure at Fairchild was just that brief two years. Marv was actually the first guy they brought on board to run the organization. I'm not sure how they picked Marv. He was a guy from the aerospace industry in southern California and they hired him to put a group together and get things started. And the group consisted of both design and process people so Marv went about doing that, and basically he recruited a bunch of guys to come on board all in about July of 1966. As the group got going and we hired our people, I ended up with 4 engineers working for me and 2 or 3 technicians. Dave Pilling ran processing. He had 4 engineers working for him and 3 or 4 technicians. Then we had John McDougall running

systems. We weren't quite sure what that meant but he was kind of trying to get the context for the circuits that we were working on.

We very quickly learned the truth of a little homily floating around Fairchild that goes something like this: If you're working at Fairchild R&D, it's easier to get something transferred to Sunnyvale than to Mountain View. For those of you who don't get the subtleties, Mountain View is where the Fairchild factory was; Sunnyvale was where the start ups went. So we very quickly learned that we had a force field to contend with to get anything transferred. We started up a bunch of products, working variously on a dial tone generator, electronic organ generator, low-power op amp, differential in/differential out amplifier, FET input op amp, A to D comparator, a Signal Corps contract with Fort Monmouth. But I'd like to focus your attention on the successes we had, which were really excellent at least in terms of their contribution to the industry, if not to Fairchild. One of the engineers we had in my group was Dave Fullagar, the man on my left. We started him working on a precision op amp which got the product name $\mu A725$, a low noise, low offset voltage op amp. One of the things that came out of R&D was a capacitor process using silicon nitride. After Widlar had left Fairchild and gone to National they came out with the LM101, which was their first op amp. It was like the 709 but was much easier to compensate and make stable because it only required one external capacitor. None of us was thinking about this but Dave came up with the idea, well if you can do that, why don't we integrate the capacitor onto the chip and make it an internally compensated op amp. We all thought that was a fantastic idea and said let's go, let's get started. Mountain View liked it so well that they said, "You need to send Fullagar to Mountain View so he can finish the project." So we did. Dave, after being in R&D for about a year I guess, transferred with his project to Mountain View and developed the $\mu A741$. It was a huge success, not only because users loved it, but also because it was easy for our manufacturing people to build with reasonable yields, which was not the case with the 709. That was certainly one of our big successes. George Erdi, who was the other superstar in my group, took over the 725 and made a very successful product out of it. Let me say that there were a number of other innovations that we brought out. One was using thin film resistors to make a micro power amplifier; another R&D guy Bob Waits who's here today developed that process. Ted Jenkins was our star NCG process development guy. When Marv and I left to start PMI, we tried to recruit him but we found out later that he already had a covert job working for the recently founded Intel in a capacity that he couldn't talk about.

Doyle: Thank you very much Garth. Our next speaker is David Fullagar, indeed, a very nice a lead in. David graduated from Trinity College Cambridge, that's in England in 1963, he worked for Ferranti in Scotland and for Transitron in Boston before joining Fairchild in 1966 where he initially worked with Garth in Palo Alto on the $\mu A725$. There he came up with the concept for the internally compensated up amp and transferred to Mountain View to bring into production what became the industry's best selling linear IC, the $\mu A741$. In 1969, David moved to Intersil where he rose to the position of R&D Vice President. In 1983 he co-founded Maxim with Jack Gifford and Fred Beck and held various positions there including Vice President of R&D until his very well earned retirement in 1999. Please welcome David Fullagar.

Dave Fullagar: First thing I want to do is pay tribute to Bob Widlar but I also want to put him out of his misery because Bob would never attend a session like this unless he suitably lubricated. So I want to put a smile on Bob's face.

[Fullagar puts a bottle in front of a photo cut-out of Bob Widlar.]

Fullagar: What I'd like to do is focus on a three year period which I'm most familiar with from mid 1966 to about mid 1969 and, you know, this has been said before but I'll say it again, an incredible period. It was exciting, it was just a creative period when Fairchild was absolutely king of the heap and thanks to Jean Hoerni's planar process, it had the best processing in the industry, the highest performance transistors, a very successful logic family. In early 1966 a processing R&D group under Andy Grove was writing the book, it turned out literally, on semiconductor processing. A prolific consumer group and absolutely number one in linear circuits, in fact honestly there was nobody else in the business at that time. I know Jack will tell some of the Bob Widlar stories but I do want to comment again back to what Norman said, he and Talbert formed this incredible duo and with almost no official sponsorship from Fairchild created a linear family, the 702, 709, 710 and 711. Very elegant circuit designs for those of you that have looked at them. And Talbert, with again almost no sponsorship from Fairchild, created a 40 volt epitaxial isolation process with lateral PNPs, vertical PNPs, pinch resistors and that had never been done before either -- and they pulled all this off in the space of a year and a half, two years maybe. Those products went on to form the basis for the Fairchild linear products and I think all of us in the design community pay homage to that effort because it was so incredible. As Garth mentioned, I started in the R&D group and then moved to Mountain View and, jumping ahead a couple of years, by 1968 there were a host of second generation products under development, Dick O'Day's 722 D to A, Colin Barry's 715 high speed amplifier, Darryl Lieux's 723 voltage regulator, Bill O'Neil's 733 wide band amplifier, George Erdi's 725 we've already mentioned and my 741 and a host of other products. Fairchild seemed to rule the world with National really being the only competition in sight. Then something happened and it all seemed to unravel. Between the fall of '68 and the spring of '69 Jack together with Jim Giles, Larry Stenger and Frank Botte went off to form AMD. Marv Rudin, Garth Wilson, George Erdi went off to start PMI. I joined Jean Hoerni, Don Rogers, and Murray Siegel at Intersil shortly thereafter joined by Bill O'Neil. Dave Bingham went to Cermatek, Colin Barry went to Signetics, Len Brown went to Motorola, Mike Markkula joined Intel (the latter two from the marketing group). It begs the question -- what happened? Why did all these people leave when the company appeared to be so successful and have such a dominant market position? The best way I can explain it is to tell a story that is to me kind of a metaphor for maybe what happened. Sometime in the late summer of 1968, Mike Scott who was in the Linear Marketing Group, decided that it would be a great morale boost if we all had a party and Mike decided that he was gonna add a little color to this party by having a number of nude models show up and the design engineers were going to be given body paints and we would get to express our artistic talents on these ladies. Now the big question was, would we use our fingers or would we use brushes. Nowadays this would be totally politically in-correct but remember this is the summer of 1968 and the time of Haight-Ashbury and the so-called "summer of love." Really it didn't seem like it was anything out of the ordinary at the time. We were looking forward to it, but about 2 weeks before this party was due to happen, Les Hogan and the rest of the guys from Motorola showed up, in their pin stripe suits and white shirts and ties and the party never happened. It was one of the first casualties of the new administration and so in my mind it was with Fairchild, at least in the Linear Group. I'm not speaking now for the Consumer Group which I differentiate slightly but, you know, in the Linear Group it seemed like we were all having a great party, it was a lot of fun and then suddenly somebody came in and turned the lights off and turned on the sprinkler system and we all left and it kind of begs the question, why did that happen? Actually it begged two questions. Why was everybody leaving and did the mass exodus cause Fairchild's demise or was the ship fatally damaged and we simply got off before it sank? In the last few days I thought about this question, the first question, why was everybody leaving, why did everybody leave and I realize I can't speak for other people, I just have to speak for myself. I don't think it's because I thought that I was going to get rich by going to Intersil. Frankly I didn't even know what an IPO was, you know, I didn't know what a stock option was in any real sense of the word and it wasn't because I had in any inkling that Fairchild was about to implode. It seemed like I was leaving at the crest of the wave frankly. Neither is it really fair to blame it all on the cultural change brought on by the arrival of the guys from Motorola, although it did

seem like a management style change which maybe took some of the fun out of Fairchild as I perceived it. Somehow it's a little bit like the Nixon White House team of Nixon, Halterman and Ehrlichman taking over management of the Beatles. Now maybe if Les Hogan had showed up with a pony tail and Birkenstocks it all would have been different. A dozen years later, Jack and I had a similar experience when General Electric took over Intersil but that's another story. But I think the overriding factor for me anyway was that I was looking maybe for more of a challenge, I wanted to start my own group, have more say in the way the company ran and Intersil at that time offered that opportunity. My office was two doors down from Jean Hoerni's, company strategies were discussed around the coffee table and by comparison, Fairchild seemed kind of ponderous. Regarding the second question: did the mass exodus cause the demise of Fairchild or did we just leave in time. I think that's maybe a point for the discussion group -- I've got some ideas but I won't get into that right now. Now if I appear to have dwelt on the negatives, I should repeat what I said at the beginning, that is was an incredibly exciting time, a very creative period and a great time to be in the industry and the subsequent years have been equally rewarding and for that I am eternally grateful: it's been terrific -- thank you.

Doyle: Thanks David. I think it should be obvious to everybody that David left Fairchild because he didn't get to paint a naked lady. Kinda gave yourself away there, David. Our final speaker today is Jack Gifford, who's often referred to as one of the founding fathers of the analog industry. Jack graduated from UCLA in 1963 and he joined Fairchild in 1964 where he became the company's first director of analog products. In 1968, Jack was a co-founder of AMD and was VP of Marketing and Planning until he moved to Intersil where he became President and CEO. Jack co-founded Maxim in 1983 and he served as President and then Chairman of Maxim until his retirement earlier this year. Jack has many awards and honors in his portfolio, too many for me to list all of them here, but I'm fairly sure that one of his proudest achievements is his election to UCLA's baseball hall of fame in 1990. Would you please welcome Jack Gifford.

Jack Gifford: Thank you Norman, to answer Dave's question, I left because I was 25½ years old and I was sitting there on a chair in a big office managing 200 people and my feet couldn't touch the ground. I just was very uncomfortable being an engineer thinking that the rest of my life was going to be sitting in this office. So I got the hell out into a smaller environment where I felt like I was in control again. I think the [degree of] success [achieved by] of most of the fellows in this room and at Fairchild is unheard of in the annals of corporate history. No company has ever spawned so much talent and the success to failure ratio is so high. I think largely it was because these people were individuals who wanted to be in charge of things. They wanted to run things. They were recruited because of that trait and that type A personality and they just weren't comfortable in this corporate environment. So we left. Like Dave says, we really didn't know what stock options were, I never have taken one of these jobs to make money, it was more for excitement and running things. Being a little guy, if I didn't start the ball game, I didn't get to play.. So I usually had the bat and the ball and I wanted to be in charge. I think a lot of us had that mentality. I want to first put a couple of things in perspective and then I'll tell a couple of quick stories. When we started the analog group, and I'll define who I mean by we in minute, there was no industry. There were basically 5 or 6 guys in our entire company that were involved in it - Dave Talbert, Bob Widlar, myself, a couple of other guys. That core took an industry that didn't exist to [the point that] when I left, 80% of an 80 million dollar business which isn't very big given that some of us have run companies well into the billions of dollars. But today the analog business, most of you probably don't realize it, is the largest segment of the integrated circuit market. It is over 65 billion dollars as a segment and it started, fundamentally at Fairchild in the mid '60s. At Maxim, we erected a monument and had a day to acknowledge what we, Dave and I and others at Maxim, considered to be the true founders of our industry. They were Dr. Jean Hoerni, who Dave and I both worked for at Intersil, and Bob Widlar who was at Fairchild. Bob primarily for

his circuit design capability, and you could have thrown Dave Talbert in there, but Hoerni really caused the industry to grow through technology more than any other individual. Dr. Hoerni pioneered micro-power CMOS for both microcontrollers and analog. We acknowledged those two as being the true founders of our business and the rest of us are basically role players. I have three stories. One I think you might be interested in is how linear circuits as a business got started at Fairchild. This took place, as Dave points out, in the early '60s, '64 or '65. The 702 amplifier was developed, bootlegged, completely by Bob Widlar and Dave Talbert as I explained already. I was a salesman, a year out of college in LA and I was one of the few guys, myself and I think Vic Grinich, in the company that had any real understanding of gain and phase relationships and how amplifiers worked and things like that. We had a design background and Bob recognized that through dealing with me as a salesman. Then as he and Dave Talbert developed the 709, they bootlegged samples out to myself and Floyd Kvamme and asked us to see if customers were interested in it as it was a very complicated circuit. In fact no one, maybe with the exception of Dave Fullagar and Bob Widlar, knew exactly what the real circuit looked like. People had the schematic explained to them by myself, Widlar, Mike Markkula and others. That circuit was not the actual circuit; there was another circuit that no one ever saw. We became stars explaining the circuit that was on the diagram. As we sold this idea and explained this circuit, there became a huge interest in the product. I was at Hughes Aircraft, which was the largest customer in the world, IBM I think was maybe second or one was first and one was second. Floyd had IBM. As an analog customer it [Hughes] was huge. They were building all kinds of missile guidance systems and they had a satellite program, they were putting the first synchronous satellites up and this product, the 709 just completely revolutionized what they could do in terms of micro-miniaturizing things, getting large voltage swings which would reduce or improve the signal to noise ratios. Within 6 months I could see, and the general management at Fairchild started to see, that this was gonna be a successful product and they wanted to make a product line out of it. So Tom Bay and Bob Noyce went to Bob Widlar, who had defined and designed this circuit all on his own without any sponsorship. Bob said, "you're gonna be happy to hear that we're gonna make a product line out of your products". Bob just looked at 'em both, and remember this is a junior engineer, I mean he's got a BS degree like I did, he was an applications engineer, shouldn't have known anything about device physics, he taught himself all of that and he says "The hell you are." He's talking to Tom Bay and Bob Noyce, two of the most sophisticated, impressive people that I've ever met and he's telling 'em "get screwed, you're not gonna do this." They got up and they walked away and came back the next day starting the conversation over again and Bob said basically the same thing, they asked "Why not?" And he said "Well first of all you guys don't know what you're talking about, you don't know what the circuit is, you don't know how it works, and furthermore no one in the company knows how it works and is used. I'm not gonna let you ruin my reputation." This is a true story, these guys are gonna ruin this engineer's reputation and he was sober at this time! Well some of the time he wasn't. They wanted to kill him but they couldn't afford to kill him because he's the golden [goose], you know, you're not gonna kill a rock star. You may hate him but you're not gonna kill him and they walked away. They came back again and they said "Well listen, we understand your problem, what would make you feel better about that?" He says "Well I want some people competent communicating and dealing with my products. They said "Okay well we'll put our best product managers in front of you and you can pick one." They ran a bunch of guys through him and he didn't like any of 'em and they finally said "Who is it that you would like?" "Well there's this kid down in LA, Gifford." They didn't even know who I was and so I get a call the next day from Bob Graham who was Director of Product Marketing and he says "Jack come up and talk about being a product manager for the linear circuit business, we're looking for candidates." I come up and within ten minutes I'm hired, you know, the interview lasted 7 minutes and I go home and I tell my wife I just got promoted, I don't know why, I have no idea, from being a salesman to running this product line." You know Fairchild, if they said to do something you did it. I was up there within a week I never had an office in my life, we worked out of our car at Fairchild. The guys that have been in sales will know, we did everything out of the trunk of our car except when we were drinking. We

did that in bars. So they wheel me into this big office and, within 5 minutes John Reddy and John Lambrose come by and I kinda knew 'em because they were executives of the factory and they said "Hey congratulations" da, da, da, "How do you like your office?" "Oh I think it's great," and as they walked out the door, John Reddy says "Hey don't get too used to this, you're gonna be out of here in about 3 months, as soon as we get Widlar under control." So here I am, I've moved my wife, my daughter and me up here and this guy's telling me that I'm just holding a place so don't unpack your bags. And he wasn't kidding. That was the plan. I decided "Well I'm gonna make it hard for 'em" and so I went out and I hired the best talent I could find. Within about 2 months I hired Mike Markkula (who later worked at Intel, founded Apple Computer) Mike Scott (who later was executive at National and also was the CEO of Apple) Gene Carter, [the list] goes on and on. I had 7 or 8 top guys, all who went onto be very successful. Within a period of a couple of years we owned 80% of the market. We were the best design/definition team in the world. We would introduce about 4 products a year. Our competitors by that time had focused on the analog market. Motorola and TI were throwing hundreds of people at this business. They were introducing like 20 products a year, not one of 'em were successful because they didn't understand the concept that you had to get a good definition. They also didn't have the designers. The design talent at Fairchild was unbelievable with Bob Widlar, Dave Fullagar, Jim Giles, Darryl Lieux, and Dave Talbert as a process developer. I mean we had designers that nobody could touch but we also had the ability to define products which [our competitors] didn't know how to do. We dominated this market by putting out about 3 or 4 circuits a year against 20 or 25 from these other two companies. Then at that point, the roof started to fall in -- started by the fact that Bob Widlar and Dave Talbert decided to start National Semiconductor [Editor's note: they went to Molectro Science Corporation that was acquired shortly after by National] They were the true founders of National. Charlie Sporck came in right after. Dave Fullagar left and then I left Fairchild and that kind of was the end of it.

<pause>

Gifford: So we're doing pretty well, all of our business was in the military market though; I mean all of the 709 business, all the 710 business. We had done some work and gotten a IF amplifier designed-in at Scott which is stereo company and Larry Blazer and Derek Bray had had some success at RCA with some circuits. We wanted to crack Zenith television. Some of you that are my age will remember Zenith had this slogan, this marketing image that they handcrafted televisions. Of course the cabinet was important - the bigger it was [the better]. They would show photographs and pictures of their circuit boards and their vacuum tubes and [claimed that] it was old world, handcraftsmanship that made the television. Yet they were getting hammered or blindsided by RCA and I can't remember who else by having a microchip in their televisions. Though the microchips were doing almost nothing, they were using it as a marketing tool but we were having no success convincing Zenith that they needed a microchip. Then one day out of the blue with a week's notice, the Senior VP at Zenith came to Fairchild with about 7 or 8 guys. He wanted to make a presentation to me about their idea for putting a microchip into a Zenith television. They had their slides and they each showed me their product plan and they showed me this idea, so they didn't blow their marketing image. They had this television with vacuum tubes in it and inside the vacuum tube they had the microchip. They wanted us to put a color demodulator IC in a vacuum tube that would plug into their socket so their hand wired, hand crafted boards remained intact! Of course we said "You want it, you're gonna get it and sure we can do that". It was the craziest idea you ever heard in your life but there was no way you were gonna talk 'em out of it. So Fairchild had this package that was called a glob top package for transistors. Some of you will remember, it was a glob of plastic or epoxy on the top of a piece of plastic and it would encapsulate a transistor. It was a very low cost manufacturing technique. It was done in Hong Kong. So after Zenith left one of the packaging engineering managers says, "Well why the hell don't we just take that package and just blow it up 50

times in size and put this integrated circuit in it?" So we told 'em we could do it and what it ended up looking like, was a big thick piece of plastic about that big around with this big plastic bubble on the top of it. It had these nails coming out of it which would plug into the tube socket and they built in on the same line, they built these three cent transistors. Of course nobody did any analysis on differences of coefficient of expansion or any reliability testing. "We don't do that stuff, not here." Anyway Zenith thought it was a great idea, they loved it, we started building it in production. A month and a half goes by and all hell breaks loose. When the set heated up, the lids popped off the top of every one of these color demodulators. So we created an unabated disaster for Zenith, pretty much shut 'em down. I mean I could tell you the 709 story too about shutting half the world down. We could make 4,000 a month and we had a demand for 400,000 a month. The yields were just abysmal. Widlar and Talbert kept it such a big secret nobody knew how bad the yields were. I had the best relationship with him and he didn't tell me anything, that's how good that relationship was. If it wasn't for Fullagar's 741, we probably wouldn't have survived as an analog company. So with that I'll turn it back over to Norman, thank you.

Doyle: I was very much involved in that era with the chroma demodulator and that was when the term "glob top" changed to "pop top." We're running a little short on time but we will take some questions or some comments from the audience.

Paul: <Inaudible>.

Doyle: Paul has heard in other sessions about Jean Hoerni and how he was described as a complicated person. He's asking the panelists if they'd comment on that.

Fullagar: I have one comment and that is that it's said that Jean Hoerni was at his most creative when he was really upset about something and he was upset a lot of the time.

Gifford: He's never been given the credit he deserves, if he had not died, he would certainly have been given the Nobel Prize. I worked closely with Jean, I saw him to be a very wise and aggressive businessman as well as an aggressive technologist. He had trouble getting conversations started, he was somewhat of an introvert but he was never meek, he'd be ruthless in a good way. If he had a technical problem, he would go right in there himself and solve it. He didn't suffer fools, he was an enormously talented person.

Dave Freeman: The 741 and those chips, are they still in production today?

Doyle: The question is, is the 741 and some of the other high running devices that we've talked about still in production?

Gifford: Somebody said they're still in running in production at National.

Fullagar: I think that's true, they're still in the Digi-Key catalogue where you can see all the old stuff. They're still available.

Gifford: That circuit sold more circuits than any other circuit in the history of the microchip and I think that includes memory of a given particular memory type.

Doyle: Another question.

Bill O'Neil: <Inaudible>?

Doyle: The question -- we had a marketing campaign which was a new product every week, 52 weeks, 52 new products and Bill's question was who's brilliant idea was that?

Gifford: It was Jerry Sanders. Some of those products were really horseshit, though aren't they?

Doyle: I think we have time for one more question and/or comment.

Bill O'Neil: <Inaudible>?

Doyle: Bill when I took on this job, it was on one condition, that there was a whole group of stories that would not be told and that's one of them. Okay I'd like to thank you all very much for attending and I want you to please acknowledge our panelists, three leading figures of the linear integrated circuit industry.

END OF INTERVIEW