Oral History of Arthur (Art) W. Zafiropoulo

Interviewed by:
Craig Addison

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Craig Addison: Could we start off with a short story about where you grew up, where you were born?

Arthur (Art) W. Zafiropoulo: Sure, absolutely. I grew up in Boston, born there in a suburb called Medford. And I spent most of my life there. Went to universities in the Boston area, majored in physics and EE. I grew up as one of two children. A younger brother 13 months younger than I was. Parents born in Europe. My father was born in Greece. Mother was born in Greece also. They came to the United States and they picked up their lifestyle and worked very, very hard. To give you some examples of some of the things that were important to me when I was growing up, my parents grew up in a two-family home and never owned their own home. To this day my parents never owned their own home. So I grew up in a relatively poor environment. But clean clothes, good food, and had access to good universities and certainly musical instruments. So my father and mother gave me a full value upbringing. So as I progressed in my life I really began to appreciate the things they did for me growing up as a young person. But it was real experience and a great environment to grow up in, the Boston area.

Addison: Did you have any strong interests growing up, like was the electronics thing something that happened early in your life?

Zafiropoulo: Actually engineering more than electronics. When I grew up my father was very interested in cars…and mechanical engineering. He later became a watchmaker. When he first started in the United States he worked at a clothing store called Scott's. It was a high end store and he was a designer of clothes and designed clothes for [President] Roosevelt, the Pope, and a number of other [famous people]. And when the industry shifted from manual designs to automation, cutting clothing with band saws, he decided to leave. And at the same time he was working as a jeweler, repairing watches at home. And so again, he was mechanically inclined and he then took on and opened a jewelry store and progressed from that point. So I guess between the cars and his knowledge of mechanical configurations it sort of just rubbed off on me. So engineering was an important part of my life, and I think mainly from him.

Addison: Can you talk about your first job, whether it was in the industry or not.

Zafiropoulo: Yeah, sure. It wasn't in the industry. My first job was in 1960 working as an associate physicist at a company called AVCO, it was Aviation Corporation. And it was interesting because at that time I received three offers. One was Xerox, one IBM, and this company called AVCO. And what impressed me about AVCO was one of the operations was close to my home in Medford. And they would give you a free cup of coffee and doughnuts in the morning. So that was really interesting to me. And it was the lowest paid job offer I had. And Xerox and IBM were higher paid, but it was more interesting to do the research work that they [AVCO] were espousing that I could be doing. And the work was in plasma physics. And they were working in the area of shock tube, MHD, magneto-hydrodynamics, and doing work with wind tunnels. So I was very intrigued by that. So I became an employee of AVCO in the physics department and spent four and a half years of my life in that area doing research mainly on Air Force contracts. Some of the work we did was to work on re-entry vehicles doing ablation studies. We did work in propulsion for space. And did some real work in simulation of radiation from atomic weapons because they'd banned surface testing of atomic weapons. So we simulated radiation impact in a laboratory. It was really a great learning experience for me to get a cross section of many disciplines. But the fundamental discipline was in the area of gas discharges, plasmas.

Addison: This would have been during the height of the space race and the Cold War.

Zafiropoulo: That's correct, yeah. It was in that time frame. In the '64 time frame it became clear that they started cutting back on defense spending. This organization, this one facility that I worked in had 5,000 people. In my group we had 100 physicists and it was a great experience. But at that point funding began cutting back. So I at that point decided maybe there was something better in my life than working on R&D contracts for military applications. Not that I'm opposed to military, but I felt that there was a great learning experience and I began looking for the next part of my career. And learning how effective and good some of these PhDs were that I worked with, I realized that I wouldn't be in the top 1 to 2 percent of that environment. So I decided to change my career path at that point. And back in that time frame we used vacuum as a tool, in terms of wind tunnel testing and re-entry vehicles, etc. So we used vacuum and I decide to leave the R&D environment and move into the industrial world. And that's when I joined GCA, in the middle of 1964.

Addison: When you joined GCA, was that in the semiconductor operations or the other side of it?

Zafiropoulo: Actually, back then GCA stood for Geophysics Corporation of America. They were doing a lot of work in areas other than lithography as we know it. They did a great deal of work with the black lung disease, in mining. And that's how they began from Cambridge, the Air Force and MIT. They then expanded to other fields of endeavor. One was in the vacuum field. They had a company that they owned that did a lot of work in vacuum metrology, vacuum heat sintering for carbide, welding for nuclear reactors for submarines and aircraft carriers. So I went there. And I actually left and went backwards in a sense for a title. Back in the 1960s it was an honor to be called a physicist. But when you go into the real world the apparent feeling back then was that physicists really don't do anything really worthwhile. So I actually took a 30 percent pay cut in 1964 to join GCA. Within six months I was making more than I was making earlier. So it worked out really well. But I went actually as an EE, an electrical engineer, and decided to go backwards a little bit and get into the real world. And that lasted for some time. Maybe a year and a half. And maybe in the '65 July/August time frame we were a small company. GCA was $35 million in sales and traded in the American Stock Exchange. So it was a small, family organization headquartered in Bedford, Massachusetts, a few miles away from where I was.

And they began looking at other areas of technology. And back then there was a technology called sputtering. And we certainly had that problem in re-entry vehicles and space propulsion where the cathodes were eroded by sputtering. So during this period of discussions with the chairman of the board and CEO Milt Greenberg, we got into this issue about sputtering, this new technology. And I tried to get away from plasma discharges. I tried really, really hard. And it lasted for about a year and a half. And then he asked me to look into it, which I did. And then we built the first sputtering system back in 1966. And at that time MRC was the principal architect of sputtering back then. Today it's PVD, but back then it was sputtering. So I then began developing technologies involving back to my gas discharges again. The only difference was that the discharges I was dealing with at GCA were cold discharges where at AVCO they were hot discharges. But the principles are quite similar.

Addison: So was the sputtering work at GCA through an acquisition or in-house?

Zafiropoulo: No, it was all in-house. We built our own power supplies. Back then it was a Hartley oscillator. Kind of a cute story to relate to that is I built this Hartley oscillator, our power supply. And for people that know Hartley oscillators, you don't control the frequency. It just wanders. And it wanders from maybe 10 megahertz to 20 megahertz. But in that region, which is not the ISM frequency band of 13.56 megahertz, or you'll get interference in television, radios, etc. And when I actually turned on these machines, these sputtering systems, and adjusted the matching network manually and got the discharge going, there'd be neighbors calling. And Channel 5 would have no audio and Channel 7 would have no video. So I was actually blocking out sections of this location. And then they became really smart. They began understanding about the FCC and I became very frightened. So [the lesson is] get involved in shielding.

So back in that time frame this whole technology was brand new and we were doing some very interesting experimentation. That later evolved into the first solid state power supplies that I helped develop. And also the whole RF power supply industry I was instrumental in developing the structure for that, through this GCA operation. But did the first 1 kilowatt, 3, 5, 10, 25 kilowatt RF power supplies. And worked with Henry Radio in California at the time. And also some real good work with a company called CCA, Communications Corporation of America in Pennsylvania. So really that was a pioneering day. It was a lot of fun, a lot of hard work, a lot of burns and discharges on your finger from the parasitics and the matching network. But that was all part of the fun of this era in time back in the '60s and early '70s.

Addison: Can you talk a little bit about the device industry during that period? What sort of requirements they had or what sort of challenges you had dealing with them.

Zafiropoulo: Yeah, the applications were quite different back then. People tend to forget that in that time frame the basic technology was NMOS and PMOS, and bipolar certainly. And very high current devices. And the other thing that's startling when compared to today is the yields were very bad. Yields were typically in the 1 to 2 percent range in the 1960s. And it's hard to fathom today that we talk about yields of 90 percent and back then it was 1 to 2 percent. You'd actually have a party when yield went from 2 percent to 3 percent. It was a very big deal. And also in that time frame I became acquainted with Hank Smith who currently is a professor, I guess retired, at MIT, and got involved in some work he was doing at MIT Lincoln Labs in x-ray lithography in 1968. I also became enamored with a flip chip technology that IBM pioneered; the C4 process in the 1960s. Today it's becoming more and more important part of my life, and the industry, especially consumer product area. But IBM pioneered that. And these were kind of the fun days in the chip industry where yields were bad, technology was really learning, where you didn't have computer designs. We used ruby lith, big cameras. It was just very interesting…lithography was contact printing, sputtering was five inch targets, wafer size…I began when the wafers were three quarters of an inch in diameter. So the evolution was kind of interesting.

Addison: Could you talk a little bit about Milt Greenberg, the CEO of GCA. He was a real character from what I've heard, pretty difficult to work with. What were your impressions of him?

Zafiropoulo: Milt Greenberg, I thought, had good points and bad points, as everyone does. And his good point was he was a risk taker. He began GCA with several other associates. I guess the bad part of Milt was he had a foul mouth, a PhD with really a foul mouth. In mixed company he would use unbelievable four-letter words. And after a while it just sort of bounced off you. Milt also, I think, was really the creator

of GCA and probably the individual that destroyed it also. So he made something and he destroyed it. And he destroyed it by not focusing. And he did things that I think were not smart. He didn't listen to people. He was afraid to make the right kinds of decisions. And when he made decisions for the most part, toward the end of the…in the 80's time frame, these decisions were not good ones. They ranged from the acquisition of Tropel, which was good. And the bad part was they bought some land, they tore down the football field and bleachers to build this large facility to do world optics. This was the Star Wars games and he was going to be the Star Wars leader and the people in Rochester were really angry with him for taking down their football field. Nothing was ever built there. And the state of New York helped fund it. These were kinds of decisions…an inventory for service that was absolutely way beyond its time, and automation, robots [that were] just far beyond what anybody really required. But he wanted to do something different and really didn't focus on the corporation. Of course later it failed miserably and began dying, I believe, in '83/'84.

Addison: So after the sputtering work at GCA, what did you do then?

Zafiropoulo: Well, I left GCA in 1974. So I spent about 10 years there. And I moved on to a company called LFE, Laboratory for Electronics. During my tenure at GCA there was a senior executive, Herb Roth, who was a Westpoint graduate. A great leader. Herb left and ended up running Laboratory for Electronics. And he tried several times to get me to go to work with him at LFE Corporation. And I kept rejecting it. In '74, coming back from SEMICON West, I was at a low point [at GCA] and mainly it was funding for R&D projects. I felt that in order for us to be successful…we needed to spend more money in developing the PVD technology. And I wasn't given the support that I thought was necessary to be successful there. And when I came home on the overnight flight Herb had called. I had breakfast with him at the Sheraton Hotel in '74. At that point he asked me to come again. And I decided to make the decision to go to LFE Corporation. Again, money has never been my object in life. So I was making, at that time, $20,000 a year. And I went to work at LFE for $20,000 a year. So I didn't leave for more money…I left mainly because of a challenge. And the challenge there was in a plasma etching environment and plasma stripping of photo resists. In gas discharges again, cold discharges. Again, I couldn't leave this field. Most of my life at that time had been spent in plasma discharges.

And I went to run a division and to really grow the division. And we did that. I had a great team of people. And we grew the division, which represented only 15 percent of the revenue of the company and 85 percent of the profits. And we grew that and when I left there in 1980 we were No. 1 in the world of plasma etching technology and sales. And there were at that point 64 companies in the world and Applied [Materials] had just entered that market. And I left [LFE] with a backlog of about 18 months. And we were shipping in the range of 30 to 40 systems per month. These were quite inexpensive. These systems were $10,000 to $11,000 each. So the industry has really grown. But again, the essence of the technology is very, very similar to what it was back then. But we were producing systems that would have throughput of a couple of hundred wafers an hour for $10,000 to $15,000. And it really was an interesting environment to be in at the time.

Addison: When you first went to LFE and started working in plasma etch, was that a really immature industry?

Zafiropoulo: Yeah it was. It was very immature. The industry really began in the late 1970s. A fellow who worked at Signetics used an asher. And these ashers were used to remove organic materials in samples for trace analysis applications. It was done right here in Richmond, California and it was owned by LFE Corporation. It was called an asher and some people still use the word ashing today. And others use the word photo resist stripping, but it's removal of organic material. So Steve Irving was the fellow who pioneered the work and took this asher and started stripping photo resist materials. And when I arrived at LFE Corporation one of the big issues back then was contamination. They felt plasma was damaging the devices. As it turns out it wasn't plasma, it was actually the photo resist. Back in that time frame Kodak was the principal supplier of photo resist. They had this resist KTMR and KFTR. And these resists were interesting in that they had tin organics in the resist. So that when you removed all the organic the tin was left behind. You went to a diffusion tube and you diffused the tin in and it destroyed the devices. And they would be blaming the asher or the stripper for that. They called it plasma damage. The fact was it had nothing to do with the plasma. So it took years to recover from this tin issue from Kodak resist back in the '70s.

So when I came in it was just beginning to clean up that part of the issue. Then the first application of etching was using it for gate nitride… to remove very thin layers of gate nitrides. The earlier method was using hot phosphoric acid with an oxide mask. It was splashing, burning people, very expensive, really a bad technology. So we replaced the hot phosphoric with silicon nitride using a CF4 plasma discharge rather than just oxygen. So that began in the early '70s and really grew at that point to more and more different applications. Poly silicon came later, aluminum came later, oxides came later.

Addison: And what was your competitive advantage at LFE with your plasma system?

Zafiropoulo: Size of the company. LFE was a major size corporation. The principal competitor in Silicon Valley was called IPC, International Plasma Corporation, which became Gasonics and that [is now] owned by Novellus. Dick Bersin founded that company. He did a great job. And so these two companies really did a terrific job in promoting the technology. And Dick did especially a great job in Japan where LFE did not do a very effective job in Asia. [LFE] did a better job in Europe. And I think, looking back now, it was mainly the location where California being close to Japan and Boston being close to Europe. It was just natural to evolve to areas of more comfort. So Dick did some really great work in Japan and in the United States in California. And these two companies were “one-two” for many, many years. And as things happen, people change their jobs, and people make mistakes, and LFE, as I mentioned, was number one in 1980. And then after I left and they ate up the backlog it then just virtually disappeared.

Addison: Was that very daunting to you that there were 64 competitors out there?

Zafiropoulo: No, not really. I really have confidence in my ability and I don't have any fear of competition. I look at my strengths and weaknesses as I do my company, and I take the appropriate action. So I don't fool with myself, kid myself, tell myself stories that aren't true. Most people do; I don't. And I build on my strength… I get good people against my weaknesses and I don't really need more people in my strengths. So I've done that all my life and I really don't have any fear. So having competition, that type, did never bother me. Even today it doesn't bother me. It's just that you've got to pick a strategy that fits what you can do and what you can accomplish. And some of these strategies may be to pull back a little bit, which we did at Ultratech when I came here. But some of these strategies are not to be number one in certain

markets, but maybe a niche player in certain markets. So you've got to evaluate the core competency, core technology, how good you are, the staff you have working for you, the timing, the competition's power. And once you get that all together you can come up with really a good solution to solving technical problems and business problems.

Addison: And at LFE were you in a management position?

Zafiropoulo: Yes, I ran a division and also directed the marketing and the engineering function of the operation.

Addison: So you would visit customers?

Zafiropoulo: Yes, sure.

Addison: I imagine you came out to the west coast as well. So what was your perception of the differences between the semiconductor device makers on the west and east coast?

Zafiropoulo: I thought everybody on the west was the land of fruits and nuts. I came from Boston where we had a lot of culture. We had the symphony. New York had great plays, off-Broadway, close to Europe. You know, the European heritage. And the perception is that people in California are crazy, they do funny things, they smoke funny stuff. Haight-Ashbury was going on. So it's a land of fruits and nuts so you just stay away from there. So I'd come in. The weather was great but every time I came, it rained. So I said they're going to give me a lot of crap about the weather. So this is really the land of fruits and nuts, totally the weather included. Well, I learned later that wasn't true. So my first impression was I can come into California, I can be there as often as I need to, and still be effective in Boston. Well, that was not true. You cannot be effective in California living in Boston. And if you look historically, the companies that have succeeded and failed in this industry, more companies have failed in the Boston area than have failed in California, by percentage. So we have GCA, we have so many companies that have just failed. We have a few left that are doing well, [such as] Teradyne. But virtually nothing is the way it was in that area. So to be successful, if you're in Boston you can do a good job if your market is in Europe. But if your market is in Asia you can't be in Boston. The time zone is absolutely crippling. And the communications, the networking, is not there. You drive 30, 40 miles between competitions, customers or competitors. Here in California you can change jobs and stay in the same carpool. So it's a whole different lifestyle change. And so I never really appreciated the value of California networking when I was in Boston until I actually came here. I thought visiting California would be enough, and it wasn't enough.

Addison: Looking at the time you spent at GCA and the time you spent at LFE, what were the things that you learned in both those periods?

Zafiropoulo: I guess the technology part was something that I just brought with me, because I understood the technology pretty well. I think I learned, in that time frame, about a different market, different industry, and different people. And I think I learned and formulated my style of management in that time frame. In research it wasn't my management as much as it was doing the actual research work, presenting papers and doing studies and getting more Air Force contracts. But once I moved to industry it was a whole different position of the people, the customer issues. So I think that was probably my biggest

education, was learning about how to manage people effectively and getting good things from people and then combining those good things with my style. So my style really is a combination of all the people I've worked with in my life, the good things I've taken from them. And I've tried to put those together in my current personality. So it wasn't just me, it's the influence of a lot of the people I've worked with and worked for that I have today in my current style.

Addison: Did you get involved in any of the design of the products at GCA?

Zafiropoulo: Oh, absolutely, sure, absolutely. Even to this day at Ultratech I get involved in some of the design. Not to the amount I did years ago. So even today I have several patents that are still pending. So I'm still actively involved in inventing, if you will. Maybe some of my people think it's distractive that I do that, but I do that anyway. And I'm very much involved in the company. Both in the management style, investor style, customer style. And also from the designing and inventing part of it. I'm very much involved in the technology of our company.

Addison: Can you talk about leaving LFE, why you left and then what you did?

Zafiropoulo: Sure. You always leave because of situations that occur. In my case it was never the people I worked with. I really enjoyed the people I worked with and worked for. When I feel stymied or have a road block…the R&D issue came up again before I left LFE Corporation. I had worked very hard to get additional funding, because I saw the potential threats coming with competition. And I wanted to move and do some infrastructure work outside the United States. And it took me a long time to get $1 million on the budget to do this. And then when I got the money I couldn't hire people to support it. So in one hand I won getting the budget approved, on the other had I lost because I couldn't spend the money that I had gotten. So I decided at that point probably a good thing for me to do is to leave. And that's when I decided maybe I'll try it on my own. And that's when I founded Drytek in the 1980. And it was a great experience for me, I was ready for that. I really had the experience, I had the ability, the drive, the intensity of working many hours. I had the contacts in terms of potential investors. So I had absolutely no problem raising the money. Everyone that I went to wanted to do a loan with me. So there were 10 people, five in Europe and five in the United States, individuals and companies that wanted to support me. I picked the one that I felt was best for the corporation, not for me personally. I turned down better deals for me, but I wanted the best chance of success. So this one individual, he provided the right kind of format for me to be successful. So we were. We were very successful. Drytek, in 1980, when I founded the company…in two years we were number three in the world. We at that point did no business in Asia except for Korea. So we did work in the United States, Europe, and in Korea. At that point we became number three out of the 60 plus companies in the business. So we really did a great job. I had a great team of people working with me. And we brought some real value to low cost designs, low cost manufacturing in that time frame…which was the direction that we focused on. And then plasma etch primarily.

Addison: So for the financing, you just went to one individual. You didn't want to spread it out?

Zafiropoulo: No. I thought it would be too difficult managing too many people. So that's one of the things I did learn earlier, that when you have multiple investors it's even more difficult. They can't reach a conclusion generally. With one person it's more challenging, but it's easier. So if I felt comfortable about

myself then I have no problem dealing with a single person. And as it turned out I borrowed $6 million from this one individual and paid him back with interest on the money that I borrowed from him. And at the end of the day when we sold the company in '86 to General Signal, he got a great check. And he deserved every penny of it. So he was the primary owner of the company, I was a minor owner…a portion of that, which was still fine for me. But he did very, very well and I couldn't have been more pleased. I won't mention his name because he's still in the industry. He's a fairly large person. And one thing he's always shared with me [is that] if ever I want a job to run his companies he'd let me do it. You never go back, and so this would never be something I would consider, to go back and to run a company that I'm running right now. This is my last enterprise, if you will, doing Ultratech right now. That's the most important thing in my life right now.

Addison: Was your funder hands-on in the company?

Zafiropoulo: No, no. As a matter of fact I had to force meetings with him. He would have meetings and I'd say I want to go over the spending, go over our sales, go over our profit. And I'd force monthly or even in some cases quarterly meetings with him. And the first question asked me, are you happy, do you want more money. And we were very happy, didn't want more money. But he was that kind of person, wanted to make sure I was happy. And at one point we had Bank of Boston as our bank. And they would come to me and say you have all this money in the bank and how about getting a line of credit to borrow money. I never borrowed any money from the bank. So we funded this thing individually. Paid it all back, 100 percent back with interest, and as I mentioned, a handsome check at the end of the day in '86. That was a great program for me personally, to get him that money…give him a return on investment. Which I did do. So that, to me, is job security. You give more than you get. And that's real job security.

Addison: When you started Drytek was it obvious that you would be in plasma etch. Did you consider other product areas?

Zafiropoulo: No, it was plasma etch. We felt at that point there were real weaknesses in the industry. It was fragmented and we probably thought that was a good idea. With my involvement with sputtering PVD in the '60s and early '70s, I gave that a passing thought. But back then companies like MRC, Randex had come about then. Varian was a very strong competitor. And these were all major companies. When we looked at the plasma etch area it was always fragmented with small companies. And I thought that would be more of a level playing field in size of companies than to go after the major corporations like a Varian or MRC or Perkin-Elmer, which at that point had owned Randex.

Addison: How did you come up with the first product? Was it built from the ground up?

Zafiropoulo: It's a great story, a great story. My first cofounder, first employee was Joe Maher. Joe had worked with me for a number of years at LFE Corporation. We went out and we bought two drafting boards. And we rented some offices in Redding, Massachusetts and we saw two designs. A single wafer design and then a vertical structure with multiple wafers but done vertically. That was Joe's concept. Mine was single wafer. We actually came back to single wafer later, but we began with the multiple wafer, vertically stacked system. And in four months we had a gas discharge going. So we sat in an office, we moved to a small location in Bloomington, Massachusetts. Then grew that facility and we kept expanding very, very rapidly. So the story was a great story in terms of how we started. We actually did all the

drawings and would go out to the machine shops and [do the] welding and painting. And we did the expediting, the purchasing. That work was done ourselves…in an office with two drafting tables, that's how we began.

Addison: So literally the two of you.

Zafiropoulo: That's right. Then we had a secretary. And then we started hiring engineers and it grew from that. So within about three months we had maybe five or six people. And then within a year we were just growing very rapidly, at that point shipping probably 50, 75 systems a year. And it was just a wonderful experience to start from the bottom up in a company and having a backer that had trust in you that there were no strings attached to the money. And if I wanted more money, $1 million, it was there available for me. There was an open check for me if I ever needed it. But I treated the money just like it was my money. I was very careful, very frugal with the whole business that we started. And this was coming from a research person, R&D person, engineering person, which in some cases aren't too frugal. They're not business-directed. But the experience at LFE Corporation helped me considerably in fundamental knowledge of learning how to run a business and understanding that part of it. I had some of that before but not as much as I learned at LFE.

Addison: At Drytek were you close to any device makers?

Zafiropoulo: Well, Fairchild was in South Portland, Maine. So we were very close with them. IBM Corporation. And Analog Devices had just begun, so we were close with them. Drytek was in Wilmington and Analog was in Wilmington. And DEC was there at the time. So we were closer to the local companies in the area. But we didn't do very much business in California at the time. It came on later. Started renting some space out here [California], had a sales office. But all manufacturing was done back in the Boston area.

Addison: Back then there was probably a big wall between the device makers and the equipment guys and nobody wanted to share intellectual property. Did you go to these people that you knew and say I'm building this etcher and what do you think?

Zafiropoulo: Sure.

Addison: What sort of interaction did you have with those device makers?

Zafiropoulo: The first thing we did was after we actually had the machine built I put together a six page survey, a marketing survey. And I went through six pages and asked them a number of questions. And most marketing people will tell you don't do that. You don't do that. You just do five or six questions. Otherwise you get a bad response. What I did was we sent it out to probably 100 people, maybe a little bit more than that. And we sent it out to the engineers and the managers. And what I found was very interesting. It talked about color of paint, it talked about software architecture, it talked about throughput issues, it talked about cost of ownership issues, it talked about mass flow controllers, pressure controllers, it went through the whole thing. And I sort of picked apart this program in that it was slanted to what I was building in the sense that the questions were focused on what I was doing. And after six pages they could either sign their name or not. And what we found was virtually all the people, after they spent all this time

filling it in, all signed their name. And they sent the forms back. And I told them we'd give them at the end a summary of the answers from everybody else. So we went back and gave them a breakout as to what percent voted for each of the different areas. So they learned what others were thinking. And then we kept those in our file. So if I visited Delco at the time, or I visited Fairchild, I would pull out the Fairchild study and look at what they wanted to see. Went back to reinforce what they did and thanked them for helping invent the machine. So we gave the customers the credit for what they had done. So now people were buying something that they invented. So that's how we used a strategy to develop this technology in the market and [gain] the acceptance of our product so quickly. It was a simple, simple [strategy] in marketing and getting information. It was very simple. And everyone told me not to do what I did.

Addison: What was the great advantage of your machine over the competitors?

Zafiropoulo: Low cost of ownership. This was a machine that, performance-wise, could equal any company in the world. Throughput was far greater and process control was equal. So it gave them a low cost machine, a small footprint, and high throughput. So that was really the core technology, which it is today. That's exactly what we did and that was the foundation of Ultratech, which we call the dawn of a new era. And we began that in 1980 and I think you've seen that term used elsewhere in other areas since then, but I believe we were the first ones to use it in that time frame.

Addison: Did you make any attempt to break into the west coast market?

Zafiropoulo: Yeah, we did. We did that later. We hired a fellow who had worked with us before, Bob Hills, who is currently working with Mattson. A very good guy. And Bob ran our operation here. But again, we weren't big enough to make a difference. We were here, we got some business but not as much as I would have liked. Looking back, in retrospect, I think if I would have made a bigger presence here, maybe some light manufacturing, maybe an acquisition, we could have been what Applied is today. Our technology back then was beyond anything that's even there today. So what we see today with Lam Research and Applied Materials, all my people back then, if you asked them this question, these companies would not be where they are today if we were in California. We were in the wrong location, but not the wrong time. We should not have been in the Boston area, we should have been in Silicon Valley. And I kind of learned that later, unfortunately, when I came to recognize the weakness of the [Boston] location. It was a terrible, terrible handicap for my company. And for many, many Boston-based companies, it was a big, big handicap not being here in California. Even today, the same problem.

Addison: Can you talk about the progression of Drytek as a company, how the products grew and how you grew.

Zafiropoulo: We began with this multiple vertical stacked electrode and I was talking to my son this morning describing how we got into the first cluster tools. We were the inventors of the cluster tools. We have a number of patents that were acquired by General Signal. In 1983 we invented the cluster tool. And Joe and I were at lunch and we're at a restaurant on Route 28 and they make great steak tips. I can taste it this morning. And we're sitting at the table and back then we had a martini when we began lunch. It was a typical martini day. We had a martini and, in the booth, there were four white plates. And we were talking about productivity and we looked down at the plates and I'm not sure, he or I, one of us, came up with the concept of the cluster tool with these four plates sitting there and said, “Gee, how about individual

process control," because we were having trouble with crosstalk between the vertical electrodes. And that discussion was going on…how we can control each wafer without the interaction to another one. We wanted separate chambers. And we couldn't do it vertically with separate chambers. It just was not practical. And then when the four plates on the table, we said, "Gee, how about a robot in the center with four separate chambers?" And that's how the first cluster tool was invented…at a restaurant on Route 28 in Redding, Massachusetts having steak tips.

So in '83 we began the whole technology in cluster tools and then we moved into a number of applications. Not just poly silicon and silicon nitride. We moved into aluminum and oxide etching. And then began to do multilayer processing. We developed a laser and point detection systems. And machines that we call the "Quad." It was in the front cover of Solid State Technology, showing these four chambers in color. And we had the first color graphics displays in the industry back in the early '80s. We called it Quad because it had four chambers on the first one. It had cassettes bringing wafers in and out through what you see today as a cluster tool. And so everything around what we have in our industry, again, Lam, Novellus and Applied and others, use that same basic format, whether it be for flat panels or for wafers. So that work extended until '86 when I then sold the company to General Signal in the summer of '86.

Addison: When you sold it to General Signal, how big was it in terms of employees and sales?

Zafiropoulo: We had, I don't know, 200 to 300 people. We had located in Wilmington. Sales were about $30 million back then. We sold the company. They came to us. General Signal came to us and we weren't really for sale. As a matter of fact, my principle backer, the fellow I spoke about earlier, didn't want to sell it. And I felt the timing was right to sell it and I felt that we needed something bigger. I was seeing the competition growing...Applied Materials, the size of that company, what they could do. And I felt size had something to do with it. It just was size and location. I decided General Signal had some presence in the industry, a major corporation. It would make sense and they came to me. So I decided that [selling] would be in the best interest of the employees and the owner, the principle owner. And I remembered saying to him, "This has been a great experience, it's been six and a half years. We've done this and been very successful." They offered seven times the assets for cash. And I thought we should do it. And he was reluctant. And I said, "What is this company worth without me?" And he said, "OK, let's sell the company." And that's when we decided to sell it. It was the right thing to do at the time. Maybe not the right company, but the right thing to do.

The acquisition by General Signal was one of pleasure and pain. The pleasure was being liquid. At that point I could live the rest of my life. I had enough money. I didn't need any more. I don't need a lot of money to live. And so the sale was one that allowed me to live comfortably the rest of my life. Flying coach is fine with me. I have no problem with that. Flying business class is even better, but I had no problem flying coach. So I had bought my first Ferrari at the time, in 1987. That's one thing I always wanted in my life was a Ferrari. To me, when I was growing up as a young boy, I saw people that had a Ferrari and I recognized that that had to be a person that was successful. So I measured success by the Ferrari. So when I bought my first Ferrari in '87 I thought, now I'm successful. That was my measure of success. Other people have different measures. That was mine. And I had always loved cars. I built cars. I raced cars when I was younger. So it came full circle back to me as something I really cherished. A piece of art, and something very special.

But then joining the company [General Signal] I then took over additional companies. I ran four other companies for them. So I had five companies at one point reporting to me. And I actually went back and fixed companies for them. And then I felt maybe I could have a bigger influence at the company by being at corporate. And at that point the people had talked to me about taking over their international operations. And I thought that'd be interesting. It would be another challenge. I wasn't married at the time. Went through a divorce in '83 and I thought at that time in my life it would be something I have time for. So I lived in New Hampshire. My office was in Connecticut, in Stamford. And I ran some U.S. companies and traveled the world. For two and a half years in that position I averaged eight hours a day on an airplane. So I ran operations in Japan, facilities that manufactured in Holland. So I had great responsibility. Restructured the whole operation overseas. And it was a challenge and it was rewarding to do that.

What was not rewarding was the organization and what their philosophy was. I remember, after I sold [Drytek], I was sitting at the [General Signal] president's meeting. There were 35 unit presidents. And we were sitting there and I was sitting opposite the chairman. And he made a comment to me. He said, “Art, you're the most recent president. We acquired your company eight or nine months ago. What do you think of General Signal?” And the whole table went quiet. It was a rectangular table and it all went quiet. And I said, “General Signal reminds me of a company that makes things that rust.” And what I meant by that was they would spend 2 to 3 percent on R&D. And those are rust companies. To spend money in technology you've got to spend 10 to 15 percent. And they were having a hard time doing that. They were doing it, but they were doing it very reluctantly. So it was just a matter of time before this whole thing would fall apart.

And I remember when I decided to retire in 1990 from General Signal, I had enough money, I had my Ferrari. I didn't need anything more in my life. I had a nice home in New Hampshire. Across the street was the wonderful Atlantic Ocean, which I love. And I didn't need anything else. My current wife, Lisa, I was with her. So I was very comfortable with my life. The travel was getting to me. And the appreciation of my work wasn't there. So I decided to retire. And a couple of weeks later Ed Carpenter called me from General Signal, chairman of the board, and said “I've got this company in California, Ultratech. We've discontinued it. Would you go look at it for me and make some recommendations.” And I had a president's package so I was being fairly paid for a year. And I said, “Sure.” So I came to California. And at that point I checked into the Marriott in Santa Clara. And I remember getting a fax. And the fax was…**“**Why don't you go through and give us your appraisal.” So I spent three days off-site. Had people come in and talk about the issues. I knew Ultratech because we'd been handling the products overseas when I was running the international group. And I knew of what happened there. I knew that the company was a very good company in the 1980s. So I began by looking at the history, what caused this problem. What did I find and what caused it. So I went back and I presented to the executives at General Signal. And I had all those people in attendance. They at first said it's not necessary. And I said, “No, I want you there because if I say something you don't agree with I want you to be honest with the management team, because they're making decisions involving people. And I'm very concerned about their decisions.”

And what I did is I gave a presentation in four parts. The first part was what did I find when I got there. The second part was how did we get here. Third was what are the options available and fourth was my recommendation. So we went through these parts. And it was kind of interesting because I could be absolutely candid, brutally frank with them, and not get fired. When you work for a company at times you

really can't be as brutally frank as you'd like to. And I was. I was absolutely brutally frank about what I found. And what they did, how they destroyed this company. And then of course they asked me to go and run the company. And I said, “Absolutely not.” And during the course of the conversation they said, “We'll double your pay.” I said, “I'm not going to go there. I'm finished with General Signal.” Then they said, “We'll give you an equity position in the company when you sell it.” So the deal was I would fix it, sell it, and go back to Boston. So I fixed it, they couldn't sell it. They came to me and said, “There is a buyer.” I said “great.” They said, “It's you.” I said “no.” I ended up buying the company with TA Associates out of Boston. I brought the Boston connection back in again. And Mike Child here in Palo Alto was just a fantastic partner as a VC. And we bought the company in '93. We took it public the end of '93.

And TA Associates, to this day, I'm sure that they were very pleased with the investment they made. I'm sure of that because they got a handsome return on that. And I was pleased with them as a company to work with. And they added great value to Ultratech. Mike Child was particularly helpful in understanding the public market and helping me understand when to raise money. So I'm indebted to Mike Child at TA Associates for his kindness and his working with me. He stayed on a year and a half after TA actually sold their position, which is very unusual. You hear about VC companies, how bad they are as organizations. And I can only tell you that if you perform, VCs are just fine. If you don't perform, they're not so good, and rightfully so. So I have absolutely no issues with VC companies at all because my experience has been very good with them.

Addison: You said initially you didn't want to sell the company to General Signal.

Zafiropoulo: Correct.

Addison: At that stage had General Signal started building up its other semiconductor operations?

Zafiropoulo: Yeah, they did. They were fairly large at that point, probably two or three in the world. They had a number coming…they had Electroglas which is part of the Xynetics group. Then they had the Hampco, Capco, Spitfire crystal pulling saws and polishing equipment. So they began exploring more and more in that area. And they had Ultratech in the lithography area. So, yeah, they were moving since the early '80s. They acquired Ultratech in 1981. So that was part of the Xynetics group, although Ultratech was founded in '79. So yeah, they became more and more intrigued with that group. And that was the founding chairman of General Signal. And it changed later…where people didn't understand the technology. And it shifted. And in the time frame of the '80s, Dave Kimball was the second chairman. He was very good. He ran Leeds & Northrup, which was a great instrumentation company. But a great, great name. Later shut down, which was a tragedy. So Dave Kimball is the individual that ran it. And at that point there was some stress between he and the board of directors. And they brought in Ed Carpenter, who was formerly the president of ITT. I don't know what his role was, but I heard that he was pretty instrumental in shutting down some of their semiconductor operations. And then he took over and changed the scope of the company. And at point it was clear that General Signal, in the early '90s, was in the process of dissolving their semiconductor operation. And in fact did. Ultratech was acquired by me and TA Associates. Electroglas was a spin-off. It wasn't quite an IPO, but it was a spin-off. And the rest was just dissolved. Drytech was then later sold to Lam Research so Lam picked up the actual licensing on the cluster tool, so they wouldn't violate the patents on that. And so they began to break it apart, this company, in pieces.

And it was interesting that Neil Bonke drove the separation of this and then also ran the Electroglas group. And I remember in '85-'86 time frame, Neil and I walking at the Moscone Center during a SEMICON show. We're walking to have lunch and at that particular moment in time, with his company public and my company public, our market cap together was bigger than General Signal. We looked at each other and just smiled. Here were these two companies that they'd just pawned off, became bigger than the company that did it. It was only for a short time, but it was on a morning walking to lunch. I'll never forget it. It was just a great, a great feeling.

Addison: Why do you think General Signal wanted to get rid of the semiconductor operation?

Zafiropoulo: Again, I don't think they understood the business. They thought the risk was too high. I thought that they felt that the R&D spending was too high. They were focused on just earnings per share, purely. And so things like R&D spending were very important [in the semiconductor industry]. And as I mentioned earlier, you spend 2 to 3 percent of R&D [in companies] that make things that rust. And you spend 10 to 15 percent R&D to develop new technology, high technology. And they were really having a difficult time with that. And I don't think they really ever understood the value of this potential that was there.

This wasn't the first time it happened. This happened at Perkin-Elmer. This happened at Varian. This happened across the board at so many companies. And it was a shame because the industry suffered because of this. And if you notice for the most part, most of these companies were east coast-based, with the exception of Varian which was west coast-based. But many, Perkin-Elmer, GCA, General Signal, these are all east coast issues. Again, I think not really fully understanding, as I didn't fully understand, the networking issue, the power of Silicon Valley, and what really needed to be done to make this thing really successful.

Addison: You said before you had five divisions that you were responsible for. Were they semiconductor-related?

AZ: Yeah, they were. They were in the crystal pulling, Capco, Hampco, Kayex, and Drytek, and then the international operations.

Addison: And you were traveling a lot to Japan.

Zafiropoulo: As I mentioned, I was traveling for two and a half years eight hours a day on an airplane. For two and a half years. So I was doing the whole world every week, essentially. Sleeping in my home, in my bed, two nights a month at the maximum and being at the corporate office maybe one or two nights a month. And the rest of the time I was in the air. I was working in the airplane. I was having meetings when I wasn't there. And then sleeping short times. But I didn't realize, in terms of jet lag, people said, “Do you have jet lag? No, I don't have any jet lag.” Well, when I actually retired in 1990 I realized I had constant jet lag. So when I retired, the two weeks [when] I was just not doing anything, I really began feeling so much better. And I didn't know I felt bad because it was two and a half years of really feeling pretty bad. But I kept driving myself and working over 100 hours a week every week. Just constant working, because work was my life, my hobby. It still is. I love my work…it's a pleasure to have a job that they pay you for doing your hobby. And that's what they're doing for me. But yeah, I was traveling

everywhere. All over the world. Japan, I've been there more than 150 times. Europe, more than 150 times. I currently go to Asia six to eight times a year now. Two week stretches. So I spend a weekend when I'm there. But I'll visit two weeks at a time when I'm in Asia, in Japan.

Addison: I guess you were going to Japan during the period of trade friction in the semiconductor industry.

Zafiropoulo: Yes.

Addison: That must have been a little bit difficult flying into Japan with that sort of atmosphere?

Zafiropoulo: I don't think it was as difficult as maybe for more political issues. I was very friendly with the Japanese for many, many, many years. So I never had an issue. I was going to Japan since the yen was 360 to the dollar. So the people that were friends of mine, even during the friction portion in the '80s, never really looked at me negatively at all. So I never felt that. And I think primarily due to the early relationships I had with them and the trust I had, even to this day, many of the Japanese executives that I knew back then still have the same feeling about me…that I'm very pro-American, but I'm really a balance person. I care about people. So even though I'm an American and the fair trade issues came up, I never really used that. We would talk about it at dinner with executives asking me my feeling and asking my opinion. But I tried to be as open and objective and talked about if they put themselves in our position and reversed the roles, talked about that we didn't understand they have no natural resources and their resources were their people, export. Much like we hear today about China. It's the same kind of thing as an export strategy for a country that's beginning to grow. So, dumping is an issue. It was an issue back then. But the Japanese are honorable people and I never ever had any issues with any Japanese person. Even through the very difficult time.

Addison: How did you go selling your equipment into Japan? Was that really a challenge because of the mentality of buying Japanese equipment?

Zafiropoulo: I did it through trading companies back then. So it was pretty common to go through a Marubeni or to go through a Sumitomo or a TEL at the time. That was a common method. We weren't large enough to provide the infrastructure and the cost to do that at that time. One thing we didn't recognize with some of these major trading companies is that they would buy the product from you and resell it to the end customer. A couple of bad things. One was that you didn't ever have to touch a customer. You were there but you were always with them with a customer. So they were controlling, essentially, what was going on. And so you never really had that one-on-one customer relationship. There was always somebody in between. The other part was the mark-up. They would mark up the equipment 200 percent and 300 percent. And by doing that they could justify building equipment in Japan. So one of the methods was it cost three times more money, we can do it here cheaper, let's build. And that's how they developed the infrastructure in Japan in terms of where they are today for export. MITI helped fund that. And again it was the survival issue.

Understand, during this time frame where people are talking embargos, the Japanese became very fearful of that. What if the U.S. wouldn't ship any more equipment to them. So they tried to be independent and keep their technology going. So the equipment industry helped them do that. We heard

the same thing for a short time in Korea. And we're going to hear the same thing in China. We're going to hear the same exact program where the Chinese are going to feel that if something bad happens and the U.S. will then stop shipping, or the Japanese will stop shipping, they'll be forced to develop an infrastructure in China to protect the possibility of any kind of embargo. So that's going to be going on in the next five to 10 years. But I never really had any problem in Japan.

Addison: During the time that you were going to Japan, was there much of a local equipment industry there?

Zafiropoulo: No, not really. Nikon just began in the early '80s. It was mainly through U.S. companies, through trading companies. TEL was principally a trading company. And most of these companies were dealing with primarily U.S., some European companies, mostly U.S. So Applied started later, because of their epitaxial reactor, having a direct operation there. But very few companies could afford, based on their size, to have a direct operation there. As we get larger we can begin doing things like that and understanding the real value of having a direct operation there. But that came much later. For many, many years we were dealing through trading companies.

Addison: So you really think that the fear of not having access to US equipment was the impetus for Japan to develop its own industry?

Zafiropoulo: And the cost, driven up by the distributors. So reducing cost, doing it internally, and the government supporting that for infrastructure purposes. So MITI would support funding…like Nikon to build a first stepper with the intent of exporting and [developing] technology in Japan and protecting themselves in case of an embargo. So all those factors and justifying that with the 3x multiplier that was being generated by the distributors.

Addison: Turning to Europe now. Europe is not really a major force in the industry these days, but what was your perception of the European semiconductor industry during your travels there?

Zafiropoulo: I thought Europe was going to be a powerhouse. I thought Philips and Siemens were great companies. I'm very disappointed at what happened in Europe. Especially Philips. Philips should have owned Europe. And it's really a tragedy what happened in Europe. I think looking back in the history of it and looking and dealing with Europe, at Siemens and other companies, I felt that the principal reason is some of the upbringing of Europeans, the mindset. Europeans are extremely frugal. And they try not to make mistakes. So they'll work very hard and try to pick the right decision before they go ahead. Where in the United States they may go in two or three directions at the same time. And spend the extra money. And time to market is really critical in this industry. And I think that because they're so frugal and they're risk-averse, that the Europeans lost. It's what's happening now in the United States, we're becoming more and more risk-averse. And that's concerning me as we go forward.

But Europe, I think, failed for that reason. And the biggest tragedy I think is Philips. Philips, to me…great technology company, great research laboratory, good workforce, educated workforce, consumer products, had no reason to fail. Even though they're thinking about a spin-off today and forming another company, the semiconductor portion of it, I think overall historically it was a failure. And the same with Siemens and Infineon, as we see what's happening today. ST has done a great job, ask Pasquale

Pistorio. He was the driver of ST and if it wasn't for him ST wouldn't have succeeded. But they succeeded by going outside of Europe into Asia, Singapore. So their successes are not so much within Europe. It's tragic the high unemployment rate in Europe today, the cost of living. So really what's going on today is an environment that's getting weaker and weaker. And that's a damn shame. I think socialism, government policy, it's just really not good. And it makes me feel sad because my parents, coming from Europe, it's where I came from essentially. But you know, it's almost self-destructive. Not because they're not smart people. They're very smart people. It's just they work reasonably hard. Except now [with] socialism, they work less. They shut down in August. And really the work week is 36 hours, in some cases less. So the work ethic has changed a lot. Some day it will come back, when they're in a survival mode again. But I think Europe in general, for me, has been a disappointment.

Addison: Did you ever come up against competitors in Europe, in the equipment space?

Zafiropoulo: Oh, sure. Electrotech was one. Chris Dobson. And Electrotech did an excellent job in developing new technology very quickly, unlike many companies. They could copy something and come out two months later with a product at a lot lower cost. I don't think Chris was a business man, but I think he's a very good technology guy. And I have a lot of respect for Chris. But going through Europe, for the most part, lots and lots of failures. ASML is an exception to that. And ASMI is an exception to that. But for the most part most of the equipment companies failed in Europe, they just failed. For the same reasons that the chip guys failed.

Addison: Let's talk about Ultratech now. After you did the management buyout what were the early steps that you took to get that going?

Zafiropoulo: It was just a great program for me. I don't think I could have done that early in my career. 10 years, 15 years, 20 years earlier, I don't think I was ready for this. I think all the years of my experience led up to the Ultratech solution, if you will. [We] inherited a company that basically was very, very sick. And people cared a great deal. It lacked direction, it lacked management. No vision whatsoever. So we went back and started at the bottom, right back to basics, as to what their core technology was. And it took me two weeks with the people that were there. I knew what the core technology was, but they didn't. And once we established the core technology, which was reflective optics, not 1x…once we understood that then we started marching off and saying what value does that bring to this product. And we said, “Well, why is this good?” At that time, they were competing with reduction steppers, Nikons, Canons, and ASMLs, which was a huge mistake. Back then ASML was almost infinitesimal. They were almost a failure in the early '90s. They were in the same boat [as us] and Willem Maris was taking it over from Philips. And he was on the verge of losing the company in '92.

So we were both in a similar position. But he had great technology and a great workforce. I didn't have good technology here. I had technology, but it wasn't equivalent to what the industry needed. So we picked our places. We said what kind of areas would require this kind of optics and core technology, reflective optics. And we came up with thick film applications. So the first market I attacked was the disk drive area. And then we dominated that market. And then we went from place to place as a niche market strategy. And we still continue to have a niche market strategy. And we had just attacked these niches where we had competition that was like us, where we weren't competing with Nikon and Canon. And I call that not a competitive strategy, but a complementary strategy. And I created relationships with Nikon, with

Yoshida-san [Nikon's CEO]…and with the people that ran Canon. I created great relationships with them. And not once did we talk about competing strategies. Always complementary. So I picked markets that were niche markets that I could really control. And we did a very good job there.

During the course of the last 15 years I began looking at ways that we can blow out of this small company position. All the way through I maintained a very strong balance sheet. I was really concerned about balance sheet. To me balance sheet is power and longevity. When you have money in the bank it's hard to go bankrupt. So I forced our company to think about the financial aspects of business. And coming from a technology person that's kind of unusual, I'm sure. But we have a very strong balance sheet and no debt today. But not afraid to risk investments. We tried many things. And then began this laser technology in '94, just a few years after I acquired the company. A couple of years later I began embarking in this laser technology for, at that point, junction formation, making transistors. And spent, today, probably close to $200 million in that area. It has great potential. I mean, I really believe this. And we have great IP, over 100 patents in this area. So that's something we began in '94 that's just beginning to develop now…that has great potential.

And then staying with our core technology of reflective optics…with the current laser system we use reflective optics. So it's the same core technology that we understood back in 1990 when I took over the company. So on balance it's been a great program for me. Very challenging. I was getting into the absolute guts of the company. They had no clean rooms. It was actually more difficult I think to fix this company than it was to start Drytek. I think it's always easier to create your own problems than to inherit them. And [we] inherited a great deal of problems. You can never change a company totally. And certainly it has my characteristics in the company today. But some of the early characteristics are still there. And some of them are very good to have. So the company is stronger today than it ever has been. Financially very strong, great technology, great products, and a wonderful workforce. And the true assets of the company are the people.

Addison: And you did an IPO with Ultratech?

Zafiropoulo: Yeah, did an IPO at the end of 1993. And we did four secondaries after that. One was a private placement for the TA Associates. Then we did three secondaries, we raised money. So the company has done a total of four offerings including the IPO. That was done in the end of 1993, about six months after I acquired the company.

Addison: Was that difficult?

Zafiropoulo: I had a great time. It was a fantastic experience. People really hate IPOs and secondaries. I love them. I thrive on these. I go from morning till night with one-on-one sessions with investors. I love what I do. And I share this with the investors. So IPOs and secondaries for me, is a lot of fun. A lot of hard work getting there. A lot of aggravation, a lot of frustration working with the attorneys and the audit firms. But during the IPO process it is a great experience. And I'd do it in a heartbeat again I loved it that much.

Addison: I haven't got your opinion on the silicon cycles in the industry. Are there any cycles where you really thought I'm not going to make it through this one? Any war stories?

Zafiropoulo: I was one of the guys who thought these cycles are over, we're getting smarter. And the facts are we're not any smarter, we'll have cycles forever. And that's good news. As I look back on cycles…that creates real value. The value I sense is that when you have a very predictable growth that's 2 percent, 3 percent, 5 percent a year then your P/E multiple, your stock valuation, will decrease because you're very predictable. When you have these cycles, as we do today with very big hills and valleys, I think this gives us a greater value for investors to make money going up and going down. So that, I think, helps us with P/E multiples. And when the industry is stabilized and mature and the growth is predictable, I think at that stage the P/E multiples will suffer. And the values and net worth of companies will decrease. So I think it's good to have these cycles. Surprisingly…if you've got a strong balance sheet and you invest in R&D spending, a downturn can be helpful to prepare for the upturn. If you have a weak balance sheet your worse nightmare is cycles. So maintaining a balance sheet, to me, is critical, critical in having any kind of future in this industry.

Addison: Let's wrap up talking about SEMI. Can you tell the story of how you first became engaged with SEMI?

Zafiropoulo: I went to the first trade show in California at the Hall of Flowers in San Mateo. I shared a booth with a rep with GCA Corporation in the early '70s. I've been to every show since then. As I mentioned I started in the mid '60s in this industry. So it's been an interesting part and a real value added to the world, to all the members, and the customers having SEMI as a worldwide trade organization. This is my eleventh year on the board of SEMI. I served as chairman, vice chairman, on the executive committee. It's been one of the rewards of my life. A kind of culmination of all the work I've done earlier and trying to share that and give some guidance to the younger people and to help Stan [Myers, SEMI president and CEO] in any way I could during this transition. And I've had a wonderful time at SEMI. And I work with the [SEMI] educational foundation, which I think is very important. I spend a lot of time with them. SEMI has been a great part of my life. And one that I really cherish.

Addison: Did you attend that meeting, I think it was in 1970 before the first SEMICON show…a meeting to talk about setting up a show. It was at Rickeys in Palo Alto.

Zafiropoulo: I was not at that meeting, no. There was the Wagon Wheel, there was Rickeys, and there was a third one up on El Camino. But there were frequented on Friday nights. I was in the east coast, so I wasn't as available. I'm sure if I were here at the time I would have been there. But again, that's part of the networking that doesn't exist, unfortunately, in Boston that does exist here in California.

Addison: Do you recall when you first heard about this concept of a trade show for the equipment people?

Zafiropoulo: Yeah. Back then…we were doing work in southern California…part of a total electronics exhibition. And they wanted to break out from that organization, that's how it really began. At first I wasn't so sure. That's why I split one booth with a rep. So I had the GCA products in half a booth at SEMICON, the Hall of Flowers. That was the first year and it was only half of one booth because I wasn't sure. I went back and I raved to Milt Greenberg and Jim Gallagher [and others] about what I had seen, what I had felt. I said we have to be there. And then we began expanding and GCA then was there in greater force in the years to come.

Addison: Were you involved with SEMI when they had the big debate about whether to go international or whether to be a U.S. organization?

Zafiropoulo: No, I wasn't. I'm glad they chose to go international. Again, the unfortunate part, those discussions were made when I was living in Boston in the '80s, and the '70s.

Addison: During your 11 years on the board of SEMI what are the big issues that the association has faced, in your view?

Zafiropoulo: I think managing the organization is very difficult. You have cultural changes. You have geographic changes. You have time zones. And I think that's a major challenge to Stan [Myers] and the board. I think that they're doing a good job. I'm sure that one can always do a better job, but I think that's something that has to be really worked on…to provide enough independence yet keep the total control. Because I think once you lose the total control, especially in standards, the industry is going to suffer. And that's one of the things that I think brings real value to this organization. The trade show supports the funding, however the part that I think is very important is the standards portion of it. Without standards we'd be chaotic in our industry. So that brings tremendous value. And the trade shows bring value to funding needed things like standards. So this trade organization is not just different because it's global, it's different because it's standards-related. And it is global. And the shows are used to finance the other parts that make this organization so strong. I think that's probably the most important thing, the differential of this organization is the standards. And being global versus other just trade show companies. This is not a trade show company. People think of it as trade shows, but it's really not. The trade shows fund the organization to do other good things. Education, standards… things of that type which I think really separate this organization from anything else like it.

Addison: All right. Well, thank you very much, Art.

Zafiropoulo: It's been a real pleasure talking with you. Thank you very much also.

END OF INTERVIEW

