

	GR: Right. Yeah, the Beaverton school district was one of the most highly
	regarded school districts in the northwest when I moved into the area. It was
	something that people all around the northwest knew about I think it still has
	a fairly good reputation. Although, Hillsboro's giving them a run for their
	money now. But Intel has, you know, Intel moving into the area really helped
	consolidate this area as a high tech area.
	RD: Interesting. What do you mean? How can they do that?
	GR: I mean, Intel moving in prompted other companies like Sun Microsystems,
	Credence Semiconductor, other companies who might use their products to
	move into this area because they're closer to the supply source.
	RD: Okay. Yeah, that makes sense.
	GR: Yeah. Now there have been some rocky times, you know, it seems like
	about every 7 to 9 years there's an economic hiccup that hits the people who are
	not too well prepared and companies suffer. There wereI don't know
	whetherif you came down the road from the north you probably passed a
	couple of fledgling semiconductor companies that fell on hard times over the
	past few years. They basically had to close up their operations cause they just
Influence of	because of the general global economy.
Inter	
	RD: Yeah. Whatwhat do you think the future is for TriQuint and for these high
	tech companies based here in this county?
	GR: Boy, II
F ,	
Economic downturn	RD: Any predictions?
	GR I hate to speculate

RD: I know...

GR There are---I mean, we're one of the largest manufacturers of components for cell phones but there are several others that are very well known. There's a company called AnaDigics on---in the Bost--excuse me--in the Boston area; and Skyworks and another company called RF micro devices or RFMD. So we have strong competition but I think we have some process technologies that will allow us to thrive for---in the cell phone market--- for several more years. And I hate to predict what the next widget is that's going be the big thing. But, I mean, nobody back in the 1980's envisioned the kind of explosive growth that the cell phone market has undergone. World wide the market for---I think there's probably something like 10 to 15 million cell phones made a week in the world. [chuckles] Or maybe per day.

RD: Whoa...

GR: and you wonder how--people must be eating them.

RD: [laughs]

GR: You know?

RD: Or...

GR: ... or losing them!

RD: Exactly! Wait a minute? Yeah, where are these cell phones going?

GR: But you can see it. You know, a company like Samsung or LG or Apple, they're constantly coming out with new models and they have new features. And they're—you know, the markets--you know, people just flock to these new phones because they have to have the latest and greatest things ...

RD: Right.

GR: ...even though what they're leaving behind is perfectly fine.

RD: [laughs]

GR: I don't know whether that kind of scenario is self-sustaining or not. You think there in the---in 1981,82, the first IBM PC was delivered...

RD: God! That's amazing.

GR: And that exploded and that became the, you know, the thing everybody had to have for 10 to fifteen years. And it, now PCs are, well, they've come up with different flavors of them. They're not the big desktop thing anymore----you've got laptops, notepads, and now tablets. Uh, don't know what's next there.

RD: What kind of technology do you use?

GR: I have ---at home I have 7 desktops, 3 laptops, uh none of the small notepads, no tablets, because I do too much programming and they're not really useful for that. But I do have a Kindle so I...

RD: Yeah I was going to ask if you have a Kindle...

GR: Yeah, because I read a lot. I was skeptical of that for a long while I said, "Nobody will buy an electronic book reader!" Well, I finally wound up buying one and I'm hooked....

RD: I know, they're great for people who like to read...and if you do any

	traveling
Personal technological	GR: Yeah, it's so convenient.
devices	RD: So convenient. It really is. Although I'm I study history so I like to be in the basement of libraries looking at old dusty books
60:00	the basement of noraries looking at old dusty books.
	GR: Yeah oh yeah. So do I, so do I
	RD: So, I still like books, soum
	GR: I don't know what the next, you know, what the next new thing on the market is going to be. I thought GPS systems would take off to a much greater
	extent then they have, although they are getting to be they're pretty pervasive. They're Guhglobal positioning chips in most cell phones these days. But I
	thought people would hav come up with a lot more consumer items there then
	they did. Now that's a that's a technology that relies on satellite
	for that as well.
	RD: Yeah. You are also, um, involved indidn't you do something with Mars?
	GR: Yeah, well, we built some chips for several organizations that wound up in
	the Hubble microscope that was put in outer space. They're still running up
GPS	there and they've been up there for a number of years now.
	RD: Are there any specific projects or products or things that you've worked on
	over the years that are your favorite?
	GR: Boy, uh, I mean there's so many things. I think thatjust going back you
	know, as I indicated that in the early days the basic material technology

was...was a fundamental issue that everybody was worried about. First people were worried that they couldn't grow these wafers that we wanted and then they said, "If we do grow the wafers you want, we're gonna run out of gallium." There's not going to be enough gallium in the world. So...oh my god...

RD: [laughs] crap! It not likely to fix that!

GR: So they solved that problem. They found large deposits of gallium in Australia. [laughs]

RD: [laughs] Okay! Good!

Running out of Gallium?

in GA industry

GR: And then we wound up with a gallium glut. But I think the most enjoyable thing was during those early years our technology grew differently than the silicon technology did because several companies had small gallium arsenide operations. It reflected this vertical integration. Like---people like Watkins-Johnson in the Bay Area, Hughes research in Malibu Beach, McDonald-Douglas in Huntington Beach in California, Rockwell International in Newport, California. There was--there were several companies on the east coast. Everybody was kind of in the same boat---they had these real small fab operations. They were all fighting the same kind of problems, trying to build similar devices and one the most enjoyable things to me was that I knew many of the people in these different companies and we did two things. We started an annual manufacturing technology symposium. The first one was in, I think, '84 or '85. And also, we had several informal get-togethers. Several engineers would come from several counties and we'd just sit down and...tell everybody what kind of problems we were having and share, you know, share any Competition solutions that that people had. It was all--it was all domestic. You know, there were no international companies there... because there were national security concerns with the technology at that time so there was--everything was held within the country.

RD: Yeah.

GR: But we had---there were very good relationships amongst all of the competing people.

RD: Wow, that's very cool.

GR: Yeah. And that I think--- there was only one company that refused to train with us and that was because we---had declined to hire their CEO as our CEO...

RD: Oooh... [chuckles]

GR:...in the beginning. There were some political problems there.

RD: Right. As to be expected, really.

GR: Yeah.

RD: Um, how long did that happen or is that still happening?

GR: Uh, there is still some of that going on to a much lesser extent because are-have stabilized quite a bit. We did go through a round of that kind of thing about 7 or 8 years ago that lasted for a few years when we made a major technology shift in it--in the--late 90's through the early 2000's. As I indicated, we and everybody else had been building what they call MESFET devices as the fundamental building block of the circuits. Now, they worked well in most applications but they have some fundamental failings in others. And there was research going on in a new kind of crystal technology called heteroepitaxy, where you take a basic slice of gallium arsenide that's polished real nicely and you grow layers-- very thin layers-- of different materials on top of it with different electrical properties. They use real exotic equipment to do that. And as you might expect, it's a technology that in its early days was like what we went through in our very earliest days. You never knew from one minute to the next what was going to work. But, we worked with several of the companies who were starting up and exploring this technology. And they were successful and we, in turn, used these wafers with these specially grown layers to grow new classes of devices. There were two classes of devices that we started building. One is called a high electron mobility transistor, which is similar in concept to the MESFETs that we were building, but didn't suffer from some of the same problems. And then there was another transistor called a heterojunction bipolar transistor, which was acknowledged to be the absolute fastest kind of semiconductor device you could build. Of course, being the fastest meant it was also the most difficult. But in working with the vendors of the material, and then our fab people working on developing processes to build these devices, we were successful in transitioning away largely from the MESFET methodology that we'd used into these new technologies. Most of what we build today is based on these new technologies.

RD: Okay.

Technology shift

GR: Now we have to work very, very closely with our vendors. We had to share some of our proprietary information with them and they had to share some of their proprietary information with us. And we didn't---there was no restrictions placed on either company as what they could do internally with that information, they just couldn't share it with anybody else. But I think that kind of thing will occur sporadically from time to time...and I know that the silicon industry has done similar things on occasion, in particular INTEL. They use a very specialized kind of silicon wafer with---- and they've worked closely with their suppliers to get exactly what they need.

RD: What do, uh, what do engineers do when they're not working?

70:00

GR: [laughs] Oh it's quite varied. Many of the engineers are avid outdoorsmen---hikers, skiers, I was an inveterate skier until kids came along. That seems to put a stop to that kind of thing for a while. They have all the normal run of the mill hobbies. We have a quite a mix of men and women in the engineering-various engineering roles--design engineers, process engineers, product engineers, who manage the products once they're--- they've seem the light of day. People doing failure analysis and reliability. There's a fairly strong mix of men and women in both areas. It's like you would find in any, you know, heterogeneous company there's some people are coin collectors other people are mountaineers...quite a number of people do the Hood to Coast run here, both men and women from the company. Myself, you know, going back to my days of wanting to be a mechanic--an automobile mechanic--I have a couple of old junkers in my garage that I keep threatening to work on. But, it's a quite varied. People are generally very accustomed to working long hours on occasion, you know. Because generally when an unexpected problem occurs or unanticipated demand for something occurs, people have to respond quickly. And that seems to be part of the culture here, that the, you know an 8 to ---a 10 to 12 hour day is not uncommon---sometimes longer.

Engineers' hobbies

RD: I'm thinking about this group of people who, when you guys were starting TriQuint, and all of the different roles that you were playing in that company and developing that company and figuring out, not just the product itself, but the company itself. And I'm thinking about people at home ----if you have a wife at home or...

GR: They have to be very, very understanding...[laughs]

RD: You must have had some really strong support! I can imagine thinking about flying to and from, you know, various regions maybe up along the west coast talking with...

GR: When we were---you know--- My first year with the group was-a lot of it was focused on designing the fab operation that was--it was sited inside Tektronix property so that was an advantage for us. But I had to spend a lot of time working with architects and other facilities people to design the fab and then we had to decide what equipment we were going to buy. So myself and several of these key engineers that I hired spent a lot of time traveling. You know, we'd spend two and a half weeks out of every month traveling away from home. Traveling to---all across the country working with equipment vendors. And at that time the equipment vendors--they didn't even know what gallium arsenide was...it was, something... something strange. We had to educate them. And the material I did---they were very familiar with silicon and they had techniques, they had equipment, that would handle silicon wafers quite well, but they failed miserably in handling gallium arsenide because of its properties. Just to give you an idea---gallium arsine's 4 ti-- for the same size gallium arsenide is 4 times heavier than silicon. So transport systems that would move wafers around, the motors in the equipment would burn out because the wafers were so heavy. Also, gallium arsenide is transparent to infrared light. It's also highly insulating, so the detectors that the vendors used to sense where a wafer was automatically on the equipment would fail, and of course the wafer would break. So we had to work through all of those kind of issues with every vendor we dealt with.

RD: that's an enormous undertaking--you're having somebody completely reassess how they're going about creating this product.

GR: Yeah, but again, we were lucky--very. Very lucky--in that we were starting up when the general high tech industry was falling flat on its face--and the equipment vendors--they would do anything to get a sale. They would bend over backwards, you know, to invest engineering time, change the design of the equipment to meet the special needs of this exotic new material. So again, you

Family support

know timing-the timing was perfect. We got a core group of top notch people from, you know, like I say all, the way from the technical operation staff up to the engineering staff ---got real good people there. We got real good support from our equipment vendors. The material suppliers were--they were hungry too.

RD: They were ready for some business too? It's really interesting. It's really, really interesting.

GR: It grew up in a different way than most start up companies grow up, but you know, most start up companies are formed by a small group of, you know, people with a good idea and they go out and they get venture capitol to fund them and they have to produce right now. I mean they have to be successful right out of the box. Triquint was sheltered quite well by Tektronix during that first period of its life because there were some senior people at Tektronix who had a lot of foresight. There was a vice president by the name of Wimvelsink, at the time he was a vice president of our engineering. Another senior manager, Tom Long, and another one, Larry Bowman. They were very strong internal advocates in Tektronix for us. We also had some advocates in the various business units of Tektronix as well. They want to use our equipment--our material. But those three people basically ran interference for us with the rest of the Tektronix management and ensured that we had the funding and they gave us the time to solve some of these basic issues that we had to deal with.

RD: It's like a mutually beneficial relationship. As one person's growing and another company's reorganizing...I feel like timing is really--- and I hadn't thought about that before this interview--- just the timing in which these companies emerged, it's really important.

Sheltered by Tektronix

GR: Yeah. If we had done this 5 years later, you know, it may or may not have been a success. It's really hard to say...

RD: Do you have children in the high tech industry?

GR: Uh, I have one son working for Intel and one son working for TriQuint....

RD: [laughs] Really???

80:00 GR: Yeah.

RD: So, there is a legacy that's being handed from your own generation...

GR: Yeah, my older boy is working for Intel in Folsom. He's a computer type. He's doing a lot of basic low-level programming for embedded systems. So, he got my programming interest. The other one got my materials interests.

RD: Cool. That has to be kind of fun.

GR: Let's see where were we...

RD: I was going to say---you're an incredible speaker. I feel like we've covered, actually, everything on my list...

GR: I was--was just trying to think uh...Tektronix did spawn a large number of companies or supported a large number of companies, several of which are still highly successful in this area. One that comes to mind right away is Cascade Microtech. I don't know if you've heard of that company or not. They have a big facility on Cornell road just a few miles from here and they have another one in Beaverton. They fabricate fixtures that are used for testing, uh, some of these fixtures and equipment--for testing some of these very high-speed devices. It's a real exotic technology discipline. Those two people were--the two cofounders of that company, actually were part of the original R and D group

that I joined. And about a year later they decided that they wanted to make this a business. So we at TriQuint, together with Tektronix, gave them seed funding and a lot of the patents that went along with their work and they've---they made it a very successful company. One other company that you may or may not of heard of is Planer Systems.

RD: I've heard of that one...

GR: Now, the fellow who coerced me to come back to the R and D group was an individual by the name of Jim Herd. He and I had worked together in the old R and D group on some of the stuff back in the early 70's. Well, he decided that he wanted to take this electroluminescent display technology off and make a separate company out of that. And he did that and they were quite successful. Of course, they, like all companies, have had their ups and down but they're still out there alive and kicking.

Other spin off of Tek

RD: A lot of those relationships that you fostered--um or that were fostered by working with people in Tektronix--those probably still exist...I'm sure a lot of these people are still around this area?

GR: Oh, definitely.

RD: Very cool. You can sort of look at each other's careers sort of blossom out of Tektronix and these various spinoffs that are popping up all over. And then of course, understanding the impact that economics probably has on business...

GR: Right. I keep thinking of other ones--Maxim--bought the Tektronix Integrated Circuit Operation. They actually bought the whole building from Tektronix, so they're located on the corner of the Tektronix campus. And they build the same kind of devices that we were building when I was part of that that organization. And several of the original Tektronix people are still there working in that operation. And there was one other thing I thought of...there was a...Tektronix did so many different things---you would just shake your head wondering how they could ever have done so many different things all at once and kept their sanity. There's a circuit board company in Forest Grove and the name escapes me right now, but it was originally a Tektronix captive circuit board company. Tek basically underwrote them and allowed them to go off on their own. There's another company called Maxtech that builds accessories for test systems that was spun off out of Tektronix.

RD: Yeah Tektronix---reading about Tektronix--there's a lot of really unique terminology like we've--as a class we've done a little bit of research. We've come across terms like--the Camelot of technology or--the mother of technology.

GR: If you ever get a chance, you should try and at one of the libraries--try and check out the video that OPB did. It's about a 45 minute discussion of how Tektronix was formed.

RD: Right. And I actually--I actually did watch that.

GR: Oh you did?

RD: My boyfriend and I watched it...

GR: When they started out in a little shop over Hawthorne street, repairing TV's--repairing radios basically. And Howard Vollum had been an electronics tech in the navy and he this idea for test equipment that will allow you to see the signals for the first time. At the same time Hewlett and Packard were doing the same thing in the Bay Area. Now it's interesting you know Hewlett Packard followed the same kind of pattern that Tektronix did, only they were a little bit behind Tektronix. Hewlett Packard split into two separate companies--one

	retained the Hewlett Packard name and another one was called Agilent.
	And the Hewlett Packard side kept their PC business, you know, their computer
	business and workstation business and software and Agilent took all of the test
	equipment. As it turns out, Agilent's been far more success full than Hewlett
	Packard. In that time frame when we were formed, the premier gallium
	arsenide companyit was a world recognized leader in the Technology was
	Hewlett Packard. And they had a head start on us. They had some absolutely
	brilliant people working down there. But they made some mistakes in funding
	the company. They decided that they were going to keep that operation totally
	captive. They weren't going to sell to the outside world. They were going to use
	the devices the group made to leverage on their equipment to give them ayou
	knowan advantage over all the other vendors in the test equipment
	marketandthe group basically vanished over a period of time.
	RD: Why? Why I wonder?
Tektronix	
	GR: They were underfunded. Because they were a totally captive company
	they couldn't get the kind of funding they needed to grow.
	RD: It sounds like a good idea, right? To like rev up this sort of engine, right?
	and put all of your moneykeep your money internal and build it up. But you
	have toin reality you have to have something coming and going
	GR: There's a balance that companies have to draw in that respect you know
90:00	there's an old saying if you want it done right, do it yourself. Well, that's the
	way Tektronix and Hewlett Packard operated for the first 20 years of their life
	and it wasit was very successful, but then doing it yourself got to be so
	expensive and so diluting. I mean, you're spending your time figuring out why
	you can't build a piece of wire instead of why you can't build a testa piece of
) X	test equipment.

RD: yeah...that's a good comparison.

GR: So yeah, I think the movement was right and it was---uh--I won't say it wasn't heart wrenching for some of the people who were involved in the transitions. You know, when companies get you know partitioned off it's quite an emotional change for a lot of people and some people throw-you know, they thrived on it, others didn't. But we were lucky. We were one of the small groups that thrived. Of course I've been told many times that the--- all the people I hired were the trouble makers in the company...

Problems with vertical integration

RD: [laughs]

GR: All the people always complained about the way things were being done. So, I wound up with a group of trouble-makers. But they proved to be the-what it took to be successful...

RD: They paid off in the long run?

GR: Yeah, yeah. It was a lot of fun, but there was---there's a lot of times when you wondered if you were ever going to get it right. One of the people I worked with for several years decided he was going to get out of the high tech industry and go on growing mushrooms. And he---he did. He grew mushrooms commercially for 10 years here in the Beaverton area until he finally decided to retire.

RD: Oh, interesting.

GR: He was growing Chanterelles and several of the other exotic mushrooms. I talked to him once not long ago and he said, "You know, growing mushrooms is just like being an engineer in the fab. You try an experiment and it fails. You try another experiment and it fails. Finally you get off your hands and walk away and it works. You have no idea why." [laughs] He said, "It was just like

what we did when we were developing the processes for the devices we were building."

RD: That--that's interesting. Do you think that's--do you think you could say the same thing today? It's still the same way?

GR: Oh no.

Experiments

RD: Like experiment...

GR: It it's much better today. I mean we were starting from a knowledge base of near zero. Nobody knew very much about this new material--what it's behavior would be like, how it--we didn't even have a good handle on how to get the starting material clean before we ever started to use it. Everything was a first time experience, whereas at that time in the silicon industry, they probably had several million man hours around the world of experience that had been shared by people moving from company to company and through conferences and whatever. Everything we did was almost like a first time experience. That's why it was so incredibility useful for us to--- various people in different competing companies---- to get together and just say this is what we're doing and it isn't working. What are you doing with the...you know...and sharing what today would be considered major corporate secrets. When the whole community was so interested in just making the technology survive that they were willing to share some of the aches and pains that they were experiencing with us and we did the same.

RD: It also sounds like...you said some secrets that you probably wouldn't---do people still share that information?

GR: There is there is I think--a lot more openness in the gallium arsenide fabrication process community than there is in the silicon, even today. The

manufacturing technology is still going on. It's not an international conference, but people do you know they get up and they bare their soul about some of the problems they they're fighting--things they may not share if how much material is being processed or how many devices they're selling--details of who their customers are...that's definitely off limits...you know, in terms of working with the basic material---that is still what I think--a very--there's still a lot of synergy between the companies.

RD: Good. That's like the core of...scientific experiments and things, too, I think. Right? It's like going through a process, hoping it succeeds, doesn't succeed, and having to like express that with somebody and share information and try and get to the bottom of it. That's my perspective--my personal perspective, is that you're sort of a detective and sort trying to put pieces together and solve a problem that you don't even know exists yet...it sounds like a very exciting career and really thrilling--pretty thrilling life.

GR: Yeah.

RD: Driving out here and looking at the incredible building and restaurants, and you know, an entire community that's been developed around this type of technology is really, really powerful. And everybody I know has a cell phone...

Gallium Arsenide Industry

GR: [laughs]

RD: ...almost everybody. Even my grandmother, who you know is, long lost when it comes to technology and I just think that it's--it's so great to be a part of this process and hopefully enlighten people to what's going on out here and how it has changed over time.

GR: What do you think will happen with these, uh, these--I don't want to call them reports--but you know like--papers or discussions--how will they---will

they be made public?

RD: Yeah, so the Washington county--the history museum--is actually going to curate a show. I think that's coming next year. They're going to use the information from these interviews that we are doing, the information that we're gathering doing research--their doing their own research. So there will actually be an exhibit on the Silicon Valley--er--Silicon Forest...

GR: Forest! Yes [laughs]

RD: Sorry... I keep saying that! Silicon Forest, yeah, not the valley. That will be--you'll definitely get an invitation to--and then, um, the next step for me will be to go through and transcribe our interview, send it off to you and give you a chance to look over it and then it actually goes into a public archive and it's available to other historians who are going to want to research this area and say what can I pull from this and what's available to me?

GR: Yeah I really wanted to put together a history of this company but I spent about a year and a half working with yet another start up in this area. And when I went over there I had had pictures of some of the very early days, the people, the equipment, the different labs, some of the things we built, but it vanished when I went to on that assignment...[laughs]

RD: Yeah...yeah priorities. Things come up...

100:00 GR: You know, I would love to have found that so we could put together an archive just for our own...

RD: You should, yeah. It's a valuable--it's an important, valuable part of every company, and of every person-- -is having the history available, you know, to people.

GR: Fortunately we still have a lot of people around the company who date back to the early days. Most of which I hired. There's one night---I think I mentioned it in the early discussion---there was, the first time I walk into a lab and saw the lady cleaning a wafer--she is still here, she is one of the senior product management role now...

RD: Cool. Were there many women at the beginning?

GR: Yes. Probably--- certainly not a 50/50 mix at that point in time, in late 70's and early 80's it was hard to find women who went through the sciences---any of the pure sciences or engineering. There were people coming and we hired several of them. One of our senior reliability engineers was a lady. Our Human resources director was one of the best HR people iv ever encountered in my life, and she was with us for several years. Several people in the non technical roles. We have a VP or a CFO, who was a lady for several years did a fantastic job for us. But over the last, Id say the last 10 years 15 years at most, we've seen a lot greater influx of women coming out of college with either bachelors degrees or advanced degrees in chemistry, math less so in physics several in engineering, and we've hired a large number of professional engerrge and women who are professional engineers in the company right now. I'm not sure if there's anybody... any women on staff right now... anybody in the executive staff who are women. There may be, I've kind of lost interest in that part of the business...

RD: You're technically retired, yeah. [laughs]

GR: [laughs] But, year.

RD: Well, thank you.

GR: Your welcome, I hope you can make sense out of it. RD: definitely! Oh yes, I'm excited to go back and research

