Oral History of Greg VanWiggeren

Interviewed by
Günter Steinbach

Recorded June 27, 2017
Mountain View, CA

CHM Reference number: X8251.2017

Steinbach: Today is June 27, 2017. We're at the Computer History Museum, interviewing Greg VanWiggeren. My name is Günter Steinbach. I contacted you because you have patents for the laser mouse, but this interview is about your whole oral history, your whole life and career so to speak. Thank you very much to agree to the interview.

VanWiggeren: Honored to be asked.

Steinbach: So let's start with your background. Where did you grow up? What was your family background like? Your hobbies?

VanWiggeren: I grew up all over the country because my father was in the U.S. Air Force. Well, when I was younger, every few months it seemed, as I got older, every couple, three years, we'd move to a new place, a new part of the country. So I moved-- lived in many different places. So yeah, I lived in many different places. I was born in Texas, lived there for a month. My father was I think stationed at an army base there that closed shortly after we left. Then I lived in Alabama and Illinois and Ohio and Florida and Georgia. Actually no, I didn't live in Georgia until graduate school. Washington state, New York, New Mexico, maybe some other places, I forget. <laughs>

Steinbach: So did you get a chance to develop hobbies with all this moving?

VanWiggeren: Well, I was just a child, so I did lots of child-like things, less connected to my career I'm sure. But yeah, I played sports with kids in the neighborhood. One of the nice aspects of growing up on air force bases mostly is that everybody on the air force base is of child rearing age, and usually different ranks of men mostly there lived in the same-- the same rank would live in the same housing area, which would have the same aged children. So I played a lot of baseball and football and basketball for hobbies when I was younger. Maybe a little bit of insight into my future career though, I was really intrigued by scientific things and notions about infinity and astronomy and things like that when I was younger. So that kind of grew over time as I got older and decided to study that formally.

Steinbach: I noticed that you actually studied physics, not engineering like probably most Agilent people. I don't know.

VanWiggeren: That's right, yeah. So I did study physics in college and in graduate school, again probably because of my interest in physics growing up. There were some inspiring points in my life that helped me in that path. First of all, I enjoyed watching Carl Sagan's Cosmos on TV when I was a kid. My parents encouraged that. And then when I was in, I think either the summer after sixth grade or the summer after seventh grade, I went to-- or maybe even the summer, yeah summer after seventh grade perhaps, I went to a summer school where it was just enrichment activities. One of my classes was taught by a particle physicist about particles. I, of course, had no mathematical capability, but found the whole topic fascinating of colliding atoms together and protons and all this sort of thing. And then another of my classes that summer was on the environment, but part of the class was to get to see an electron microscope in use. I thought that was pretty cool too. So that was a key point of inspiration for my later career.

Steinbach: How did you choose the colleges you went to?

VanWiggeren: Well, I guess I did choose. I had read about Caltech I think growing up. I guess Richard Feynman was there and it was a famous physics school. Oh, I watched The Mechanical Universe TV show on PBS growing up, so there was a professor that started each program with a lecture from Caltech. Heard about MIT, so I applied to those two schools, also Georgia Tech, because I was living, when I graduated from high school, in Florida, just south of-- in the panhandle, just beneath Alabama and Georgia. So Georgia Tech was nearby and I had gotten a tour there, potential scholarship, so I applied there. And also, the University of Illinois because my parents were state residents of Illinois, because when you're in the military, you move around a lot, you're allowed to have some flexibility in your state residence, and they had both spent a lot of their time growing up in Illinois and maintained their residency. I actually lived there six years of my life and visited grandparents regularly. So I applied to the University of Illinois, and I got into all those schools and was accepted to all those schools. I don't remember what my first choices were, but I remember my last one was the University of Illinois. But I had received a scholarship there, so my parents told me that's where I was going. <laughs> So that's how I was-- how I chose my university.

Steinbach: And in-state tuition, of course.

VanWiggeren: Actually, my scholarship was to waive the tuition. My parents still paid room and board, which I'm grateful to them for that. So yeah, how did I choose? Well, it wasn't so much me choosing. <laughs> I suppose I could have chosen to go to the other ones and take on student debt or something like that, but the alternative path was okay. And later, I discovered the University of Illinois was a perfectly fine school, allowed me to reach whatever potential.

Steinbach: It's a good school.

VanWiggeren: So I had no complaints, but at the time I wasn't very familiar with it.

Steinbach: But for grad school, you went to Georgia?

VanWiggeren: Georgia Tech, yep. Again, interestingly, I had-- I got married to my wife two weeks after graduating from undergraduate with a Bachelor's degree. So we had tried to plan to go to graduate school in the same area, obviously. Anyway, one of the schools where that was possible was at Georgia Tech, because my wife was accepted to Emory for law school also, so that made a nice situation for us.

Steinbach: So what about after you got your PhD? Did you go to Agilent right away?

VanWiggeren: Well, I stayed around and did some post-doctoral work for, I don't know, I guess about six months for an electrical engineering professor there, Thomas Gaylord, a man I respect quite a bit. But while working for him, though I was looking for outside employment either at a government laboratory or an industry, I had decided I didn't want to be a professor. So anyway, my first professional job after that post-doc was with Agilent, yes.

Steinbach: Which was Agilent already at that time?

VanWiggeren: It was.

Steinbach: About 2000 or so, right?

VanWiggeren: I joined September 1st of 2000.

Steinbach: How did you choose Agilent over others?

VanWiggeren: Well, as much as I like physics, I also like building things and making things and I had seen that a lot of the professors' time at Georgia Tech was spent trying to write grant proposals, and this seemed less interesting to me. So I thought maybe in industry, you'd have a chance to have an impact on the world, people could use the things that you designed or built. In a government laboratory as well, there might be some more hands on research that I could do. I did graduate with expertise in Chaos theory, so that narrowed my choices I think also. <laughs>

Steinbach: That would be considered theoretical physics?

VanWiggeren: I actually did experimental Chaos theory. That's indeed how I was hired at Agilent. I had developed for my thesis work a ring laser that was chaotic, and so I could demonstrate communicating with this laser, chaotic laser.

Steinbach: Chaotic in the sense of jumping between modes?

VanWiggeren: Chaos has a certain technical definition, a complex theory. So in that sort of sense, it was evolving in a way that was difficult to predict ahead of time, but followed some dynamics that you could understand. So it wasn't random.

Steinbach: It tracked other things.

VanWiggeren: Yes.

Steinbach: And so...

VanWiggeren: But yeah, so my laser work actually was what opened the door to some of the positions that I could considered in industry.

Steinbach: Would you actually use the chaotic property as an advantage for communication?

VanWiggeren: Yes, we thought of it-- thought it might be helpful for encryption. The analogy is that with a traditional radio, you modulate a carrier and then you have on the receive side, you have a local oscillator that is provided and you can demodulate. With Chaos-- chaotic communication, you have a chaotic carrier, but you could also synchronize. This is one of the properties of chaotic system, sometimes you can couple them together and synchronize their behavior, and then use synchronized chaotic oscillators to demodulate whatever was modulated. So that was fun.

Steinbach: Sounds fun. So Agilent hired you for your laser experience?

VanWiggeren: That's pretty much correct. I think they were desperate. <laughs> It was the telecom bubble at the time when I was hired.

Steinbach: Yes, 2000. So what was the first project that you were put on?

VanWiggeren: Heterodyne optical network analysis. So it was fiber optic test and measurement in general, so I was going to be using a swept laser to basically characterize the linear optical properties of the device. Another way to say that is we could get the Jones matrix that represents oh, the amplitude and phase and polarization of this device at each frequency.

Steinbach: Linear properties?

VanWiggeren: Linear properties, yeah.

Steinbach: And you got several patents I saw in that field?

VanWiggeren: Yes.

Steinbach: So heterodyne, meaning you have a local oscillator that you-- well...

VanWiggeren: Yes.

Steinbach: I guess if you, what if you are looking at a passive device?

VanWiggeren: Well, that's what we were doing. We'd look at passive devices. It was for a passive component test in a way. But yeah, we would send a laser beam, a swept laser beam, so its frequency was changing over time, hopefully linearly. It wasn't really linearly. We had to calibrate that out. And then you took a delayed version of that signal and mixed it in the fiber with the signal that had come either through the device or reflected from the device. Now you had two beams that slightly offset frequencies, because this is a swept laser and one's delayed relative to the other and so they're slightly different frequencies and you can beat them to a low frequency on a photodiode, a lot of analogous behavior toward mixing and...

Steinbach: And you have to be careful...

VanWiggeren: ...heterodyne mixing.

Steinbach: ...that the difference stays constant I assume?

VanWiggeren: Yes, and it doesn't stay constant. In fact, we calibrated that out.

Steinbach: So did that go into an instrument?

VanWiggeren: That's fun to talk about.

Steinbach: Or did the bubble burst?

VanWiggeren: Yeah, the bubble did burst about the time we were having some good success. We developed a method to completely characterize a device with one sweep of the tunable laser, very clever, and we were able to calibrate all sorts of things out so that we got a nearly ideal measure of the device. Unfortunately, we did work with a division in Germany and other than some advice about, "Well, you should use faster photo receivers" or something like this, not much of what I had developed actually was incorporated into the system that Agilent was selling. It was beginning to sell about that time, just as the bubble started to crash-- or to pop. They had plans to evolve it and accept some of our technology, but then the bubble really did crash and that put an end to that-- well, my research project in that area and that product was discontinued. Interestingly, there was a competitor doing a similar thing and they still exist and still sell this product, but we do not.

Steinbach: Who was that?

VanWiggeren: Luna. I forget the name, but Luna. Maybe it's Luna Technologies, I forget, something like this. We did have the fundamental-- anyway.

Steinbach: Did Agilent ever reprise that product?

VanWiggeren: No.

Steinbach: No?

VanWiggeren: We never.

Steinbach: So they're not in the optical network analyzer business anymore?

VanWiggeren: We are not, yes. Yeah Günter, you may remember that-- because you worked there, our light wave business and our optical test business shrunk dramatically.

Steinbach: Yeah. So you could think that in the meantime, it has revived.

VanWiggeren: It has revived, yeah, but it's still not to the same number of people or the same-- they can't support the same number of instruments anymore I guess.

Steinbach: Yeah, those were heavy days with the stock at 160 for a brief blip. <laughs> There were founders options.

VanWiggeren: It's funny you mentioned that, I can remember the first day I was hired-- I can't remember, I forgot his name. Anyway, the lab, the communications and optics research laboratory, Waguih Ishak came by my desk and he handed me my signing bonus stock options because they gave those out at that time. They had to, to hire people I guess. And he said, "Oh look, forty-seven dollars, that's a great deal for you, stock options at forty-seven." Never saw forty-seven again. <laughs>

Steinbach: I think mine were at eighty.

VanWiggeren: Yeah, yours were at eighty, huh?

Steinbach: And we had one guy display them on his bookshelf in a beaker of water to show them under water. <laughs>

VanWiggeren: So you were there at the beginning then.

Steinbach: Yeah, I was there-- I rejoined just before they announced the split from HP. Anyway, so that died and then what did you do?

VanWiggeren: It seemed a very powerful technology I thought and my boss also felt the same way. So we tried to find other applications for it-- what would be the easiest thing to do, besides light wave test and measurement. Is there any biology or chemistry that you can do with it? So we did look at that, that's right. But really, the next thing we ended up doing was so I was part of this-- I was with two other researchers, Marc DuPuis and Tong Xie and myself, trying to figure out other research that would make sense for us to explore. And while we were doing that, Semiconductor Products Group representative, Jack Wenstrand, came and told us that Agilent really needed a new mouse, optical mouse technology.

Steinbach: That was right then.

VanWiggeren: That was right then, yeah. That did seem like it was impactful, so we started to do research about how can we make a better optical mouse? I know they took better mouse trap, but better optical mouse. So that was what followed.

Steinbach: So what did you suggest and how was it better?

VanWiggeren: Well, the context was if I remember right, Agilent and HP had, both had rights to the mouse patent and HP sold theirs to Microsoft, I think, something like this. Microsoft began selling competing products against Agilent, and so we felt we wanted some differentiation. Could we make a better mouse? Because there were some surfaces the mice didn't work on. So we explored a number of different ideas. I can't remember all of them. I do remember that I was working on one. It was based on a laser Doppler velocimetry where you get feedback into a laser as it moves and it creates a modulation that you can detect. So I think the frequency of modulation tells you how fast you're moving, or something like this, and that would be a good way of making a new mouse technology, I thought. Turned out I think it was relatively complicated, but it was something I started to look at. Around that time, Marc and Tom were looking at a different technology that I don't recall, but it also was not working so well. So we were sitting around a table one day wondering what we could do and I remember telling them both, "It seems like we need the light that comes off the surface to interfere with itself, maybe that would give us some ability to track changes." Tong said, "You mean like a Dammann grating?" and I didn't know what a Dammann grating was. But anyway, he and Marc went off and developed a Dammann grating technique to do that and it worked pretty well. Ultimately, they ended up not even doing that, but finding a related technique where they didn't need any gratings and just used coherent light with the laser on the surface. I think that's the technology that went forward. I didn't really participate in the development though beyond that.

Steinbach: But you had the first idea?

VanWiggeren: Yeah anyway, whatever it was, my comment, maybe got them started on it, yeah.

Steinbach: Does it then work very similar to the LED mouse in that it just sees roughness? Does it make speckles that move in different ways?

VanWiggeren: Maybe I should have read up on this before I came. <laughs> My impression is that it is similar. When you had this laser, it did something with the laser to make it-- I'll not be able to remember the details, I'm sorry. But somehow, they are creating surface contrast, even on relatively flat and shiny or smooth surfaces. There's still enough contrast using the coherence properties of this laser that they can track changes in motion. So it's very similar in that way. We did have other ideas. I think you did see a patent on speckle. I looked at it more carefully after you talked to me. I guess we didn't move forward with that one, but that was one option. We did study speckle now that you mention it. I forgot about that.

Steinbach: I was wondering about it because speckle I think isn't so correlated, like you move in this direction. The speckle doesn't really necessarily move in the same way.

VanWiggeren: I can't recall why we dropped it.

Steinbach: But the mouse did work better?

VanWiggeren: Yes, it has been a commercial success, I would say.

Steinbach: Does the laser also use less power than an LED or is that not...

VanWiggeren: Well, I don't know. I do not know.

Steinbach: Because I have one wired mouse which I think is LED and one wireless mouse which is a laser I believe.

VanWiggeren: A laser?

Steinbach: And I wonder whether maybe the two...

VanWiggeren: I wonder too, yeah. Lasers can be maybe more efficient. You can put all the light in the direction you want to look instead of an LED, which is omni-directional. That's a good question. I don't know what the trade-offs would be exactly.

Steinbach: But of course the mouse did not remain in Agilent, a product, very long, because?

VanWiggeren: I think we-- oh that's right, so yes, the mouse was not an Agilent product very long because the company took its Semiconductor Products Group and I think sold it to some other purchasers that then created a company called Avago and coincidentally, I think just a couple months ago, Avago purchased Broadcom and changed their name to Broadcom. So that's been a very successful company as well.

Steinbach: Do you know whether they still sell mouse chips?

VanWiggeren: I hesitate to say that I know that they do, but I believe they do.

Steinbach: So what did you go on to do?

VanWiggeren: So after that, again wondering how to take what I knew and use it usefully in the company for Agilent, I met a sort of a senior researcher in the life sciences organization who told me that Agilent really would like to develop a biosensor for proteomics. There was a big...

Steinbach: Who said that?

VanWiggeren: Daniel Roitman. I don't know if you'll recall him, but he was quite a character.

Steinbach: I recall the name.

VanWiggeren: Also, a hero of mine. But anyway, we need a proteomics biosensor. Some people do it using surface plasmons and I wondered, well, how are they making these measurements? I started reading some papers and thought, "Well, I bet we can make measurements better" using this technique that I had developed for the optical component characterization. So I would interrogate the biosensor with a heterodyne approach was the thought, and there may have been some potential there. But you learn things and we figured out well, we didn't need to do it that way, there are other ways, and we ended up creating a very nice technology in that space I think. That's been licensed now to some other company.

Steinbach: Agilent does not itself use it?

VanWiggeren: Much to my dismay, no, we did not. There was difficulty-- in fact, we had an eager division at the time of Agilent wanting to get this technology and were talking about all the plans they had for it. They were pushing the envelope in the life sciences doing new things and at the time, 2000-- gosh, it would have been '07, '08, something like this. I think Agilent was trying very hard to get its return on invested capital up. We had a CFO and this division had not made a profit in a couple years or something like this and they were told-- well anyway, the division was eliminated, the one that was going to take our technology. So anyway, at that point, we ended up licensing it.

Steinbach: As a side question, what are surface plasmons?

VanWiggeren: Great question. They are a solution to Maxwell's equation that are sort of, to me, a combination of electrons and optical waves, but I guess they really are what they are. I think you might also hear them as a plasmon polariton wave. The way we use them in the sensor is you illuminate a thin metal film with light. Maybe the film is thin enough that it doesn't absorb all the light. It's just a very thin film. But the free electrons in the middle will oscillate as they're driven by the oscillating electric field of the light wave. If you do that at the right-- well, if your phase and frequency match I guess, the light and the electron wave, you can get a propagating wave where it's sort of a mixture of the two because the electrons oscillating on the surface create a traveling polariton wave, because they're radiating as well as they oscillate. So you end up with this coupled wave between the electrons and the polariton that propagates only in the near field on the surface in a reactive zone. So that was pretty interesting too.

Steinbach: Oh, then if you have some goop on top, it changes.

VanWiggeren: That's exactly right. Yeah, so we would put some goop on the metal film and maybe attach certain biomolecules and then flow through some fluid, other biomolecules, and if they interacted, it would change the refractive index of the goop on the surface. This is all happening on microscopic scales, but a lot-- but this surface wave, surface plasmon wave, allowed you to detect really minute changes in that refractive index, an order of 10^{-7} refractive index units. It allowed you to see microscopic things with a beam of light interrogating the sensor.

Steinbach: Does it react fast?

VanWiggeren: Oh, well there's a limit to how quickly you can flow a fluid with dissolved molecules in it across the surface. You'd want your sensor to be relatively small, have a small volume so that it would happen pretty quickly, and you'd have to have the chemical reactions happen. So they have their own kinetics they call it, I guess is the rate at which the molecules bind or dissociate, and some of those can be very slow. So even if you get the fluid there quickly, it can still take minutes for some of these molecules to build up on the surface and you can watch the process happen, the surface binding. But yeah, we tried to make it so it was like a tenth of a second to wash through the cavity of the-- the fluid cavity for the sensor so that you could see reactions on that order of time.

Steinbach: But you would have to somehow calibrate I assume to the response of the light to what was actually happening chemically, right?

VanWiggeren: Yes, indeed. Well, we're sending refractive index changes, so as I recall, I went to the cafeteria and borrowed some sugar and made some sugar solutions of different concentrations. Apparently you can buy such things, but I was in a hurry. <laughs> So we did, we calibrated the system over some orders of magnitude of concentration.

Steinbach: Cool.

VanWiggeren: Yeah, don't tell the cafeteria. <laughs> It was condiments actually.

Steinbach: So what then?

VanWiggeren: So that was surface plasmon resonances. That was a great product, I was very proud of that. Disappointed when it sort of fell through from an Agilent perspective. After that, now I had expertise in measuring surfaces, changes in refractive index on metal and thought maybe I could measure electric fields if I put some sort of electro-optic type substance on this film, the gold film, it would respond to electric fields and change refractive index and I could image. By the way, our solution ended up-- for the surface plasmon resonance sensor allowed multiplexing by having a camera that looked at the surface. This was a breakthrough at the time because cameras weren't thought to have enough sensitivity and in fact, even the camera I chose didn't have high sensitivity, but it was fast and I could average a lot. And we also figured out how to use laser light instead of LED light, so we'd get a lot brighter illumination of the surface and that combination allowed us to have basically an imaging sensor. Well, if I can do that, maybe I can measure electric fields on surfaces of things using a surface plasmon resonance sensor. We thought maybe we could apply it to flat panel display tests because there are a lot of-- well, they have thin film transistor arrays and sometimes the transistors fail and you need to be able to see those and make sure that there aren't too many. One way we could imagine to do that is to pass this sensor over the surface and look for where there was a gap in the electric field. There should have been a field of a certain value and there wasn't. So anyway, that was a thought. Then I visited TOG site in Japan to talk about that, but before I got very far on that, I was in the lab talking to an institution of the lab's, Rory Van Tuyl, and we had both visited Santa Rosa and heard some of their experts tell us about the challenges of making better network analyzers. So that was the next project actually. So I kind of almost got started with the surface plasmon resonance sensor for flat panel displays, but before I did, I ended up transitioning to a different project that came about because of the conversation. Shall I just keep talking or did you...

Steinbach: Oh yeah, sure.

VanWiggeren: So we had heard one of the challenges was how do you keep these two synthesizers they need for a network analyzer, one RF stimulus and one local oscillator, how do you keep them offset and still sweep them fast? That was a challenge. So I went back and I was thinking to myself about my days in graduate school and how I had been using a ring laser and it had a comb spectrum. If you looked at it on a spectrum analyzer, you'd see all these combs. I thought well, what if you had a comb of frequencies? You wouldn't have to synchronize two synthesizers and step them as quick as you can over this whole space and have to wait for them to settle and slow your sweep down. You'd just have all the tone simultaneously. So I suggested that to Rory and Rory said, "Oh well, we could use a pseudorandom bit sequence to do that."

Steinbach: But you have gaps?

VanWiggeren: What's that?

Steinbach: You have gaps between the tones.

VanWiggeren: You do have gaps, yes. But even the network analyzer, I guess in the old ones, they would be swept, but most modern network analyzers are steps now. So they sort of have gaps in that way too. And that was the start of the digital network analyzer project. That went sort of proprietary now that I think about it.

Steinbach: You do have some patents.

VanWiggeren: I do have patents on this, yes. So some of it's published. Yeah, some of it's published, which they say-- I guess I can talk about it in general terms. Even though it's published, I think we are asked not to talk about it very much.

Steinbach: That's fine.

VanWiggeren: Another sort of

limitation, yeah.

Steinbach: The basic idea is you have a source with a comb of frequencies?

VanWiggeren: That's right.

Steinbach: And then you-- how do you get the RF though?

VanWiggeren: We have another...

Steinbach: You have three or two combs?

VanWiggeren: We have two combs, that's right. So mathematics tells you how you can design the two combs so that they will-- all the frequencies you care about will fall in an IF that's measurable by you with some relatively inexpensive analog digital converters, low bandwidths, and make sure that these tones don't fall on top of each other, because that's a problem. So we do all that. And it turns out you can make very fast measurements that way. A challenge that this technique would have of course is nonlinearities are an issue. When you mix things in a mixer, the mixer's not completely linear, nor is the amplifiers and so on. So if you have all these tones present simultaneously and you're trying to make a network analyzer with 120dB of dynamic range, you have to make sure they don't...

Steinbach: I was going to ask you about this.

VanWiggeren: Oh, you were? They don't create spurious mixing products. So we had a trick we applied to greatly fix that I would say. Dynamic range, I think it is nonlinear, so I think-- well, it depends on how much effort you put into your electronics I would say. We do have-- well, anyway. <laughs> So anyway, straight forward would be you'd get the 70 or 80 dB I would say.

Steinbach: Now is this your current work or are you on to something new now?

VanWiggeren: Onto something else.

Steinbach: Which you can talk about or not?

VanWiggeren: So yeah, you want to know everything I do, well maybe it'd be interesting to develop a portable version of that technology I told you about. So after the DNA project, there was another project or two to make it portable. About that time, I was promoted to a manager in the research labs so I could lead that development. So anyway, now if you ask what am I doing, well a lot of it is management and it's not one project, but I have really a lot of fun in my job because I work with a very diverse team. We have people who are photonic integrated circuit designers and we have people who are millimeter wave experts and other people who are DSP experts and software experts and FPGAs. A variety of projects go on at any given time. So it's hard to say exactly what I am doing personally at this time.

Steinbach: And do you still get to do some technical work?

VanWiggeren: Oh yeah, yeah.

Steinbach: So you help your people?

VanWiggeren: So I have noticed that I did tend to work on that following projects of the DNA technically in addition to managing, but the group seems to be getting bigger and that gets harder to do. Even so, maybe there's one project that's particularly urgent or I have some skills I'll sort of try to add a little bit of, I think the jargon is wood behind the arrow, myself. For example, the last couple days, I've had a couple people doing urgent simulations for some design of a system we're developing. I didn't want to slow them down, so when a business partner asked us to make some measurements of our preliminary design, with our preliminary tool, I did it myself, because I didn't want to slow them down. Yeah, I think in Labs, one of the nice things is even as a manager, I feel like I'm still pretty deep-- I have to be pretty deep technically and be involved. I don't do a lot and I don't always do all of the inventing and all that, but I still contribute technically somehow it feels like. So that is a pleasure.

Steinbach: You mentioned several projects that went to other companies or well, didn't get pursued inside. Were you ever tempted to follow them elsewhere?

VanWiggeren: Yes. <laughs>

Steinbach: But you resisted the temptation.

VanWiggeren: Never, never reached the threshold, but I did think of it, yeah. So that's pretty much-- I don't know if I have any great deep thought processes on that. Part of me wondered, well is this the right technology to stake a career on, or make a career of? One of the nice things of working at Keysight Labs is that it seems like there's always a new bit of technology to explore and drive. So I have not run out yet. I don't know what the new things will be, but anyway, one of the advantages is I don't have to do just one thing.

Steinbach: I saw one patent from your PhD work. Can you comment on the difference between Georgia Tech research lab and now Keysight Labs?

VanWiggeren: Sure, I think so.

Steinbach: In terms of the technical work and the way you work.

VanWiggeren: Yeah, I think so. Let's see. If I go back to my thesis, obviously I was less a mature researcher then, had less context, so that's interesting to see now that I have a better-- a broader view of the world I would say. But doing my thesis research, let's see, this was in Chaos theory. It had some practical applications that made it interesting. What I should say is potential practical applications that made the research sort of interesting. "Well, can you make it do this because that would be-- that might be helpful someday." But I think that that research in the Chaos theory realm was relatively fundamental. It wasn't particularly applied. It wasn't expected that it be applied. It'd be great if it could be. So that's a difference. I think at Keysight-- well, when I was in graduate school, interesting research, good science, somebody's never done it before, that was all important. Same in Keysight research labs. But there's this additional hurdle of it has to make business sense also. And so in a way I think as an-- in academia, if you had money, you could be much more free about what you wanted to study, what you wanted to spend your time doing. On the other hand, I like the discipline and the challenge of trying to do something that no one's ever done before in a research way, and have it make business sense. So it's like it increases the degree of difficulty. It's also satisfying when you succeed.

Steinbach: Also, you don't always know ahead of time if it will make business sense.

VanWiggeren: You do not know, yeah.

Steinbach: You have to find that out. That's part of it.

VanWiggeren: You have to use your best judgment, yeah, and be able to communicate to senior management why this is a good use of your time or your team's time and what budget and so on. At the end of the day, we have to show a return on investment. Interestingly at Labs, we do not feel that we have to be successful in all of our research. In fact, I think the thinking, at least for my group-- yours might be different, your former group might have had a different philosophy because there was so much at stake.

Steinbach: Yeah, they were coupled pretty tightly because they were so expensive to make a chip.

VanWiggeren: But for my group, the idea was if we succeeded all the time, if all of our technologies worked out, then we weren't trying hard enough. On the other hand, if none of them work out, well that's another issue too.

Steinbach: You were also not trying hard enough. <laughs>

VanWiggeren: That's right, either way, we're not trying hard enough. So it's an extra degree of difficulty having to have a business justification for the research now.

Steinbach: And I guess you are the first-- as the project manager, you're the first instance of deciding, will this work and if you think you have to propagate up the ladder, how would you say it works?

VanWiggeren: Yeah, I think anybody on the team can come up with ideas and concepts. If it's not me though, they have to explain it to me and point out why this is important for the company and how it would be done, what resources they would need and then I'll communicate that upwards. And if it's my own idea, well I'll probably talk to experts in my team or in the company and check that all my assumptions are right and do that too.

Steinbach: I guess we're through Keysight and Agilent. What do you do outside of work?

VanWiggeren: Well, I have a family that keeps me pretty busy. I have two boys. If you wanted to go into hobbies, let's see, I like to play the piano. I don't get much time to do it because I have a small house and a lot of piano, and the rest of the family doesn't care for it. <laughs> Let's see, I also am a member of a church, so that's a Sunday morning activity mostly. For the last eight years I was realizing, ten seasons, I have been a little league manager for baseball, so that's another hobby of mine. So between those things, I think that keeps me pretty busy.

Steinbach: So your kids are spaced apart? I keep hearing little league.

VanWiggeren: I only have two kids, yeah, but one of them is about three years older than the other. So yeah, he started when he was five. I was his coach until he was ten. Then I swapped back to the younger kid and did him up until he's eleven.

Steinbach: Anything else you want to say?

VanWiggeren: I don't think so. Did that cover a typical researcher? <laughs>

Steinbach: And you are young enough that you may well return here in another ten years or so.

VanWiggeren: That'd be great, Günter, I hope to see you again.

Steinbach: Thank you very much for the interview.

VanWiggeren: Oh, you're welcome.

END OF THE INTERVIEW

