ORAL HISTORY: John Staehlin

About John Staehlin

John Staehlin was born January 9, 1930 in Baltimore, Maryland. After graduating from high school in 1946, he became a machinist apprentice at Baltimore Broom Machine Company before moving to the Bethlehem Steel Company. While at Baltimore Broom, Staehlin began attending night school, first at the University of Maryland for drafting, then Edison Vocational for welding. His education continued in mechanics and strength of materials at Bethlehem Steel and the Johns Hopkins Night School. In 1954, Staehlin was drafted, and served two years at Redstone Arsenal as a machinist, during which time he attended night school at the University of Alabama Extension. After leaving the military, Staehlin applied at Westinghouse and began as an engineering aide on BOMARC in the Antenna Advanced Development section where he stayed throughout his Westinghouse career. In 1961, Staehlin completed his mechanical engineering degree from Hopkins. He then earned a master's from the University of Maryland in 1965, and was awarded the Lamme Scholarship and studied at the University of Michigan for a year. Staehlin was quickly promoted at Westinghouse, eventually becoming lead mechanical engineer of such programs as AWACS. Staehlin was a part of other important programs at Westinghouse including APQ-72, AWG-10, B-1B, DIVADS, F-22, EAR and GATOR. Staehlin retired from Westinghouse in 1994, but about six years later he returned to what was now Northrop Grumman to help with the Dodge van electric vehicle. He retired again, then returned once again as a consultant to Northrop Grumman for another six years, retiring yet again in 2008. Staehlin remains busy within engineering and design with his non-profit company Volunteers for Medical Engineering (VME) which designs devices for people with disabilities. Staehlin holds several patents both from his career at Westinghouse and VME.

In this interview, Staehlin talks about his education and long career in mechanical engineering. His night school program, the various schools he attended, his graduate school work and the Lamme Scholarship are covered, as well as his inspiration to go into engineering from his service at Redstone Arsenal. The many projects Staehlin was a part of, particularly AWACS are also discussed at length. Staehlin talks about his role as a mechanical engineer and inventor, and his position as lead mechanical engineer as opposed to supervisor, as well as his work with electrical engineers and other companies such as Boeing on projects like AWACS. Staehlin also discusses his interest in CAD, and his continuing work in invention and design with VME.

About the Interview

JOHN STAEHLIN: An Interview Conducted by Sheldon Hochheiser, IEEE History Center, 14 October 2010

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Interview

Interview: John Staehlin

Interviewer: Sheldon Hochheiser

Date: 14 October 2010

Location: National Electronics Museum, Baltimore, Maryland

Background, Baltimore Broom

Hochheiser:

It is October 14, 2010. This is Sheldon Hochheiser of the IEEE History Center. I'm here at the National Electronics Museum in Maryland with John Staehlin. Did I pronounce your name correctly?

Staehlin:

That's correct.

Hochheiser:

To learn about his life and his career at Westinghouse in Baltimore. Good afternoon.

Staehlin:

Good afternoon.

Hochheiser:

We could start with a bit of background. When were you born?

Staehlin:

January 9, 1930.

Hochheiser:

And where were you born and raised?

Staehlin:

In Baltimore, Maryland.

Hochheiser:

What did your parents do?

Staehlin:

My father was an accountant and my mother was a housewife.

Hochheiser:

Were you interested in technology and science and things like that as a youth?

Staehlin:

Well, not very much. Just a regular kid.

Hochheiser:

When did you graduate from high school?

Staehlin:

In 1946.

Hochheiser:

And what did you do upon graduating from high school?

Staehlin:

I became a machinist apprentice at the Baltimore Broom Machine Company here in Baltimore.

Hochheiser:

What led you to that rather than something else?

Staehlin:

Well, my father knew a man that ran a machine shop and he thought that I was mechanically oriented. So I started doing that sort of work.

Hochheiser:

And then you moved on from there to Bethlehem Steel?

Staehlin:

No. I found out immediately that I needed more education. So I went to night school to learn how to do drafting and to draw up designs. And I started innovating a little bit there at Baltimore Broom Machine Company.

Bethlehem Steel, Education

And then, my brother went to work at Bethlehem Steel Company making a whole lot more money than I was making. So I switched my allegiance to Bethlehem Steel Company.

Hochheiser:

Were you continuing throughout this to go to school at night?

Staehlin:

Yes.

Hochheiser:

And where were you going to school at night?

Staehlin:

I went first to University of Maryland Institute to learn drafting.

Hochheiser:

Right.

Staehlin:

Then I went to Edison Vocational to learn welding because welding was a big feature of the Broom Machine Company. And then, when I started at Bethlehem Steel Company, they had the best apprenticeship around, such that I took mechanics at Bethlehem Steel Company. Then I went to Hopkins Night School and took mechanics for credit. I took strength of materials at Bethlehem Steel and then at Hopkins and that worked out great. Then I got drafted.

Hochheiser:

So you worked at Bethlehem Steel until you got drafted?

Staehlin:

Yes.

Hochheiser:

And how far along were you in your education at that point?

Staehlin:

I was about four years, four years total at night school.

Hochheiser:

Which put you where as far as progress towards getting your bachelor's degree?

Staehlin:

About a third of the way. Maybe a little further.

Drafted, Redstone Arsenal
Hochheiser:

So then in '54 you got drafted.

Staehlin:

Yes, it ruined my career. It was total devastation because I was in a really good position in my career. I was the lead machinist in a millwright gang and I had all kind of repair

records of equipment at Bethlehem Steel Company. So I thought they ruined my career. But it turned out I ended up as a machinist at Redstone Arsenal working for German scientists, and then I really got interested in engineering.

Hochheiser:

When did your aspirations change from being a machinist to being an engineer?

Staehlin:

Working with the German scientists down at Redstone Arsenal.

Hochheiser:

So after basic you were at Redstone for your two years of service?

Staehlin:

For almost two years. And I went to night school down there at University of Alabama Extension School.

Hochheiser:

So you were able to continue your education even while you were in the army.

Staehlin:

Yes.

Hochheiser:

That's great.

Staehlin:

Yes.

Starting at Westinghouse, Early Projects, Degree

So when I came back out, I made an application to Westinghouse and became an engineering aide at Westinghouse.

Hochheiser:

What led you to want to come to Westinghouse?

Staehlin:

Well, it was an engineering company and a big company here in Baltimore and they offered me a good salary. They offered me an engineering aide salary that was equivalent to first class machinist salary, so there was no question about that.

Hochheiser:

And what was your initial assignment as an engineering aide here?

Staehlin:

I was working on the BOMARC A feed balancing system. That was my very first assignment.

Hochheiser:

Who did you report to?

Staehlin:

Gene Stombler.

Hochheiser:

And how long did you work on the BOMARC project?

Staehlin:

Oh, it was a very short time. Maybe less than a year. Then we went on to the APQ-72 and AWG-10 antenna systems

Hochheiser:

What were your roles as part of the team?

Staehlin:

I was a designer and inventor. On the Q-72, I invented a polarization control switch for the feed horn that accomplished an added polarization setting. The Q-72 had two polarization settings for the RF energy it was putting out. And we changed it to three. Right and left circular and linear from right circular and linear.

Hochheiser:

Okay. And for the AWG-10?

Staehlin:

AWG-10, I helped with the spoiler that pops out that gives you a beam pointing down towards the Earth for ground mapping.

Hochheiser:

And at the same time had you resumed your studies at Hopkins?

Staehlin:

Oh, yes, I continued. I never interrupted those studies even during the two years in the army. I graduated after 11 years of night school.

Hochheiser:

Yes, when you're doing it in night school and holding a full time job it takes a while.

Staehlin:

It takes a while.

Hochheiser:

When did you finally get your degree?

Staehlin:

In 1961.

Hochheiser:

And that was in mechanical engineering?

Staehlin:

Mechanical engineering at Hopkins.

Hochheiser:

Okay. We talked about BOMARC, the APQ-72, the AWG-10. Were there other projects that you worked on during those early years?

Staehlin:

Oh, yes. The APQ-81 was I think the predecessor of the AWACS. I was working on a mechanism that ended up providing a slant scan capability to the feed system. I've been inventing the whole time. My whole career has been inventing, and I love that process. The Typhon system was being done in the West building and they needed some tracking antennas for that system so I worked on the tracking antennas for the Typhon system.

Hochheiser:

You were not in the West building though?

Staehlin:

No, always in the East building for 37 years.

Hochheiser:

But then, ultimately, the Typhon system did not succeed and the project ended.

Staehlin:

Well, I don't know where that ended up, but it was a successful radar system at some point.

Hochheiser:

Right.

Staehlin:

The RF engineers wanted to have an antenna feed that would take the RF energy and instantaneously switch it from looking down to looking up, and then have it progressively go down, and then again switch back up. And that was the predecessor of the AWACS system, which has its saw tooth scanning capability.

Hochheiser:

What department were you in? Where were you organizationally?

Staehlin:

I was always in the Antenna Advanced Development section.

Hochheiser:

You were in that section for your entire career?

Staehlin:

Yes. My entire career was in the Antenna Advanced Development section at Westinghouse, and then at Northrop Grumman - the same people, same section - for six more years.

Graduate School, Lamme

Hochheiser:

Now, once you got your degree did you then get promoted from engineering aide?

Staehlin:

Oh, yes. I was getting progressively promoted the whole time. So I was well beyond an aide after the first couple years. But then, I went for my master's degree at University of Maryland.

Hochheiser:

Also at night?

Staehlin:

Yes. Well, part time.

Hochheiser:

Okay. So now, if you're doing it part time, did you cut back on your hours from full time at Westinghouse?

Staehlin:

No, no.

Hochheiser:

So you went for your master's degree while you were in full time at Westinghouse.

Staehlin:

Then I started my Ph.D. program.

Hochheiser:

When did you get your master's?

Staehlin:

'65.

Hochheiser:

So a much shorter path than your bachelor's degree.

Staehlin:

Yes.Yes, much shorter.

Hochheiser:

What led you to want to go on past the bachelor's degree?

Staehlin:

I needed more training, more technology. So then I started on my PhD program, and then had this great award, the B.G. Lamme Scholarship. They told me to just go become more creative.

Hochheiser:

So basically, you won this scholarship from Westinghouse that enabled you to work full-time on your studies.

Staehlin:

My first full-time education. They said, you can go anywhere in the world. Just become more creative going for a PhD. Not necessarily to get a PhD, but you can go for it.

Hochheiser:

Right.

Staehlin:

I had a sick mother-in-law, so I could only go as far as [the] University of Michigan. But I took a lot of electrical courses there and got almost all the course work done for my PhD.

Hochheiser:

Right.

Staehlin:

My thesis was done. I had one course to take and I came back from Michigan to take that one course at University of Maryland and the AWACS program was in its peak and I was the leading mechanical engineer on the antenna and never did get the course finished.

Hochheiser:

So you're one course short.

Staehlin:

My almost PhD.

Hochheiser:

I know lots of people who are almost PhDs, but that almost usually means they never did a thesis. They got all the course work done and took the exams.

Staehlin:

No. It's interesting. I had my thesis done. It was in creativity. And I came back to the University of Maryland and they said we don't have anybody that can evaluate your work and so that screwed that up.

Hochheiser:

Yes. How long was the Lamme Fellowship? How long were you out?

Staehlin:

An entire year.

Hochheiser:

So you were able to spend one entire year out at Michigan.

Staehlin:

My first year in college. I had so much time. I was auditing courses through lunchtime. Lots of time.

AWACS

Hochheiser:

Can you tell me a bit about what you did as the lead mechanical engineer on AWACS?

Staehlin:

Oh AWACS, I started working on AWACS when it was overland radar.

Hochheiser:

Way back at the beginning.

Staehlin:

We developed the means for cutting the slots in the waveguides which went from cutting one slot at a time on a rotary table on a jig bore, to cutting a number of slots at one setup on a numerically controlled (NC) milling machine, to eventually cutting single slots on an NC mill but using laser interferometry to position each cut.

Hochheiser:

Right.

Staehlin:

They had this long stick RF radar waveguide and they were cutting slots in it on a jig bore because they needed the accuracy of the slots. You can picture this 20 foot long stick and you're cutting a slot close to one end. They're swinging this one way for one slot, another way for the next slot. We cleared half of the machine shop out of the way so we could do this. We developed this slot cutting technique and slot sanding and so forth. And then, we developed the extrusion that interlocks - one extrusion interlocks to the next one and the next one and it's all riveted together. So we developed that process. Lots of people worked on it.

Hochheiser:

Were you the supervisor then? Were there people working for you?

Staehlin:

No, I was not a supervisor ever. I was the lead mechanical for innovation.

Hochheiser:

Okay. So were you the only mechanical engineer working?

Staehlin:

No, no.

Hochheiser:

So you were part of a group of mechanical engineers working on the mechanical engineering aspect. That's what I was trying to get at. It's not clear to me.

Staehlin:

Absolutely, on the huge projects like AWACS there were hundreds of engineers working various aspects of the program. My role was the lead mechanical on the antenna design.

Hochheiser:

Okay.

Staehlin:

That's what I was trying to get at also. It was never an individual effort.

Hochheiser:

Right.

Staehlin:

I was the lead mechanical engineer on the final design configuration since I had returned from University of Michigan in the middle of the design phase.

Hochheiser:

Do you have an idea about how many mechanical engineers were working on this?

Staehlin:

No. It could have been thirty.

Hochheiser:

A lot?

Staehlin:

Yeah, it was a lot.

Hochheiser:

And who did you report to?

Staehlin:

That's a good question. Well, Ed Mittelman was the section manager. He's the one that kept me going to college. He's the one that encouraged me to invent more design solutions. So I ended up with over 400 inventions through Westinghouse and Northrop Grumman.

Hochheiser:

How closely did you work with the electrical engineers on the AWACS project?

Staehlin:

Intimately. Always. And for my whole career. And in fact, my son-in-law who works at Northrop Grumman is an electrical engineer.

Hochheiser:

I know the AWACS project went on for many, many years.

Staehlin:

Yes.

Hochheiser:

How long did you work on AWACS?

Staehlin:

Six to eight years. In '68, I had a year off, '70 to '71 for my Lamme Scholarship.

Hochheiser:

Right.

Staehlin:

And then, I came back and worked on AWACS through the development and competition phases and then helped with some of the designs for the production versions. But then I went on to other antenna projects.

Hochheiser:

How did the mechanical engineering aspects of the AWACS antenna evolve or change as you went from overland radar all the way into the production designs?

Staehlin:

Oh. A huge change. The overland radar was about three foot by ten foot. We bought sections of radome and mounted it up on the antenna range and did a series of tests. We did additional tests under the belly of a Constellation, I think it was. They had a big belly radome. We did all that testing and then came up with the design for the full scale array and that's when I left. So I didn't have anything to do with the back end of the full scale array for the first testing. When I came back from Michigan we found a terrible maintenance problem getting into phase shifters. And so, we met with Boeing Company. We needed to have the manifolding behind the strong back and the antenna ahead of

the strong back. We talked to structural engineers at Boeing Company, and in his exact words, there's no way in hell you're going to get a hole through my bulkhead for this manifold assembly. We took a lunch break and I went out to the parking lot with this Boeing structural engineer. We argued over that point for a long time. We were out in the parking lot and I said, oh, wait a minute, there's a Sunbeam Tiger. Well, I go to look at it in the parking lot. He said, that's my car, do you want a ride? So we came back from the ride and he said, now, let's talk about this plate again. And we got them to put the manifold behind the bulkhead so you could go up in there and take phase shifters out readily. And that configuration is what they have now.

Hochheiser:

Now, this parking lot, was this out at Boeing or here?

Staehlin:

Boeing Company.

Hochheiser:

Okay. Did you spend a lot of time at Boeing?

Staehlin:

Yes. We were in the competition phase.

Hochheiser:

Right.

Staehlin:

So with a couple electrical engineers we were from home to Seattle to McDonnell in Los Angeles, home to Los Angeles to Seattle many times.

Hochheiser:

But you were not one of the Westinghouse people [who] actually moved out to Seattle.

Staehlin:

Oh, no. No.

Hochheiser:

I've heard stories. I've spoken to several people who actually ended up spending months living out there working on it.

Staehlin:

Oh, yes. Yes.

Hochheiser:

But you just were on the road a lot.

Staehlin:

Yes. And with short bursts.

Hochheiser:

Right.

Staehlin:

Meetings and the like. But I was always with one of the lead RF guys, or maybe two of them. And I worked directly with the guy that did the original calculations for this slot that were alternating where you cancel out the mutual coupling. He was a genius.

Hochheiser:

Who was this?

Staehlin:

Dick McComas. He died shortly after the AWACS program. A wonderful amazing guy, a brilliant guy. So that was quite an experience.

Hochheiser:

Were you there when they had the fly off and the decision?

Staehlin:

I was flying back with Johnny Pearson who was in charge of the whole AWACS program for Westinghouse.

Hochheiser:

Right.

Staehlin:

Riding back with them, we stopped in Denver I think it was, and he said I've got to go check and see whether any decision has been made. He walked back with this huge grin on his face. We had won, so we bumped up to first class.

Hochheiser:

Sounds like a good way to celebrate.

Staehlin:

It was great. Now, another very important thing that happened in this process was getting these slots accurate. They went from the jig bore, which was three eight hour shifts to do one stick, to a numerical controlled machine for doing the slotting of maybe 20 slots and then shifting it over and doing another set of 20 slots. But that still gave you a periodic error, tiny errors, but errors nonetheless.

Hochheiser:

Right.

Staehlin:

So they ended up indexing every slot but positioning the waveguide using laser interferometry which eliminated the periodic errors. I wish I had invented this but I didn't. One of the manufacturing engineers came up with an indexing scheme where

you cut one slot and index the waveguide and that was the key to the wonderful performance of AWACS.

Hochheiser:

Who was it who came up with this, do you recall?

Staehlin:

I don't recall a name. I can see him, but I can't -

Hochheiser:

Yes, I know that one.

Staehlin:

And now, a second thing that was key to AWACS performance was we had extrusions and the extrusion manufacturer said that they can't do more than plus or minus five thousandths internal waveguide tolerances. We needed plus or minus two thousandths. We went up there - and I said we, because I was only a little part of that.

Hochheiser:

Sure.

Staehlin:

But we went up there and showed them how to instrument the temperature of their billets and control the extrusion pressure. We also analyzed the stretch and twist processes and showed them how to gain added consistency. They got it down to plus or minus two thousandths, and then they started selecting sets of waveguide extrusions so we could get even closer than that. So it was a big development.

Hochheiser:

Yes.

Staehlin:

That was.

Hochheiser:

Yes, being able to push the precision like that.

Staehlin:

Yes.

EAR Program, B-1B

Then we went on to the EAR (Electronically Agile Radar) program.

Hochheiser:

So once AWACS moves into production then you move on to the EAR program.

Staehlin:

Yes. I'm not real sure of predecessors of the EAR.

Hochheiser:

So you come into the program after you're done with AWACS.

Staehlin:

Yes.

Hochheiser:

Where was the EAR program when you started?

Staehlin:

It was just starting. So I worked with the phase shifter developers and the draftsman and the other mechanical engineers to get the precision in the manifolding and the location of all of the EAR phase shifters. The EAR is a whole flat plate array of cylindrical shaped phase shifters, so they had to be very precise in their location and couple into the

manifolding in the back of the array. We actually had a machine shop enclose one of their large NC machines in curtains to hold the temperature exactly the same all day long every day to get to precision in the manifolding and the plates and associated parts.

Hochheiser:

And again were you one of a group of mechanical engineers?

Staehlin:

Always.

Hochheiser:

Always?

Staehlin:

Yes. I was the lead on a few of them, like the AWACS.

Hochheiser:

But someone else was the lead on the EAR?

Staehlin:

Yes, there were several. I was probably in an advisory capacity at that time.

Hochheiser:

What does that mean?

Staehlin:

You're there to advise on how you would recommend doing something, but not necessarily responsible for getting the draftsmen to do it.

Hochheiser:

I see. But was that still something that occupied your full time?

Staehlin:

Oh, yes. Well, it might be on two or three jobs at the same time.

Hochheiser:

Well, did the two or three jobs all relate to different parts of EAR?

Staehlin:

No, no. Two or three separate jobs.

Hochheiser:

Okay. So you were split - AWACS I got the impression you were -

Staehlin:

Pretty much all the time.

Hochheiser:

That's what I'm getting at. AWACS was pretty much occupying your full time.

Staehlin:

Yes.

Hochheiser:

But when you moved on to EAR you were doing other things as well?

Staehlin:

Yes. Lots of proposals.

Hochheiser:

Okay. That's what I'm getting at. And what were some of the other things besides EAR you were working on?

Staehlin:

Well, I'm kind of out of the sequence. I'm not sure what hit when.

Hochheiser:

[Interposing] Well, that's - that's okay. So the EAR, you start working with the EAR about when?

Staehlin:

I don't know. It might say on my resume.

Hochheiser:

Well, let's see. No, you don't have a date by EAR. That's okay.

Staehlin:

But then, EAR went - we then started the B1B program.

Hochheiser:

Okay.

Staehlin:

And this is I think very interesting. The B-1B program started out as two F-16 style arrays, two separately servo-controlled antennas. I had done 56,000 hours of drafting on this thing. I had it all done, ready to build. They changed the design to a phased array antenna.

Hochheiser:

Okay. From two separate antennas to one phased array antenna.

Staehlin:

Phased array antenna. Then one of the system engineers came up with the idea of having it sit like this (tilted upwards with respect to the aircraft longitudinal axis). You'll see out there, in the Museum, the B-1B sits like this, but when it wants to look out further, left or right, it rotates about that tilted axis. I was lead mechanical engineer on that whole antenna assembly design program.

Hochheiser:

Well, that must have been quite tricky to get it so you could accurately aim it in very different directions.

Staehlin:

Oh, yes. It had a dog that it released, shifted over - the dog went in and precisely located it. That was done by a young engineer who is now one of the lead advisory engineers.

Hochheiser:

And who is that?

Staehlin:

I knew you were going to ask that. His name is Marc Oclair.

Hochheiser:

That's fine.

Staehlin:

Ok. I had three young engineers working on that with me in the antenna section and all three of them now are either managers or senior advisors, so it was quite a development program for engineering.

F-16, CAD

Hochheiser:

Now, had you been involved with the F-16 radar developments also?

Staehlin:

Yes, very much so.

Hochheiser:

So now, we're backing up since that comes before B-1B.

Staehlin:

Yes.

Hochheiser:

Which is okay, but can you tell me a bit about that?

Staehlin:

Well, I worked with other mechanical engineers on those designs and I did some, the first and only computer programming I did with CAD systems. I came up with the program for making F-16-like antennas automatically. You put in certain parameters and the whole thing is designed on the CAD system.

Hochheiser:

Now, would this have been sometime in the '80s?

Staehlin:

Yes, I would think so. And Doug Comstock was the lead on that F-16 antenna.

Hochheiser:

What led you to try a CAD approach on this?

Staehlin:

Oh, I'd been trying to get to learn CAD. I always wanted to do computer aided design. And I always ended up having to farm it out because I had so many jobs to do. I had this draftsman and that one do it. That was a big switch from the drafting board to the CAD program. Some of them switched, some of them didn't. But I always wanted to be able to do that and never got the chance till after I retired. And now, I do CAD drawings all the time.

Hochheiser:

That must be quite a switch from draftsmen on tables and paper.

Staehlin:

It is. I have a company, Volunteers for Medical Engineering. I formed it 28 years ago while I was at Westinghouse. And we design devices for people with disabilities. So I've been given a CAD program by the Solid Works and Solid Edge people, and I do it all the time. I still do it all the time.

Hochheiser:

Yes. But those capabilities must seem amazing thinking back from your days when you were learning as a young man how to be a draftsman.

Staehlin:

Yes. Yes. A big switch, a big change. The other big change is the rapid prototyping. Ten years ago they started getting rapid prototyping capabilities and that changed a lot of things at Westinghouse or Northrop Grumman at that time.

DIVADS, More B-1B

Hochheiser:

Another program I see you worked on is DIVADS.

Staehlin:

Oh, yes. Again, I was the lead mechanical engineer on that.

Hochheiser:

And about when is this? Is this before the F-16, after, alongside?

Staehlin:

After.

Hochheiser:

After the F-16? Before or after the B-1B?

Staehlin:

Before the B-1B.

Hochheiser:

Okay, now I've got it in order in my head.

Staehlin:

I think Warren Von Uffel here at the Electronics Museum gathered a bunch of data from us to get a chronological order of things.

Hochheiser:

Right.

Staehlin:

But yes, DIVADS was DIVision Air Defense System and we had the job. It was going to be as big as the F-16. And so, with AAI we designed antennas that mounted to the tank, one mounted in the back of the tank, raised up like this and spun around. That was a search antenna. Another one mounted to the side wall of the turret. And so, AAI integrated that into their turret top. And this antenna popped up and was the gun laying antenna for the DIVADS. It worked perfect. We made a demonstration and it worked great. They kept saying, we see something, but we don't see any helicopters out there. Then all of a sudden a helicopter would pop up. But then, the whole thing blew up because the Russians had helicopters with rockets on them and they could be out

half a mile further than our guns could go. Now, I don't know all of that for certain, but that's the story I got.

Hochheiser:

So the program got cancelled?

Staehlin:

Yes. I mean, we built a number of them. Yes, it was devastating.

Hochheiser:

Yes. You've been with the triumph of AWACS and then here's a program where you met your technical goals, but then ultimately the customer cancelled.

Staehlin:

That's right, yes. [Interposing] If instead of Twin Bofors guns we had had rockets on ours then we'd have been in great shape.

Hochheiser:

Yes. The radar worked.

Staehlin:

Just the way it was supposed to.

Hochheiser:

You must have had some interesting challenges, because on one hand you're dealing with AWACS with really big -

Staehlin:

[Interposing] Yes, huge antennas.

Hochheiser:

And then, you're going and dealing with airborne antennas. And now, here you're dealing with mobile ground antennas.

Staehlin:

Armor plated mobile, yes, it was a big change.

Hochheiser:

Yes, it must have been quite a challenge to design the antennas for that very different environment.

Staehlin:

Oh, yes. We invented a few things for developing the parabolic shape of the linear parabola for the search antenna. Yes, it was a lot of fun.

Hochheiser:

I bet. So after DIVADS you went on to the B-1B?

Staehlin:

I think so.

Hochheiser:

Yes. Anything more to add about the problems with that?

Staehlin:

No, I don't recall anything. I was just amazed at how critical a sixteenth of an inch was when you go look at it. We went to visit where the B-1B was being built. And you look at this little tiny antenna way up in front - and that airplane is huge.

Hochheiser:

How closely did you work with the - now B-1B, is that also Boeing?

Staehlin:

I'm not sure. I think it was.

Hochheiser:

Well, in that case, you did not work as closely with the airframe manufacturer there as you had back in the AWACS days.

Staehlin:

No, I didn't need to.

Hochheiser:

That's what I'm getting at. Did you need to work closely?

Staehlin:

Well, the AWACS, we visited a lot and discussed things a lot.

Hochheiser:

Were there other projects that you had over the years where it was necessary to do that kind of work with the other contractors, with the prime contractors?

Staehlin:

Not for me. I'm sure [for the] B-1B there was a lot of interfacing with them, but not by me.

Hochheiser:

Right. But unlike with AWACS your role didn't require that kind of interface. That's what I'm trying to get at.

Staehlin:

That's correct.

Hochheiser:

Okay.

F-22, GATOR

Then the other thing I see here is the early systems for the F-22.

Staehlin:

Yes, absolutely. We were working on the design for it, early stages of the design. I forget what they called that. But we configured antennas for it and then of course the phase shifters changed, the manifolding changed, the system changed, and I was off doing something else at that time - or I think it was right close to when I retired.

Hochheiser:

Okay. Other systems or notable projects that I didn't know to ask you about?

Staehlin:

Well, the final thing that I worked on at Northrop Grumman was the GATOR program.

Hochheiser:

This is when they called you back after you retired?

Staehlin:

Yeah, I came back.

Hochheiser:

What can you tell me about the GATOR program?

Staehlin:

Well, I helped them configure the system for the GATOR program, worked on the proposal. Worked on different schemes for doing the antenna deployment and the like.

Working at Westinghouse, Key Inventions

Hochheiser:

What was Westinghouse here in Baltimore like as a place to work for you?

Staehlin:

Wonderful. I can't say enough. My career just blossomed. They were ready. They allowed me all kinds of freedom to invent things. So I have 17 patents for them and 11 more with someplace else, with VME.

Hochheiser:

Yeah. What do you see as some of the key inventions you made over the years at Westinghouse?

Staehlin:

That's a good question. The polarization controller for the APQ-72 won us a competition.

Hochheiser:

What was the Q-72?

Staehlin:

Q-72 was the APQ-72.

Hochheiser:

Oh, APQ. Okay.

Staehlin:

I'm sorry.

Hochheiser:

That's okay.

Staehlin:

It's a spinning feed horn that has linear polarization and right circular polarization. We were due to do a competition - a fly off competition - and they had me invent a polarization control switch that gave you left circular, right circular, and linear, and we beat the competition terrible as a result of that. And it was a very interesting little tiny thing. But did the trick.

Hochheiser:

About when was this?

Staehlin:

I don't know. I have a patent on it.

Hochheiser:

Well, we can certainly look that up.

Staehlin:

It's listed there I think. But anyhow it was early in my career, when they were still doing drafting tables and all that good stuff. I'm not sure which ones to mention.

Hochheiser:

Are there ones in particular you'd like to tell me about? Maybe that's a better way to put it.

Staehlin:

Well, I have a space antenna that opens like an umbrella. It's a huge space antenna.

Hochheiser:

And was that for a specific project?

Staehlin:

That was a proposal effort. So I invented it and they patented it for me. I'd have to look at what my patents were. I forget.

Hochheiser:

[Interposing] Well, you brought along a list, if you want to refer to it, that's a good reason for having brought it.

Staehlin:

They're all the wrong ones. They're all the ones for VME. No, I don't have a list of them.

Hochheiser:

That's okay.

Staehlin:

We did come up with a way - there's a thing called HOBE, honeycomb before expansion. It looks like a piece of solid metal, but you can flex it in one plane. We were trying to develop the dogwood antenna system, which was a long snow shovel shaped antenna. We wanted to determine the appropriate shape for it, and so we would build sheet metal shapes in the form of a parabola, go test it, then come back, build another one. That was very expensive and laborious. We took this honeycomb before expansion sheet of material and just made templates. You put the template up against the HOBE unit and the template would shape the parabola to wherever you wanted it. So the templates were real cheap to do and that gave us the ability to place the feed, place the shape, test it, place it again, change it, so that it was really quick variability.

Hochheiser:

Did this feed into any larger systems?

Staehlin:

It developed the dogwood radar antenna shape.

Hochheiser:

Now, what was the dogwood antenna shape used for? Do you know?

Staehlin:

It was a side looking radar mounted underneath an airframe. Oh, I know of one. Under a helicopter we had a pod and they wanted a way to stow the pod rapidly. And so I had a spline shape that no matter where the antenna was when you entered this spline shape it ended up in the right position underneath the helicopter when they were landing. That was one of my inventions.

Retirement, Called Back, Northrop Grumman
Hochheiser:

So you were full time on the Westinghouse payroll until 1994?

Staehlin:

Correct.

Hochheiser:

And what led you to retire at that point?

Staehlin:

Well, I was 64 and they had a buyout and so I retired.

Hochheiser:

So you retired a year before the date you would've had to retire?

Staehlin:

That's correct. And then, I stayed retired for like six years and then they called me back, said they had a problem with the electric vehicle. And so, I came back to work on the motor problems they had with the electric vehicle which turned out to be a manufacturing problem.

Hochheiser:

Electric vehicle for what?

Staehlin:

[Interposing] Dodge van electric vehicle.

Hochheiser:

Okay. So this is not on a military project they called you back for.

Staehlin:

That's correct.

Hochheiser:

So when you came back after six years, it was now Northrop Grumman rather than Westinghouse.

Staehlin:

That's what I'm trying to remember.

Hochheiser:

It would have been because '95 is when the sale was announced.

Staehlin:

Yes.

Hochheiser:

So if you came back in 2000 or so, it was Northrop Grumman.

Staehlin:

Yes, that's what it was. And then, I retired again, and then I came back for like six years and retired two years ago.

Hochheiser:

Now, when you came back, were you a consultant now?

Staehlin:

Yes, in the same antenna advanced development center.

Hochheiser:

In what ways, if any, did things seem different around here when you came back than they had been before you retired?

Staehlin:

They were the same as far as I was concerned. It's still a great place to work and great people to work for.

VME

Hochheiser:

If you want to tell me a little bit about VME, I'd certainly be interested unless you can think of other things that I didn't think to ask you about your career at Westinghouse.

Staehlin:

Not right now.

Hochheiser:

Well, in that case, if you want to tell me a little bit about VME, there is certainly time to do that.

Staehlin:

As I mentioned, I was an inventor and I had loads of ideas and I thought I had a lot more ideas than Westinghouse needed. So I formed this company of Volunteers for Medical Engineering. I started working with Dr. [Arthur] Siebens at Good Samaritan Hospital. He was working on a hand closure device for quadriplegics, an electrically driven, servo controlled orthosis. I developed a mechanism for that and the F-16 servo

engineer did the servo control for it. And so, they put EKG patches up on the shoulder of the user and he closed his hand by tensing the muscle. He would tense the back muscle, and then open the hand again. This guy wanted to play cards, so he wanted to be able to deal his own cards, play his own cards. So we did that. We met a young lady who was 21 years-old, in college, had an aneurism in her brain and was totally paralyzed. Her father was talking to her by her blinking her eye. We started to develop a Morse code for her and somebody beat us to it, wonderfully. And so, she sends Morse code with the [touch] of her hand. But through therapy she was trying to move her legs finally and the therapist thought she was firing opposing muscles simultaneously. So one of the electrical engineers put EKG patches on the muscle we wanted to exercise, made a tone generator, so "whoop whoop" when she was exercising that appropriate muscle. The tone generator would tell her that. We invented a blink system for totally paralyzed people with a scanning cursor on your computer screen. It scans down, you blink your eye and it stops it and steps across. Blink again, and it speaks for you or types for you or whatever. I've developed a bone lengthening device, an implantable bone lengthening mechanism. VME has developed.

Through Hopkins Senior Design Projects, we've done a number of programs. Every year, we do a senior design project. We've done it for 16 years. I didn't do all this now. We had a lot of volunteers. We developed a curved keyboard, made up of infrared detectors as a section of a sphere. And the client has a mouth stick that's an infrared source. When you puff on it, it transmits to the buttons on the keyboard. And so, he would just go "puff, puff, puff" to type anything he wanted into the computer. And lots of things like that.

Professional Societies, Career

Hochheiser:

Were you a member or otherwise involved with any professional societies, ASME or anything like that over your career?

Staehlin:

ASME I've been involved with, yes.

Hochheiser:

In what ways were you involved and did it contribute to your career?

Staehlin:

Well, we had meetings with ASME and they were considering making us part of their organization - they have separate divisions for steam and this and that. They were considering making us part of one of their divisions, but nothing ever came out of that.

Hochheiser:

Looking back, how would you characterize your career?

Staehlin:

I wouldn't have changed a thing. It was great. It still is. I'd come back to work at Westinghouse or Northrop Grumman anytime.

Hochheiser:

In what ways, if any, did Westinghouse evolve or change over your many years here?

Staehlin:

It got better and better as far as I was concerned, as far as advancement and interest in advancement and encouragement to advance. It just seemed like more and more they were interested in you getting more education and doing more, promoting yourself.

Hochheiser:

Everything I'd thought to ask you I've asked you. If there is anything you would like to add, you're welcome to do so.

Staehlin:

I can't think of anything. I do appreciate all the support that management has given me to further my career and to further my company, to promote the company within the company. It's been a really mutual thing. Right now, Jim Pitts, the President of the Defense Center or whatever they call it now, he is a strong supporter of our most recent programs. And if you have anybody that has a need for something that's not on the market in the way of devices to improve the independence of people living with disability, we're here to help work to create a solution for that person.

Hochheiser:

That's great. Well, in that case, I think we're done.

Staehlin:

That's wonderful.

Hochheiser:

I thank you very much for sharing your recollections.

Staehlin:

It's been a pleasure.