

6-17-2015

# Interview with Conrad Haber

RCA Heritage Program

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## Recommended Citation

RCA Heritage Program, "Interview with Conrad Haber" (2015). *RCA Oral History Transcripts*. 25.  
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**File Name: 0806151412\_Conrad\_Haber.mp3**

**File Length: 0:25:13**

**[START OF TRANSCRIPT]**

**[0:00:08] Conrad Haber:** My name is Conrad Haber and I started as a Systems Engineer here June 23<sup>rd</sup>, 1969. I worked with at the time it was Government Communications Systems Division, GCSD. The reason for coming here was because of all the space work that RCA had done with the ranger series, and all the moon pictures and photographic works. Once Apollo started up, this was the place to come and work. I made sure I got down here, and came in on the rotational program. And ended up getting an assignment up with Ed Nossen, up in the communications systems area. Ed was doing a lot of the Apollo work. I was in the perfect place at the right time to get in on that.

**[0:00:53] Jim:** Okay. Let's talk about your first assignment.

**[0:00:57] Conrad Haber:** Right.

**[0:00:57] Jim:** You know, if you had mentors, what your impressions were, why you came to RCA?

**[0:01:05] Conrad Haber:** Yeah, I think the primary reason for coming was the space race was at its height, and as a technical person, I mean that was the place to be. I looked at what was going on, couldn't get into NASA. They weren't hiring. I decided the next best place was to come to a company that was providing all the hardware for the space effort. That was RCA, was a significant supplier. I came here and the group was phenomenal. The people here... Ed Nossen who was I ended up working for, who did a lot of work on coming up with some very creative solutions to solve navigation problems, and communication problems on the space program. In particular, between Apollo and LEM, and other things. I had people like John Allen and Carl Solomon to work with. Who were senior engineers and were exceptional people in terms of bringing along a young engineer, and inviting me to meetings. Just watching how these people think and solve problems was an incredible learning experience.

It's one thing to read about problem solutions in text books, but another thing to sit next to some really experienced people and watch how they frame a problem. Things they pay attention to. Things they don't pay attention to as an engineer, and understand how to really solve the key parts of the problem, and come up with a solution rather quickly that's effective enough to really get the design going. That you can't learn in a book. These guys were great

at doing it. I was very fortunate to be around three or four exceptional people, and I learned as much as I could from them.

**[0:02:42] Jim:**

How did they treat you?

**[0:02:44] Conrad Haber:**

It was interesting; I mean I felt rather intimidated. As a student, you know, I had all this knowledge in my head, and I thought it was important to remember equations and all the things I had learned. I figured these guys weren't even going to recognize me, but they treated me as a peer. They explained things to me. No question was too stupid to ask. Slowly I became comfortable with saying, "I don't understand that. Could you explain that a little bit more?" There was nothing I asked that they wouldn't answer. If they couldn't answer it or if they did answer it they would give me some references where to go and look further. This was pre-internet. So you just didn't go Google this stuff and I mean you had to go to the library and do some research to look this stuff up. Having somebody there who could actually explain things to you was way more valuable than it is in these days when you can go Google and tap into experts who have written things, and different documents. Via your iPads, and all this stuff. It's a different world back then.

**[0:03:46] Jim:**

What was your contribution?

**[0:03:48] Conrad Haber:**

I thought I wasn't really going to have much of a contribution being so young. I think I had just learned all this stuff, but the interesting thing was something that turned out to be very significant for them. Was I would check all the calculations on the radio communication links from...in space. So RCA built a LEM, not a LEM, but the Lunar Rover. Which had a lot of the video transmitter and would send pictures directly back to Earth. Okay. There as a transmitter and a RF link, and somebody analyzed how much powder was necessary to get a good signal quality on the ground. This was pre-calculator. Everything was done in slide rules. Everybody was using slide rules to do these calculations. I looked at the documents and went through them. I was trying to understand how you do these calculations with very complex wave forms there. I did the math and looked like I found a mistake. I checked it ten times, and it looked like a mistake. It looked like they weren't transmitting enough power to get the picture quality on the ground.

I went to Frank Ortson; he was one of the guys that was working with. I got his attention and said, "Hey Frank, it looks like you guys aren't transmitting enough power." He says, "Yeah, okay, okay. I'll check it out. I'll check it out." Well about two days later he called me in, and he was all happy. He said, "You know, there was a mistake. It was four watts too low." He said, "And that would have degraded

the picture quality on the ground.” He says, “Which would have been a disaster, because that stuff was getting piped all over the world from the moon.” Actually I found that problem (laughter). I was pretty proud of that, and that was one of the things I did. I wasn’t here even a year when I found that out. It was pretty cool. Getting some congrats from some of these really high powered guys that I had a lot of respect for was an incredible experience. Yeah, I really enjoyed it.

**[0:05:42] Jim:**

Did you do any calculations the same way they did?

**[0:05:45] Conrad Haber:**

Well I just... They just put... Yeah, they had equation and they said, “Here’s the equation that defines the laws. If you put in this power it works out.” Like I said, my slide rule is the only you can do it. There are no calculators. Nobody had any. There was zero calculators. That technology was not invented yet. You go through with the slide; if you’re familiar with slide rules I’m sure. Most people aren’t. I mean you have to take care of decimal places in your head, and all that has to be done in your head as you move the slide. There’s a lot of calculations. It’s very easy to make a mistake. I checked it, like I said, ten times, and it was off. It was wrong. I was... It was a big deal to them and then it became a big deal to me. It was a very good experience.

**[0:06:28] Jim:**

Talking to some of the other people involved with Apollo there is a story developing about the rendezvous radar, and maybe it was either less than adequate or maybe it needed a backup. Do you have anything you can add to that?

**[0:06:45] Conrad Haber:**

Yeah. The rendezvous radar was critical, because what the radar permitted was when the LEM took off from the lunar surface after landing it had to re-rendezvous with the command service module. A command module which was... Which was orbiting...orbiting the moon. The primary way that the LEM could find these space craft was to use the rendezvous radar, but NASA’s design philosophy was that any systems that are critical to life support, like life support itself or radar like this. Because if those guys couldn’t find the command module to get back, they were done. They were dead. They don’t have one system. They always had two systems at least, backup.

While the rendezvous radar was the primary system, they ended up using the ranging system that Ed Nossen developed, we developed here in Camden. Ed was the one to use the communication radios as a way to get range and range read, and sort of help you steer and find the command module if the LEM rendezvous radar was not working. That, Ed’s system got high priority. It had to be working

and on every launch to make sure if that radar failed, we had a backup. In fact that system works so well that when we did the Apollo Soyuz transfer experiment where the Apollo spacecraft and the Soyuz spacecraft actually docked together back I think in '75 or so in orbit The Russians used our ranging system to find the docking module. Which was pretty cool. We gave them the schematics and stuff, and of course you have to build a transponder. They don't have any semi-conductors, they only had tubes. We actually built it for them and got it installed on Soyuz. Which was really cool. That was the primary system for doing the rendezvous, and it worked really well. They docked up, and it was cool.

**[0:08:51] Jim:** We're all familiar with Apollo 13.

**[0:08:54] Conrad Haber:** Mm-hm.

**[0:08:54] Jim:** It sounds to me that you may have actually experienced that time?

**[0:09:00] Conrad Haber:** Yeah. This was part of the learning process of being part of what was going on, and sitting in the room and listening to all the real movers and shakers, solve problems. Thirteen, we built the command radios. All the command radios for the 13 module. For all of the Apollo modules. What happened was we got a call from NASA, and they said, "Hey, have you guys ever figured out what would happen to the radios if we powered them down, and they had condensing water on them? Would they power up and operate again?" We said, "What?" (laughter) They said, "For real."

They next thing I knew there was a phone call, a conference call, all the guys in the room. I snuck in the door and sat in the back of the room and watched this thing unfold. Basically what they were described the problem and they asked us, "We got to power down the command module. Of course when we do that with the water vapor in the air it's going to condense out. When we fire up, your radio has got to work, or we can't communicate with these guys. Have you ever tested it that way?" "No." "We need you test it."

Guys went off and took them in environmental lab, you know, put them in with the humidity. Got them condensing in moisture. I wasn't doing any of this. I was just watching this unfold. It was incredible. Yeah, they worked. The guys got back, we closed with NASA. There was a lot of fury. We were working like through the night. Just running on this thing 24-7 to get this question answered. It was an amazing time. Our radios, we said they would work, and they worked when the guys powered up that command module, those radios were on. They had grounds... and they got comms with CAPCON on the ground. Worked really good. Good stuff. I didn't

design any of those. I can't take any credit for all of that, but it was great being a technical person. Just being around guys who did, and watching this whole thing unfold.

**[0:10:55] Jim:**

Now, how does your career get from there to where you are now as a Staff Systems Engineer?

**[0:11:03] Conrad Haber:**

I think I... The funny thing about engineering is that technology changes rapidly, and as we all know even faster. It's geometric with time. The thing that is invariant with time are the underlying physical principals under which devices work. The approach to solving problems which you can't learn in a book, and those lessons once you learn them will really, really transfer nicely to the newer technologies as they come through. The terminology changes, the technology changes, but at the heart of all of this are the same physical principals. When you have problems, the way you solve these problems are the same as they are back then. Everything I was fortunate enough to learn in school and from the people I work with, and have mentored me here, has transferred over the 46 years to now. I can still sit in a room with guys who are half my age and we can solve problems together. I can participate, and get solutions. That's an incredible feeling to be able to do that.

Even though when I came into work here, we were transitioning from tubes to semiconductors and as everybody knows now, most people don't even know what a transistor is anymore. I mean, it's just flat packs and integrated circuits, and the technology is so far advanced from anything we could have imagined back then. The physics is the same. The math is the same. How you solve a problem is pretty much the same. Those are the things I think I've really valued having learned here in my early part of my career.

**[0:12:41] Jim:**

Are you now mentoring engineers?

**[0:12:44] Conrad Haber:**

Yes. As many as I can. The young folks in here, and I just give them... I just dump everything on them. I mean, I give them what I got. As much as they can stand. Because I'm not going to be here very much longer, and some guys check out early other guys can take it in. The thing that's really great about a lot of the young folks that come in now, is which I didn't have, they'll go off. You know, I'll give them a dump on some RF stuff and how you solve a problem in communications. They'll take notes, and they'll go off, look at the words, things they don't understand they go on Google. Keyword searches. They'll get articles, they'll read them. In one night they can do all this. They come back to me with follow up questions the next day, and they say, "Hey, I read this paper. I read this."

In '69, when I came here, that would have taken weeks to research. They're real fast. I can get to a lot of guys. In fact, I've got three guys that I'm working with. They're very bright and very interested, and as long as you have the interest you can take advantage of the fabulous technologies out there now to learn things. I'm excited about that.

**[0:13:55] Jim:**

Let's talk about your RCA co-workers.

**[0:14:00] Conrad Haber:**

It was intimidating. Guys like Ed Nossen who were, you know, had 40 patents, and just about a genius in terms of doing things, but still would take the time to interact with me. Look at my stuff and he wasn't a very talkative person, but he would pay attention and give me some guidance. There were guys here like other people, like Jim Feller, who had not only great technical capabilities but had photographic memories. They could remember every detail about everything they've ever seen. They were phenomenal people working and interacting with them as well. There were some very talented designers here who were very capable of using the existing technology to build circuits and radios that worked phenomenally. Like Sam Pietrofitta who was one who worked on the command module radio. That was before I came here back in the late '60s. I came in '69, but I had a chance to work with Sam a lot on some other RF programs after that.

We had a mix of what I call the very conceptual people. Who could deal with the mathematics and the concepts, and we had some very, very technologists who could build things. Getting those groups together was very powerful. We had talented people in every one of those groups. Made some fantastic products, and responded to problems very quickly.

**[0:15:29] Jim:**

What about your supervisors? Did they value your work?

**[0:15:35] Conrad Haber:**

Yeah for the most part they did. I noticed no one ever discouraged me. No one... Everyone took the time to look at what I did. A lot of times when I saw how my task fit into what was going on in the program, it really wasn't significant. A lot of what they did was, but they looked at it as a learning experience for me, on something to learn. No one ever said... No one ever dismissed anything as being trivial, not correct, or no one made me feel inadequate in any way. We're always encouraged to learn more and to do things. Then only when I could see what happened at the end, I could say, "Gee, that piece of work wasn't going to make it anywhere." I wouldn't have known it from when I got reviewed to the...

**[0:16:20] Jim:**

Did you feel that RCA valued your work?

**[0:16:22] Conrad Haber:**

Yes. This place was a technical company, and it was run by engineers. Engineering talent, technical skills were valued very highly. That may have been the demise of this place in terms of its business modeling, and being able to be competitive into the future. As an engineer, this was a phenomenal place to work back then. We were working on programs critical to the space race, the defense of the country, with really confident people, and we had good contracts. We had the funding here to do things and we did them. Learned a lot.

**[0:16:59] Jim:**

We heard from a lot of people a term, "the RCA family." What's that mean to you?

**[0:17:05] Conrad Haber:**

I've never worked anywhere else. I came here for about five years. I wanted to get out of school, get some experience, and move on. Get to another environment. I'm still here. It's not RCA anymore. It's changing, it's changing. There's still remnants of the culture back then. When I came here, this wasn't a job. This was a career. The people that you interacted with, it wasn't a sterile interaction. It was an interaction that was almost like a family. I mean you had people who were concerned about how you were feeling. How you're growing technically, and how you were supporting the overall organization. There was a lot of concern about that here, and they were concerned about bringing people in. People took care of people.

Even people who were key contributors and for some reason they were a little off their game, these people are part of the family and were assigned places where they could still produce. Still be productive and still come to work. I think in a modern company that was a little more Draconian, those people might have been laid off, discharged. You know, "What have you done for me lately?" Kind of attitude. There was not much of that back then. When you did something significant and there were people who did very significant things in this company, the family took care of you. Because you had made a key contribution, and you were a valuable person. Yeah maybe you changed now, you're a little different in the kind of things you can do, but we owe you. You're part of this family. We owe you. We're going to find a place here where you can still be productive. I don't see that in companies now. I don't see that attitude towards people anymore. It's more, "Yeah, you did that great thing but you got paid for it, and now what are you doing for me?" That wasn't the way it was. It was truly like a family. Like you treat your siblings and your parents. Through good times and bad, that was your family, and you stuck together. That really was how it was here.



**[0:19:05]** Therefore, instead of staying here for five years, I'm here for most of my career. Or all my career. For that reason. I mean that's a layer that makes it really nice to come to work. You have that relationship with the people, technical challenge, and get paid for it. I mean, it doesn't get much better than that, I don't think.

**[0:19:24] Jim:** What about outside of work?

**[0:19:27] Conrad Haber:** Oh. How do you mean? Would I...

**[0:19:29] Jim:** Did you associate with any of your co-workers outside of work?

**[0:19:35] Conrad Haber:** Yeah. Engineers, there's a wide spectrum of personalities. Engineering, its traditional engineering personality, very introverted, quiet, kind of nerdy. We had those kind of guys, and I was sort of like that back in the beginning of my career. I mean, that's sort of the kind of folks that got attracted to engineer school. There were other people here who had totally different personalities. Like John Allen was somebody that I was fortunate enough to work with who turned out to be... Was a senior scientist here at the end of his career in Camden. He was in that systems group with me. John was an excellent engineer, a very vigorous guy; he had a Christmas party every year. Which he invited me and my wife to the first time we were here. It was incredible.

I mean, I work with these people, now I'm going to be invited to this social event. Not only was John there, but all the people that I worked with were there. I saw everybody in a totally different venue. This was a "have fun" kind of environment. It wasn't technical. People were bringing in dishes they had made, and this happened every year. Every year that John was working here, and even after he left until he passed away. We went to the party every year with him. My wife and I, we went to every party. Those kinds of things were really special.

Of course, travelling with these guys on trips. When we would go on these trips they'd bring me along just to observe and see how things were going. Incredible experience watching how these people... Just the discussions. We'd talk about world affairs. These were multifaceted, really rich people from a human standpoint. They had a lot of facets and personality and being exposed to that was a great experience. I had a lot of that. These guys were great. That was a great... That's part of the family thing. Where you get to see all the facets of somebody and you can have a much better relationship with them, and when you know who they are.

**[0:21:26] Jim:** Yeah, we also heard from people about lunch hour and Christmas Eve, and things like that.

**[0:21:36] Conrad Haber:** (Laughter) Yeah. Christmas Eve here was a day you wanted to come into work, but you didn't do any work. There were parties. People would have celebrations. John Allen, from the systems group, every Christmas Eve he would have a poetry reading session in the conference room. Where he would start reading... I forget it was somebody from... I forget now... something about the north country and being in the Arctic...He would read these poems, and ordinarily there would be soda and food and snacks. We'd be going on doing that. There was a lot of discussions and having a good time. Every Christmas Eve that's how it went. We worked for a couple of hours and spent the rest of the day there with the rest of the family so to speak, having a good time.

**[0:22:25] Jim:** We've also heard from people about RCA's influence on South Jersey. Do you have anything to say about that?

**[0:22:35] Conrad Haber:** Well, I think RCA was... RCA and Campbell's Soup were South Jersey. I mean everybody in this area that I ever met either worked at one of those two places or knew somebody who did, or had a family member that was here. When both plants were here, there were a lot of restaurants and support places, and stores, Camden changed a lot since then, that supported all the people here. There was a lot of business that we provided them. Anytime people asked me where I worked, of course I'd say RCA, and they'd know exactly where and "Who you worked with?" You know that kind of discussion. You know they either knew somebody in here, had worked here themselves, or had a family member that did. It was... just seemed like South Jersey was either Campbell's or RCA. I was surprised. I came from New York City when I went to school and came down here in Southern New Jersey. I knew nothing about, but it was pretty clear that those were the two big companies.

**[0:23:35] Jim:** Alright so, how would you sum up your time here at RCA, your career? How would you sum that up?

**[0:23:45] Conrad Haber:** I would say it was a great personal experience. In terms of meeting some incredibly fine people. It was an intellectually stimulating and rewarding experience, and I got a chance to really grow technically. More importantly work on some programs that really had an impact on the world. Space and some of the other areas I worked on in the classified arena. Which I got a chance to see what the impact of those was. That is very fulfilling. It was very fulfilling to me. I'm still working now. It's been 46 years, and I wouldn't be doing that if I didn't still feel it was something really special. I'm going to have to

change that now, but I look back and it was a great ride. I really, really enjoyed, and I hope that the engineers that start now and I know that corporate environment's changed; there are still a lot of problems to solve out there. I hope they end up with the same experience that I had, because I couldn't define it in a better way.

**[0:24:53] Jim:** Well, I know you to be one of the best systems engineers I've ever encountered.

**[0:24:57] Conrad Haber:** Thanks Jim.

**[0:24:57] Jim:** I hope your time here isn't too short, yet, because you are critically needed about your job.

**[0:25:03] Conrad Haber:** Yeah I enjoy it. It's good. The young people are incredible. These young folks coming out of college now are very talented guys. That's encouraging, and it's great working with them.

**[END OF TRANSCRIPT]**