Molly Graham: This begins an oral history interview with Dr. Russ Schnell for the NOAA 50th Oral History Collection. This is our third session. The date is April 6, 2022. The interviewer is Molly Graham. It's a remote interview with Dr. Schnell in Boulder, Colorado, and I'm in Scarborough, Maine. I think we had left off with your time in Kenya. The next thing I have in my notes is your time in Spain as a scientist there. I just was curious how you were thinking about your career at this point and the next steps of your career.

Russell Schnell: I didn't really ever have a plan. Whatever came up and looked like an opportunity, I took it. Some good decisions, some not so good. But I didn't really worry about it too much.

MG: I guess, since you alluded to it, what were some not so good decisions?

RS: I'll come back to that in a little bit, if I can think about it. Mostly, they were good decisions. Or I made them good. If I made the decisions, I stuck with it. Some of the bad decisions were some of the people I hired at different times, and then had to terminate them, which was terribly hard for me to do – weeks or months of one decision and having to do it.

MG: You don't have to say names, but how does that transpire? What does that decision making process look like?

RS: Well, one of the hardest ones was a staff member who we hired to go to the South Pole for the winter. So we trained that person and got them all ready, and then they went to the pole. Then we started hearing strange things about the way he was – simply playing basketball, he was very aggressive and blaming other people. He just didn't seem to fit in. Then I had to make a decision if I was going to pull him out. He'd be there for a year, or he'd come out. So to make that decision, we couldn't let him know it was going to happen because the South Pole was such a fragile system. He could screw up something – a computer or power system. So I waited until an airplane was flying into the South Pole that was going to pick up some people. An hour before the plane landed, we had two guards go and take him to his room, tell him to pack up; he was leaving in sixty minutes. He took what he had. He was escorted. We waited until the plane was running, stuck him on the plane, and took him out. That was hard on him and his family; he had no idea. It was like an unannounced execution almost. But it had to happen because in winter, if you have people that are causing trouble, there's nowhere to go, and it just gets worse and worse and worse and worse.

MG: Because people get stir-crazy and cabin fever?

RS: Exactly. It's dark for six months. There's something called the South Pole stare; after a while, they have this blank look on their face. People are psychologically tested before they go, but sometimes you miss some of the stuff. There hasn't been any real bad years in the last six or eight. This was ten or twelve years ago that this happened. So they're getting much better. Things really got better at the South Pole when they started sending women. The men started to try to impress the women, being nice, washed better, had better manners, stop swearing – things like that made a really big difference. Because now instead of trying to fight with other men and

try to outdo them, they were trying to cater to these women. I think you can think of the dynamics, locked up for six months.

MG: How does one prepare to live there? You said there were some steps ahead of time.

RS: Well, first of all, you have to have a person apply who's interested. Then there's a process of interviewing them. Then if they make their initial interviews and it looks like we're going to hire him, then they go to a psychological test. The National Science Foundation has a program office in Denver where the people go for site tests and other tests and drug tests and medical tests. Then, if it looks like we're going to hire them or we do hire them, then they go for training; they go for fire training, first aid, da-da-da-da. Then they go with the potential group that's going to the South Pole; they go for feely-touchy time, and they learn to work. Then quite a bit of attrition goes on for that. In the last few years, when COVID came, after they were selected and vetted and ready to go, it would take them about a month from the time that they leave the US until they get to the South Pole because they have to go into quarantine here, then they go into quarantine in New Zealand, and then they go in careful quarantine on the coast of Antarctica at McMurdo [Station]. If they make all that, then they get to go to the Pole. So it's a long process. By that time, you pretty well know if they're dedicated or not, if they're willing – and they can quit up to the last hour of the last plane.

MG: How often does that happen?

RS: To our people, that has never happened. To other people – the scientists are the smallest number of people at the station. They need people to run the electricity system – generators. They need people to maintain the building, cooks, the cleaners, the mechanics, the cab drivers, and then you come down to one or two scientists. It's like a big military system; the real fighters in the field are supported by this huge infrastructure, and that's exactly the way it is there. So sometimes people who are going to be machinists or cooks or something, they realize it's not good for them and then they leave. That causes a problem because then you got to find another person to get him in there. So there's always a few extra people potentially ready to go. It's a very expensive operation to operate down there.

MG: I can imagine.

RS: Yes. Our scientists or station chiefs – we start them with the NOAA Corps a year before they're going to go to the South Pole, or year and a half. We send them to Samoa to direct our Samoa observatory for a year. That pretty well makes them well trained when they go down. So that's kind of a carrot; you get to go live in the tropics for a year, and then you go to the South Pole for a year. Then you come back to Boulder for some months or longer. Then sometimes we hire people from that.

MG: I wouldn't know how to pack for that trip.

RS: You don't take much because in New Zealand you're given all your clothing pretty well except your personal items. You're allowed a certain weight but not a lot. But then there's a store down at the South Pole. You can buy toothpaste and things like that.

MG: Has the South Pole been pretty well protected from COVID?

RS: I don't think there's ever been a COVID event at the South Pole. I think there's been one in Antarctica, but not at McMurdo. So people are pretty careful about it.

MG: Just getting back to where you were in the late ’70s, how did this position in Spain come up for you? And tell me more about it.

RS: It was a UN [United Nations] project to see if you can make rain on the plain in Spain, literally. My thesis advisor Dr. Vali in Wyoming – their aircraft, the Wyoming research aircraft was hired. He then approached me because he knew I probably would be interested, and I agreed to go and work with him as an aircraft scientist. The aircraft would have three people on it: a pilot, the project leader which was generally Dr. Vali, and then me, instrument operator in the back running the equipment. So we would fly almost every day up into the clouds to see if they would be able to be seeded. We would look to see if they had ice nuclei in them, or if they had snowflakes, or if they were ice. It was a little bit interesting at times because we would fly into these clouds that had a lot of supercooled water, and of course, our plane would ice up, so then we'd have to let it come out the bottom and go down. Then the heat lower down [inaudible] would melt the ice off, and then we could go back up and do that. The plane's engines sometimes would sputter because they were getting frozen up. It was relatively safe because we knew we had clear air below and warmer air.

MG: Any close calls?

RS: There's always close calls, but you don't worry about those.

MG: How did your wife and daughter at the time adapt to life there? How were they spending their days?

RS: My wife would take our daughter out on a stroller and walk around. But my wife couldn't speak Spanish and where we were living, there was very little English, almost non-existent. On the weekends, our base was at a Spanish air force base. So on the weekends, we would go out and have lunch at the officers’ mess. There were some other people who spoke English, and we got to know them. My wife found it a little stressful being alone all day long with the baby, but the baby learned the cadence of the Spanish language because she was just learning to talk then. She eventually was able to speak Spanish later in life very well.

MG: You weren't there for very long. Was it a short project?

RS: Yes, it was a winter project, started in December and was finished in the spring. I just took a leave. I was on a postdoc at NOAA [National Oceanic and Atmospheric Administration]. So I just took a leave from the postdoc.

MG: When did the postdoc with NOAA begin? I just want to get a sense of your introduction to the agency.

RS: It began in 1975, but it stretched over about six years because I worked for a while, then I went to Kenya for a few years. So they put it on hold, came back, worked for a few months, went to Spain, came back, and I went somewhere else. Anyway, I finished it, and then I came back. They were very amenable to doing that. That was great because I knew I had a place to go when I came back.

MG: Your position with NOAA changed in 1979. That was with the Cooperative Institute.

RS: Yes, the Cooperative Institute is a joint institute between NOAA and the University of Colorado. About half or more of the employees at NOAA are in that cooperative Institute. So I was able to get some funding, a year of funding, to do some carbon dioxide research. I started with CIRES [Cooperative Institute for Research in Environmental Sciences], as it's called. I was in CIRES off and on. It's all soft money at that point. I had to write proposals. I was fortunate there was a lot of money available in those days from the Navy, from the Army, from nuclear defense agencies, da-da-da-da. Since myself and my buddies were willing to go anywhere and do anything, we did. [laughter] So we had lots of funding, and most of the funding was run through the university. But there was very little accounting for it. I would walk around with hundreds and hundreds of dollars in my pocket on projects, and we'd take people out to parties and stuff like that. As long as we did what we agreed to, they didn't care about how the money was spent. We did projects for, as I say, the Army, the Defense Nuclear Agency, Navy – did a lot of work for the Navy. A lot of travel around the world, basically. [laughter]

MG: Can you tell me about some of the research you started doing around 1979 with CIRES?

RS: Most of that was focused on ice nuclei sources and how to control them. I developed a project with a professor, Dr. Ray Fall. We got money from different agencies, but also from companies like Kodak and Advanced Genetic Sciences. We were developing ways to protect plants from freezing. We developed ways, but when you went out into nature to apply them – they were good in the lab, but in nature, nature just overwhelmed you with other things you didn't know about. But in a lab, we could bring plants down to, in centigrade, minus four or five centigrade, or in Fahrenheit, down to twenty-three and keep them alive for days by removing the bacteria that were causing the nuclei to cause them to freeze, but that worked [beautifully]. It looked great in the lab, and we got private money from venture capital companies and stuff. But as soon as we started working in the field doing that, nature would bring in a rainstorm that had all these bacteria in it and put them on the plants. Then they were back to having frost susceptibility, and they would freeze at minus one, minus two Centigrade. We did that for a number of years. In the meantime, we were also doing other projects. One of the more interesting ones was when Star Wars was being developed. You remember that term? But that was going to be operated from White Sands Missile Range in New Mexico. So they started building huge buildings and infrastructure there. I'm talking twenty, thirty-thousand square foot buildings to house – they were going to shoot lasers up. But myself and some friends were hired to measure the black carbon. When a laser is shot, if there's black carbon in the air, the laser gets diffuse, and it loses its power quite a bit. So we were doing measurements for the military of black carbon from planes and on the ground. We had a very nice program. Then one day where they were going to put this huge laser in, I was there with the manager. We were talking, and I

could see planes coming over. They would come to a certain point and turn and go; they weren't allowed to fly over White Sands Missile Range, but they can fly right along the edge. I just pointed up and said, "Look, that plane is putting out hundreds of pounds of black carbon per second." You could just see his face go. Now, they'd probably spent two hundred million dollars or half a billion, and he realized that planes putting out their exhaust would nullify much of the program. But fortunately, within a few months after that, [Ronald] Reagan and the USSR made a deal that they wouldn't use Star Wars. It probably wouldn't have worked from that site anyway, or they would have potential problems.

MG: How come it wouldn't have worked at that site?

RS: Because it had the space, and it was no clouds; you can't shoot lasers very easily through clouds either. So it's a very dry desert climate. They could have probably done it somewhere else. But they'd already invested unbelievable amounts of money – something so simple as that.

MG: What was sort of the endgame for Star Wars? What was the ultimate goal to achieve?

RS: To shoot down satellites and missiles with lasers. That was the ultimate goal. I don't know if it was going to work, but that was their ploy.

MG: I have in my notes that you looked at Arctic aerosols during this time and put together a sampling program related to Arctic Gas and Aerosol Sampling [AGASP].

RS: Yes. When the money from the White Sands and the Defense Nuclear Agency and those things started drying up very quickly, I was within about a month or two of running out of funding, and we were going to shut everything down; I was going to look for a real job. There was an announcement that you could bid or put a proposal in to get aircraft time on a NOAA P3 aircraft. Those are the hurricane hunter aircraft. So I developed a short proposal, saying that we would take one of these aircraft outfitted with the same instruments that are on a baseline station on the ground and fly it above the Barrow baseline station to see what was really happening above because our Barrow observatory had been running for many years, but it just sat on the ground and measured. We had no idea what was going to happen above. I fortunately got maybe a hundred and twenty flight hours on a very expensive aircraft. Then we put together and went to different agencies to get money. The ploy there was I'd go to one agency and say, "NOAA is going to give me this multimillion-dollar aircraft, and we're going to fly it free in the Arctic. Would you give us some money to help us?" And they'd give us – "Okay, we'll give you twenty, thirty, a hundred thousand." "Okay." Then I would go to the next place and say, "Look, we've got this thirty thousand, but we can't cut it. We need another thirty. Would you just please?" After the circle, eventually we had a million dollars, and then we actually went up to the Arctic. To get people to come on it, I would offer them a free ride on the plane – scientists – and mount their equipment, but they'd have to pay for data analysis. So we've got probably twenty different, thirty different scientists from around the US to bring their sophisticated equipment, mount it on the plane, and then they'd get many flights in the Arctic free. That was a real opportunity for them and really cheap for me, too. So we had this incredible group of people. At one time, we had thirty-some people in Anchorage based on the plane and flying. Our very first flight that we made, we fly from Anchorage, up to Barrow, which was five or six

hundred miles, and then fly over the ice and do profiles. We had incredible layers of haze. It was unbelievable. The pollution was worse than it was in LA [Los Angeles] at that time. And they were in layers. The first flight we did, we had seven distinct layers of this. It was just mind boggling how much. So, of course, we followed up on that. Then we took the plane and flew it to Greenland, to Thule, Greenland, and did a flight or two out of there into the Arctic, where we found – El Chichón volcano had blown up earlier, some months before or maybe even a year before. We were able to find the layer of the volcanic ash that was coming down in the Arctic. The plane just happened to find that layer. Then, we moved the whole operation to Bodo, Norway. So we could fly along the Russian coast in that area. We flew flights there. But almost every flight was totally new data. So we got back, and we published very quickly a whole addition of *Geophysical Research Letters* on our results. Then we did analysis for two years. Then we decided to go back. The first program was called Arctic Gas and Aerosol Sampling program. But then, we had enough excitement that we got the plane again three years later. So then we had to call it Arctic Gas and Aerosol Program, Number Two. So we went back to the Arctic, repeated it, and did a little more work for the Navy. That was fairly successful. Then we publish two full editions of dedicated journals on our results. So, of course, that got us money and time to do the third program. So every three years, we did this four times. Then, at the last program in ’92 or ’91, the USSR was falling apart. Over the years, I'd been to Russia maybe twenty times since I was a student in 1968. I went to Russia on an exchange with Komsomol and the British Union of Students for a month, and I met people there. Then I went back the next year and a few other times. So I had some contacts, really good contacts high up in Russia because people had moved up to directorships and stuff like that. So we made a deal that we would – well, two deals. We would put a scientist on one of their planes and then also one of their scientists would come on our planes, and we would fly together over part of Russia. Also, this is when there was a lot of interest, as I mentioned before, on the Bennett Island plume, where every once in a while in the spring and winter, you'd see a big plume come from this uninhabited island and go across the Arctic. So some people thought that the Russians were dumping nuclear reactors there, and other people thought it was methane leaking out. Methane was just becoming of interest because of the climate issues there. So I was able to get money and convince some people in the different funding agencies that we would take a bunch of instruments, rent Russian aircraft in Russia, and fly to Bennett Island. They laughed and said, “Okay, I'll give you a few dollars for that.” Then we took those few dollars, wangled it in a circle, and finally we had more than we needed. So we put all the equipment together with a scientist from Berkeley, Dr. Tony Hansen, who was a personal friend. He put together most of the instruments. Then we flew them up to Nome and initially rented one American aircraft to fly across to Russia. But when we started loading equipment, we never had enough space. So I rented a second one, and the airline there trusted me. I gave them a credit card for fifteen thousand dollars for a flight across, and they accepted it. We packed up the planes and went. In the meantime, we'd arranged for a plane to come down from the Arctic coast to meet us in a city called Provideniya, and that transfer worked fairly well. I had a lot of cash with me and twenty dollar and hundred-dollar bills, about forty-thousand of it in the suitcase. We transferred a lot of that to the other plane with nobody knowing that we'd done it because that amount of money, anybody would have been tempted to take it. Russian people made what? Forty dollars a month was their income. We had a thousand or ten thousand times that. So we had to be a little careful. But anyway, that aircraft went up to the Arctic. Dr. Hansen stayed with that aircraft. I went back to the US because we had a satellite set up to look for this plume. We changed the game. Just

friends and people who were interested in this were able to change a satellite remote station in central Alaska to look just over the horizon. So when the satellite went by, they could pick it up. I watched it, and one day, *boom*, there was the plume. They had put all the equipment in another plane that had a twelve-hour duration. Off they went and found the plume. All it was was cloud, nothing else interesting.

MG: What were the kinds of things people had guessed it was?

RS: The first thing the military thought it was where Russia was getting rid of their unused or their ancient nuclear reactors. When you got an old nuclear reactor, even after it's not good in the power plant, you got to keep it cool and the rods cool for a long, long, long, long time. It's a real problem. So somebody, because they saw these plumes, said, "Well, it looks like steam," because it comes right out of the island. So they thought that's maybe what it might be. Other people said it was a methane leak. There's a lot of methane under the Arctic Ocean, and every once in a while, it was leaking. It would come up and cause this cloud to go. That's what a lot of USGS [United States Geological Survey] people thought it was. I thought that's what it was, too. That's why we took methane measurement equipment with us because we had really thought that's what it was, and that was going to be a real great discovery. But people were just interested in why this one island in the middle of the Arctic Ocean would make this plume that would go two, three, four hundred miles. It was something interesting. So we convinced them that we could do that. I think a lot of them were a little skeptical, but we managed it, and it worked very well.

MG: Yes, I'm really curious about this. In your interview with Sonya, you talked about how this was one of the scariest but most fulfilling projects you'd ever worked on. Even just planning it must have been so complex.

RS: Kind of, but planning it, we just planned –okay, we're going to take instruments; we'll get them there somehow. They'll get a plane down to pick us up somehow. We trust them. They better trust us. We'll meet at noon on a certain day in this little village airport, and then they'll do the work. Tony and I had done things like this before. So we knew how to do these things, and it worked. But money counts if you've got a handful of cash and a stressed economy. Our only issue was we didn't really know what the Russians would do when we showed up. Would they let us in? Would they give us problems? I think they were kind of surprised and overwhelmed by it all. The Soviet Union was collapsing at that time. The people out in the East were many, many time zones away from Moscow, and they were just desperate to do anything. A handful of dollars – you could buy an airplane practically. You could. You could have bought an airplane and flown it back.

MG: What did you need that forty thousand dollars in a suitcase for?

RS: To make things work, aircraft time, pilots, and machinists, you had to pay people, you had to buy meals. Oh, we also took alcohol – whiskey – and thousands and thousands of American Winston cigarettes. I mean, literally, we had hundreds of pounds of this stuff. Those two things, the cigarettes and the American alcohol – Dr. Hansen doesn't smoke. But when he was on a plane, he'd pull out a package of these American cigarettes, put one in his mouth and light it. All

the crew would just – eyes wide open. So he'd give them a cigarette. "Oh, you want –?" Then he put another – and they were, all of a sudden, friends. At the airbase where he was staying, the same thing.

MG: For how long were you able to operate in this sort of Wild West mentality for the funding and the various projects? I was just curious when that changed.

RS: About two and a half years. We went back the next year. We took a bunch of American scientists to show them how easy it was to do stuff. We spent weeks in Chersky, flying around and showing scientists how easy it was. But things even then were starting to change. The government was coming back in. In fact, when we left or tried to leave, they took some of our samples and equipment; they wouldn't let it leave Russia. One of the people we took over was a glaciologist, and he was very interested in permafrost. So he got a lot of good permafrost samples, but they confiscated those. We had other equipment we left in Chersky and just abandoned it because we realized that the door was going to close, if not tomorrow, next month or something. So we just cleaned up everything, gave all the gifts we could – give the alcohol, the cigarettes, a handful of money – jumped on the plane. They took us down to Provideniya. No, sorry. They took us down to Provideniya, but then we got the Russian plane to fly into Alaska and drop us off. That caused some problems, but we got around those. They fined me potentially a hundred thousand dollars for doing that because we broke customs regulations, we broke FAA [Federal Aviation Administration] regulations. Here we come, fifteen people in a Russian aircraft landing in Anchorage unannounced. But we had no option at that point. Eventually, all the fines were nullified once we explained what we were doing and stuff like that. But at Anchorage, it did cause a stir. Here's a Russian aircraft sitting on the tarmac unannounced

MG: If I mess up on my timesheets, I get a talking-to from my supervisor. Did you have a supervisor that was directing you?

RS: No, not at all. I did get reprimanded, of course, but what could they do?

MG: It was already done.

RS: It was already done. It's better to beg for forgiveness than ask for permission.

MG: You had told a story to Sonya about sort of leaving the forty thousand dollars under some things in the plane that you hoped Tony would find, but that if he had gotten caught, he'd probably still be in jail. Can you tell me that story?

RS: Yes. I got caught with the money going in. They searched me and searched my briefcase. "What on earth is all this money for?" I said, "Well, I got a big project in Alaska. I got to pay for it when I get back." So they said, "Okay," but they put a guard on me. Then our plane from – I had hired a plane from Nome; it landed. So they said, "You better get on that plane and go home." So I took the suitcase with me, walked to the plane, but then – "Oh, I forgot something." So I went back to the Russian plane with the suitcase and dumped the money on the seat and then covered it up with maps and a hat that was there. Then when I came out without – I left the suitcase in there because I didn't need it anymore, and the guard noticed that, so he made me go

in and get the suitcase and then go into the US aircraft. So everybody thought things were copacetic. But to tell Tony what I was going to do, as they were escorting me out, I pretended to throw up. I almost did. So we went off to the toilet. The toilet was just a little building beside the airport with a hole in the bottom. It was terrible. I told him what I was going to do.

MG: I wonder if you can say all the ways this could have gone wrong.

RS: A lot. In those days, we found out that if you didn't panic, and you looked like you knew what you're doing, and they thought that somebody higher in Russia was supporting you, you could do almost anything, not quite. It was amazing for those couple years. We even had a Russian research aircraft fly along the – we met them in international waters. We flew together doing measurements, waving to each other. [laughter] We had put an English-speaking scientist on the Russian plane, and then I had a Russian-speaking scientist on our plane. So everything just worked out. The aircrew were really excited because we were flying probably a total – two planes together had to fly about a thousand miles to find each other at a single point over the Arctic Ocean, hundreds of miles from land, and they did. That was the day before all of the navigation we have now. They were using sextants, looking up at the sky, and all kinds of stuff like that. The Russians were a little lower than us when we saw them, but we met. It was pretty neat.

MG: It seems like good foreign relations.

RS: Yes. And later on, the son of the commander of the air base that we were at, Dr. Hansen got him a student internship at Lawrence Berkeley [National Laboratory] as a visiting scientist/engineer. He eventually stayed in the US.

MG: Tell me a little bit about Dr. Tony Hansen. Where did you first meet him? How did your working relationship evolve? What's his background?

RS: He was from Britain. He came to Berkeley to do his PhD I guess in some kind of nuclear physics work. Then he stayed on and developed a way to measure black carbon. Black carbon was very difficult to measure. So when the program was going to the Arctic, black carbon was a big issue. I contacted Berkeley Lab – somebody told me that – and then talked to Tony; he agreed to bring his instrument and mount it on the plane. He could speak Russian; that was part of it. His mother in England – that was the time when the Russians were really progressing fast – said, "You better learn Russian because it may be the language of the future." He went to Oxford University. While he was there, he learned to speak and write and read Russian perfectly. So he was a very great asset. And he was game to do it. "Okay, Schnell, let's see if we can do this." He was still working at Berkeley at the time. Eventually, he took that black carbon measurement system, resigned from Berkeley, and formed a company, Magee Scientific, which became very successful selling commercial instruments to develop and measure black carbon. Then, through some contacts I had and he had that eventually developed in China, we opened a market there, and he sold hundreds of them to China because they have a lot of black carbon problems. So all of the cities and agencies have these, and they can measure. They can see when the black carbon is building because they know it's coming from power plants and cars. Then they put in – "Okay, people, you have to have odd number license plates today," and things

like that. So I was still with university for fifteen to eighteen years. That was really neat because I didn't really have a boss.

MG: It seemed like you thrived in a boss-less environment.

RS: Yes.

MG: Getting back to your work with CIRES, I wanted to ask what accounted for those layers of pollution that you were encountering in Barrow and other places.

RS: They were coming from Eastern European countries. So what would happen in winter [was] these countries are burning a lot of coal, and they had a lot of industry, and there were no clouds in winters. It's very cold so the air would pick up a layer from one area and move it into the Arctic. Then, of course, as they were moving, there was another layer coming with them from another area, and then another layer from somewhere else, and they just moved like a multi-layer cake, and they didn't mix. They just moved over the whole Arctic like that. So you'd fly through them, and you'd see, "Whoa, look at that big layer," and then it'd be clear air. Then another big layer. At one time, the layer was so thick that we thought that we were breathing our own aircraft exhaust. The airplane would circle around, and it must be pollution from the plane because you can't expect – but eventually, we worked out using trajectories and measurements that were being done in Norway, you could tell when the plumes were moving over Norway, and then we watched them float – yes, they came right over Alaska eight days, six days later. So we had a lot of good PR [public relations] about that, papers, and publications. Wow, it really is working. We found that by the time we got AGASP-IV, which twelve years later, the pollution was much reduced because the USSR had kind of collapsed. So they weren't running a lot of their industries in the Arctic as much, and countries were getting concerned, and the economies went down in Eastern Europe. Hungary, East Germany, Poland were all breaking away from the USSR. So they weren't producing as much stuff. There was a real lull in economies.

MG: There was more awareness then, too, of greenhouse gasses.

RS: All of that was really coming. People were realizing that we all live in somebody else's sewer, basically.

MG: The other detail I wanted to ask you about that work was you had to convince the P3 folks to put thirty holes in the planes. Can you say what that was about?

RS: Yes. Well, that plane had never been used to measure anything other than meteorology. So when we first went down to Florida – it took us about a year to put the full equipment together. We told them we want to put in about thirty inlets in there. "What are you talking about? Not in my plane." Then we talked to them. Eventually, what we did is we took windows out of the plane, and then put a big metal plate in the window, and then made our probes go through the metal plates that way. We got them all excited about this, too. Tony and I are fairly exuberant much of the time and convincing, and we'd take them out for a meal and a drink. "Oh, yeah, we'll do anything. Let's try it." They were excited to be able to fly in the Arctic because when

there's no hurricanes in winter, they don't have that much to do. So this happened late in winter, early in spring when it was kind of a dead time. So, we did that. Other groups, later on, used a lot of our equipment. There's still some of our equipment thirty years later being used that we built – some pump systems because you had to bring all this air into the plane on all these things, then you had to get rid of it. You just can't pull it in. So we had a big exhaust system. The air would go out the back end of the plane and dump out. You couldn't bring in air and then split it into two instruments because one instrument shuts off a leak, then the air would go back and screw up things. So that's why we had to have all the inlets for different systems. But then you had to pump all the air out the back of the plane because everything had to be in balance or the instruments wouldn't work. Luckily, most of them did work. Some didn't. We had enough that we could get good data. We published 286 papers from this and four dedicated journals – the whole journal dedicated to just this stuff.

MG: That must have made the folks at CIRES very happy. Besides the authors, what institution was supporting that work?

RS: The authors, whoever made the paper. I was editor of two of those editions, and other people were editors of different ones.

MG: Was there anything else you wanted to say about the AGASP project?

RS: In the second or third AGASP, we brought in a lot of other countries, and a lot of other people to do measurements. We had measurements done in Canada, Norway, Sweden, Svalbard. Then we had four aircraft flying in different places. The Canadian had one. The University of Washington flew out of Greenland. And the Norwegians flew out of Norway. We all worked together to snap a picture of the whole operation. I'll tell you one story. You may have heard about this. After our first really successful programs, near the end, we were moving the plane to Greenland. We had a party in Alaska in a bar, and I started buying drinks for everybody in the bar all night long. We announced when we all got drunk that we were going to the North Pole the next day, and we wanted to do something special. We wanted to ask all the women if they would donate their brassieres and underwear and sign them, and we'd dropped them on the North Pole, so we could get in the Guinness World Records. So, we got two garbage bags full. We couldn't go the next day, but later, we did drop them on the Pole. So then when we got back to NOAA, we were bragging about this, and that got up to headquarters, and they killed it very quickly. It wasn't a good idea. In retrospect, that was one of the bad ideas.

MG: Would the record have been the most undies in the North Pole?

RS: Ever dropped on the North Pole because women had never been there. We didn't think about the bigger picture. It was just we were a little bit drunk and having a great party, and everybody was singing. This was on St. Patrick's Day. Everybody was having a good party. It was a great party. [laughter]

MG: The next thing I have on my list, which I think was concurrent with some of the work you were doing with CIRES and AGASP is that you were director of a Special Operations Group and going to these remote locations. Can you describe what that was?

RS: Yes. Sometimes there's different government programs that need something or are interested in something, or they need some specialist measurements made and they may not have the resources to do that, or the people willing. So we set up something called the Special Operations Group. Everybody in it – [their] last name started with S. It ended up mostly eventually doing the work for the White Sands Missile Range. Then we also did some work for the Defense Nuclear Agency. The US and other countries would simulate atomic blasts with huge piles of TNT – I mean, thousands of tons of TNT. They would blow it up, and then see what – they would plant a forest, and see if the forest blew down. They put airplanes around and houses and – [imitates explosion]. Also, when they were setting us up, they would dig holes and put a layer of gold, a layer of platinum, a layer of something and something else. Then they wanted to know where that dust was going. They wanted to know how high. So we sold them on the idea that we could predict where it would go and direct a plane into it. So NASA [National Aeronautics and Space Administration] had an aircraft that they were going to use to measure this, but they didn't know where to go for it. So we developed a program to show that we would tell them exactly where the dust was at a certain time and date. So we got funding for that. I sent two of my postdocs to Washington to run the computers to predict where it would go, and I stayed out at the blast site. It was amazing to see. The ground shook. You could see the wave coming. We were miles away from – you could actually see a wave coming through the ground, the air. Anyway, the dust went up. But it didn't go the way that a lot of people thought because the winds were different. So I stayed there and watched the meteorology. The two students working in the computers in Washington – I said, "Tomorrow afternoon at noon, give me your best guess of where this plume is going to be." So we worked all night long. In the morning, they said, "Okay, our best guess is this." Because this big NASA plane had to fly from somewhere down in Texas. We gave them an X and Y and an altitude. We were lucky. Unbelievable. It was right in the center of it. It was somewhere up over Colorado or Wyoming, up in that area, coming from New Mexico. They could see the different levels of the gold and iridium and all these other things that were tracers to see how deep the crater went and where the stuff went. So we got a very nice paper out of that one, too, with the workers. We had a lot of luck in life. Amazing.

MG: I also meant to ask when you were talking about Tony and your work in Russia, was that under the purview of something called the Working Group 8? What was that?

RS: Yes. The US and Russia developed a program where scientists would meet and talk about what we could do jointly. Most of the meetings, for reasons unknown to me, were in Russia. Maybe the Russians didn't have the money to come; though they did come occasionally, or at least once or twice to the US. But we ended up going over there more often. That's where we developed a lot of good contacts, too. A lot of people were uncomfortable for whatever reason [with] scientists and government people going to Russia, where Tony and I – it was a real piece of cake. "Wow. You can let us go? Yeah, I'll go." So we developed contacts, and things just developed from there.

MG: I have in my notes also that in 1981, you became a certified consulting meteorologist. I didn't know what the motivation was behind that or how that credential helped you.

RS: Yes. The American Meteorological Society has an accreditation – a couple of them. One of them is for newscasters; you can become accredited. The other one is to become a certified consulting meteorologist. In those days, in the late '80s, it didn't look like I'd have much of a career. So I got that certification in case I had to get a real job somewhere or start a company or something. It's a matter of – you have to have certain credentials, you have to have published a number of papers, people have to write letters of recommendation, then you take a written exam, and then you take an oral exam.

MG: I think you mentioned some of your work in China, but when did you start becoming an invited guest to do lectures there? Who were you doing that through?

RS: In NOAA, there was a Chinese scientist in a similar group as I was; she had grown up in China, left, and went to Taiwan when Mao Zedong came into power. I became friends with her. My wife is Chinese, but not from China, from Singapore. This lady, Dr. Parungo – she was married to a Filipino at that point – had kept friends and knew families in China. One of them said, "I'm going to invite you to come for a month. The government will pay you, and we can see if we can develop some programs." So she invited me and my wife Suan to go because Suan is Chinese and I'm willing to do it. So we did, and it was an unbelievable trip. They paid for – they treated us like royalty because, in 1983, this was one of the first scientific groups coming. Since she knew people there, we had so much freedom. We actually stayed in a place where the former Chiang Kai-Shek's home was. We stayed in his home. He had a big resort area, and we stayed in his home. It was kind of getting decrepit at that point. But they were trying to show off to us, of course. We got to see – I mean, they took us everywhere, all over the place, of course, to the Great Wall and then to all of the museums, and then out to the tombs. There's a lot of tombs in China under big hills that they haven't even dug out yet. They're going to do it someday. They took us out to where those terracotta warriors had just been discovered. There were only a few of them. They were actually digging them out. This wasn't long after they'd been – they had no buildings over them or anything; they just had a tent there, and they were digging away. "Look, here's this warrior." It was fantastic. I've been back there twice since. Now they've got big museums, and everything's covered up. They got that chariot they found, a beautiful chariot. That's all in a museum. It's different, though. When we first went there, we saw the people who discovered – the man who discovered it. He was digging a well and found that. So we were just treated. We had a car, a driver, and two guides all the time and just taking us. Of course, Farn could speak Chinese, and they would laugh and talk – "Oh, yeah. Let's go see something there." They were happy to have us because they got free meals and good meals. We spent the better part of a month – now what was interesting – I had taken my wife with me to Russia the month before because I'd been invited to St. Petersburg for some Working Group 8 meeting or something. Then, a month later, we're in China. So we could compare. She and I both felt we'd much rather live in China than Russia because Russia was so difficult and people were so depressed. This was before communism fell in the early '80s. Whereas in China, you could feel them expanding. Mao was gone. He's dead. "Yay." People there living in their USSR housing – it was terrible. High-level scientists would live in an apartment building, but they had to share a kitchen and a toilet with other people like that. I made friends with some people. Then I went back many years, many times later. The second or third last time I went, this one guy who I'd been in touch [with] for twenty-some years, he now lives in a more palatial

building than I can afford – marble floors, big six-foot TV screens, separate kitchen for the maids. Things have just unbelievably changed.

MG: Remind me what year it was that you came to Hawaii? Was that where you were before coming back to Boulder?

RS: Yes, I had developed a brain tumor. I was still in CIRES, and I realized that if this didn't work out, I better have a government job for both the medical, and then my wife would have some kind of income. The operation was very successful; everything worked out. But, at that time, I applied to be director of the Mauna Loa Observatory. Fortunately, I was given that job. So we moved to Hawaii for eight or ten years.

MG: When was it that you first came to Hawaii?

RS: I may have told you it was really cold in Canada one winter. So I applied to the University of Hawaii. They immediately said yes, and it was only ninety dollars a semester. So I just quit my job and went to Hawaii. I loved the climate. I moved there in ’91, but we kept our children in school until the summer of ’92. Then we all moved there.

MG: I have a number of questions I want to ask you, but I am wondering if we can take a quick bathroom break.

RS: Let's do it.

MG: Okay. I'm going to pause the recording. [Recording paused.] I'm going to ask you about your time in Hawaii and your health scare a little bit. But before that, I wanted to make sure there wasn't anything I was missing up to this point. I had in my notes that the origin of the Schnell’s Laws came from a detail around 1989 that you were doing – a field campaign.

RS: Yes, that's when we were doing the Defense Nuclear Agency blast. The two postdocs, Pat Sheridan and John Kahl, were in Washington for maybe a week working on the computers, getting everything ready to do the projections. They had a lot of spare time. Both of them were fairly new postdocs at that point, and they’d sit around. They said, “Remember when I first came; Schnell did this.” He said, “Oh, yeah, same thing.” So they started writing these things down, and they wrote out lists. Eventually, they called them Schnell’s laws, and they were quite funny. But they then printed them up and mounted them on their door actually.

MG: And how many are there? Can you rattle some off for me?

RS: I think they come up with eight or ten. The first one was, if something is worth doing, it's worth doing quickly. I think the second was something to the effect – I can actually send you them. I’ll find them. It was, if you need more money, make sure that you ask somebody for it, knowing you've already done the work. That's kind of what we would do. We would do some research, make some progress, and then sell that idea to somebody. We already knew it was working. We had the data. That was easiest. Another one was, it's much easier to ask

forgiveness than ask for permission. I'll send you them. I don't remember them anymore, but things like that.

MG: It makes me think you must have been a great boss to work under because you were a little free and easy with the rules and flexible in terms of driving your research.

RS: Yes, that has been mentioned occasionally. I came very close to getting into trouble a couple times, but never happened, which was good.

MG: What would trouble have been? Could you have been fired?

RS: Or gone to jail, probably.

MG: That's trouble.

RS: I'll tell you one – not the worst one, but one. Somewhere along the way, I got funding to set up a program in Mongolia, an aircraft program to do flights. We wanted to see the air coming out of Russia, what it was looking like. So I can't even remember who gave me the money. But we got a pile of money to rent an aircraft to fly every month from Ulaanbaatar up as high as it could go, taking samples, come down, and ship them back to us. I went over there a few times, and the program was working well. But we had to go back with new equipment. I had set up to go. Again, you had to have a lot of cash for that. I couldn't go. So in the end, I sent a younger staff. But in the meantime, I had written out what was going to happen and got it notarized, saying I can't go; this person's got to go on short notice. He's going to have a pile of money. He's going to go over there. He's going to pay for aircraft and da-da-da. I got it notarized, and that was good. Then I couldn't go, but this guy went. Somehow, my travel orders showed that I should have gone, but somebody else did, and all this money disappeared. So somebody then complained to [the] IG [inspector general], and the IG started an inspection. One day, two men with guns on their hips knocked on my door and started talking to me. "Where did the money go? Why didn't you go?" It looked like I absconded with the money. One person in the building in finance didn't like the way I operated at all. So he was the one who filed the complaint. He might have totally believed that I was doing something wrong. But after it finally came out what was going on, I pulled out this notarized sheet and their faces – this is all legal. Our time has been wasted. All this inspection is useless. But had that not been there, I'd have been in trouble probably because we couldn't prove where the money had gone, etc. That was close.

MG: Were you able to recover the money?

RS: Oh, we spent it. He took it, and we paid for the aircraft. We hired a very high – just to back up. The US Embassy and other embassies in countries that are less developed, they hire a company from Finland to put a plane with two pilots in each of those countries just waiting to take people out. In Mongolia, the Finish plane was a very beautiful two-engine, high-performance, turboprop – and they weren't doing anything. So we hired them to do our work, but of course, they had to be paid. That's how we paid them. They did excellent work for us. They loved it because they were able then to do something. They'd sit around for weeks and not fly. But if somebody got sick at the embassy or in the country, a foreigner was there and got

sick, they would put them on a plane and fly them to China or somewhere where there was good medicine. But there's planes like that sitting all over the world just waiting for embassy people or somebody to get sick. That's how they get out. It may not be as bad now, but at one time, you couldn't trust the local – like in Mongolia, it was still [under] Russian control. We were just lucky to get that plane, and it worked. We ran that program for two years.

MG: You've had a lot of lucky breaks in your life.

RS: Oh, every day, a new one almost.

MG: And now I want to hear a little bit about what brought you to the doctor? What led to the discovery of your tumor?

RS: I was in a little car accident, nothing serious. I had neck pains that came after that. I thought it was from the car wreck. So I went to the insurance company. They said, "We have to get you checked." So they sent me to a doctor in another city. He did a lot of tests and said, "It's nothing to do with an accident. Let me look at your fingers." He looked at my fingers, and they were all kind of swollen. And then he said, "Do you have acne?" Here, I'm thirty years old. "Yeah." He said, "People at thirty years old don't have acne." There's a certain tumor that causes these problems. So I was sent to another doctor, and they did some tests. It was called acromegaly. I was still working at the university at that time. So I went to the university teaching hospital. The operation is kind of neat. They lift up your lips and your nose, and they open that up and roll it back, and then they drill straight to the back of your head and do the operation in the back of your head. They can't come in the back because it'll go through your spine. But this thing was on the front of the spine. After I was out, it was terrible swelling. It was all loose up in here. But it worked – one hundred percent.

MG: Were you worried about your brain function after the surgery?

RS: Oh, yeah. That's why I applied to get the job at NOAA in case I was a government employee; they couldn't fire you.

MG: You were thirty years old when this happened?

RS: Thirty-something.

MG: This would have been in the late '80s?

RS: Yes, late '80s. Maybe I was more. I don't keep track of time. Our family structure, when I was growing up, we never celebrated birthdays much. It was not an issue. Back to that picture. Do you want to see where I was sitting in it?

MG: Yes, yes. I can pull it up on my screen. Let me just explain for the record that you had emailed me a picture of a family reunion. It was just one side of your family, and there were a lot of people in that picture.

RS: It must be a hundred and twenty or a hundred and forty. That was just a family dinner we had.

MG: [laughter] It's incredible. Okay, let's see if I can find it. Here we go. I'll have to put this on your oral history record so folks listening to the interview know what I'm talking about.

RS: You had asked me where I was in the picture.

MG: Right. I'm going to share my screen.

RS: Okay. In the center, you see the stairs going up and people sitting on the stairs.

MG: Yes.

RS: Go right to the top, and you'll see a man and woman sitting on the stairs. Come right down. Come down one level. Move the cursor just to the right. That's me.

MG: How old were you in this picture?

RS: I would assume about twenty.

MG: Could you name everybody on the bleachers here?

RS: I knew all their last names, not all their first names of the younger ones because they were coming so fast. Look at this. Look down on the bottom left. I know their first names very well. She's my aunt. But look at the three kids. They eventually had five or six kids. Every year they had one – *boom, boom, boom, boom, boom*. I couldn't keep track of all of them as they kept coming. The next year, you'd count them; there'd be ten more new kids like that. You knew the mother and father well, but you couldn't remember the children's names.

MG: Do you know who took this picture?

RS: Another aunt took it. She had a camera. Most of us didn't have cameras. So she set it up and got us all before lunch. She said, "You can't have lunch until you sit up here and take this picture."

MG: I can't imagine the grocery bill for serving lunch to this many people.

RS: Well, everybody brought [food]. It was a potluck. It was no big deal. You bring enough for yourself and a few others.

MG: It's incredible. All right. I'll stop sharing this for now. I don't know how well it will translate over the air. Well, how come you didn't celebrate birthdays growing up?

RS: I don't know. Just wasn't the thing.

MG: How long did it take to recover from your brain surgery?

RS: Probably a month, maybe. But I was out of the hospital in two days. They said it's not an uncommon operation. They were teaching students how to do it. That's why it was very cheap.

MG: Were there any aftereffects? Did it impact your sense of smell or your memory at all?

RS: No, just worried my wife and children. They thought I was going to die.

MG: Maybe you said something like this in Sonya's interview, but did you attribute the brain tumor to activities earlier in your life, such as exposure to certain chemicals or radiation?

RS: Possibly could have been chemicals. In the shop my father had there was welding going on all the time. The fumes from flames and electric welding. Every day was a big fire in the – what do you call it? – where you bend iron and make things in. It was exhaust from vehicles running in the building. I spent a lot of time there. I don't know if that had any relationship to it. But people always want to blame something, so blame that.

MG: You mentioned your children. Did you expand your family and have another child after your daughter who was born in Africa?

RS: Yes. We had a son about eight years later. He was born in Boulder.

MG: Now tell me about your role as the director of the Mauna Loa Observatory in Hawaii? What is the history of the place and the purview of the work being done there?

RS: Okay. The Mauna Loa Observatory was set up in the 1950s to measure – what really started was measuring some things about solar radiation. But then it soon started measuring gasses. Dave Keeling – the name might ring a bell. He was the person who started atmospheric CO2 measurements at Scripps. He brought an instrument out and set it up there. So that became kind of the center of carbon dioxide measurements. Then, within a few years, he saw the CO2 rising every year. Since Mauna Loa was above any pollution, it had to be a global background. That's something called the Keeling Curve. That's where the whole global greenhouse gas increase and climate change hypothesis was verified. The CO2 was going up every year. The observatory expanded into other measurements because it was such a good location. But the original 1950s building was there when I came, and it was too small. So again, for whatever reason, I was left alone, kind of ignored, as long as the data came in. So we started expanding Mauna Loa. When I came there, there were about three buildings, and when I left, there were twelve. All but one of those were paid by non-NOAA money. The military needed to send laser beams with voice on them long distances so that the Russians couldn't listen to them. So they had a site on another island high on a mountain, and they wanted to send data from Mauna Loa over there, but there was no place for it. So they agreed to build us a couple buildings. So we built a couple buildings for them, and they paid for them. We used that idea to put our equipment in them after they left. Then there was a need to build a new building at Mauna Loa that would look at the sunrise on the eastern part of our site. But we didn't own the land; we only had four acres. So I applied to the government of Hawaii to get four more acres of land to expand our program.

After a couple of years, we were able to get this land – four acres. But then, when we decided to – we had some money to start the construction. We did tests for the foundation and found out that this lava seventy-feet deep was nothing but just ash and you couldn't build a building on it. So NOAA was in a situation of not being able to do this building. The person who had the money was going to retire or move on at NOAA. So I talked to him and said, "Why don't we build a bigger, better building right in the middle of our site, where we know there's good solid rock?" And he said, "Yeah, good. Here's the money." So at that time, a professor from the University of Wyoming was now the director of our lab; he had taken that job. He knew me quite well from Wyoming. So we agreed that we would build this building right on this new piece of land. So we got permission from whoever we needed to, more or less. Then it was too expensive to hire Hawaiian people to build it because how do you haul the stuff all the way up there, and it's high altitude, and the people would get sick up there. So we made a deal with a company in Washington to build a free prefab building in seven sections. So they built it. They put the wiring in the walls and everything like that, and the plumbing. They brought it up on one trailer at a time. They would bring up a section, and then the foundation was made. So we got a big crane, and we dropped a piece down and set it. Then, the next couple of days later, bring up another piece, slide it in, click it together, and then eventually, you had your whole building all put together. You can't tell that – then they put siding on it, which makes it look like one complete building. That was called the Network for Detection of Stratospheric Change building. And then NASA moved in one of their LIDARs [Light Detection and Ranging] there. They took maybe a quarter of a fifth of the building on one end for their LIDAR to look at the aerosols and ozone high up. Then we put a LIDAR – and then we moved a lot of our equipment that needed constant temperature in the buildings, and we set it up so that if it got too hot, it would blow air out or suck in cold air from outside and vice versa. We could keep within half a degree temperature in certain rooms that needed that. Then where do we get money for –? Oh, yeah. The National Center for Atmospheric Research has this facility on the site to look at the solar cycle; it's called the high-altitude observatory, where they look at when there's going to be flares and predict it. One of their groups that does similar stuff – they needed a place. So we got some more funding from them to build another structure. Then there was a group from Taiwan; they needed a high-altitude place to do work, looking at – I don't really know what they looked like. Something in deep space. They needed some. They were willing to help us pay to get on site, and we charge them a rent. So eventually, we became a center where we were bringing in thousands and thousands of dollars a year in rent for the different programs. We would help them, and we hired people to help them. But our road was a terrible, old, one-track, broken up, terribly expensive road, eighteen miles long to get there, and holes in it and accidents. I had met Senator [Daniel] Inouye. I can't remember how or where I met him, but we struck it off. We asked him if he could pay for the road. He never said anything, but he also was a very good friend of Hawaii. So, at one point, he said, "Schnell, you're going to get five million to work on your road," and five million appeared in an account to help work the road. But that wasn't quite enough to finish it. Then he died not too long after. So then the new senator from Hawaii managed to get it all through, and we got a very nice road. Now, it's a tourist road; people come up there because it's good. Driving up Mauna Loa, you drive through all these different ages of lava, and the different colors; there's black and red and some with vegetation, very fresh, glistening. It's a fantastic drive. So people go up there just to see the lava, and the road is holding up very well, which was very good. The staff love it now because it was kind of a pain driving, hitting all the potholes, and single lane road accidents – people coming down, not

knowing that there's a vehicle coming up – things like that. That was probably the best thing I ever did for Maula Loa was get the road.

MG: Well, tell me about the work that the observatory was doing, that the lab was doing. What were they looking at? What was your role in the science that was taking place?

RS: The role of the observatory is to measure long-term changes or long-term measurements in the atmosphere. But almost everything you measure is changing a little bit, except solar radiation from the sun is pretty constant. So we measure carbon dioxide and methane and all of the halocarbon gasses that destroy ozone. But then a lot of other universities and governments want to do their measurements side by side with what's happening at Mauna Loa because Mauna Loa is considered a world standard. So we have measurements from Australia, where we fill air flasks every week, and then they compare their data with ours. We do the same for Scripps Institution of Oceanography. Eventually, there's probably fifteen or twenty guest programs like that that the Mauna Loa observatory takes and [does] measurements for different groups. They have a specialty that they need a high altitude. We have instruments from Canada, Japan, Taiwan, New Zealand, and then universities – Colorado State University and different universities around – Penn State. We take samples for them or do measurements. UC [University of California] Davis had a big program there. Of course, Scripps is a very large program. Some of them have their own equipment. Some of them just take air samples or flask samples or samples on filters; it depends on what the program is. Every day, the staff goes up except Saturday and Sunday. But sometimes, they go up then, too, if it's needed. They do calibrations and checks on all of these different instruments and take the samples and ship them back. So, there's this very integrated program that just keeps moving through the years, especially the carbon dioxide curve; you can see it's going up faster and faster and faster every year. Methane is going up very fast, too. We're monitoring, of course, the dust and dirt from Asia, the Chinese dust there; that pollution is going down a little bit. But everything is exciting. You can see stuff changing on a weekly to monthly basis. Then, of course we caught a company in China cheating on the Montreal Protocol. There's a gas, CFC 11 [trichlorofluoromethane] that's used in making foam and refrigeration. All of a sudden, the curves at Mauna Loa and at a site we have at sea level started going up. This is a banned gas. So working with trajectories from Mauna Loa and from Cape Kumukahi, they worked back and doing measurements in a cooperative program we have in Korea – two programs there – eventually, pinpointed the town or the city that was doing this. Then the scientists who discovered this, Dr. Steve Montzka, talked to the Chinese people, work with the UN. China believed right away – it's hard to believe. "Yes, we know your work. It's all open. All your calibrations are open. All your measurements are open. We believe you. We believe this is real." Within about four or five months, it went down, but somebody else is cheating now over there somewhere. So, again, they're starting to find out. It could be India. It could be Vietnam. It could be a company inside there which the government doesn't even know about because it's better and cheaper to make CFC 11 than to deal in cocaine because your upfront product is cheaper, you can sell it on the web in the US, you don't go to jail for it, and the profit margins are very high. But eventually, they'll have that figured out. I say "we." As of the first of the month, I'm no longer employed there.

MG: The first of this month, April?

RS: Yes, first of April, March 31st.

MG: You just retired?

RS: Yes.

MG: Well, congratulations.

RS: Thank you. [laughter] I think.

MG: Is there anything else you wanted to say about your time in Hawaii? You mentioned your colleague came over from the University of Wyoming to become the director. Was that when you were transitioning out?

RS: No, that was about halfway through the time I was in CIRES that happened. He wasn't in the same department as I was in Wyoming. He was in physics.

MG: What was his role at Mauna Loa?

RS: No, he wasn't at Mauna Loa. He was a director in Boulder, the director of the Global Monitoring Division. He was the boss of the whole division. He was kind of a laissez-faire person, too, which was very good. "Get it done. Tell me later how the data looks."

MG: It must feel good to be trusted to do your job and not have to have a lot of micromanagement.

RS: Yeah, a lot of smoke and mirrors helps.

MG: [laughter] Well, what else stands out to you about your time in Hawaii and the work you did there?

RS: Oh, I loved it. The climate was great. The staff was fantastic. After a while, they'd do anything for you just to get it done. I was one of the first younger staff they ever had. Always, directors before were older, well-established people near retirement than young. So it was kind of interesting. I was much younger than most of the staff, especially the secretary. She'd been there – she [was] hired out of high school, and she was older than me. It was quite enlightening. She wrote a history of Mauna Loa, as did one of the older scientists. Two of them have histories. Their reaction to a young person who didn't follow bureaucracy to the letter was quite exciting for them, or depressing, however you put it.

MG: Was that kind of approach easier to do in a place like Hawaii, where it's so separate from the mainland and maybe not under so much scrutiny from headquarters?

RS: Totally. That's how we could put buildings on the site without even people knowing it was happening.

MG: In your interview with Sonya, you said something like, "I changed the parameters of how that place worked." What did you mean by that?

RS: Before, they didn't really like doing work for other agencies. If they did, they wouldn't charge them for them. It was always a strain on the staff. So I changed it around that we'd make space, get a building, you come, you bring your equipment, we train people, but you have to help cover the costs because our budget was always kind of limited. At one point, later on, we were zeroed out. Our total budget for all observatories was zeroed out in some kind of a shuffle of budgets, but we did get it –somebody else at NOAA picked it back up later. It was always precarious in that respect. Now, I think it's safe because all of a sudden, long-term measurements are the thing because now you can look back – what happened in 1959? Well, here it is, and here's the calibrations, and here's the history traced to NBS [National Bureau of Standards?] standards. It's trustworthy.

MG: So, what made you transition back to Boulder?

RS: The gentleman who was the director from Wyoming had been director for a number of years. He wanted somebody to help him run the place. He said, "You better come back and do that." I was more or less told to do that. I guess he trusted me and wanted to have a deputy that would do things.

MG: Tell me your title in Boulder and describe the work you were doing in that position.

RS: Okay. When I first came back to Boulder, I was director of Global observatory operations. So we had six full-time staffed observatories at that time. My responsibility was to keep the funding going, keep the staff, keep the measurements going, keep the cooperative programs – we had a lot of cooperative programs then. Other people had observatories which we worked with – Australia, New Zealand, and then China built a big one. It was modeled after the Mauna Loa Observatory. So we had Chinese delegations come over. Taiwan made a beautiful observatory; I was on their committee that selected the site and helped them get their observatory going. They did a really high-class [observatory]. Japan revitalized the Mount Fuji observatory; I was on the committee that helped them with that. I went to China to the grand opening of their observatory. Then, a number of times later, we gave them instruments and helped them, and they do flasks for us. So that was a real dynamic growth period during that time. We were always begging for money to rebuild the Barrow [Atmospheric Baseline] Observatory because it was built in that discarded military building, a temporary building that they'd built for radio frequency tests and then gave it to NOAA. So it was a temporary building that had been there for twenty-five years and falling apart. So we begged and begged for money every year. Finally, at the point where I was near retirement, we got a huge amount of money to build a new building and new housing. Earlier on, a friend of mine in the Weather Service was getting money when President [Barack] Obama was revitalizing the economy when it was in a recession. We managed to get two new houses, the best houses in all of Northern Alaska. You can imagine; in the 1980s, early '90s, spending 1.2 million for a house, a thousand square foot house; that was a pretty big price. But we got two of them – beautiful house. The staff was happy. Before that, they were living in converted shipping containers. That was a whole new change in life. Now, we've got a new

observatory, which was opened last September, but we haven't had the grand opening yet because of COVID. It's one of the best in the world now.

MG: Where is that?

RS: In Barrow, Alaska. It's about six miles east and a little south of Barrow. We have forty acres of land there.

MG: Well, tell me, what else you got to do in this role at the Global Monitoring Division?

RS: I was given the freedom to also do research of my interest or whatever else. I also, of course – then what happened [was] the deputy director retired, and I was appointed the deputy director. So then I had more responsibility for staffing issues, budget, stuff like that. About the same time – early on, we moved from an old building on the east campus to a huge new building that NOAA had constructed in Boulder, which was a new facility, very nice. I got to help to design parts of that and put in extra electrical cords. That's just when everybody was trying to get a computer. Initially, the design in an office was one plugin for a light. So we eventually made it so you can put in ten or fifteen plugins under the floor. So things like that, and then labs put in fume hoods because you needed – so, little things like that we managed to get into the building – and a loading dock right for us. The experience in Hawaii showed me when we were building there [that] you can't have enough wall plugs because everybody [has a] computer. In those days, you had to have one plug for computer, one plug for your screen, one plug for your memory, and one plug for your lights. So just to sit at your desk, you had to have four plugs. Then, if you had an elevated desk, you had to have a fifth one. Well, you know how it is in the house now. You need so many plugins. In a lab, it's even worse. And in an office, the same thing. So little things like that. Then, I helped him in the move. That was something interesting, where I got into a little bit of trouble. We didn't have money for new furniture, but all our furniture in our old building was metal. Remember that big metal military government issue? And they were all gray. So I made a deal with a metal spraying company to come in at night after everybody's left and move the stuff out into the hall and spray paint it, and it would be dry by morning. We would put it back in in a nice mellow yellow or brown color. But I forgot to let the university know. Apparently, the – what do you call them? – those tiles had asbestos in them, the floor tiles. So in moving the [inaudible], we were scratching the floor, and there was this big issue that we were putting asbestos into the atmosphere, so the cleaners wouldn't work up there for a short while because they thought they were going to get contaminated, and they made a big issue of it. But they inspected it and found out that we weren't causing any of that, but that delayed us almost a month – and all kinds of inspections. I was reprimanded many times for doing that. But in the end, it worked out fine. So we just finished painting the furniture and moving it all over. So we all had – instead of that gray. Again, the boss said, "Take care of it, Schnell. Goodbye." So I did. The staff was happy because they had nice furniture – painted.

MG: You reminded me to ask about the technological advances you've seen over the course of your career and the impact they've had on your work.

RS: Mauna Loa is probably the biggest change. When I came there, all of the data was mostly stored on strip charts, huge strip charts with ink. By the [halfway point] in the time I was there,

internet was not discovered yet. But I found out NASA had a special way that they sent data from wherever they had a site; they would send it by satellite, and it was separate. There wasn't the internet, but there was a satellite. Since they had a site, I convinced them that they had to send their data with the satellite and, in the meantime, would you please give us a few channels. So we were one of the first places in NOAA, anywhere in NOAA, where our data was coming right in real-time to Boulder through the satellite link. So we'd send it up with the satellite, send it over, and they would drop it down into Boulder and also down into Hilo. So we got rid of the big strip chart recorders. Then computers were just coming in, so we would take old computers that people weren't using at first. A lot of the instruments don't need a big computer; they just need to chart time, date, temperature, pressure, and one data point. So all your old Macs and stuff [that] people were getting rid of, we took and hooked them up to the computers and then sent the data. Then, of course, later on, there was a revolution, where we all got new computers and stuff like that. But we fortunately had a young Hawaiian who had grown up in Hawaii and worked at the Mauna Loa Observatory since he was a student. He was a computer whiz, and he took that all over. Darryl Kuniyuki is now the Director of Mauna Loa Observatory.

MG: In 2020, you stepped down as deputy director. What have you been doing since? What has your role been since then until just the other day?

RS: I went on to kind of a partial retirement two years ago. Since then, I've been just finishing up different projects that we had. But I was also writing papers, of course, and doing work, a lot of it in oil and gas fields. We started to notice that methane was going up and that was just when all of the fracking came into the US. So everybody thought all the oil and gas fields were causing the increase in methane. So we got quite good funding from a lot of different agencies and oil companies. Again, serendipitously, I met a Canadian who was the deputy director of a huge gas field in Utah. People were blaming them for putting out the methane. So he gave us a few million dollars and another group in NOAA [gave us] a few million dollars to see if that was really true. So you went to Uinta Basin, and we ran two seasons of maybe upwards of forty people conducting measurements on the ground and with aircraft in there in the winter to see how much pollution was coming from the oil fields. The first year we did it, it was windy all spring, no snow, and there was no pollution because the pollution would get in this valley only when you had temperature inversions in winter. But the second winter we did it, beautiful temperature inversions, huge amounts of ozone were produced that were way beyond legal limits for people to work in across the whole fields because the temperature inversion in this Uinta Basin would hold all the pollution in. There was snow on the ground. Sunlight would come down, bounce off the snow, cook it, and make huge amounts of ozone. So we developed a system to measure the ozone without flying. We put our instruments on balloons on a huge deep-sea fishing rod – motorized. So we'd press a button in the balloon, and the instrument would go up a thousand feet or more, stop, and it'd get above the layer, clean air, and then we'd bring it back down up and down all day long. We did that in two different places. We would monitor the production of the ozone and when it went away, and we got a lot of good publications out of that. Also, the other groups together, we figured out – the other group from the Chemical Sciences Division in NOAA figured out what was producing the ozone. It was kind of a new process that we hadn't really known. But initially, I had discovered this ozone production in winter. In winter, you never really measured ozone because the theory said you couldn't produce ozone in winter. But the sister of a friend who was working for us told him that

they had huge ozone up in the northern Wyoming gas fields. She was willing and sent us the data on it. I had a student who had won the NOAA science fair somewhere in the east, I think North Carolina, and his award was to come to NOAA for a summer – he was still in high school – to work with NOAA scientists. They asked around, and I said, "Sure, I'll take him," because I was involved with science fairs a lot. He came there. The week he came there, I didn't know what to do with him. He was a smart kid. He was very computer literate. So I gave him all this data from the basin in Wyoming and said, "Plot the data by time and day." He started plotting it, and you could see the ozone was going up starting at ten in the morning, would peak at two in the afternoon, then go down at night. And that's not a natural process. That's something – and it just every day [was] the same. So it was obviously driven by sunlight. So we worked it out a little bit and figured out that, again, in winter, all of the pollution from the drilling – hundreds of oil rigs and vehicles and everything – was putting out all this stuff that the sunlight was then coming down through, bouncing off the snow, and causing the ozone. We published this in *Nature*, and this high school student got a first publication in *Nature*. He came back eventually to CU [University of Colorado] and got his PhD. And now he's a professor in a very prestigious university in the UK [United Kingdom]. He was a very smart student and very nice to work with. He knew how to plot data in many different ways. We figured that out within about a week and a half what was going on.

MG: And you could extrapolate that to other places?

RS: The Uinta Basin was having the same problem, and they didn't know really what was causing it, and they didn't want to really know but then there were regulations coming in; you had to control ozone and methane. We got the money from them, and the Bureau of Reclamation gave us three hundred thousand one afternoon. I called in the morning, and by afternoon, they agreed to give us three hundred thousand because, again, I knew this lady was retiring, and she didn't know what to do with all the money she had collected. So she gave it to us to work, and that saved us. Then we hired planes – Scientific Aviation in Boulder – and we put instruments on there to fly up and down and through all this and get the picture how big it was. From the ground and planes, we were able to capture the whole picture very well.

MG: In your career, have you ever received pressure from lobbyists, politicians, or stakeholders to do or not do certain research?

RS: Stakeholders and politicians at times were sketpical, especially the governor of North Dakota. After we found this in Wyoming, there was a meeting in Denver, where a few people came, including the governor of North Dakota because North Dakota had huge fracking operations, as you know. I gave a demonstration of what was happening in Wyoming and in the Uinta Basin. I got a big bowl, literally a bowl about three feet across; it must have been used for people who were having catering [for] big parties or something. I said, "Okay, this is a bowl." And in the bottom of the bowl, I had a bunch of marbles. I said, "These are all your little oil wells, and they're putting out pollution. It's got to go somewhere. It's in a bowl. And then the wind blows across the top, and it just takes all the pollution out." Then I took a big piece of saran wrap, put it over the bowl, and said, "Okay, now, when you have an inversion, which means as you go up in the air, at a certain point where it gets warmer, then the air cannot go through that; it stagnates." And that's why you have pollution layers in cities in winters. I said,

"Okay, now, your pollution is sitting in there, the sun is coming in, [and] it's building up. The ozone has got nowhere to go. The pollution has got nowhere to go. It's trapped in that basin." He said, "I don't want to know anything about that. I don't want you guys to do any measurements up there. You are not allowed to come in." And he walked out of the room. So probably happening there, but nobody knows about it. Also, they almost shut that place down a few years ago because the price of oil went down to almost nothing. They never had a good pipeline to ship things out. The town of Williston almost died because oil people left and all the empty housing and stuff. I'm sure it's back now. He was one of the most highest-level people that I talked to directly that was very dismissive. But that also happened in the Uinta Basin. The Uinta County council – we also showed them the same thing, and they said it has to be coming in from outside, California's pollution coming in. They didn't want to know because they were getting huge amounts of money and taxes and severance fees and stuff like that. In Vernal, Utah – I don't know if you've ever been there, but it's a remote city, and it's got beautiful schools and swimming pools, indoor rinks, and parks are all amazing, and they've got a big research center all from that money. They were doing extremely well. But they didn't really want to know what was going on. But they didn't stop us. Eventually, we actually got to use some of their facilities. So, in the end, everybody came around, I think. We were just there to get the science as long as we were allowed to do our measurements. They couldn't stop us because we used public roads. Also, the Wildlife Service has a wildlife preserve right in the middle of it. So we did all our measurements from there. That way we could do whatever we wanted whenever we wanted.

MG: In 2010, you were getting a lot of awards and recognitions and an honorary doctorate for your work. I just was curious what that was like for you and if it was an opportunity to sort of measure and reflect on your contribution to the field.

RS: Maybe, but most of those came by surprise. It wasn't like you apply for something and wait. One day, like at Mauna Loa, the head of NOAA was coming for a visit. He came up there on a visit, and halfway through the visit, some food appeared – the staff brought food – and then he said, "Oh, by the way, you've got the NOAA Administrator's Award. I'm the administrator, and here's the award. Let's have lunch." Things like that. The same thing in Alberta. I went to the University of Alberta. A person that I had met was doing a story on rural Albertans and their accomplishments. She had approached me, and I wrote a story to go into this book that she was doing. From that, she got to know me, and she saw things. So she had written a nomination, sent it in, and it was successful. So they gave me an honorary doctorate. That was quite a big [to]-do because they did it at the graduation of the university, and I was the keynote speaker. I got to wear a big hat and a robe of many colors. [laughter]

MG: Well, I know there's things we've probably neglected to talk about. When you think back on your career, is there anything else that stands out? Any other projects, field programs, or stories you wanted to share?

RS: Yes. The singular most advantageous and noteworthy scientific invention was the discovery that living bacteria could produce ice nuclei, make water freeze at unbelievably warm temperatures, and they were probably doing this so that they could have food because the plants they killed they then drank the sap. But inadvertently, those nuclei got into the air and made rain that also fell on them to make the plants grow. It went from two people in the University of

Wyoming, a very unknown university, discovering something like that, to where now there's centers all over the world studying this. Myself and Dr. Vali, who was my advisor, have just finished a two-part history of how this all happened and the serendipity all the way along. We're probably going to submit it for publication in the next month or two. It's fairly long. So there's part one and part two. Part one is the early discoveries and what we did. Part two is the later discoveries and how other people have picked it all up. There's probably two annual conferences [inaudible] just on this every year. The next one is in Denmark in September, which I'll probably go to just as an observer; I have nothing new to say, but I just like to see what other people do. At the annual AGU [American Geophysical Union] meeting, there's always a section on just these nuclei. There's an aerosol conference every year, and there's another section on just biological ice nuclei there. But now, they're so sophisticated in what they're doing with molecular biology and gene splicing and stuff like that; they can take a sample and tell you how many nuclei are in it and where they came from just by looking at the genes that they left. We didn't even know about that when I was a grad student.

MG: Do you ever go back to that moment when you were cold and visiting your uncle and stepped into that government office and think about the other paths you could have taken?

RS: The University of Alberta has a large hospital. If you have a serious illness, you probably go there because it's one of the few hospitals at that time that would do that. I had an uncle who had cancer. He had been transported up there, and he was a patient. So one late afternoon, after classes and labs were done, I walked over to the university. While I was there [at] the University Hospital, which was maybe a mile from where I was living in a dorm at the university, a cold front had moved in, and it was exceptionally cold. I spent most of the evening with him because he was more or less in a hospice situation. Then I was walking back, and I was so bloody cold because I hadn't dressed for the time and I was [wearing] shoes that weren't adequate. There was a small government building that had lights on. I walked by the door, and it had a foyer. All the buildings have a foyer where you have an outer door, then you have an inner sanctum where you leave your coats and boots, and it's warm, and then you get into the building. So I went into that and sat down. I was shivering for a while. This place was doing government work, and they had twenty-four-hour guards. The guard saw me out there, came out, and said, "What are you doing here?" I said, "Oh, I'm coming to apply for a job." He looked at me, went back in, got a form, and gave it to me to fill out. I filled it out. They wanted to know what I was studying and what attributes I had. I put in there that I could fly a plane, and I was a good student, and I was from a farming community; I knew all about da-da-da. A few months later, I got either a phone call or a letter saying, "Please come over. We'd like to talk to you." I talked to one of the people who were involved with something called the Alberta Hail Studies Project, ALHAS. He said, "You're from a farm. You know all about hail. You know when it kills the farmer's crops. You can fly a plane. You've got good marks. We'd like to offer you a summer job to come and work on studying the hail. When, occasionally, we need to go out to look at hail damage, you'll fly a plane out, and you'll map it." Man, that was fantastic. A nineteen-year-old kid allowed to fly a plane, no boss – the boss was somewhere else – do what you want because all of the people working on this were from the UK or from McGill University. They knew nothing about [the] outdoors. They knew nothing about farms. They knew nothing about land outside of a university in a big city. So they said, "Go out. Take measurements. Here's a truck. Put instruments in it." It was unbelievable.

MG: I'm wondering if you ever wonder what would have happened if you hadn't stepped into that building, how your life would have unfolded.

RS: Yes. I was scheduled to go into medical school the following year. The Air Force was going to pay for everything and pay me a salary; it was a good thing. But in the meantime, I also won a scholarship for any university in Canada, all expenses paid, including transport and housing. So I thought, "Well, I'll put off going to the Air Force and the medical school just for a year. I'll go to the farthest university I possibly can in Canada, and it ended up being St. John's, Newfoundland, Memorial University, which happened to be, in fact, a very good university because Newfoundland for centuries was a colony of Britain. The universities were all British universities, and they paid the professors well to go over there, and they funded it well. So it was just still echoing because Newfoundland only had become a province of Canada in 1949. And then the university still was a British university because the professors didn't leave. So I got a very good education there. Then I came back to the hail studies. That's when the University of Wyoming, which had an aircraft program studying clouds, had been contracted to come to Alberta and do flights. I love planes, and I like freedom, and I like programs. The director of the air program said he was starting a graduate program in atmospheric science and would I come and be his first student. I said, "No, I'm going on to medical school." And he said, "I'll pay you." I said, "How much? Oh, like a staff? Like a faculty? Free tuition. Free travel. Are you sure?" "Yeah," he said. "Well," I said, "I can't come now because I just won another scholarship to any university I want to probably in the world. I'll come next year." So I put off going to medical school. I'd won a scholarship – I think I probably told you this before – from the Rotary Foundation, and they said, "Well, where do you want to go?" And I was a young country boy; I wanted to join the sexual revolution because no opportunities for that were afforded yet in my life. I wrote down "Sweden," but my handwriting is terrible. I wrote S-W, a vowel, and a couple more consonants and a vowel. When it got to the award office, the only place they could figure out was SW-vowel-da-da-da – "It must be Swansea. Where's Swansea? Swansea, Wales, okay. Schnell wants to go to Swansea, Wales. Here he goes." Swansea, Wales is a very conservative, very religious, very go to church twice on Sunday place, and the university is the same way. So, it put that on hold. But it worked out fine. I didn't get a lot of study there because I was working and doing other things. Then I got another scholarship while I was there through the British Union of Students to go to Russia for a month as a guest of Komsomol. So I went to Russia. I didn't do much study, so eventually, I went back to Wyoming.

MG: I would be eager to read that publication with Dr. Vali if you're able to share that at some point.

RS: I think it's more of a history than an ego trip. When we first did this work, we did it all in Wyoming. As I say, Wyoming is not known for being at that time yet a good center for atmospheric research because it had just started. When I was the first student, it wasn't even a department, really; it didn't become an Atmospheric Science Department until the second year I was there. So who knew about Wyoming? We did a lot of stuff that we never published on. So that all shows up in this group of papers. I'm sure people will look at it and laugh about some of the things that we did and didn't do there and how things progressed. A lot of people, later on, repeated what we had done without knowing what we'd done. Twenty years later, they're all

excited about an experiment that we had done twenty years earlier and just never published because it wasn't the central focus of what we were doing.

MG: I also wanted to ask about the last two years of your career, what you were working on and how it was impacted by COVID, and your personal experience of COVID.

RS: The last two years, I was only working two days a week. But that happened just when COVID started. So we couldn't go in much. I was doing two funded projects. One was – or one still is – when COVID started, a lot of companies in China and their subsidiaries in the US started advertising to sell instruments that produced ozone that killed bacteria and viruses, which they do. But they also neglected to say that you can't be around using his instruments because they produce such high ozone; it's going to affect your lungs. About that same time, I was working in the ozone group; we finished publishing papers. One of the staff, his mother and father had put one of these ozone generators in the crawlspace of their house to get rid of mold, and they hadn't closed the crawlspace. They turned it on in the morning and went away during the day. She came back. She'd thought they'd shut it off, but it wasn't; the house was full of ozone. Her lungs were burned. So I got some funding to test those instruments, but it couldn't be done because we couldn't go to the lab. So in about two weeks, we're going to be able to start that program. So I was collecting these devices; I bought a number of them. Very interesting – the FDA [Food and Drug Administration] has no control over that. There's no control over these devices being sold – or wasn't in the US. Because they were sold, you could use them for – at that time, it was to ozonate a room and get rid of smells and stuff. But there was no caution [about] how much ozone they produced. I was able to test some of these in my house. About halfway through the COVID time, companies started producing a bag that you put these in that has an ozone destructor. So you put your equipment in there that you're trying to deozonate – they were actually sold as CPAP [continuous positive airway pressure] cleaners. I happened to have a CPAP, so I would put my CPAP paraphernalia in there and then check it. But I suspect that their ozone destroyer, which is a little filter that's on the outlet of his box, gets overloaded very quickly because ozone was starting to come out. So they made this bag and sold it. But it was only probably good for two or three times, and then it was – so we're going to test all of that and then publish a paper on that. I got an extension of two years on that grant, but I have to be finished in June. So I got to get to work on that. Then I got money for something else. What was that? I'm trying to think. I'm spacing out, but there's another project I've got to finish. Oh, yeah. Back to the Chinese cheating on CFC-11. At the same time, there was a lava flow in Hawaii that cut out the road and stopped our measurements at a tower where this was discovered. So I got funding from a NOAA UAS [Uncrewed Aircraft Systems] program gave funding; I made a proposal, where we would take a large drone and use that to pull up a sampling line high up, equivalent to this, the height of the tower that we couldn't use any more in Hawaii, and then run a power line up to the drone, and just let it sit up there for hours and hours. Normally, you can only put a drone up for twenty minutes. But now we have a system with a tether to the powerline; it'll sit up there for a week if you want to leave it. It's such that it has the brain enough that it will turn into the wind. So with the wind picking up – and it's told to stay in one place, so it'll change the propellers and stay right there. We couldn't test that in Hawaii because of the travel restrictions and the restrictions on Mauna Loa staff not to get exposed. They can't go to the observatory. What do you do with all your measurements? But on May 23rd, we're moving the whole program out to Hawaii. The drone is out there. We're taking people out.

They've been trained, and we're going to start the program that week. And then I got to finish that program up by the end of June also and write the report. Another serendipitous thing. Along the way, these DJI 600 drones are fairly expensive, and there's not too many of them. But another government agency, the Marine Corps, had a couple of these super ones. I happened to find out that a person there I vaguely knew had two of these brand-new systems with the tethers – it's a real super one – that he didn't need anymore. He'd never unpacked them. He paid piles of money to get them custom made, and then they went on to a better – so, he took him out of his records and sent them to me personally. I gave them to NOAA. So now we have three of these really good "tow trucks," we call them, and we're going to be able to then use them to move onto ships off the coast of these countries that are cheating now on CFC 11. Nobody can stop you from measuring eleven miles off the coast. So we'll be able to hopefully use them on ships or small islands to pinpoint where this cheating is occurring. Another serendipitous occurrence.

MG: You sound very busy still.

RS: Yes. All pay for that stopped, but that doesn't matter. I'll still do it for a few months because it's so interesting.

MG: Well, I'm curious about your life outside of work and your family life. I know you have a number of hobbies.

RS: Yes. One is building little free libraries. I got started with that [because] my daughter asked me to build one for her in St. Louis, and I did that. It caught on. and yesterday, I finished, I think, number seventy-one. They're in every continent on Earth, except South America. The reason they're in all these places is because I used to fly so much with United Airlines that they would allow myself and my wife to take a hundred and forty pounds of luggage free. So we've taken them to Australia and set them on Aboriginal reserve. I got one right on the South Pole because I was responsible for that observatory and was there a few times. Got them in Wales [and] got it on Mount Fuji, Japan. One of the neatest ones is now in northern Uganda. There's a lady I met in the Boulder area who goes there once a year to teach women how to be midwives because there's no real hospitals there. This is in an area where a hundred and fifty young girls were grabbed by the Lord's [Resistance] Army and taken as sex slaves. Most of them never came back. Some did. So there's a school there started by a church. She took a library over, one that was collapsible. I made it and then collapsed it, and she put it in her suitcase. We sent two hundred pounds of children's books there in English because English is their main language in that part of Uganda, strange as it is. We've got pictures now of these kids getting their first colored picture book in English that they can read. The pictures are fantastic. The kids are sitting around with their eyes wide open. We also have a video of them being taught in English, trying to read these books. They've been unschooled for years. It's quite a mess. It's a very poor area. So we'll be sending more books there every year. She's going back in a few months, and we'll send a bunch of books as excess luggage on a plane because that's much, much cheaper than sending them any other way. You get fined. The airline is happy to charge you that, and you're happy to pay it because it's so much cheaper than sending it. That way, it gets through customs on the other end. It's a neat way of shipping things around the world.

MG: And a good opportunity to travel along with the luggage.

RS: Oh, yeah, definitely. [laughter]

MG: Well, is there anything else you wanted to say about the work you've done, your career with NOAA, or other memories you have?

RS: Oh, I'm sure there's a lot of them there. But I think you should ask the questions of things that would fill out your storyline. You must have questions. I'm willing to answer most of them.

MG: Well, we've spent about six hours answering my questions. I think I've gotten to the end of them for today. But what might happen is in transcribing our interview and giving you a chance to review it, other things might pop up. So we can tentatively plan to meet again if there are other things to cover.

RS: Yeah, I'd be happy to do it. One overriding activity or principle that developed, and you've seen it as it happened, was serendipity, and ability to change streams within an hour on a whim, and to take risks that most people wouldn't take, and people thought it was terribly risky. But I really knew what was going on ahead of time. It looked like taking a lot of risks, but they really weren't. In Russia, I knew what I was doing, and I trusted my friends on the other end. The same anywhere. There was a little smoke and mirrors in a few places, but there was a very good fire making the smoke.

MG: Yes. I think you weren't afraid to fail or to have something not work out.

RS: Oh, there were a lot of failures; you don't know, though.

MG: We've talked a lot about serendipity and these wonderful opportunities. Have there been big regrets or challenges along the way?

RS: Oh, one of the biggest regrets, of course, is not going to medical school, and not going back to my community to pay them back, or to have gone into the Air Force because I was in the Royal Canadian Air Cadets, which is a preview to going into an officer position in the Air Force. I would have probably – as I told you before, myself and another cadet were the first ones to spend a summer in Israel with the Israeli Air Force because we were pre-selected to go in to be leadership in the Canadian Air Force. The other cadet who was with me in Israel was younger than me, two years later in university graduating than me. So I'd have been two years ahead of him. All of the tests we were given before, I was quite a bit better than him in a lot of subjects, especially in people – I call it people interactions, people manipulations, whatever you want to call it – than he was. So I'd have probably been ahead of him, and he became a general in the Air Force, number two in the Canadian Air Force. I might have been number one if I hadn't screwed up along the way somewhere. So those are the regrets. I still visit with him occasionally. I go to Canada to meet with him and his family. Those are the two biggest regrets. They're regrets not that I didn't lose out, but I still was quite successful in other things. But you always have lingers.

MG: I'm also curious how your family life unfolded. Where did your children end up? Do you have grandchildren?

RS: Our daughter that was born in Kenya – we gave her a name in Kenya while we were there, Wanjiku, which was the name of the daughter of the patriarch who started the Kikuyu clan, and eventually, they became the leaders in Kenya. Then I took her back to Kenya, and people recognized her when she was twelve years old. "Oh, there's (Wanjiku?), who never cried." Because she grew up with no interaction with other children, when she started crying, we would tell her, "No, no, not allowed." So if it's not allowed, she didn't cry. She didn't know that other kids did, and that's how they got things done. She eventually went on to university at a very young age, fifteen or so; she was accepted because I didn't know you could apply to universities – you don't have to graduate from high school. They'll let you in. That's fine. So she went in. She was young when she graduated. She couldn't rent a car. She couldn't get a job. So she went into the Peace Corps for a few years in Bolivia and then stayed in Central America and ran orphanages for a while. Eventually, came back, went to school, got a couple of master's degrees, and then started buying real estate during the great real estate depression, where you could buy a very nice house for thirty to fifty thousand dollars. She'd fix them up and rent one room to a student for five hundred. So she had a forty-thousand-dollar house bringing in two thousand five hundred dollars a month, and her mortgage was three hundred dollars. She got fifty-two units now. Then she ended up marrying somebody from Washington University, who she had met years before. She worked at the university for a few years and then became a full-time mother and runs her real estate from home. She started the little free library, and then she had me build them for different schools in the area. A few years ago, she started a company called Eerie Babies, E-E-R-I-E Babies, with grotesque little heads of babies in different forms with horns and smiling and doing strange things. But she's doing very well in that. Our son was born years later, so we had two single children; they hardly knew each other because he was seven or eight when she left home. He did well in school like she did. He was actually a consultant for an oil company when he was an undergraduate, doing electronics for an oil company. Then he was paid to be a grad student. He got his Ph.D. in electronics engineering and now works for a company designing electrical systems for cell phones, and for computers, and for car computers. He's doing quite well. He makes more money now than I did when I finished in the government. He's also bought a few houses. He owns seven houses in the area that he rents out to people, generally not students. Actually, we are the mortgage company mostly for them because I didn't mention that I had a friend when I first moved here, the first week or two I moved here. He and I talked, and he wanted to get into real estate. So together, we cobbled together a little money, and we decided we'd either go totally bankrupt in a couple of years or maybe make some money. Fortunately, we bought a few apartment buildings, again in a depressed time. They worked out well, and now we own all kinds of properties around here, in Florida, and stuff. So we don't worry about income. He manages it. His family, his four children, three grandchildren, sisters are all part of it, and they do the managing of it. Some of the properties I've never even seen. There was something else you asked me that I hadn't told you about. Oh, grandchildren. Our daughter has two sons, ages ten and eight. Our son is not married. He was in a long-term relationship that ended a year ago.

MG: Well, I think I've gotten to the end of my questions. I want to thank you for all the time you spent with me and for all the information. This has really been so fun to talk to you.

RS: It's been fun. Oh, back to our children – our daughter is a spitting image of me in many respects. The son is very conservative. I sometimes wonder – he doesn't like traveling much. He doesn't like risk. He likes to follow the law exactly, and he loves Japan because everything works, everybody's obedient, the trains run to the second, the people are courteous.

MG: So is he a little more like Suan?

RS: I would say yes. She's listening in now. [laughter]

MG: You have such an impressive career and personality. This has really been a treat for me. I hope we can stay in touch. The next steps are the transcription, and that might uncover a few questions I forgot to ask, or as you read through, you might realize we left out some stories. So it's not hard to get together again and record an addendum.

RS: Yes. And I'm sending your daughter one of the little train engines I made. Maybe it'll ship out tomorrow or the next day.

MG: That's very kind of you.

RS: It's one I built a year or two ago, but I don't have time or energy to build them now because I've got six libraries sitting in my garage and out front that [has] to be done.

MG: You have your hands full. I totally understand. I'll send you some pictures.

RS: Oh, yeah. I'll send you some pictures of other kids who received little free train engines. Their mothers are usually more excited than the kids, but the kids do love them, too.

MG: I think she'll be thrilled.

RS: Okay. Have a good day.

MG: Dr. Schnell, thank you so much. Have a good rest of the day.

RS: Bye.

MG: Bye-bye.

----------END OF INTERVIEW----------

Reviewed by Molly Graham 6/5/2022
Reviewed by Russell Schnell 12/31/2022
Reviewed by Molly Graham 1/27/2023