Oral history interviews
collected during the celebration of the
50th Anniversary: 1965-2015,
Space Science and Engineering Center, University of Wisconsin-Madison.

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ZOOM11

David R. Cismoski
Linda Hedges

11 September 2015

6:44 minutes

Linda Hedges: Would you give us your name and the date please.

David R. Cismoski: Yes. David R. Cismoski. September 11, 2015. And I wanted to tell a couple stories about my stay here at Space Science and Engineering Center. I was the administrator of resources during the period April 1968 up to February 1975 when I moved to Colorado State University, Fort Collins, Colorado to become department manager of the Atmospheric Science Department. But during my stay here at SSEC there are a couple of interesting events that I wanted to record for the record.

One of them dealt with a situation that I encountered on the second floor of the building. And I don't remember the exact year or the month, but it was an interesting situation. I was walking around the floor, just checking the rooms and that, and I realized that there was funny smell that was in the air. And I recognized that smell as formaldehyde. And I said "Oh oh, what's going on here on this second floor room." So I went into the room and there was other rooms that were off of that and I went into the other inside room and here on a table that had a white cloth on it was a cadaver of an elderly gentleman and upon further inspection that cadaver had had numerous work done on the arms and the legs and on the muscles and on the bones. But there wasn't anybody in the room at the time. So upon a little further investigation I found out that one of the professors who was involved with some space science work in the anatomy department had run out of space in which to do his research, research being on muscle tissue and bone density, and had brought the cadaver over to SSEC, to my knowledge without permission, and had continued his work over here at the Center on the second floor, doing his investigations. Needless to say the cadaver was moved back to the academy department and the area was made whole again from my perspective. But that was a real kind of jolt and it wasn't anything that I would want most people to see.

The second story is more personal. I can actually give you some dates on this because it had to do with the birth of my youngest daughter, Cheryl, and this actually occurred in that would be 1969. And it on was December 20th that SSEC was having their Christmas party at one of the hotels on the Capitol Square. And we were just having a great time, you know, dancing and having a few drinks and socializing and partying and my secretary, Kathy Rudibush [spelling?], I'm going to give Kathy credit for this because she was the one that kept a level head on this. She got a call from my wife, Shirley. And Shirley was expecting, not quite this soon but you know when things happen, like your water breaks, you've got to move quickly. And Kathy took the call, came over and got me and of course I wasn't in the best of shape at that point in time, dragged me over to the bar, and had a couple cups of coffee poured immediately, made me drink the coffee, took me by the arm down the stairs, onto the street, pointed to where my car was parked in the parking lot, and says "go get your wife." And that's exactly what I did.

Now we lived in Monona, so it was a little drive from the Capitol Square to Monona and then back to Saint Mary's Hospital, and I believe that was on Park Street. Anyways we did make it and Cheryl Ann Cismoski was born on December 21st, early in the morning. And of course, if I remember right, that's the shortest day of the year but it was the longest day of the year for me.

So those are two stories that I just wanted to put into the record, completely different. One that dealt with a gentleman's decision to have his body used for science, which is death. And the birth of my youngest daughter, which is life. And something for the record. Thank you.

Linda Hedges: Thank you, sir.

David R. Cismoski: You think that will work? [laughs]

End of audio.

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Dave Jones
Tony Wendricks
Jaclyn Lang

September 2015

35:06 minutes

Jaclyn Lang: Ok, so the recording has started. You name and your position.

Dave Jones: I'm Dave Jones. I've been working at Space Science since February of 1978. As I think was related during the talks yesterday, the building was half empty back then. I mean there was a lot of empty rooms in the building. You could just about stake your claim anywhere. What else?

Tony Wendricks: Alright. So what are some of the things you did, Dave? This is Tony Wendricks, again. [laughter in background]

Dave Jones: Well, I started out as a student employee. In fact a friend of mine in one of my classes told me there was an opening. Mark Shawyer [spelling?], I don't know if you remember Mark Shawyer. He used to work here.

Tony Wendricks: Yes.

Dave Jones: He told me there was an opening here. I almost didn't even apply for it because there's no way I'm going to be able to get hired at Space Science and Engineering Center. Well, I came in anyway and he told me to see Leo Skille who was one of the other former electronics techs that became building managers. And little did I know that he wasn't looking for somebody that had all these academic attributes. He wanted people that were good with tools and people who just were willing to work in any area and try anything. What did he say? He used to say "self starter." He wanted a motivated, self starting type people. So somehow I guess he thought with all the other previous job experience I had that I was worth hiring so I got hired here. I was on the student crew doing all sort of random jobs around the building. A lot of it was with the GOES antennas because at that time we were building more feed assemblies and things. We were switching over to transistorized equipment in the feed assemblies so we were actually building new feed assemblies. We were doing a lot of antenna maintenance. And so that how I kind of got my start in the antenna business which now I'm the, at this point the only person that

Tony Wendricks: How many antennas were here at the time?

Dave Jones: There was only two. Yeah, good point. Only two on the roof. The big ones on the southeast and southwest corners.

Tony Wendricks: What's the census now on the antennas?

Dave Jones: Let's see. There's one, two, three, four, five, six, seven I think on our roof. Plus one down Orchard Street and one over on Engineering Research Building. We filled up our own roof and had to start putting them elsewhere. So that's sort of was my connection into the antennas which has now grown to where I'm the, at this point, the sole person that knows anything about the antennas. Worked with the McIDAS systems. Worked into that building and testing equipment connected to the main frame. A lot of it was ingestors and data processing equipment, the data that came from the antennas as well as some of the other equipment that connected terminals to the main frames. Worked through all of the phases from the Harris computers to the IBM main frame. We built systems here. We at the time had control over all the hardware and software so we had control over the whole product. We would build, test, integrate systems and then pack them up and send them. We'd install them at NASA places, at NOAA places. We did some private companies like Federal Express.

Tony Wendricks: Where were some of the places you traveled?

Dave Jones: Well, I've been to Johnson Space Center, Cape Canaveral, National Hurricane Center in Miami. Federal Express, we did a system for Federal Express in Memphis.

Tony Wendricks: The Federal Express one. I remember was very impressive in that they were able to save more money in the fuel savings by using jet streams, the air currents, tail winds I guess is the term, in a very short period of time, six months maybe. They recovered the cost of the McIDAS systems. That's my recollection. There was something like that.

Dave Jones: Yeah. I remember hearing a similar thing. That and just being able to judge if they had a window to take aircraft off quickly if one was coming up. Yeah. I heard that, too. A lot of things in places like Washington, the World Weather Building. I got to take a trip to Australia to record satellite data because we were building an ingestor for the Australians and we couldn't see the satellite so I packed up some of Rick Suomi's tape recording equipment. Shipped it down there. I went to Spain. I went to Madrid to do an upgrade and training on their main frame connected stuff which is still in the IBM era. And then we kind of drifted away from building our own hardware. There came a split where the decision was to make McIDAS pretty much a software entity and buy stuff off the shelf. So it was at that time when I was getting fairly slowed down in my work responsibilities that this ADR Salt Pill project came along and so I was kind of drafted to be part of the crew to figure out how to make it, what to make. I remember Tony and Mark and Bob Paulos and I forget who else was in that first meeting but just trying to figure out what Dan McCammon wanted and how we were going to do it because we didn't have any idea how we were even going to build this thing. It was a case of just brain storming.

Tony Wendricks. And nobody saying "I don't think we can do that." But everybody thinking that. No one wanted to be the first one to say that. And that's how it worked out. Ken Bushane [spelling?] was the designer draftsman from Bit Seven at the time.

Dave Jones: Yep.

Tony Wendricks: And I'm not sure, was Mike Geen [spelling?] in that meeting?

Dave Jones: I think he was. Yeah.

Tony Wendricks: Yes. There was a very limited number of people but it was just beyond me how we were going to do it. But I wasn't going to say. I was not going to be the one to say we can't do it.

Dave Jones: Yeah. Well I had "don't know" squared because I didn't even know what I didn't know at that time.

Tony Wendricks: But then a key element because keeping those wires, one thousand six hundred wires, separated in the cylinder that is seven or eight inches long and what? Two and a half or three inches in diameter? The key element was Ken Bushane coming up with perforated stainless steel. And it had to be stainless steel because the crystal we were to grow in it, which was ferric ammonium alum, would attack most metals. Gold or stainless steel were OK.

Dave Jones: Not to mention it was in an acid solution.

Tony Wendricks: Yes. That's right. That's right. So perforated stainless steel sheet and Ken knew of that. And then when you looked in a McMaster-Carr there was any number of holes per inch so we picked on that was closest to getting us the number we needed and that's when we turned Dave loose. He's wearing glasses now because of this project. [laughs] [laughter in background] You go ahead, Dave. Tell them about stringing those wires. That was the major effort here.

Dave Jones: Yeah, well I guess I was the one that was going to handle the wire even though they were thermal conductors, not electrical conductors. I remember hearing about how the density of the wires and at one point the idea was kicked around, maybe we could come up with a series of little plates that would have notches in them that we could fill a layer at a time but that was kind of tossed aside. And yeah, then I didn't remember it was Ken that came up with the perforated sheet. But then it was just a matter of basically like threading a needle once we got the gold attached to the proper things on the one end and so then we decided

Tony Wendricks: What was the diameter of the gold, Dave?

Dave Jones: That I don't remember.

Tony Wendricks: Very small. Hair-like almost.

Dave Jones: Yeah, it was almost like a hair. Yeah, it was, I want to say maybe eight mil but I'm not sure of that number.

Tony Wendricks: I would have guessed five, but somewhere in there. It's just memory you know.

Dave Jones: Yeah.

Tony Wendricks: But Dave kind of glossed over that. Threading a needle through these holes. One thousand six hundred times. On each end. And then having them connect to specific spots.

Dave Jones: And having to alternate a wire from say the input mechanism with a wire from the output mechanism. Because the crystal had to first charge itself from the cold source and then pay that cold back out to the sensors. So they had to be alternated so it was all uniform throughout the crystal. I remember we were kicking around an idea for how we were going to attach the ends when they got strung through there and because I had been involved with some of the early McIDAS circuit boards, we used a thing called wire wrapping where the wire would wrap around a pin on the bottom of a board. And I had my wire wrap gun and so what we did was made a little plate that fit behind the back end of the wire arrangement and then I wire wrapped all those. So I'd string a wire through each end. Pull it tight. Put it in my wire wrap gun. Wrap it on there so each one was pulled through and wrapped down tight so they were pretty much taut. There would be a little slack in them but they weren't supposed to be touching each other if possible. So that was probably a good week's worth of long days, getting those wires strung. And then another problem we had was now how are we going to attach them to the back plate, the perforated plate. And that also had the problem of having to be able to withstand the salt and the acid. So I remember this Stycast epoxy which somehow somebody knew that was a glue that was going withstand, I don't know, maybe the earlier non-metalic versions of the salt pill I think used Stycast epoxy. So when I got the entire thing strung full of wires then I just put a layer of Stycast epoxy on the back sheet of perforated metal and then when it was hardened the next day you just trimmed all those wires off.

Tony Wendricks: There was a step in between there wasn't there? The heat treating?

Dave Jones: Oh, yeah yeah yeah. We had to

Tony Wendricks: We had to heat treat those after Dave had strung them because they had lost their what? Conductivity.

Dave Jones: Yeah, the conductivity. The flexing of the wire, the more it was flexed the more it effected the conductivity so the wires had to be reannealed again. I still remember when we took that first one down to Physical Sciences Lab in Stoughton where they had a big oven that we were going to anneal. And a couple of the people just saw that thing full of wires, because it wasn't in the can yet, it was just the two plates and the jigs. And they saw those wires and they were just like wow. I've got pictures of that still on the SSEC web site. There's a ADR Salt Pill pages.

Tony Wendricks: That's right.

Dave Jones: That's got pictures of the work in progress and finished with the gold wires. It's got the can. And then we had, well you were involved with building the can, having it made, having the

Tony Wendricks: That was how we got this project. Because people at Goddard had been trying to make these sealed up, it's a second stage of a refrigerator. But it has to be sealed up, hermetically sealed up so that the crystal does not get any exposure to the outside air. They were never successful because they used epoxies and glues and friction fits. Tight press fits and the like. But they always leaked which deteriorated the crystal which would lower the lifespan of the instrument. At any rate, Dan McCammon from Space Physics was at a meeting and he heard about that and he came up with this scheme of welding and braising and silver soldering. And it was some very intricate work. The PSL welders were involved. I got to carry that can around. I call it a can, but I mean instrument really. But anyhow I go to carry that because it was going to be a spaceflight hardware. When we were doing it really wasn't the lead, it was a back up. Which was an unusual situation in itself because the Goddard people were still hoping to see it went up. But NASA Goddard in a very unusual protocol had us make a back up for their back up. Which our back up because the flight model. Because they didn't succeed in fact. Anyhow, they had been at this for approaching ten years. When we got it it took us six months to come up with the first one. But all of those joints on the top were fantastic welding, and braising and everything else. And I had to carry it and watch it, make sure that it wasn't mishandled, wasn't dropped or anything of the sort. Every time it would get gold plating I would drive it to Chicago. Sometimes I would stay overnight and get it there and have them

Dave Jones: Well it was more than gold plating, too, because the thermal conductivity of the stainless steel was not very good so they had to plate copper strips all the way along the length of the can, all the way around so that the temperature.

Tony Wendricks: That was the outside.

Dave Jones: Yeah, so it was more thermally conductive that way so you had to lay out and work out to have those plated onto the can first before you had the whole thing gold plated.

Tony Wendricks: Just as Dave's wire wrapping experience at the Center came into play, my printed circuit layout came into play with that because I actually taped it up with printed circuit type tapes and then had it plated so that the copper went in the right space and the copper was separated, they were just strips, they were separated and they could not contact each other because they would make something called an eddy [eddy?] current, I can say the word, I don't know what it is. At any rate, Dan McCammon was always cautious about it. And every time he asked for something like that one of us could accomplish it. It was a fun thing to do. It was one of the highlights of my time here.

Dave Jones: Yeah. I remember another thing that we had to do was test the thermal conductivity of that wire with an electronic test. And we had to test that beforehand and after and I remember he

Tony Wendricks: "We" means Dave.

Dave Jones: and Dan McCammon ended up preferring that we would do that testing rather than his students because he thought I guess we did it a better, faster job on that. And so then once the can was constructed we had to grow that crystal inside of it. So if we had a camera. We can use this as an example, but so we had similar to this only the wire wasn't the same but we had a can that we couldn't see inside of and we had to grow a salt crystal by injecting solution every so many hours pulling off the depleted solution, mixing a new batch, putting it in there. And we had to be careful that the crystals didn't form too far up on the wires and cause voids inside there.

Tony Wendricks: I want to interject one thing, Dave. And when Dave was stringing those wires he left two columns that were what? Less than a half inch, they were like three eights of an inch

Dave Jones: Yeah, quarter inch probably.

Tony Wendricks: Quarter inch. So that we could put the solution in all the way to the bottom on either side. Put it on one side, take it out on the other. Or either one. And he had to leave that space when he was stringing the wires. Go ahead Dave.

Dave Jones: Yeah, so then we had to grow this crystal and grow it slowly, uniformly without causing a void inside or a pocket of solution because that could cause it to fail or degrade the operation. So what we did was we were over at Space Astronomy and we spent I don't know how long, weeks over there, practicing figuring out how we were going to do that. We wrapped this in foil so we couldn't see the inside of it. And that's how we practiced our techniques and I think we grew a crystal in there twice. We'd finish it off. We'd rinse it out. We did it again.

Tony Wendricks: To grow that crystal it took twenty four hour operation.

Dave Jones: Yeah.

Tony Wendricks: Was it every six hours?

Dave Jones: Yeah. And seven days a week, too. Come in on Saturdays and Sundays. I know with the salt pill it was the longest continuous string of days that I've worked at Space Science. I think I worked like twenty days in a row.

Tony Wendricks: I guess I never kept track of that but I'm sure I did the same thing.

Dave Jones: Yeah, because we both would come in on the weekends and do our

Tony Wendricks: Mornings and nights. Afternoons.

Dave Jones: Yeah. Mornings and nights. And so rigged up this little light here and we could stick it down inside the pill and then we'd look in there to look at the condition of the wires as to whether there was crystals growing where they shouldn't be. Just kind of inspect the surface. There was just a lots of little gizmos that we thought up and used.

Tony Wendricks: Innovation. A bore scope was too big to go in.

Dave Jones: Yeah.

Tony Wendricks: Or anything of the type, that we had.

Dave Jones: Yeah, I remember thinking a one point about maybe using one of those peep holes from a door, if we could rig that up somehow. But that didn't work.

Tony Wendricks: Well, I know of a new one now but ____________________ but that's a whole different things. Those would be much more expensive than what you came up with. Anyhow that was quite a process to learn. Quite satisfying when we got done. And then Dan McCammon had a way of weighing this crystal to see if it was solid. And I don't remember the numbers but he was always very impressed with how solid a crystal we had grown. And that was the whole goal of what we were to do. That was pretty neat. That was pretty neat.

Dave Jones: Yeah, I remember he was always encouraged by what we did and he encouraged us. So then came the final weld. We had to be careful even how it was, how the caps were welded on those holes on the end because

Tony Wendricks: to close up the holes we were using for the fill ports

Dave Jones: because he could have destroyed part of the crystal. So I don't know, you worked with those guys at PSL

Tony Wendricks: In order to do that we got an old metal trash can. Filled it with ice chips and water. And submerged it almost to the rim. We also had to put thermal couples on the end. There was mounting holes on the end. So we mounted some thermal couples around that ring. And had to record the temperature that those thermal couples got to. Because, what was the temperature that if the salt crystal would get to it would deteriorate?

Dave Jones: That I don't recall.

Tony Wendricks: It was not very high.

Dave Jones: I just remember the operating temperature. Sixty milliKelvin or below

Tony Wendricks: Sixty milliKelvin. That's very near absolute zero.

Dave Jones: Yeah.

Tony Wendricks: That's minus like four hundred or something degrees.

Dave Jones: When we were testing it over at Physics, for a while we had the coldest known place in the universe because we were measuring this device working lower than the temperature was speced for which was sixty milliKevin. It was lower than that. I mean theoretically we knew there was a lot colder places in the universe but we had actually measured and proven. We had the coldest known place in the universe.

Tony Wendricks: Yeah.

Dave Jones: And I sent Tony an article about a year ago of some other

Tony Wendricks: Somebody had beat us.

Dave Jones: Some other project had done a colder, measured a colder temperature.

Tony Wendricks: If I remember right that puts it in the minus four hundred and fifty degrees Farenheit.

Dave Jones: Yeah.

Tony Wendricks: But, the cylinder itself could not go over like a hundred degrees? There was some number. I wish thought to look it up before. So when you're welding on it that generates a lot of instant heat. Anyhow, we put it in that ice bath and the welders

Dave Jones: Those guys at PSL. Those welders and braising guys.

Tony Wendricks: John _____________ [Sane?] and Ron Smith.

Dave Jones: Yeah.

Tony Wendricks: Fabulous job. Fabulous job. And then the machinist out there that we worked with at the time. His name escapes me right now. But he was an instrument maker. He just dialed stuff in. In fact one time when ours actually became the flight unit, when they decided that the Goddard one was not going to work, they took ours off the shelf and they went to use it but the fill ports, the stem on the fill ports, we had a little riser on the end of them, was too high. Somehow I don't know where that came from, where that spec didn't include cutting that back or something. But anyhow it was too high. So they had to be cut off and then rewelded. But since it now was The Flight Unit that they were counting on and we hadn't made the spare yet, they sent it back here. They sent it back here and they came with two or three of their quality assurance people with it. And they took it out to PSL. Tim Saylor [spelling?], that's the machinist. And Tim Saylor on one side of his machine running the dials, cutting that off, making a new flange for it to fit into. And all of these guys standing on the other side. I was there. I don't know if Mark was there, but I know there was five or six people watching him. If you've ever had to do something that's very precision and have five people watching you.

Dave Jones: Yeah.

Tony Wendricks: And he just did it like was a concert and he was the maestro. His hands were going across that machine. It was beautiful. It was beautiful. But that was the kind of workmanship those guys put in.

Dave Jones: Yeah, they were as much a part of the innovation and success as we were.

Tony Wendricks: Oh yes.

Dave Jones: They really did a lot. So then we built another exact identical unit as a flight spare. Then once we had pioneered the first way then it was just kind of, we had documented how we did everything. And we got in a rhythm there because I think ultimately I think we built five of these things. And I don't know in how many years time.

Tony Wendricks: Well, the reason we built five, well there was two them for airplanes right?

Dave Jones: Yeah. Those were eight hundred wire ones. Three sixteen hundred wire.

Tony Wendricks: Yes, but the sixteen hundred wire ones. Unfortunately the first one didn't make it into orbit. So what had happened is it was to be launched

Dave Jones: From Japan.

Tony Wendricks: from Japan. It was a Japanese Space Agency collaboration and they had the launch vehicle and their second stage rocket had a burn through on the side. Now, I wasn't at the launch but there was a web cam that refreshed itself every couple three seconds or something. And I was watching. And it went up and then it kept up, up, up. All of a sudden it canted over at an angle of, I don't know, a hundred twenty degrees or something, maybe a hundred degrees. And I thought, well, good it pushed it into orbit. And that was end of what I was watching on that web cam. Came to work the next day and heard that no, that was a failure in that it had made one lap around the earth and "Baluch" back into the Pacific Ocean.

Dave Jones: Yeah, but that was

Tony Wendricks: So then when they went to do this the next launch a couple years later they wanted a spare for that one.

Dave Jones: Yeah. But that first launch was back, at least for me, I only had dial up access to the internet back then so I couldn't watch that streaming thing. I tried to watch that streaming video and I couldn't. So I didn't know until, I don't know, maybe it was the next day back at work. I don't know if it was on a weekend. I don't remember when the launch was.

Tony Wendricks: Yeah, the next morning.

Dave Jones: Finding out that oh, it didn't make it. And it was so disappointing because the one thing I always wanted to be able to say is I had had something in my hands, I had built something that was flying up in space. I wanted to be able to see it go overhead, you know. And then to find out that it crashed into the ocean was just a real bummer.

Tony Wendricks: Is this the forum to tell where David planned to get the track of that satellite? And invite me and others with a six pack to watch it go overhead? [laughter in background]

Dave Jones: Yes. Because I do that. I still do that. Now there's a website where you can put in your location. You can put in where you are and the date and it will tell you all of the satellites that are coming over. Where to look. What time they're coming over. In fact the one that is in orbit right now is on that database but it's so dim I have never been able to see the thing yet. I still have hopes to maybe someday see the one that's actually flying. But so the first one was a big disappointment and then

Tony Wendricks: It certainly was.

Dave Jones: So we had this flight spare that was sitting somewhere for a long period of time, a year or two. And then we get word that oh, this project has been resurrected and they're going to try and fly It again. So then we, at that point I guess our flight spare became the main one and we built another flight spare. That one was launched and I've still got a picture of that up on my cabinet of the launch of that rocket. And it went up and it made it into orbit. We were happy. Now it's up there and it's working. And then we found out a couple days later from Dan McCammon that the first couple cycles that it worked better than what they had written the specs for but the thing that made this part we made work was a big Dewar, like a big thermos bottle full of liquid helium and because the liquid helium was what would charge the cold in this thing. So what this satellite had in it, which sounds really bizarre, they had this big giant thermos bottle full of liquid helium, which is one of the coldest things you can have. And to keep it cold, it was encased in a chunk of solid neon because like dry ice, neon is even colder than carbon dioxide. So I just imagined this thing up there with a big thermos of liquid helium encased in solid neon and I thought I wish there was some money to work with. I would have loved to have had them put some tubes on the side of that so as the neon evaporated off they could have lit that, had neon lights on the side. That would have been awesome. [laughs] [laughter in background] So you've got this thing out there with a Dewar, basically a thermos, and something happened with the Dewar. It got a thermal short in it so that it lost its insulating capacity. And it a short order it boiled all of the liquid helium out of the container. So now the rest of that instrument is still working, it's still orbiting but our thing only lasted a week or so. Right? Something like that.

Tony Wendricks: Something like that. Two cycles is the thing I've heard but I don't even know what a cycle is.

Dave Jones: Yeah. I don't know how long

Tony Wendricks: Unfortunately it's not a year's cycle.

Dave Jones: Yeah.

Tony Wendricks: So one of those, I don't know which one it was, but I got to deliver it. I got to hand carry it to Goddard. Because, as I said earlier, it was not to see a temperature over, I'm saying a hundred but I don't know what the number really was. So consequently I got to carry it, hand carry it. It was a nice trip. But the interesting thing is, can you imagine what it's like going through airport security with a cylinder that is, well it's all gold with some copper rods sticking out of it. ______ gold plated copper rods. But for all practical purposes you know you could make a bomb that looked like that in a heartbeat.

Dave Jones: Yeah.

Tony Wendricks: Well, I got through airport security easier with that than ever without it. Because Space Science wrote a letter. We contacted the security guys there, the checkpoint there. And instead of going in a line I went right over to the head of the line, to the side of the line, and passed right through. Didn't have to show them anything. So, it was interesting.

Dave Jones: So, you remember what year that was, the successful launch. I don't remember. I think the failed launch I want to say was about '96 or '7? Maybe it was later than that.

Tony Wendricks: Dave, I can't remember.

Dave Jones: The successful launch is after 2001 or not. Going through airport security would have been a lot

Tony Wendricks: Yes, it was right in that timeframe I think.

Dave Jones: Yeah.

Tony Wendricks: It was right in that timeframe. Beginning of that stuff as I recall. Because somehow I think we were working on these until 2003. But I'm not positive.

Dave Jones: Yeah.

Tony Wendricks: That's my. But I think it was right in the 2001 era. Interesting stuff. Fun project.

Dave Jones: Yeah.

Tony Wendricks: Fun project.

Dave Jones: Yeah, it was. It was probably as fun and challenging and interesting a project as I've ever worked on here because it was just all stuff that I never knew before.

Tony Wendricks: Yeah, what it really brings home to me is things that were said yesterday. That Space Science is a place that turns people loose and lets them do what they can do. And the attitude of the place. Attitude of the people doing it. They can do. Whatever it takes to do it. That's pretty neat stuff.

Dave Jones: It was that way when I came here and it's an infectious thing that I think just keeps getting passed through.

Tony Wendricks: Absolutely. But that was the peak of it for me.

Dave Jones: Yeah.

Tony Wendricks: That was the peak of it for me.

Dave Jones: Yeah, it was for me too because we wrote the rule book the first time we built the thing. I mean anything other thing I've done here there's already a rule book for it somewhere. Interesting.

Tony Wendricks: Alright, Dave. Good job.

Dave Jones: Well, thank you Tony

End of audio

Oral history interviews collected during the celebration of the
50th Anniversary: 1965-2015, Space Science and Engineering Center, University of Wisconsin-Madison.

ZOOM0013

Ron Koch
Sarah Witman

September 2015

8:58 minutes

Ron Koch: Are we going?

Sara Witman: Yeah.

Ron Koch: Alright. So my name if Ron Koch. And I have a few, I guess of the best memories I have of working at Space Science. A couple of them were when we were developing the control system for the WIYN Telescope in Tucson, Arizona at Kitt Peak. And one of those would be the first time we started up the control system and commanded the telescope to move. And the telescope began to move very slowly and it overshot its target by like twenty degrees or some huge error. You know. But it did gradually slow down and turn around. The feedback was working. And it turned around and it came back and it overshot a huge amount in the other direction but not quite as much. And so it was just a ringing by a large amount slowly coming back in. Management was not happy because of the huge error and it wasn't precisely tracking and quickly pointing but I knew that that was just a matter of tuning at that point. I knew all the hardware and the software, an incredible amount of stuff, had to all be working correctly for that to happen. And so it was just a culmination of that project for me. It was one of my best days.

And then related to that, later on that same telescope and that control system there was a shimmy that would happen in the telescope when it moved. And I had designed the encoder board. It was an electronics board that interfaced the feedback sensors for the telescope, interfaced that back to the control computer. And it was pretty well agreed that something was wrong with that board, that it was missing counts or something. And so we spent a lot of time looking at the board, trying to analysis it, get it to mess up. But the design in the end was vindicated. The board was checked in several different ways and it was vindicated that it was catching every single count. And the culprit turned out to be some residue that was on the encoder track that was making the wheel on the encoder slip. And so all that needed to be done was to get out a scrubby pad and some cleaner and clear the goo off of that track. And so for that design to be vindicated, that was another one of my best days.

And then the third story I have was on the enhanced hot water drill for the IceCube Project. And we needed to get the hose that delivered hot water to the drill and the cable, the control cable that transmitted power and communications to the drill head, we needed to get those pay out at the same rate and go down the hole together without feeding in too much of one and then having it get tangled up in the hole or whatever. And we also wanted most of the weight of the drill head to be support with the cable, not the hose. And so these are two totally different media. The hose is like three and a half inches in diameter, the cable is only about an inch in diameter. They're being paid out from two completely independent reels. The two motors, the two different gear ratios. And so I came up with the algorithm and the equipment to do it and then a student named Ted Schultz implemented that algorithm and these motor drives that communicated back and forth to each other very rapidly. And we figured out a way to simulate this, to drag this hose and cable out into a field under a great deal of tension. And we ran the test and it was unstable. The hose first sagged and dropped to the ground, the arc of the hose and the cable. And then they backed off and it came, it overshot in the other direction and came way up and got almost taut. And then it went down and dragged on the ground again. And then it was coming back even faster and it was going to overshoot and possibly like damage equipment, tear the hose, you know, do bad stuff and so it was I hit the emergency stop to shut it all down before it did that. And then Ted went in, tuned his algorithm, and we tried it again. And the hose and the cable paid out perfectly together. It almost looked too good, like it was just an accident. And so Ted ran out of the building and he jumped on the hose which there was a sensor that measured the tension in the hose and he was able to pin it down on the ground as it's still feeding out and then when he got off the hose and it came right back up to the level it was at before and just kept paying out perfectly. And it went to the South Pole and drilled eighty holes for IceCube that way. So that was a great day.

So then I got a few other little remembrances. I remember an engineer here named Rob __________ had some periodontal surgery so he was off work a few days, very tender gums, teeth and jaw from this work. And Dave Jones, a technician and friend that worked with him, was good enough to put on his desk for when he returned a little box of jaw breaker candies. [laughs] When he got that, so he could see those.

And then Dave and my supervisor. Bob Oelkers, he was out for a while. He had a hernia repaired. And so for his return we took about half a dozen Sola transformers, they used to be used on the McIDAS workstations and they're made of iron and cooper transformers. They probably weighed about seventy pounds apiece. And we put a half dozen of those on the floor of his little corner office so that when he came back with this freshly repaired hernia he could spend the day tripping over those. [laughs]

And then there was one that was played on me. I was getting my mail out of the break room when John Roberts was in there getting coffee. And I had gotten my phone list. Every month we got a phone list. Every month they were on a different colored sheet of paper so you knew if yours was up to date or whatever. And my phone list was there and I looked at it and I commented "yep, I still work here." And I explained to him that since we'd started direct deposit paychecks and so on, I said that reading my name on that phone list was the only way I know I still work here. And so he took that idea and the next month he went to the whoever in the business office made up those phone lists and he made one special, he had one special copy made of the phone list without my name on it and had that delivered to my mail box. [laughs] So when I pulled it out of there I knew exactly who was responsible and so I come down and said "what did I do?" [laughs] [laughter in background] So those are my stories.

Sarah Witman: OK. Thank you.

End of audio

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ZOOM005.

Scott Lindstrom
Jean Phillips

10 September 2015

3:01 minutes

Scott Lindstrom: My name is Scott Lindstrom. I work at SSEC. I came here in 1982 as a graduate student from Penn State. My major professor at that time was Charlie Anderson and one of the great things about working with Dr. Anderson was that he used McIDAS. So we got to load up satellite images and that was one of the great things about McIDAS back then is it was the only thing you had that could loop satellite images. So he was interested in storm top dynamics for tornadic thunder storms. A couple years later Barnaveld happened. He did a lot of work on where did the debris from Barnaveld end up. So I worked with him for a year before I changed topics and got another major professor, Dr. Houghton, but that was really great that first year just to use McIDAS, to look at the imagery. And ____________________ and I were two of his grad students. _____________________ [Carmin Finskey?] maybe was another one, I can't quite remember if that was her last name or not. She married Carl _______________ [Youngbluff ?]. So we were his little research group looking at thunder storms in McIDAS and one of the first things he had me do was actually look at the contouring program that Tom Whittaker wrote so I was across the street at DoIT on their Sperry Univac, 11780 I think, looking at the code for C ________ F which is actually still in McIDAS.

Jean Phillips: So that computer was not in-house.

Scott Lindstrom: No, it was across, it was down stairs where they had, I guess it was their big computer. I just went down there and tried to get the code. I don't even remember what I was trying to get the code to do. I just remember I had to change the code in C __________ F to do something and that code is still in McIDAS.

Jean Philips: Really?

Scott Lindstrom: Well, not the stuff that I changed, but this was code that Tom Whittaker had written. Because he worked a lot with Charlie Anderson also.

Jean Phillips: So this was what year?

Scott Lindstrom: 1982.

Jean Phillips: 1982. OK, so the first public demo was just ten years before that.

Scott Lindstrom: Right. And I think I remember seeing it as either as a junior or senior at Penn State. Someone came and gave a seminar, because John Dutton who was the department head or something maybe and Rick Anthes both got their degrees here so there was a lot of interaction between Penn State and Wisconsin. And someone came and gave a talk and they showed the imagery from McIDAS and it was just all we had there at Penn State was either thermofax or just still pictures. And to be able to see animations sort of, maybe they showed a movie, I can't quite remember. I just remember thinking wow this is really cool. [laughs]

Jean Phillips: And everybody else thought so too

Scott Lindstrom: Yeah.

Jean Philips: OK. Anything else?

Scott Lindstrom: No.

Jean Phillips: OK.

End of audio

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ZOOM0009

Paul Menzel
Sarah Witman

10 September 2015

3:01 minutes

Sarah Witman: Alright. Could you restate your name.

Paul Menzel: Sure. This is Paul Menzel reading a contribution from Allen Huang for the celebration of SSEC and Professor Suomi's legacy.

Professor Suomi has inspired me directly and indirectly through my advisor Bill Smith and others. He has had a profound impact on me and my fellow students. It was been long lasting and significant. Professor Suomi might have been the first scientist to see the value of GPS occulation as a technique for satellite remote sensing to sound the atmosphere. Through his private consulting firm, Suomi Scientific, he assembled a great team including Bob Fox, the SSEC executive director at that time, the SSEC associate director John Anderson, and of course, the wizard Bill Smith, and me. Through the guidance of Bill Smith I was to develop a forward simulation model and retrieval algorithm using able transformation to simulate the physical relationship between the bending angle, pressure, temperature, and water vapor. With others I was then able to study the feasibility of such a sounding technique. At the end of the project I remember very clearly that at the SSEC Christmas party Professor Suomi handed out several envelopes as tokens of his appreciation for our team's work. As one of the recipients I was truly inspired by his ingenuity, spirit of innovation, open mindedness, pursuit of scientific discovery and courage and problem solving. SSEC has become one of the largest non-governmental and non-profit meteorological satellite data centers routinely receiving and distributing data products from 12 GEO and 12 LEO satellite missions. And to Professor Suomi's and Bill Smith's credit, SSEC has grown to offer end-to-end satellite receiving, processing, application, and distribution of software packages and systems for worldwide users in five continents. As an international student I have benefited and inherited from SSEC's true spirit of collaboration without boundaries. While I'm not here in person, you can be assured that I am somewhere on the road carrying Professor Suomi's invisible torch to continue his great legacy of advancing optimal use of weather and environmental satellite data which is now emblazoned on my business card. I'm sorry that I can't be here in person but on this special occasion Professor Suomi would be sure to be very proud of what he has inspired us here at SSEC.

End of audio.

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ZOOM0012

Bob Rabin
Linda Hedges

September 2015

53:09 minutes

Linda Hedges: And we are recording.

Bob Rabin: So my name is Bob Rabin. I came to SSEC to work here in January of 1989. I was and still am a permanent employee of N-O-A-A for work for the National Severe Storms Laboratory in Normal, Oklahoma. I'm originally from this part of the world so I was eager to have the opportunity to come up here and that opportunity arose because of John Lewis who had worked here in the 1980s with the NOAA group under Kit Hayden. And he had taken a position at the Severe Storm Lab. It moved from here to Oklahoma back in the '80s, I don't remember the exact year but I'd say roughly '86, '87 maybe. He was hoping to establish somewhat of an ongoing relationship between CIMSS, SSEC and the Severe Storms Lab in Oklahoma mainly because of his experiences here while he worked here. I know he really found this to be probably the best place to work of all the places he's been. So he was hoping to get some sort of a program started where there would be an exchange of scientists and so I volunteered to be the first to come up here. [laughs] And it worked out very well, especially for me. There was no reciprocal movement in the other direction at least at that time, no scientists that were willing or interested in going to Oklahoma. Actually just prior to that I should mention our lab, the lab in Oklahoma, is really focused on, had been focused on weather radar analysis and developing weather radar such as the Doppler radar system that's currently used today by the Weather Service. There was virtually no satellite expertise there or research projects involving the use of satellite data and I was always interested in expanding into satellite analysis so I saw that as an opportunity to do that when I came here. And I think our lab saw it as an opportunity, too, for me to maybe gain some expertise and bring it back down there. So it also allowed me, so prior to me coming here before that invitation came to come, John was instrumental in getting a McIDAS system established in our lab. Back then it was in a main frame but it was one of the stand-alone machines with the racks. So he was successful in getting that done and that then kind of set the foundation for me coming here to work further with McIDAS in particular. So I loved that. And I came here, as I mentioned, in January of '89. There wasn't a specific, well defined project as I recall at the time although it was kind of centered on one of my great interests. I did this back when I was at McGill as a masters student, looking at the interaction between the land surface and the atmosphere in terms of convective cloud development and convective rainfall. So I had done some research, published a paper, that was actually published after I came here but I started the work using McIDAS while I was at NSSL, that looked at preferential cloud development over winter wheat areas in the Great Plains. That was more of a visual observation based on animations of the clouds using McIDAS during the day. There were some other aspects of it as well. So when I came here I continued that work and I had a close collaboration besides with the NESDIS scientists that were here, ___________________________ . I also developed a close working relationship with Dave Martin. Dave, I and eventually Elaine Prins but prior to that, oh I can't think of her name now, from Brazil.

Linda Hedges: Cutrim?

Bob Rabin: Yes, thank you. Elen Cutrim. Actually all three of us had a close working relationship and so we extended the studies that I'd worked on before coming here initially on these observed cloud patterns over differential land use. I would say too the Brazil Amazon area in the Rondonia state actually that Elen was very familiar with and so we worked on that. Again McIDAS as pivotal to doing that work. It allowed us to animate, to create the images that were based on essentially short term climatologies of cloud cover and then relating those visually to the deforested area and we found that there was more cloud cover in the afternoons over the deforested area which was kind of what we expected in the dry season. So that work went on and then we extended it one step further and that was to look at the effects of agricultural areas outside of areas we had looked at. So we identified this region in central and southern Illinois which the glaciers, when they reached their furthest southern extent in central Illinois and retreated, left almost a boundary I would say between very deep soils to the north, rich deep soils where the corn and soy bean belt developed, versus a more limited root zone depth in the area to the south which is mostly pastures and it wasn't cultivated as heavily. And so we had a hypothesis that in dry summers you would see a difference in the soils moisture between the two because the soils moisture would be depleted more quickly in the areas where corn was grown because of shorter roots and that might then affect cloud cover. So we indeed saw that qualitatively and published that in a paper as well. So that work went on. Bill Raymond was also involved in this to some extent because Bill grew up on a farm northeast of St. Louis, in Illinois and was familiar with these differences. We looked at an area, again we used McIDAS, in this case not so much to look at cloud differences but look at the skin temperature or the differences between then emission, the radiative temperature of the land in the so called Mississippi delta which is not the delta, the mouth of the Mississippi, but this flat area surrounding the flood plain around the Mississippi River in eastern Arkansas and adjacent Tennessee and maybe Mississippi to some extent where they grow rice and things like that. It's a hot spot and so that stands out in the satellite, the GOES, or any satellite infrared images when it's clear as being much, much hotter than the surrounding land. Bill coined the phrase "agricultural heat island." We think of urban heat islands of course because it was somewhat induced by the agriculture differences in that area and then we looked at cooperative temperature data in that to corroborate that observation with the satellite and indeed found that the minimum temperatures were elevated in that area just like an urban area might be. So I thought that was kind of a unique study that Bill and I had done that was again kind of a branch off from this land surface atmosphere interaction experience that we had.

I wanted to mention also Bill Hibbard. Bill played a pivotal role in my life in some of this work because he was just developing VisAD at the time. This was after Vis5D and Bill being a brilliant computer scientist as he was had developed this software system, I guess you could call it, that was designed to enable visualization during an algorithm development period. So if you're developing an algorithm and tweaking the equations you could have sliders that would vary the parameters and you could immediately see what it did to the results. That was, I think, what the purpose, the goal of that was. So VisAD stands for, the AD stands algorithm development. I had approached him about the problem I was having in trying to interrelate different variables that had images assigned to them whether it was land use, cloud cover, ground temperature, whatever. And then to actually do mathematical statistical comparisons, correlations and such with these. And so he said “yeah, I have this tool VIS-AD” and I think I was maybe one of his first early guinea pigs to kind of help him on how to proceed with this. And it wasn’t a system you could pick up and use like Vis5D at that point. It really did involve designing, knowing something about the programming language or the programming, not the language so much, but the outer shell of it to design the actual interfaces you were using, say what variables to put on the sliders, what range of values, that sort of thing. So it would have been difficult for someone just to pick it up who wasn’t maybe immersed in that field and quickly do it, so I felt really blessed because I had Bill’s help to do that for me. I told him what I wanted and he designed it. It was on this SGI machine. I can’t remember what floor it was on, but he had a large SGI powerful machine at the time, a big display system and a graduate student working with him. So that went fairly quickly. Bill as many people know had kind of broken away from, and I know it was a bit of a struggle for him from my understanding, was because he was very innovative at the time and going down somewhat of a different path that had been gone down before and apparently there was, to my understanding, there was a little bit of resistance to that because there was sort of this main stream IBM machine that McIDAS was developed, worked on that. And then Bill had this sort of new tool that was out of the box more and using a different type of computer system. He apparently wrote his own initially, programming language for this and then later discovered Java which was out there already but not well known like it is today and then he scrapped what he had done and said he “wow this is so much better.” But I think he had some, that was my impression, that he had a little bit of a fight on his hands to carry his work forward at one time. I’m sure he could tell you more about that than me, but anyway I was very blessed to have his help and he was truly interested because he saw this as a user that could benefit from that tool. I also saw that eventually in some ways leading into his McIDAS-V, again I’m not an expert on what happened but my impression was that all the libraries that were developed for VisAD were in some ways utilized in and eventually worked with Java. The Java language was somewhat of a foundation for McIDAS-V. The concept of McIDAS-V might not have been his vision, but some of the tools, I think, were instrumental in that. I could be wrong, but that’s my impression. [laughs]

So I wanted to say a little bit about the NESDIS group as well that I worked with. Kit Hayden ran that for I think all the time that I was here. And Steve Ackerman had arrived. Steve spoke, I think, about his early involvement with the ERBE project when he first came here yesterday. He talked about it yesterday. I was interested in branching out in many areas so one of the things I sort of conjured up at the time was looking at the impact of deep convection on the radiation budget so if you had say due to climate change more or less convection in a certain area would that tend to have a cooling or warming effect due to the anvils spreading out and this sort of thing. So Steve being very, an extremely enthusiastic person took me kind of under his wings in a little bit to help me get started to use the ERBE data to address that question. So I started working on that. It was interesting. It never really lead to any publications that I can recall, anything formal anyway, but it’s very interesting. And then that kind of lead, and I felt that Steve had a close connection with the NESDIS group even though he was, and I don’t know exactly how that worked, if he had some grants that some of the federal people were working on, I don’t know, I don’t remember. But then that lead into some involvement with the passive microwave work that went on here with Lynn McMurdie. Her husband got a faculty position here. He was an oceanographer. I can’t remember his name right now. And she of course came along with him and got a position at SSEC or CIMSS. She was working primarily on the water vapor distributions in cyclones over the oceans, essentially looking at moisture feeds. Sometimes they call them atmospheric rivers today but using the passive microwave sensors on the SSMI instruments which were on the DMSP satellites which were defense satellites. So then I got hooked into that project. I wasn't looking at the same thing. But John Lewis was, of course, still in Oklahoma, and had developed a research project which involved several people from here, once I was here, called GULFMEX, which was studying return flow of water vapor from the Gulf of Mexico in the late winter, early spring when you get return flow from after a cold air outbreak. That moisture was, is a challenge to model properly because of the lack of observations out over the water so it involved many different aspects of the actual physics of the air mass modification and things like that. There was actually a field program and Bob Merrill, Gary Wade, Kit Hayden to some extent, Bob Aune were all somewhat involved in that, and myself. My involvement then revolved around the SSMI precipitable water measurements that I was learning about from Lynn McMurdie that then we also tied in the GOES sounder derived precipitable water as well. Gary Wade was a master at visualization with McIDAS and even though he was color blind he knew just how to [laughs] use the right colors. It was actually interesting because I look back on it, several other people tell me about that. There were some paper published but it really wasn't in the context of what it was remembered for. We were developing something that was referred to a blended product. In other words, we were essentially just taking information, images from say the SSMI precipitable water which is just only over the water, doesn't work over land or didn't back then, and then we would fill in. So that was product number one and then we filled in product number two over the land which would have been the GOES precipitable water. But then you have clouds where SSMI gets it through clouds because it's microwave, but the GOES infrared does not. So then we filled the holes in using some model analysis. So we have a three tier analysis. Not very sophisticated but it was blended in some way and had discontinuities and then we would loop it and many years later I confronted a forecaster in DC, Camp Springs at the time, who works, just retired, he worked at the satellite analysis branch, so he's part of NESDIS but collocated with the Weather Service there. I learned from him at this had all evolved over time, but he looked back at that early work and saw it as the beginning of that and was very excited about it. Later on I think Stan Kidder actually kind of picked up that idea, he may not have been actually aware of all the details that were done here, but at CSU they actually now have a very polished blended product and they call it a blended product. [laughs] I remember receiving some criticism at the time because it wasn't, they said you should be assimilating the data in the models which of course is being done, had been done, but that's the way to go, just assimilate in the models. But this is a little bit of a different perspective because we weren't changing any data, like data gets changed in models [laughs] and you don't know why, it's just blended, it's assimilated in a mathematical best fit, where here we were just taking observations and looking at them in different places. So different perspective. And then I think Tony Wendricks, not Tony Wendricks. Oh I can't remember the fellow's name, he's here now. There have been other approaches to this that use a time varying blending that makes it look seamless. I forgot the term for it now. My mind is going blank. So anyway there have been a lot of variations to this but I just wanted to mention that it I think started with that work here with Lynn McMurdie, myself, and Gary Wade, and some others. And then of course that experiment of GULFMEX also tied in with validation work going on in the NESDIS group here on how well these retrievals worked with the GOES sounder so we had some special rawinsondes over the Gulf and of course on land and we could compare things. That was published. But what I did see in the NESDIS group of course the main emphasis was while I was here was on the sounder and uses for the sounder in forecasting from GOES. Paul was heavily involved in that as well. And I think there was a little bit of, maybe disappointment isn't the right word, but in terms of demonstrating the usefulness of that data in numerical models for forecasting I don't think was ever fully realized. I just don't think it was demonstrated adequately the positive benefit in short term forecasting. Certainly globally over the oceans it was a different story but mesoscale forecasting, that was one goal of the sounder because you had every hour another sounding. And so much of the emphasis was trying to show usefulness of it in different ways and it was used certainly in a qualitative way by forecasters and still is but I don't think, in my opinion, there may be some different opinions there, I just think it was. And I actually think that that lack of showing an impact, a positive impact, may have been a large factor in GOES-R, the first GOES-R satellite, or first two, not having a sounder on it. Of course, cost being probably the main driver, but I think if there was a really strong, really strong evidence of the importance of this in the mesoscale forecasting it would have happened, maybe. [laughs] So, yeah, looking at the history from then to now I think that was all kind of tied together and there were many years of course that went into that.

Kind of general comments, I found that SSEC and CIMSS to be, like John Lewis, probably the most exciting place for me that I've ever worked. [laughs] I was here after I came in '89 I think what was set out for me is that I could stay full time for two to three years. They weren't quite sure how to arrange it at first with whether I would take a leave of absence and then work for the university but they decided it would probably be better just to stay the way you are and just be a visiting scientist, which I was. But I wanted to stay [laughs] and I did stay. I stayed much longer. Unfortunately my wife did not like the cold winters; she's from France. She didn't like the winters there either. [laughs] So she would tell people in Wisconsin, they'd say "well, how did you like living in Oklahoma?" And she'd say "Oh, it was good except for the winters." [laughs} And they'd say "What are you doing in Wisconsin?" [laughs] And she'd say "I don't know." So she got the point where she just moved back and we were already, I'd go there for a week here and a week there, but after she moved back then it was 50-50 and then gradually became less and less. But I still try to keep a connection. So I'm very grateful for the family atmosphere here in allowing me to stay part of the family even though I'm not here very much or very often, having a place to work. And I think it has been very beneficial.

One thing that I should mention, too, about the history, I mentioned earlier that John Lewis had envisioned a exchange program essentially and we never did get people from here to go down, say for a year, to work at NSSL. Many years later though things began to change a little bit or in a very unpredictable way with the establishment of a testbed in Norman called the Hazardous Weather Testbed. And the evolution, the preparation for GOES-R and the algorithm development here for GOES-R, began to shift toward, some of it towards convective, products for convective storms, so overshooting tops, storm initiation, convective CIs they call it, things like that. Cloud top cooling rates. So because there were new projects that started up here that people like Wayne at one time and others had funding for, then people here started developing those products and so the testbed was a means to begin to showcase them or test them, the one in Oklahoma. That happened in the last five or ten years, probably more in the last five years. And so there was more out of an eagerness for people to go there for a limited time, we're talking about a week here and a week there, but SSEC or CIMSS has had a presence in that testbed for the last four or five years where someone was there for the entire time and it lasts for a month or two every spring. You could say it's a field program not collecting observational data so much except observations of how forecasters are using it. [laughs] So that was kind of a, I would view that as a success that I think John's vision actually came to pass. It was just a different form that we couldn't have envisioned back then or even envisioned how that would have evolved. And I think there is also, I think the involvement has actually gone beyond that so people like Jason Otkin are working with people there on data simulation ________________ **[transcriber question: assimilation?]** problems involving satellite data so there's more crossover because of the development of the science, the way it happened, I think.

I saw myself as having some soft influence, maybe, on some of the development of those algorithms because a lot of the initial studies that were done that might be thought of as the reasoning, being the basis of some of these algorithms actually were published a long time ago back in the '80s by people like Bob Adler and people who were at NASA Goddard primarily. They were kind of forgotten for a while because there was no opportunity to implement them at the time. And it wasn't until the GOES-R program was starting to spin up that there was a opportunity to revisit some of these ideas. And I was already back at NSSL most of the time and I started actually working on some of, at least looking at some of those ideas again and bring it other people's attention. One of the students here, I can't of his name right now either, but I might in a minute. Jason Brunner was a student and so I think I was kind of on his committee I guess, I don't know if I was officially on his committee but helped him with the research. His idea was to look at enhanced Vs which is a signature, thunderstorm tops in the ____________ infrared, cloud top temperature in the form of a V or a U shape and go back and actually compared what you see on GOES with the polar orbiting high resolution imagery like from MODIS but then look at severe weather and see how did these signatures relate to severe weather. Another person was Kris Bedka that was working on overshooting tops, kind of a similar idea there. What is the temperature difference between the overshooting top and the surrounding handle? Is that a useful parameter for identifying the severe storms? Or trying to estimate the severity of the strength of the updraft. Things like that.

I think that all kind of grew out going back to the literature in the '80s and so I think I may have had some role, although I wasn't part of many papers on the subject here, in encouraging or getting interest in looking at those things in maybe a small way. I don't know. [laughs] And those are all going, many of those algorithms will be part of the GOES-R suite so it's something that is actually going on.

Oh the other thing I forgot to mention are the, and I was so touched yesterday by the talks that went back to the very beginning of Vern's idea of getting winds from movement. I had my first ten years at the Severe Storms Lab, I worked mainly with clear or Doppler radar where we actually have a radio velocity estimate. But not in storms, in the clear air out ahead of storms or before storms to also measure winds but mostly in the boundary layer. So I saw, I had an interest in maybe trying to couple the two together and that's what I'm working on now. [laughs] So I've been working closely with the winds group here the past year or so, Chris [Velden] and Steve Wanzong, and Dave Stettner primarily. We have a project that involves some people at NSSL, SSEC, Colorado to look at uses of the one minute data in severe storms forecasting. This actually goes back further, I think about the year 2000, so about fifteen years now I actually learned how to run the winds code and was running real time water vapor, winds from water vapor imagery every thirty minutes in the operational version of this once every three hours and the goal there was to see if it was qualitatively useful for forecasters down in Oklahoma, the Storm Prediction Center in particular, in identifying features that might not be in the models, they might not see in the models. So we did this and published a little paper on it showing some cases where storms were forecast based on a model, that the divergence aloft, that's where they're looking at as a signature from the winds, showed that there wasn't much divergence preceding it and so no storms did form. And then looking at it the other way around there was a case or two where there was divergence aloft, storms did form but they were weren't by the models so it doesn't always work that way. But anyway the idea was to put this ____________________ information into, which again was a different approach because most of the main stream approach was to assimilate these winds in models and to do that you have to carefully edit the winds and get rid of them if they're too deviant from the background or model which you would expect. So you're kind of throwing out the baby with the bath water in a way just because of the nature of it. You can't keep those without incorrectly disturbing the models yet if you throw too much you could be throwing something valuable away. And so my thought was well let's just minimize that editing and just show what we have and compute these kinematic properties like divergence because, and that works well when you have thunderstorms because you have this strong deviant flow due to the divergence aloft in the anvil. That _______________ thrown away the data gets into a model, but forecasters _______________ might give us an idea of the strength of the updraft and things like that. So that was kind of the general idea behind that work. Now since we've had these super rapid scanned campaigns, it's given us the opportunity to begin running the big winds much more frequently and then getting many more winds using visible imagery in the low levels. So Chris', the winds from here has been working very hard for a number of years now to try to optimize the algorithm to work with these super rapid scan data sets. That really blended well with the study that I was involved with and so this last May, I believe it was, the group helped me get the code running on another computer here that wasn't so bogged down and actually run it in real time every ten minutes where they were only running it every hour and then making the output available on our web page to actually look at the patterns. So that's kind of what I was working on and then we were looking at some archive cases and rerunning it every five minutes. So just trying to look at the value right now it hasn't been looked at in that way before. Where you get the winds, are they really, how useful are they compared to the Doppler radar winds? So I have this web page with, I should mention Tom Whittaker because I worked closed with Tom for many years on some, I would say, his cutting edge tools for animations on the web. I like to just put things out on the web so I can show it to people and not have to run sophisticated software so the latest is the ________________ fog of course. And I think to some extent Tom has in the past, I've been kind of his guinea pig too at little bit because, you know I'd be wanting to put lots of overlays on and different things I know his other users like that, too, so I wasn't the only one but I think it was probably helpful for him, too. Tom involved in some, he actually got funding from a few projects that I was involved with that were funded through the NOAA HPCC which is a High Performance Computer Initiative basically. So we had a storm, it was called Storm Track. It was a tool where all the, there was a tracking algorithm run on the convective storms from satellite in an automated way in real time and then all that information was essentially archived in a data base. There was a storm ID, a time, a date, location. And then all these attributes were mixed into it, were collocated with it. So say from different data sources so you could have radar reflectivity, you could have atmospheric stability from model analyses but it was in a storm relative frame of reference. Then there was a web page, it's no longer working, where you could go back to archive cases. You could put real time cases and you would bring up a display and it showed you the tracks. You would click on the track and then the computer system would go into this database and then plot the time series of these other variables, cloud top temperature could come from the satellite itself, from radar, lightning data, whatever and you'd get these time series but they were in a storm relative frame of reference not fixed to the ground in time. And look at evolution of different parameters, how they related to each other. We maintained that for a few years. It was a little bit of a struggle to get it to be very visible say to the Weather Service because they had strict fire wall regulations so I was never successful with getting it out and we ran out of funding and then kind of, I would say, it just not working right now.

But another thing I wanted to mention, I think it might be the last thing I can think of right now, is the WMS the Web Map Server project that Russ Dengel and Sam Batzli and I'm trying to think of some of the other players in it. But which is a fairly recent start up project here, as I understood it, seed money I think was getting it going initially, to develop web pages that are based on Google maps and all the different products can be displayed on them. User friendly and everything. So I was really excited about that and we got some funding actually at one time, two or three years ago, to get some machines at NSSL that would mirror the ones here and then we took some of the output from some of the radar algorithms. It hasn't really taken off yet but we are on our end and in Oklahoma it hasn't taken off and I think one of the reasons was a disconnect [laughs] in the why do we need our own machine if we can just bring up the web page from here. And that's kind of gone that way. So but there are pieces of information that are being fed to the server here that come out of radar algorithms primarily from Norman. Rotation, shear from the radar velocities, mesocyclone detection, hail probabilities, things like that are all part of the menu here now from that so that's another kind of cross pollination, I would say.

And then, oh, one of the other things I worked on, getting back to land surface, relates to the another use of satellite data that maybe has been a little bit underutilized and that dates back to the work with George Diak and to some extent with John Mecikalski because I believe he worked on it, too. And that's to try to estimate surface fluxes, heat and moisture between the land surface and the atmosphere based on, to some extent, heating rates or thermal inertia of the land surface as sensed by satellite. So you look at the temperature rise, rate of rise, say from sunrise to mid-day roughly and that's blended with a numerical model in their case but I kind of took that in a slightly different, a simpler direction and looked at it more statistically using those temperature rates, rise rates, to relate to surface dryness, not necessarily putting a number on it but relatively wet and dry regions and applied that to fire weather potential. The Storm Prediction Center, one of their responsibilities besides tornadoes and severe thunderstorms is issuing fire weather outlooks which is mainly atmospheric but of course the land, the state of the fuels, is key as well. So that's another, maybe a more of a unique use of the satellite data that's related to George Diak's work and others. I also worked with George and John when he was here. We were intercomparing output from the ALEXI model it's called, the one that was developed here, to SSMI estimates of surface soil moisture. So we did some work on those. That was I think a NASA funded project.

So anyway I really do feel blessed to have the opportunity to be here still and have been here because not only the comradery of the family of people here and the general interest I think of everybody has in the breadth of work that goes on but just in my own mind just having the opportunity to work on so many different things that were, I wasn't put into a cubby hole and said you're going to work on mesocyclone detection for the rest of your life using Dopplar radar [laughs] which happens to some people, it happens to some people and probably even here to some extent, too, with the GOES products you know you might be working on retrievals your whole life but maybe that's what you love to do. [laughs] So, yeah, and it is a unique, John always told me because he, John Lewis, because he worked in so many different places "Bob" he said "there's no place like SSEC." He said "It's just, you know it's not perfect, no place is perfect," he said, "but no place came __________ . He said, "just no place came close to it." You know he's in Reno now at the Desert Research so we're from NSSL so he's still dealing with NSSL management but he's probably also dealing with DRI so [laughs]

So yeah I probably forgot something but that's [laughs] and it's also nice to see people that are still here that, you know I've been here since '89 so that's twenty six years I guess and so many people were here obviously a long time before me and to have that history still there. Being in the same building I think helps. We moved to a new building; the Severe Storms Lab moved to a new building about ten years ago and the idea was there was this beautiful structure and you're going to have the whole meteorology world in there, the collocation of the university atmospheric science and Nexrad and all. Oh well, it looked real fancy but you know obviously there some good points to it but I think there's something about staying, longevity and [laughs] having those closer contacts. I don't know. Sounds like too much of a sprawling building. It becomes not as easy to bump into people and people are just kind of tied up in their own things. So I don't know. It's hard to say. I know there was talk here at one time of moving to the science, what's it called, on the west side of Madison? Science Drive or something? There was some rumors that maybe they were looking into the possibility of relocating into a newer facility, a bigger facility, space obviously is a problem sometimes, but it never happened and I was happy for it [laughs]

Oh, I have a couple stories about Reid Bryson. I have fond memories of my little contact with both Reid and Verner. I didn't know Vern very well unfortunately. John was always telling me "you need to go talk to him about your proposals." And so he gave me the advice that I've heard yesterday because many people I'm sure about keeping things short which goes contrary to what people might, some people say well it should be more detailed and Vern told me, he said "don't say too much because you don't want to give every detail in there." That was his view and I agree with that. Unfortunately I see the other. Things have become somewhat more standardized probably than they were and so there might be these criteria, so I had a review the other day that I got back and they said there wasn't enough detail in the methodology. Well that's their opinion. [laughs] But the thing I remember about Reid Bryson. I always enjoyed, I always had this interest in climatology even though I've been working on the other end of the time spectrum just because that's the job I had [laughs] But I'm fascinated with climate and I remember Reid Bryson giving some talks that were just amazingly interesting to me. One was about this theory about the shifting of the north magnetic pole. And I didn't understand. It seemed to be more empirical. I think he was relating the position of the north magnetic pole that did changes in the climate. And somewhere down deep it made some sense to me. I don't know almost like it was intuitive. But physically it was hard to say well was it really significant, I don't know. But more recently I've got very, one of my passion has become working opportunities to do outreach educational work with minority students and tribal students which is another story I probably don't want to get into here but and I had the chance to go to Barrow Alaska a couple times and learn the language and all that with the Iñupiat people. And I came across a few videos actually about elders in Northern Canada and Alaska having an observation recently that the sun is rising from a different point and setting at a different point in the sky than it used to up there. And of course, being a scientist, my first reaction was well that can't be. I mean that would have been detected obviously but it's come up over and over again in the last year. I just saw a news article about it so it's interesting and so I kind of related that back to Reid Bryson's idea of the shifting pole. [laughs] Not the North Pole, but the magnetic one. I said maybe there's something there we don't understand and so I see so many scientists that are kind of, I was surprised when I went further in science and find a lot of scientists were the most closed minded people I've met [laughs] and I'm not blaming anyone but anyway I saw that connection. I thought that was interesting.

And then the other thing was I got on the elevator on a cold morning with Reid Bryson one day, we were going up, all bundled up. It was maybe zero degrees Fahrenheit outside. And he looked at me and he said "It's very simple. People think the climate's so complicated. In the winter there's less energy coming in than going out and the summer is the other way around. So yeah, it's colder in the winter."

[laughs] So I still remember that. It was a very [laughs] just so interesting because we make things so complicated sometimes and try to elaborate on things too much. It's really not hard to understand in just basic terms we can forecast that variable. [laughs] It's the details that get difficult.

So I'll close here and I just hope that SSEC continues to flourish and I know there will be new challenges obviously economically and changes in political structure and such but that the science and comradery and family nature of the institute can live on.

Linda Hedges: Very good. Should I end the recording?

Bob Rabin: Yeah.

End of audio.

Oral history interviews collected during the celebration of the
50th Anniversary: 1965-2015, Space Science and Engineering Center, University of Wisconsin-Madison.

ZOOM006

John Roberts
Sarah Witman

September 2015

1:27 minutes

Sarah Witman: Alright. Whenever you're ready.

John Roberts: Ok. This is actually a third hand story. It's about Dr. Suomi working in the lab overnight which he often did. He did everything at the Center from being the director to being the person that did the wiring wrapping on the boards. And he was in a lab one night and he was working on wiring wrapping a board for some computer he was working on. And he got stuck on something so he called up Jim Maynard who was the guy that ran the lab. And Jim's wife Mary was our human resources person at the time. So he called her house at three o'clock in the morning. And Mary answered the phone, figuring that there was something wrong and as soon as she heard who it was she said "Dr. Suomi, what's the matter, what's the matter?" He says "Oh, nothing, nothing. I just need to talk to Jim." And she said "Where are you?" And he said "In the lab." And she said "Do you know what time it is?" He said, "No, no. What time is it?" And she said "It's three o'clock in the morning." He said "Oh, Mary, I'm so embarrassed. I apologize." He said "I had no idea. I lost track of time. I'm sorry I got you out of bed. Just ignore me." "No no", she said, "It's fine." He said "Are you sure?" And she said "yeah." And he said "OK, now can I talk to Jim?" [laughter in background] And he did. [laughs] That was the man.

Sarah Witman: Alright. So

John Robert: That was it.

Sarah Witman: Is there anything else?

John Roberts: No.

Sarah Witman: OK. That's perfect. Thank you.

End of audio

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Recorder2ZOOM0005

Krissy (Dahnert) Slawney
Jaclyn Lang

5:16 minutes

Krissy Slawney: I'm Krissy Slawney, formerly Krissy Dahnert, I guess I should say. Ten of my twelve and a half years here was spent as Krissy Dahnert before I got married. But my story here like I said started twelve and a half years ago. I was a senior here at UW, graduating in human development and family studies and criminal justice. So I was headed for social work or police science basically. But I saw that there was a job posting for this Space Science and Engineering Center in the loading dock, shipping and receiving. And it was my last summer here. I just needed a job. I had done all my internships and so I applied and worked that summer down on the loading dock. Met a ton a great people here. Shipped stuff all over the world, Europe, you name it, everywhere. And what struck me the most was how much stuff I was shipping to Antarctica. So I met a man named Tony Wendricks [laughs] who is a staple here at Space Science and I told him, I said "all this stuff I'm shipping for you to Antarctica, I would like to go with it sometime." And I said that jokingly of course. But be careful what you wish for because after I actually graduated, I became an LTE then here just temporarily.

But at that time Ice Core and Drilling Services, ICDS, was starting the development of the disc drill project, the biggest drill project that we've had. And so I started doing some purchasing for that. Not in the actual purchasing office, but there was just such a large amount of hardware to purchase that they needed some help. So I started doing that. And then when they needed a field crew in 2006, this is three years later after I started, they needed a field crew for Greenland so I was lucky enough to get onto that with I think maybe seven or eight other people. So I spent my first time away from home for any length of time sleeping in a tent out on the ice for about two and a half months I think we were out there. And so they say that gets in your blood. And the ice really did that for me. So I came back and was able to get a full time position here with Tom Demke in quality assurance and safety. And I still got to work with really closely with the engineers and the management here at Space Science, just in everything quality and safety but focusing on the ice drills and everything polar. So I worked with Tom from 2006 to 2010 and kept deploying with the disc drill. I did six seasons in Antarctica from November to February and a couple more trips to Greenland. Just loved every minute of it. Couldn't bring myself to leave and go back to social work [laughs] or down that path I originally thought.

But after quality and safety, a position opened up within ICDS, or now Ice Drilling Design and Operations, for just a field project support manager. And I really loved the logistics side of things. Shipping things, you know that's where I started here and I still loved it so I moved full time with IDDO as part of SSEC. And I worked with principal investigators, shipping their stuff everywhere, coordinating their projects. So I did that for a few years as well and then in 2014, very recently, the program director of IDDO retired, Don Lebar, and I had been working under Don for several years and I do think he was grooming me for the position I guess but I just loved the organization and I love Space Science, having worked in all those different positions. Loved the people here. And so currently I find myself as the program director of IDDO. [laughs] [laughter in background]

So, many jobs here, but I guess the overarching theme for me at Space Science here is, and from stories I've heard of Verner Suomi, he really cared about the people, not just about getting the work done. But he cared about the people and that's one thing I have to say about the directors here. They have always cared about us so much. I mean they cared about my career path here. You know, I didn't have a science background or an engineering background but they really cared enough to make sure that I loved what I was doing. They gave me every opportunity here to move into things if my interests changed so I'll be forever grateful for that. I mean, nobody grows up thinking I'm going to go drill ice cores but [laughs] I guess that's how it happened so I hope to stay here for a long time. I mean that seems to be theme for people here. We just, everyone is great to work with and I hope to stay here a long time.

End of audio.

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ZOOM0015

Kenneth Walker
Linda Hedges

11 September 2015

32:14 minutes

Kenneth Walker: Are we ready now?

Linda Hedges: There we go. Now we're recording.

Kenneth Walker: Now we're recording. I'm Ken Walker, Kenneth Walker. And years ago I was one of the early electronic technicians. I was hired by Professor Robert Parent who was a director of a group called the Electrical Standards and Instrumentation Laboratory. They were actually part of the Grad School at that time I believe and physically housed in what is now Engineering Hall on the second floor. Anyway a small group, the function of this organization when the electrical standards part there was one technician that calibrated water __________ [hour?] meters in particular, the instrument that's on the side of all of our homes and measures the electricity. These had to be calibrated and checked every some many years to make sure that we're not being overcharged or unpaying the utility and that sort of thing. The instruments in that room were all traceable to the National Bureau of Standards at the time so that was the state's facility. This was, Professor Parent had a engineer by the name of Harry Miller who is unfortunately deceased, and Harry had the responsibility, the oversight of the Standards and the Instrumentation Laboratory. The Instrumentation Laboratory did electronic service for other university departments or maybe it was some other state departments, I don't remember if that was the case or not. I was hired on as a technician working for Leo Skille who was the lead technician and Harry Miller's office was between the Standards and Instrumentation Laboratory, so those were my direct bosses. Professor Parent was across the hall. We did quite a few interesting things for other departments on the campus, the Enzyme Institute in particular, a lot of instrumentation was built for them. Electronic equipment was repaired which was even now for the Carbone Cancer Center, the McArdle Hall actually was the building I remember going over to work in. We did work for the Physics Department. We did work for Psychology Department and calibrated, repaired laboratory instruments in general.

Well, simultaneous to this there was a couple rooms in the basement of Engineering Hall under the Mechanics Department and B352 and 53 was the numbers that I remember. And anyway in those humble little rooms Professor Parent and Suomi did some, they constructed and engineered some of the very early instrumentation that was flown on the early weather satellites. I came in at a time when the TOS series that would probably already be a third generation, a spacecraft that flew Professor Suomi's radiometers that measured the Earth's heat budget. That was a big thing at the time. And after a little time in the engineering, or in the instrumentation laboratory, I was transferred down to the, I say down because it was in the basement of the building, I was previously on the second floor, but it was really a big move up. And in fact that was very roots and beginning of, of course what is todays fifty years later, over fifty years later, the Space Science and Engineering Center because we were still the Electrical Standards and Instrumentation Laboratory. S-S-E-C engineering system center hadn't been formally created yet. In that group were a couple, there were some really, really fine people. I mentioned Harry Miller, Leo Skille. Harry may have actually assisted work on some of the, maybe some of the very early instrumentation that flew on Explorer and maybe the early, early TIROS satellites.

There was an engineer in charge of the group that was called the Satellite Group, Dave Nelson, master degreed engineer under Professor Parent. And a technician, very talented technician by the name of Howard Haggens [spelling?]. Howard and Dave were just dynamic people. And I'm sure that's why they were part of that group because things had to be done, had to be done in a hurry because there was a time when satellites were going to be launched and if you weren't there, it didn't fly. You were replaced with, wires were cut and you were replaced with what we called a golden brick. And that was the nickname. But they would have to replace the instrument package with a mass and a weight that was equivalent to the package to maintain the weight and balance of the spacecraft. And at that time it was ounces. They weren't launching tons of things. Ounces were very, very important. This all happened, oh I think I was hired, I don't have the exact year but I'd like to think it was 1963 or maybe shortly before.

Another technician that was hired at the same time that I was, was Stan Sitz [spelling?]. Stan Sitz and Howard Haggens were together working for Dave Nelson and I'm going to say downstairs. And at that time I started working for Leo Skille upstairs and in the Instrumentation Service Group. There was another grad student that was back in another little room in this basement of the Engineering Building. His name was Helier Rognerudden [spelling?]. He was a grad student from Norway and he and his wife both did their graduate work here at Wisconsin. She as a biochemist and ended up having a great career with what be the equivalent of our FDA in Norway, did a lot of food science work. And Helier went on to be a very successful engineer. He had his own firm, his own company, did a lot of great things. And while he was starting as a grad student for Professor Parent, he was also engineering some of the ground support equipment and devices. This was all prior to integrated circuitry, discreet transistors. Everything had to be hand built, but Helier, some of the data handling, some of the data processing at that time, instrumentation, Helier designed. And I think it became part of his master's thesis. Another grad student by the name of Jerry Sitzman shortly joined up with that group. Jerry and Helier, we were all great friends. I think that's part of the culture. We all become friends working for this organization. I'd like to think I'm still one of them. [laughs] So and then it wasn't too long Terry Schwalenberg I remember came in and he may have even started working as a student. And Terry became an engineer with Space Science very early when Space Science was formed also. And there were numerous other graduate students and pretty soon this went from one small room, we invaded the room next to us and we started growing our little empire down there. And oh my gosh, a lot of things were going on. I really felt fortunate to belong to this group. Suomi would come in and get us all excited. We liked to call it excitement and inspiration at the same time and it really got us moving. And in a good way, in a way we wanted to. Sometimes it was frustrating because we were feverishly spending lots of time trying to meet a deadline and then all of a sudden a barrage of new ideas would walk in the door. [laughs] And now what do we do? Drop everything and start the new ideas? I don't think so. But anyway it was really, really some fun time.

And on the other hand Professor Parent, fabulous individual, he was the detailer. He was the one that was responsible for making sure that the flight instruments and the ground support instruments were designed and worked properly. And he made darn sure everything was right. All the analysis was done, computations were completed, double checked. Took a little while but when he put his stamp of approval on something, boy you could take that to the bank. So there was quite a combination between Suomi and Parent. And anyway, of course to pursue some of those wild new ideas and great ideas which eventually were implemented, many of them, many of them not maybe, but a lot of them were and became very successful. And Parent would have to say ok hold on just a minute. [laughs] If we're going to do this we have to do it right. And great combination. So maybe that's why things actually ended up working.

Well it wasn't long and I think it may have been around 1965, anyway the formal organization of the money came in to form Space Science and Engineering Center. And the Instrumentation Systems Center. Now this little group that we had, we had the opportunity to join, as technicians anyway, to join either of the two groups. It was totally up to us. Well, it was, once you get started working for Suomi and the early satellite work, boy, that's pretty hard to walk away from that. So I and Stan Sitz and anyway a few others of us, Dave Nelson, Jerry Siztman, and I think Terry Schwallenberg, at the time. We said ok we're going to go with the Space Science group and that was housed at 601 East Main in the upstairs of a kind of a warehouse office building. It may have been an old MG&E building, Madison Gas and Electric. I'm not sure about that. But it was an empty building. It was a place for us to go. And it was again David Nelson, I have to say myself before I forget, Jerry Sitzman, Terry Schwalenberg I'll repeat, and there were two gentlemen, two instrument makers, machinist instrument makers. The two best ones on campus is what it took to build some of the early mechanical portions of the flight instrumentation. Very close tolerance work, especially for the small incremental tape recorder that Howard Haggens and Stan worked on. Those were actually originally designed and built by an outside organization, Astronautics Corporation of America over in Milwaukee. I've got to say a little bit about that. That was a company that was formed by a grad student of Professor Parent. A gentleman by the name of Nate Zelazo. And I have a write up about him. He started a very successful company making flight instrumentation for aircraft, a lot of it for the military, space hardware. And they were the ones that designed and built that first incremental tape recorder about the size of two packs of cigarettes, if I can use that analogy. But that instrumentation along with an electronic box which was somewhat larger and the sensors, the flat plate radiometer sensors is what was eventually flown on these early spacecraft.

Well that work was started and some of the flight hardware was completed before we moved over to 601 East Main. So it was a pretty hectic time. We had flight hardware to deliver, calibrate, test, all the sort of environmental testing and things that went on and was pretty darn extensive. The equipment had to sustain mechanical vibration tests, severe thermal cycling tests, some of it done in vacuum. And we even took some of this equipment over to the Delco Electronics Division of General Motors which was in Oak Creek, Wisconsin and they had the facilities. They were doing some of the early Apollo guidance system design and some heavy work for the Defense Department but they had some fantastic vibration testing and thermal vac equipment that we didn't have here on campus. So anyway, in amongst all of that we moved over to 601 East Main. The machinists, I'm sorry I just have to skip around here a little bit, but getting back to these two machinists. There was a mechanician shop down the hallway in the basement of this engineering building. A machinist by the name of Bob Sutton, who everyone know, loves, anyway it was Bob Sutton and another machinist by the name of Randy Langdon, an older gentleman that worked in a machine shop that was in the electrical engineering department. Well Bob Sutton was with the mechanician shop and Randy Landon was ready to make a move. So he's the machinist that came with us to 601 East Main. Randy was an older gentleman and oh he was like a kid in a candy store. Here we had the money to buy new lathes, they had the lathes, a six inch Harding, a thirteen inch or a ten inch Clausing if I remember correctly. And boy, these were state of the art machine tools. And maybe even a Bridgeport mill came in at the time. And so Randy did a lot of great work over there at 601 East Main.

Leo Skille then came over. Leo first went over to the Instrumentation Systems Center in the new Engineering Research building. And then he moved back over with us in Space Science and became the technician supervisor or lab supervisor at 601 East Main. And he finished his career at Space Science at 1225 West Dayton. I think I got the address right. Ok, thanks. Anyway, Dave Nelson left for greener pastures. He had some tremendous opportunities. He went off to Aerospace Corporation and an engineering professor by the name of Ted Bernstein came and filled the function of chief engineer. Dave Nelson had that title earlier. Well, there was a new generation of flat plate radiometers and weather satellites coming on that we were going to be part of called ITOS, TIROS-M. And totally different package. Some of the new engineers on that, they came along was Bob Wallersheim. Bob Wallersheim was a graduate student of Professor Bernstein. And I think those of us in Wisconsin, Wallersheim is a pretty common name and maybe his first love, he was a great engineer but he had a lifelong interest in wine making and anyway of course started what is now one of the, probably one of the really good, it's the biggest winery, largest winery in Wisconsin and it's noted nationwide and maybe even worldwide. And it's a great entity in itself. But Bob Wallersheim, it was a real joy to work with him in the development of the TIROS-M. Again I was involved with the flat plate radiometers. We had a new generation of sensors that also presented us some new challenges. But it all ended up working.

Another gentleman by the name of Bob Dombroski started in mechanical engineering at the same time. And there was a mechanical engineer by the name of Joe Miller and Joe hadn't actually, I don't think Joe worked on the satellite program. He did some other things that were being supported by the early Space Science and Engineering group. But Bob Wallersheim and Bob Dombroski both become involved in the TIROS-M ITOS series of satellite work. Oh, some other names that I remember that come in at the same time, the technicians and the staff was starting to be added, grew rapidly. Tony Wendricks came aboard. He moved on over from the D-O-T Bridge Department which was near Engineering Hall, and joined us at 601 East Main. Incidentally Tony and I are best of friends. Gene Buchholz, technician, was added. He came over. Jim Maynard, these are all of the first wave of technicians that came in over at 601 East Main.

I really apologize if I don't remember everyone but I'll go onto a couple other projects I was involved in at that time and these were meteorology related. Dr. Stig Rossby, Eddie Wayflew [spelling?], I work, in fact Dave Nelson was still there and we worked really, really hard on a couple of instruments that flew on a Convair 990 out of Ames Research Center in California. And I had the great pleasure of being part of those flights. And an electrical field mill and electrical conductivity sensor that was added to the aircraft. And then there was, I forget his actual title, but Pete Kuhn was a National Weather Service, Department of Commerce employee, and he was a colleague of Suomi's in all of this early work. And we flew an instrument of his that was added on and it was an upward and side-looking radiometer of a sorts. I remember what it looked like. Maybe have a couple of old pictures of it, but boy that was a lot of fun.

Oh, time went on and it wasn't long and we headed over to the new building at 1225 West Dayton. We had been watching this thing go up fifteen stories, one of the tallest buildings on campus. And that was going to be and it turned out to be quite a place to be. Somewhere along the line another gentleman added in and I'm not so sure if Mike Shaw [spelling?] came with us at 601 East Main or after the move to West

Dayton but that's another name in that era. Well, once we got over to the new building there was a very large electronics laboratory. Took up one whole side of the building. And I believe it was on the fourth floor. Leo Skille headed up this group of technicians. There was quite a bunch of us. So he has my sympathy for putting up with us but there was Jim Maynard, Bob Herbsleb, Doyle Ford, Chuck Blair, Bob Oelkers, Gene Buchholz, Stan Sitz, myself. Mike Becker came a little bit later and again we were all working for Leo. And Parent spent half of his time as co-director of Space Science and Suomi, of course, was the director. That lineage went on. And lots more people. I remember Terry Schwalenberg being one of the engineers. I remember early scientist Larry Sromovsky. Oh gosh, there's just all kinds of names. Engineers that came along, Evan Richards, and I remember Fred Best and all of these guys Jerry Sitzman, they all had their offices. Boy, we were living in a pretty, pretty darn nice place. Then I think shortly after I ended up departing Space Science for a company that Professor Parent was doing some consulting for back in the early '70s. And I was given an opportunity to join a startup company in the machine tool related industry and it was a lot of fun. Unfortunately the founder and president of that company passed away. But Professor Parent kind of opened up a new door for me. I remember Dave Jones coming in and that would be just about the time, oh maybe after I left but I really apologized for any names that I may have omitted or may have forgotten after fifty some years but anyway that's kind of my story.

So I came back to Space Science for a short time as you go. Stan Sitz and I were actually working for the same company here in Madison at one time. And that was in the mid '70s, late '70s, actually may have gone into the '80s. And anyway market changed and so they didn't need all of the people that were hired so Stan and I ended up going other directions. I came back to Space. I had another offer pending that I couldn't put my finger on yet. That was a friend of mine directed another company and anyway so as a friend I couldn't commit one hundred percent but then I came back to Space Science and boy did I have fun. Got back with Evan Richards and Jerry Sitzman and Fred Best, all these guys were here and a few of the technicians were still here, many of them. Leo and so forth so it was back to the good old days and I had the great pleasure of doing some cable and harness work for the DXS program that Dr. Kraushaar brought over to Space Science and Engineering. Well then along came this other situation for me which was actually an industrial sales job with a local company. Talked it over with Professor Suomi and gosh you know we talk about life coaching and all that sort of thing. And I was on the receiving end of that and you know what do you think and I don't feel good about saying I've got this offer pending. He said "you know Ken," he said "that might not be a bad idea." And he always encouraged us to pursue what we thought was maybe best, and whether it was or not, he never got in anyone's way. If you made a decision, he supported you and obviously if it didn't make sense I'm sure he wouldn't have. So I remember that. And another little remembrance I have, not small thing. When he was in the hospital toward his, it wasn't too long before he past, I remember visiting him at University Hospital. And he was, he had all kinds of paraphernalia, and IVs and little tubing and all of that. And anyway he was looking at that and he says "Do you know where I can" he knew I was in the welding supply and gases and scientific gases that we were selling, and so anyway he said "do you know where I can get some of this little tubing, some of this little stainless, thin-walled tubing?" And I said "Oh wow." I said "Well," I said, "I do know somebody that manufactures stainless tubing but not hypodermic tubing, or that fine diameter stuff, thin-walled tubing." So anyway this customer of mine, I went right down to Janesville and talked with him and told him the situation, told him about Dr. Suomi looking for this tubing and what his situation was. Well, this gentleman had a friend out on the East Coast that worked for a company that made just this kind of tubing. And so we air shipped some of it in, air mailed in some samples. I brought it back up to the hospital and showed it to Dr. Suomi and asked him if this was what he was looking for. "Wow", he said. "That's perfect." I then asked "Should I leave it here or do you want me to take it to Bob Sutton?" And he said "You'd better give it to Bob Sutton." So that's the last time I seen him. And it's a profound memory and I greatly appreciate having to share some of these things.

I also, Professor Parent, his wife and I participated in a launch of one of the TOS satellites. Somebody put a smudge. One of the things I did was I was lucky enough to do probably all of the construction of the sensors themselves. It was a job that wasn't the most attractive thing to do and whatever, but it was fun. And it wasn't just putting all this little stuff together. It kind of goes back to Suomi telling us about his younger days when he worked for the Civilian Conservation Corps in Minnesota digging ditches. Well, being out there he wasn't digging ditches, he was building a national forest. So [laughs] these early sensors, oh my gosh, they were everything from Reynolds Wrap aluminum foil was actually the disc material that was used in these early sensors. Dacron thread from a wedding veil, and I'd like to think it's from a wedding that Suomi was at and he got the idea that this would be exactly the right kind of thread to use to construct these sensors. And so he came into the lab down here in the basement, I'm backing up again, in the basement of that engineering building, with these strands of the white, pinky thread that he pulled out of this wedding veil. And it worked perfect. We built all of the sensors with it. And it was just, because it didn't fray, there wasn't any lint, all that sort of thing. And we always hoped that everything was going to stick together with the epoxy glues we were using. This was pretty early stuff back in the '60s. And somehow it all worked. It survived the thermal testing to the point we actually thermally cycled these things from almost liquid nitrogen temperatures to over one hundred degrees Centigrade and they somehow survived. But I got to give credit back, too, there was two types of coatings that was put on these sensors. There were black sensors and there were white sensors. Some of the very early sensors, the hemispherical sensors, they actually experimented with different kinds of paint. Black paint, getting paint to stick to this stuff was really a problem. Well anyway Suomi had the idea that the right kind of material would be a heavy anodized coating, clear anodized coating, over a shiny piece of aluminum. Reynold Wrap was fine. Stan Sitz was the guy, the technician that figured out how to anodize those, that aluminum foil that was used for the white sensors. Paint, anyway I don't know if it was Suomi or Parent or who or Dave Nelson, but the Mautz Paint Company here in Madison had a formula [laughs] it turned out to be the best paint they could find to stick to these aluminum, little light aluminum discs so it wouldn't peel off but it also had the most desirable thermal characteristics, the emissivity and absorptivity of the infrared. And so, that stayed. It didn't look real pretty but it was a nice rough black surface and every sensor we made was coated with that same Mautz paint. So anyway, a little home town story. [laughs]

Golly, I know there's a lot more to talk about and things to remember and I'm sure there's things that I should have talked about and should have remembered and I apologize to anyone for that. And anyway I guess that's kind of it for now. And something nice to tell my grandkids about [laughs]

Linda Hedges: Would you like the recording to end now?

Kenneth Walker: That would be fine. Thank you.

End of audio

Oral history interviews collected during the celebration of the
50th Anniversary: 1965-2015, Space Science and Engineering Center, University of Wisconsin-Madison.

ZOOM0016

Kenneth Walker
Linda Hedges

11 September 2015

14:34 minutes

Kenneth Walker: Well, once again I, as we go on, think back. I forgot another name, an engineer that came along that was a lot of fun to work with, Scott Ellington. Just talked with him last night in fact and I omitted his name unfortunately. There may be others again that I apologize for but there was one more story back in the satellite work. After the TOS series which I got involved in which was called TIROS Operational Satellite. Their official names were actually named after the Environmental Science Services Administration – ESSA – so they were called TOS and formally I think called ESSA after launch. And there was ESSA 3, 5, 7, and 9 and so forth. And about half of those satellites in that series flew out flat plate radiometer package. Then along came the ITOS next generation, a prototype version was known as TIROS-N, quite a different satellite. Instead of rolling like a cartwheel in space and spinning like the TOS satellites, the ITOS Improved TIROS Operational, that was a stabilized satellite so one side of the spacecraft was always oriented toward the Earth. So now our flat plate radiometers were always looking at the Earth and not being rotating looking at Earth, Sun, space and all of that. Anyway we built I think five packages for that program and this was, I remember Bob Wallersheim, Bob Dombroski and myself at the time traveling out to Hightstown, New Jersey to the RCA Astroelectronics Division to do the final calibration and testing of those packages, as I did with Dave Nelson in the earlier days with the TOS packages. Extremely interesting. The ITOS came along and five packages were built. Obviously the first ones were the hardest to build and they were radically changed, radically different from the TOS versions. We went to from mechanical tape to discreet electronics to actually had integrated circuits, early integrated TTDL circuits that we, TTL rather, that made up the electronics, a lot more capabilities, recording, counting, all that sort of thing. And I did a lot of that assembly and reflow soldering and so forth of these new little flat packs things that was state of the art at the time. Felt really good about what we built as we got into it. The fourth one was supposed to be the final flight model. The fifth unit was a spare which incidentally I seem hanging at the Smithsonian in the late 1980s. Up next to a Soyuz spacecraft and all that. And I says "oh my gosh, look at that. I built part of that." [laughs] So that was kind of cool. I hope it's still there. Anyway the fourth package was the one that gosh we felt good about that. This thing worked. It went together easy. It tested. We had very little, if any, rework on it. And this was the one that was really going to fly and do the best job and last and be the most reliable. Well, unfortunately the launch didn't work so well. These things were launched off Vandenberg Air Force Base. NASA had a launch site out there. Going into polar orbit, went south under the South Pole, it was supposed to be in orbit by the time it came around the North Pole. Well, instead it never made orbit. One of the final stages failed and it ended up in, we called it The Drink, the ocean up near the Aleutian chain. Boy, that was a disappointment. That was our baby and now it was forever gone.

Back, one more thing, a great memory was being involved with the one and only launch that I actually got to participate in was with Professor Parent. His wife and I joined up with them, flew out, and something happened. There was fingerprint smudge or something put on one of the sensors, one of the flat plate radiometers. Well, I was the guy that built it so, ok we'll have Ken come out and see if he can clean it. [laughs] So I put some fingerprints on one of them back here, a spare, and then worked with a little alcohol and various other things on cotton swabs. You've got to be really careful because anything you do around the spacecraft at this point was very critical. There were camera lens. Primary instruments on the spacecraft were two Vidicon television cameras that took visible daytime cloud cover pictures. Actually these spacecraft even had a small recorder to record, it wasn't small at the time, but it recorded the television pictures for later playback. And one inch Vidicon cameras but the lens, of course, were extremely critical. Any chemicals that you use around the spacecraft, you had to make sure there wasn't any outgassing that would condense and subsequently coat the camera lens. That would of course interfere with the primary mission and couldn't be tolerated. So anyway we got the sensors all cleaned up. This was done in a gantry house on top of the rocket. Went up with an elevator. It was pretty cool. And a nighttime launch was going to occur. So we were at a small motel in Lompoc, California and in the middle of the night you would hear rocket launches going off and the ground vibrating and all of that. And so this went on. We got held up. There was a failure in the launch vehicle. These were Delta rockets that are basically recycled or remanufactured Thors, many of them brought back from England in the old ICBM days. And they put solid state boosters on them and so forth. And the Delta rocket was just used for many, many missions. It went on for a long time. Maybe even still exists in some form. But that was the launch vehicle and the guidance computer in that thing actually had electron tubes in it, vacuum tubes, little pencil tubes. And a little pencil tube failed in the guidance system of the launch vehicle and of course it couldn't launch. So we waited for a week. Bob Parent, his wife Winifred and I had a grand week in California waiting for this stupid tube to come along. So then we went up, did one last inspection of the flat plate radiometers because now they've been sitting there for a week and inside a gantry house but they were still on top of the spacecraft. Well, they got the guidance computer repaired and checked out. And oh boy, OK, I'm going to see my first launch. So the three of us were back in a block house in a fallback area but still pretty close. As close as it was safely be allowed and all ready with camera in hand and all that. So minutes before launch or maybe even seconds before launch, nice clear evening, but just before launch a cloud cover moved in, maybe five hundred to a thousand feet [laughs] and so they lit up the spacecraft. Everything lit up, the ground shook and all I got to see was this thing go up into the cloud and then everything lit up because the cloud diffused all this light and we could hear all this rumble and listen to it and disappear. So that was my, instead of being spectacular, well, it was still spectacular but [laughs] unfortunately that's what it turned out to be. So then again, I have to say that during the part of the program when we were over before 601 East Main was set up for us to move into, Professor Parent suffered a severe medical issue and I believe it was heart related and he was actually on medical leave for quite period of time. And came back, oh my gosh, totally rehabilitated, suntanned, he and his wife went out to the Bridger area in Wyoming which they loved and put their camper in place and spent the whole summer out there. He was very thankful, very grateful individual at this time. He always did care about everyone a lot but he was a classic, worked very hard, didn't have a lot of time. And anyway but now it was a different lifestyle and I got to enjoy that phase of his lifestyle and we would stop at an airport and go into a lounge and have drink and he said "Ken, sometimes we just have to sit down and take it easy." And that was very good to hear from him. And then something else happened to him medically but that was also a loss. I thought an awful lot of Professor Parent as many of us did that worked for him or the few of us actually that were there at the time. So I certainly with regret I have to acknowledge his passing.

Others that certainly are no longer with us that were coworkers, friends, wow, really good people. Jim Maynard. Jim and I worked together at the Air National Guard. We were both technicians, electronic technicians out there, weapons control technicians at the time. Lots of fancy electronics. Jim was just an excellent guy. Jim passed away fairly recently. Doyle Ford. Doyle Ford was a technician that came with us at 1225. I believe he was with PSL, Physical Sciences Lab, before that. There was an unfortunate, during those years, a very, there was a tragedy. Airplane crash at O'Hare. [transcriber note: 1972] A DC9 that was taking off, with two of our people on it. And anyway, another aircraft taxied across the runway in front of it and subsequently the aircraft that Chuck Blair and John Kruse were on crashed, burned. They lost their lives. Chuck Blair was a technician. He did a lot of great things in his own right. John Kruse was an engineer. Actually I think he was a year or two ahead of me in high school out in Sun Prairie. And that was a sad, sad time at Space Science. I mean, these were guys that were just key people. Chuck Blair worked closely with Professor Suomi and a scientist from Israel bu the name of Nadav Levanon. I'm hoping I'm pronouncing that correctly. They, Chuck has a lot to do with the design and the success of a radioaltimeter that flew on radiosondes that was developed. He and Suomi both spent quite an amount of time in Israel on that project that Nadav Levanon had basically conceived of. We lost Leo Skille within the recent past, within the last year, year plus. Anyway that was, again Leo was an old friend. He mentored a lot of us. He brought in people that he knew, people that he selected. I'm talking about the technician staff now which was this big list. All of these technicians that I have mentioned, Leo was the one that selected. I was fortunate enough to be one of them. So Leo, his loss was certainly felt. Another engineer friend of mine, lots of stories that we don't have time for, but a fellow that was a great pleasure, Jerry Sitzman, to work with on a project. Boy, Jerry also was a master degreed engineer who was I believe, Professor Parent was his major professor. Boy, anybody that came out of that group, we all thought the world of the people we were working for and it was, a bunch of us guys were all friends. Those of us left continue to be so. We get together for lunch once in a while, Mike Shaw, Bob Herbsleb, Stan, Bob Oelkers, the whole bunch that are left. Mike Becker I believe lives down in Texas so we don't get to see him. Anyway it was quite a group. I'm very fortunate to have been part of it and to know and certainly with regret acknowledge those that have passed. Thank you.

End of audio.

Oral history interviews collected during the celebration of the
50th Anniversary: 1965-2015, Space Science and Engineering Center, University of Wisconsin-Madison.

Recorder 2ZOOM0002

Tony Wendricks
Leanne Avila

9 September 2015

51:26 minutes

Tony Wendricks: I'm Tony Wendricks. I'm probably the longest standing employee at Space Science has had. I was not with the founding of Space Science but I came a little over a year later in January 1967. So having said that, it was a pretty exciting place to come to work. It was in the '60s when President Kennedy had made the promise to go to the Moon. There was a space program. It felt like we were part of the space program. It was very exciting. And Dr. Suomi, of course, encouraged that. He encouraged a lot by a lot of things he said just about all of the stuff he was involved in but that's not probably what I want to talk about. I want to talk about people and things.

So Leo Skille is the first one. He was my supervisor, the initial supervisor. And a man named Gene Buchholtz, who was also one of the very first hires, and I started at the same time. I mean, At The Same Time. Same day, same minute. We parked our cars next to each other. This is when Space Science was in rented space over on 601 East Main Street. Parked our cars in the parking lot, walked across the street together, not knowing each one was, both, either one of us was a new employee. And we get to the door, one of us opens the door for the other and said I'm looking for Leo Skille. The other one said so am I. So we started at the very same time. Anyhow, Leo was a very good supervisor. He was always looking out for the employees, trying to get us a better position, increase our position, increase our value to the Center but also to ourselves. He was very good that way. He also, how shall I say this, took care of an individual named Howard Erdman [spelling?]. Howard Erdman was a stock clerk and he was probably the biggest individual you could ever imagine. The year before he came to Space Science he had twenty six W-2s. That means he was looking for a job the day he got a new job. Somehow he was very good at getting jobs I guess. But when he started at Space Science Leo kept him for a long time. He had some very interesting activities, I would call them. For instance, one time an engineer, Bob Dombroski, was trying to make a very light weight panel and he had honeycomb and two films of aluminum and putting them together with close cell polyurethane which is a two component Styrofoam kind of material. You mix them together and then it would foam up much like the stuff that you put in cracks and seal windows and all that stuff with. Only this was a very early version of it, before anybody knew about that other stuff. So Bob was doing these experiments. Well, Howard thought it would be fun to see how that worked. He took a coffee cup and put in part of the chemical and put in the agent and it started to foam. And it didn't take long and it was foaming over the top. Howard didn't know what to do with it so he ran to the floor drain and dumped it in the floor drain. Yes. It plugged the pipe really tight. That's only one of the Howard Erdman stories, there's a million of them.

Who else should I talk about? Well, at that time the chief engineer was a man named Dave Nelson. Brilliant engineer, brilliant engineer. He didn't stay real long but he was my first engineer that I had to make some drawings for. When I got to Space Science there was no drafting department. So I established it. And the work ethic there was when it's your turn you do it. And you do whatever it takes. In thinking about this fiftieth anniversary, I've come to realize that that was kind of the theme of the Center and I think it still is very much so. Whatever it takes. Over the course of years it has gotten to be much, much more structured. It has to because there's far more people. But was it whatever it takes. Fact is the first week I was on the job there was a project called TIROS-M which had a flat plate radiometer on it. And that flat plate radiometer needed some drawings. The very first week I know there was at least two of the nights I stayed until eleven o'clock at night making drawings because it was my turn to do it and whatever it takes. Pretty neat feeling. Pretty neat feeling to be part of the group like that.

It was really enhanced by the fact that I'd come from the highway commission. I was in a bridge design section and mind you, this was in the '60s when military was not real popular but the bridge design section was set up in a very military style. We had squads and we had squad leaders and all that kind of stuff. So coming to Space Science and having this open atmosphere and everybody enthused and going was a really great treat. It served me well. That's why I'm still here. [laughs]

Let's see. Who else was in there? Well, Bob Sutton was not the machinist at the time. There was a man named Randy Langdon. Randy Langdon had been around for quite some time. Very good, very, very fine precision machinist. And then he had his machine shop up there and all like that but then when we moved to this building, the Space Science building, Bob Sutton was hired and for a period of time we had two machinists. And of course, Bob is as fine a machinist as there is or was. Made a lot of very nice pieces for spaceflight hardware. And I think Bob had very much the same attitude about, just like everyone else, whatever it takes. So it's the WIT thing.

Ken Walker, Ken Walker was one of the founders. I guess Randy Langdon would have been one of the founders, too. When Space Science was formed they were formed out of a group called some sort of standards lab or something like that. And the people, the individuals in that lab had a choice to go with Space Science and Engineering Center or with Instrumentation Systems Center. Randy Langdon, Ken Walker, amongst others chose, and Leo of course, chose to come with Space Science. Stan Sitz [spelling?] would be another name in there. He was an electronics technician. Ken was an electronics technician. Jim Maynard was not with that group. Jim Maynard was with meteorology but he integrated into Space Science, too, at a later date.

So what have I got here, some other things. Elton Walk [spelling?]. Elton Walk was the first business manager, but now it would be, not executive director but I guess that was the kind of position he had pretty much. Elton was a very enthusiastic individual, too. He always was upbeat and it was just a treat to work with him. I don't know if he's going to be around for this meeting tomorrow or not. I would like to see him if he still is in the area.

Professor Parent. Professor Parent is a name that you don't hear a lot but I think, in my mind, Professor Parent is the reason it's called Space Science and ENGINEERING Center because Dr. Suomi was the space science guy. Professor Parent was an electrical engineer. And the two of them had teamed up to make spaceflight hardware before the creation of Space Science. That's how they became Space Science. Professor Parent was, I think his title was Associate Director, I might be wrong. Oh, by the way, all of these are my recollections. This isn't necessarily fact. [laughter in background] So Professor Parent, yes, was a very nice man to work for. But I understand earlier he had been a much more demanding, driving individual than when I became involved. And that was due to the fact he had a medical problem, he had a heart attack and he was told to slow down and he became a real ___________. He was as fine a gentleman as there ever was. Now, he may have been like that before, but he just was a driver, previous to what I knew.

Who else was in there? Oh, Vicki Epps. Vicki Epps was Dr. Suomi's, at that time they called it secretary. And Vicki knew more about what Dr. Suomi was doing than he did. She knew his travel. She knew all of his, every movement he made, she knew about it. Well, certainly not every movement because Dr. Suomi was a known tinkerer. He had labs wherever he was. And he would test out some sort of concept and then he would try to bring it to the engineers to make it, to have them do it. There were stories and I have no verification of this but, there were stories of a piece of spaceflight hardware that needed to be integrated into the satellite it was going to be on and it was finished up in a hotel room the night before. Put together, I should say. Final assembly was done in a hotel room the night before. Again, that a story that I had heard. I was not there for that.

Leanne Avila: Which satellite? Do you know?

Tony Wendricks: No I don't. I think it was a little recording device of some sort. Ken Walker is going to be [here] this evening and tomorrow. And I will ask him about it. He was more likely to have a better idea about it.

Let's see. So there was that. Dr. Suomi. When we moved into this building, Dr. Suomi, well he had asked for me to draw things for him at Main Street, but when we moved here somehow he found my office. And he would come in on a regular basis and ask me to make a diagram for his class lectures or something like that. And one morning he came in bright and early. I was feeling pretty chipper and I said "good morning, boss." Wrong thing to say. He did not want to be called boss. He let me know. But then some time later, maybe more than once but once that I know of, he wanted the engineers to do something that they didn't think would work. He wanted them to break a Christmas ornament, a round Christmas ornament,so that they could use the inside of the silvered ornament as a concave mirror. And they didn't like it. They didn't think it would work. He wound up pounding his fist on the table and saying "Damn it, it's my money and you're going to do it." They did it, proved it, didn't work, and everything was good. Anyhow, he didn't' want to be boss. He didn't want to be called boss.

What else have we got here? Projects. Lots of projects I've been involved on. From, well that TIROS-M all the way to I suppose the last physical project that I was involved in was the Adiabatic Demagnetization Refrigerator. I can say those words. I now know what they are. I didn't know what they were before that. But that was part of the excitement and fun of doing things here, was being involved in that kind of thing. I'm now involved with Ice Coring and Drilling Services, but in between we had worked on other satellite projects. There was OSO, Orbiting Solar Observatory. There was TIROS-M. There was any number of that I, oh, Pioneer Venus. I'm going to slight somebody by not remembering, but that. And of course, there was DXS, Diffuse X-ray Spectrometer. Before that there was Space Telescope. DXS was one of the more interesting things that I've done. Probably more, I don't want to say exciting, but it was somehow in a totally different category and that was making a patch. You know all of these spaceflight programs have patches. So when it came time for us to have a patch for the

DXS program we had a little contest and anybody could submit a sketch. And I think it was Wilt Sanders who was the project manager on it, scientist on it, submitted a sketch of what wound up being, I mean it got molded and revised and all like that but it wound up being the patch. I got the design, do all of the final design and that and send it for approval and all like that. It took a lot to get it done. The last correction that they made was to, I should have a patch to show you but I got some at my desk, anyhow, the last correction they made was the stars that were on it could be construed as a crucifix and they didn't want that so I had to make sure that the lengths were appropriate for it. At any rate, pretty neat to think that something that I did and drew hangs in the Houston Control Center. And was worn by astronauts and passed out to a lot of people so that was pretty neat.

Space Telescope. Of course everyone knows the Space Telescope. Unfortunately our biggest claim to fame is that we were affected by the mirror. We were the one, of the five major instruments we were the one that was taken out to put in the corrective optics. But before that happened we got, we, the Space Studies Department, got a couple year's worth of good data.

Let's see. Oh, the ADR, that's easier to say. The ADR, that was a great challenge and that showed what Space Science is all about, too. It came to us through Dan McCammon over at the Physics Department. Because the NASA Goddard people had been trying to make this salt pill, we wound up calling it, for going on ten years. But they never succeeded with making it leak-proof. Dan McCammon devised, dreamed up, whatever term you want to use, a scheme of welding, silver soldering, brazing, all sorts of things, using only gold and stainless steel. And in six months we produced a functioning ADR. Now, we only produced it as a back up because the Goddard people were still trying to get theirs to go. Theirs did not go. Ours did. One of the biggest challenges of it was finding a way to make one thousand six hundred skinny, skinny gold wires, string oh about five to six inches without touching each other. How do you do that? And then still be able to connect them to posts or sockets on the end? When we were in that first meeting that day there was probably five or six of us. And it seemed impossible. And I kept thinking definitely you can't do that. It's just not going to happen. But I also thought in the back of my mind I was saying, I will not be the one to say you can't do it. We're going to find a way to do it. Whatever it takes, we're going to do it. So we had a gentleman from Bit Seven that was going to be a designer on it, designer draftsman. I should say CAD specialist because they're not draftsmen anymore, they desexed [?] drafting, that's a separate issue if you've noticed on my list over there. I was a draftsman. Then I went through a drafter when they desexed [?] us. Then I went through a CAD specialist when they gave us a computer. And then because of the ADR and the way I interacted with various groups, I became a project coordinator. But anyhow, Ken Bushane [spelling?] was that man's name who was the Bit Seven individual and he knew of a stainless steel sieve kind of plate, so we worked with it. Found out that there was a particular one screen that had just the right amount of holes for us and then Dave Jones painstakingly sat and strung gold wires through it, over and over and over. So when you make one of these you can't make one, you have to make a back up. You got to make a spare. So we did that twice. Put it together. We had to grow a salt crystal with it. It operates on a magnetic field, all these kinds of things. So that's why it couldn't touch. Very interesting project. We get done with it. They test it out. It didn't leak. And it out performed anything, more than they expected. It was a two stage refrigerator is what it was. First it was cooled in a liquid helium bath and then it cooled down to almost absolute zero. At one time it would have been the coldest known object in space. I say that because it was a collaborative project with the Japanese Space Agency. And unfortunately their launch vehicle had a problem. So it got one lap around the Earth and then "paluch" into the Pacific Ocean. So we did make them another one and that one got launched and that one operated for a while but because someone had left a value open it didn't have the operational life that it needed. So unfortunately that wasn't a success. But out of making those, they had a couple of airplanes that used a similar sensor panel that they needed cooling. The project was called Hawk. They asked us to make two more for that. The good thing about that is they didn't need to have sixteen hundred wires, they only needed eight hundred. But Dave still strung them all. What a fabulous job he did. There was a lot of other technical challenges but that was the peak of it. That was probably the most interesting project that I've worked on.

What else do we talk about here? My office? Well, like a lot of people in this place I've moved a few times. [laughter in background] Of course, we were in rented space when I started out on 601 East Main. But then we moved into this building. I moved into 421. 421 is a pretty good sized room. I think there's about eight people in it now. At that time I was the only person in it. At one time the drafting department, drafting room, whatever you want to call it, grew to have three full time individuals, Nick Ciganovich, John Short, myself. And as many as a half a dozen students. That's when McIDAS was going strong, the development of McIDAS and they had schematic after schematic after schematic. And we did them.

Which reminds me. Schematics. When I started with Space Science I had no idea what a schematic looked like or how to draw one. But the people here gave me a little bit of nurturing and encouragement and diagrams to make and I wound up making them. And then they needed print circuit boards so they explained what it takes to make a print circuit board and pretty soon I'm laying out print circuit boards. This is before there were computers so it was all done by hand. It was all done in two planes. One plane, two planes and then it expanded to four, up to ten planes. But originally it would most likely be one or two layers of circuit board. So I made electrical drawings, mechanical drawings, illustrations for publication, illustrations for proposals, signage for the building, anything. Whatever it takes, you know. That's what I did. So that was pretty nice, too.

There was never a dull moment. Ah, that's not true. There were dull times. Some of those projects were repetitive over and over and over again. There was one project where we had to take computer print out pages, you know those eleven inch wide, fourteen inch wide, whatever they were, and make isobar lines over and over and over. And they were six feet long and there was probably six of them that they would make a mosaic and then they'd take a picture of it and it would go off into some research that I don't even understand. But that's not unusual, not understanding things that I was doing.

When we were starting with that salt pill, the ADR, we were over in the Physics Building because Dan McCammon's lab was over there and that's how we were learning how to make, to grow these crystals. And in the elevator was a sign about, something about neutrinos. So Dave and I were reading this sign about neutrinos. It was foreign language. It was strange stuff. But Dave looked it up a little bit, told me about it and looked it up some more. Got to know what they were a little bit. Still don't understand a whole lot about it but after that came the Ice Coring and Drilling Services and lo and behold they were the people in Nebraska that did a program called AMANDA which was the predecessor of IceCube. And it was all about neutrinos. And now you get more of an information and education about neutrinos. So that was pretty neat. And IceCube started here in Space Science with people that were involved in ICDS and then eventually it got big enough and funded enough so that it needed to become its own entity for lots of reasons not the least of which is NSF wanted to avoid the appearance that ICDS was only IceCube because it was that big a project. So anyhow, they split off and became their own entity and as you know very successful. But it was fun to be involved in the beginning of that, too.

ICDS. So ICDS became IDDO. That happened when ICDS was a contractor with NSF and then it became a cooperative agreement. There's a real success story for Space Science in IDDO. Krissy Dahnert. Krissy Dahnert is a current employee but Krissy Dahnert is now the director of IDDO. She started on the loading dock, literally started on the loading dock as a student. And as time went on and she graduated and needed a job somehow we wound up retaining her. And she got a position in quality and safety. It was kind of a way to keep her and then she asked about going to Antarctica. Well, she was asking me about going to Antarctica when she was on the loading dock. I said to her "be careful what you ask for, you might get it." And of course, she did. She proceeded to keep on asking and next thing you know she's spent six seasons, I think it was six, in Antarctica, one in Greenland with that drill. While she was going to Antarctica we needed to have lead drillers and then Jay Johnson was our lead driller but when Jay had to come back to Madison to go to some classes to further his education, we needed a lead driller. Krissy was just a natural. She fell right in and did a great job. So then as IDDO got more projects to do she became, she moved up to the twelfth floor with us to become the field projects manager. Did such a great job at that that she was always given more to do, every time, all the time, all the time. And now she is the director because when Don Lebar who had been the director retired she was a natural for it. When he would go on vacation, she would take over, write the reports, talk to people. And she got to know everybody up and down the line because she had gone to Antarctica so many times and everybody knew and appreciated her skills. So really nice success story. Whatever it takes, again, you know, people do it. Over and over.

I should go back and say that the reason we got the ICDS contract was because there was a time when a man named Bob Paulos was here and he was very prolific at writing proposals. And he was never discouraged by not getting these proposals to come in. It's kind of like fishing I guess. You just keep casting and pretty soon you hook something. But anyhow, a man named Bob Morse over in the Physics Department talked to Bob Paulos about bringing the contract here when it was up. Nebraska had it and it was up for rebid. So Bob wrote a proposal. And part of that was because of the AMANDA program. The AMANDA program was based out of the Physics Department here and they would have Physical Sciences Lab do the work for them. So Bob wrote that proposal. When he was writing it my involvement started. He called me in one November day and he said "hey, would you like to be involved in ice drilling, ice coring and drilling services." I said "sure. I don't know. Wait, what do I have to do?" Yeah, he said "project coordinator. We need to put a name down here. Is it ok if I use yours?" That's how I became project coordinator from CAD specialist. So that's fifteen years ago. Wow is right. Fact is that's a real wow because that contract, that drilling contract for the NSF had never stayed in one place for more than five years before that. It started out when the first time they offered one was in Nebraska, University of Nebraska. Then after five years it went to the University of Alaska. After five more years it went to back to University of Nebraska. But the people here, the engineers, and the support staff and everyone else did such a fine job that we have retained it for fifteen years. And our next cooperative agreement I believe it up in '18, so we're going on a very good string. No need to believe it's going to go anywhere else. But there's always that chance.

What else we got here? Where did I spend time at SSEC? What does that mean? My research, huh? [laughter in background] I didn't do much research, obviously. I did do a lot of support. I was in support.

Who was my mentor? I would have to say Leo Skille was for a long time. And then any number of people in the department. I worked for anyone who needed drafting done. And there was a lot of people over the course of all these years. Ok, I can say forty nine. [laughter in background] I wasn't here for all of them. Only forty nine. Any number of people. Professors from meteorology and grad students and engineers. You name it. There was even a project for someone in grad school that I did some illustration on. Because of the skills I learned here, people that would leave and go to other smaller companies, start up companies, when they would need drafting services they would ask me if I would do it in my spare time. So for some period of time, I don't know, it was probably ten or fifteen years I had a hobby drafting business at home. And using a lot of skills I had learned here. It was fun. Fun to be involved in crazy things. From one of those projects was making control motors and the box that housed it for cattle feeders [laughs] to I don't know what all, just beyond what I ever thought I'd be involved in. It's just been a great, great ride.

Let's see. What's that last one? Things. Research related work that occupied your time. Well the organizational culture was, like I said earlier, very, very energetic, very can-do. Whatever it takes. I keep saying that. I say that because since the planning of the fiftieth I've heard a radio commercial about, I don't even know what their product was, but they were saying over and over that they would do whatever it takes to whatever, get their goal whatever. And they said it was a WIT attitude. I thought boy that's really what had happened here.

Notable time. Events during your time at SSEC. Too many to mention, to even think of.

Retirements. There's been a few. [laughter in background] Only two of me, two of mine. The third one's coming before long I think.

Awards. Well, we did get an award for that ADR, including a little medal and a commendation. For several of the spaceflight projects we would get an award, a certificate and they were usually pretty nice. They were eleven by fourteen, officially done by Goddard or NASA or some organization like that.

Well, retirements. The most memorable retirement was Leo's because a group of us got together and rented a limo and drove him up to the Capitol building and had arranged with Senator Risser to meet in the Senate Chambers and that's where Leo was presented his retirement certificate from the State of Wisconsin and Senator Risser stood there and read it to him. Leo's brother from Rice Lake was down here for that. And, oh, there must have been eight to ten of us from the Center. It was really fun. Leo was a special individual in that situation.

Celebrations. Most celebrations I don't think I want to tell you about on tape. [laughter in background] Just let me say that there are some individuals who worked hard and played very hard. I will say that one time we were having a little bit of a celebration in the building, Pioneer Venus, proof of concept. And the executive director at the time didn't think we should be partying as much as we were. And he came in and said "this has got to stop." But no one stopped. So then he went over to Dr. Suomi who happened to be in the lab on the other side of the hall, tinkering with some electronics and told him about it. It was the end of the year. It was Christmas time and Dr. Suomi said "eh, the boys need to let off some steam once in a while." I won't go any deeper than that. [laughter in background]

______________________ a mouse once. Fred Best put together this chart of all of the projects that we worked on, that the Center has worked on. It's amazing. It's amazing. I didn't plan on talking when I came in here. I just happened to see you set up in here. I was going to see Jean.

So. Milestone stuff. There's twenty five years of McIDAS and all this kind of thing. Each step along the way for McIDAS. Each advancement along the way. I was reminded of an early predecessor to McIDAS when I got off the elevator on the fourth floor yesterday. In the room that's right across from there, there's a bar hanging from two cabinets and on the top of it was some black plastic hanging down. Over on Main Street there was a dark room made like that, to test out, to put together and see how it would work. Not a McIDAS system, but it was a facsimile machine. The early spin scan camera did a line at a time of course. Facsimile machine worked very similar. So Dr. Suomi put this all together in his mind and then had engineers and technicians go at it. So Bob Oelkers was in this plastic enclosure that was the dark room at the time. And it worked. They got it to work. They got it to look like a cloud picture, very crude cloud picture compared with what you see now. No comparison. So there was all sorts of things like that. And of course, at one time there was a complete photo lab on the third floor here, half where the library is now was all photo lab and in the center room it was all photo lab. At that time they were taking each picture that came and developing it. It took like twenty minutes to produce one scan, full scan of the Earth. And it would get an image and then they would send it. And then, of course, Dr. Suomi realized that if you take this image and this image and this image and flip them like you do cartoon images, you could see clouds moving and that's a big advance. But then it became some sort of an imagining machine where they would flash them up. I don't even know how it worked but I remember seeing it. And all like that. Incredible. And of course, then the story goes he was watching football one time and he saw the video tape and the rerun and that was the beginning of McIDAS as we know it.

So maybe you can edit this out if you want to, I don't know. During the sixties shortly after we moved into the building. We moving into the building in '68 or '69, I'm not sure just when. I think it was the fall of '68. There was a lot of campus unrest. The demonstrations against the Vietnam War. And a focal point was always the Army Math Research Center which was over in Chamberlin Hall. Well, we were asked to volunteer to stand watch on our building. The first floor of our building, the windows were boarded up with plywood so they wouldn't get broken in these protests. And the one little office that's in the lobby behind the display case in the lobby, those windows were left open so we could see out. And our job was to watch out the window and see if the crowd was coming, if the protesters were coming toward Space Science, to call protection and security and let them know. And that's all we were to do was just sit there. Didn't know why but we thought we were protecting the building. This is the part that If whoever doesn't want it

Leanne Avila: Do you want me to pause?

Tony Wendricks: No.

Leanne Avile: OK.

Tony Wendricks: Because it's history. But if someone, anyone, says no that's a secret then take it out. So here it is. In the basement, B13, was stored the Army Math Research Center computer. When the bomb went off in 1970, they did not blow up the computer. The computer components were in our basement. I didn't know it when I was guarding it. I was told by another employee that he knew that was why we were doing that. So then conspiracy theorists come along with the next level of this thing. And they say that's why those doors are double doors and it's bomb proof and all like that. That the building was being built in 1968 and they beefed up that room because they expected, they anticipated to use it for that. I don't know if I can stretch it that far. So that's one. I mean I don't think a lot of people in this building today know about it, have heard about it. Why, I don't know. I don't think it was a secret. But I did get to see the, they looked to me like room partitions, filled with electronics of course. That's what a computer consisted of at that time. And it took up the whole room. Full of them, full of them. Crazy.

Let's see. What else? I mean I could go on forever talking about individuals and telling stories about individuals but I don't know about that. So, I did Google it and that guarding the building, after it was done we were given a letter of commendation from the department thanking us for doing that. I think I have that letter somewhere. I've searched the last week, turned my basement upside down. I didn't turn my office upside down because that's too much of a mess already. Not quite as much of a mess as Hank's [laughs] [laughter in background] and you know Hank had his cleaned for him once.

Leanne Avila: Did he?

Tony Wendricks: So I just like to needle Hank a little. He did me once, too. Oh, this letter. It came to us. Each one of us that did that. Yeah, Hank pulled the best April Fool's joke on me that you could ever imagine. It's not that long ago. Maybe, well, ten years ago maybe. I was involved in coordinating a meeting that had fifty or a hundred or a hundred and fifty, I don't even know the number anymore but people writing to me, emailing to me. And Tony Wimmers, I think, was the initiator but he recruited Hank really well because my email address is tony w at ssec dot wisc dot edu. And Tony Wimmers thought this would be a good April Fool's joke if we take his email address. So Hank sends me this email on April First that says "effective this afternoon, I'm going to give the tony w at ssec dot wisc dot edu email to Tony Wimmers." And I read it and I thought oh no, not now, I've got all these people writing to me, how is that going to work? And then I didn't know if he was serious or not. But I thought well Hank's not going to do this to me. But I did check with Nolin, I can't come up with

Leanne Avila: Scott

Tony Wendricks. Scott. Scott. Why couldn't' I come up with that name. Anyhow, Scott Nolin and Scott says "no, no, no, we'd never to do that that fast." So now I'm suspicious but I still don't know. I go back and read Hank's email and it says "I had breakfast with Tony Wimmers this morning and he asked me if he can have the tony w." So I wrote back to Hank and said "well, if you're angling for dinner or some beer, maybe I'll give it to you." But I really didn't know then. I said, "ok if you're going to do this please just give me til the end of whatever date it was for that meeting." Anyhow, he let me sit there for most of the rest of the day and about three o'clock the two of them come in and they had really set me going. [laughter in background] So, I owe Hank one.

I tried to give him a parking ticket once. When he had parked on the loading dock and I had picked up an old parking ticket. Unfortunately it was a warning. So I put it on his car and when he came out he picked it off the window, opened it up, looked, there was no charge, put it back, and he didn't even worry about it. He didn't care. So it didn't work so good. I still owe him one. [laughter in background]

What else? You know celebrations. Back when Space Science was younger, much small group, much less people, we used to have formal Christmas parties where we would go to a restaurant and have a nice dinner. And usually someone would have a cocktail party at their house before that and all that kind of stuff. It was pretty neat. Bob Fox did some of that but that was more casual. Over time it just kind of shifted and changed. Yeah. And there was a bowling league. That was fun. I don't know. Do they still do bowling?

Leanne Avila: I think so.

Tony Wendricks: I don't really know if they do or not. But I haven't been involved for lots of years. I did, I seem to be picking on Hank, but I did take a couple ice cream cones off of him on bets [laughs] who's going to get the higher score or who's going to get the most pins on the next ball or something like that. So we'd go upstairs and have a Babcock ice cream on the way out. There's a nice Paul Menzel and Hank story but that will have to ___________________ so I won't go there. They probably know what I'm talking about.

Yeah, I think that's good enough.

Leanne Avila: All good? OK. Well, thank you very much. Appreciate it.

End of audio.

Oral history interviews collected during the celebration of the
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Recorder2ZOOM0003

Tony Wendricks
Leanne Avila

9 September 2015

3:50 minutes

Tony Wendricks: OK, well to continue with what I was doing before. I thought of a few more things. Socializing. I can count five marriages of people who've worked here. Wow is right. I don't know if I should. If I try to name them I would leave someone out but I guess I'm going to do some anyhow. And the one that comes to mind most is Jim and Mary Maynard. Or Mary Hanson, now Maynard. So we used to have, I mentioned we used to have formal Christmas parties and the like and then there was this one year when all of sudden Jim and Mary were sitting together a lot. Next thing you know, they're an item and then they get married. Congratulations to them. Kelly and Barry Roth. Dee and Gary Wade. I said how many? Five? I meant three, right?

Leanne Avila: [laughs] You're at three so far.

Toney Wendricks. Oh, Jenny and Denny Hackel. Oh, and the fifth one was a couple of students, I don't remember his last name but his first name was Dave and her name was Ann. She worked in the mail room. Dave was an engineering student and I believe they wound up getting married. Now, those are the ones I know about. There may be others but that's the ones I know about.

And I'm going to say worst times in a few minutes. The worst time was one day when we lost two coworkers in a plane crash. There was a project that they were on and they were flying through Chicago. I don't remember if they were taking off or if they were landing. I think they were taking off and another plane clipped the tail of their aircraft and in so doing set their plane on fire and they perished in the fire. The worst of times. The worst of times. But there were very few. Bad times were very, very few. My time at Space Science, as you probably can guess from the previous hour that I've been talking, was very good. And it was a real growth experience for me to the point which I'm going to read from my first resignation letter. The last paragraph. The first paragraph, the first part is talking about why I'm retiring and it's mostly to collect a pension check. But the last paragraph goes like this: "That said I would like to express my appreciation for each and every one of the thirty six years with Space Science and Engineering Center. They have been a major factor in making me who I am." I started as a young lad, obviously, I was twenty years old I believe at the time. Maybe twenty one. Twenty one, so yeah, quite young. They have been the best of times and the worst of times but there's been one constant – SSEC was, is, and I hope always will be quality people. Thank you. Now I'm all done.

Leanne Avila: That's very nice.

Tony Wendricks. Yeah, it was so nice

End of audio.