The American Meteorological Society in collaboration with
the University of Wisconsin-Madison Space Science and Engineering Center

An interview with

Pam Sullivan
Program Director
GOES-R
National Oceanic and Atmospheric Administration

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NATHANS: This is Jinny Nathans, librarian and curator at the American Meteorological

Society, and I'm here with Jean Phillips who is working with me on the AMS [American Meteorological Society] Oral History Project, and we are interviewing Pam Sullivan from NOAA [National Oceanic and Atmospheric Administration]. It is September 30, 2019, and Pam, I'm going to start by asking how you got interested in meteorology, or were you more thinking about satellites in your younger career?

SULLIVAN: I was definitely thinking more about satellites. I'm of the age where I watched all the moon landings when I was a little kid, and all the grownups looked like they were interested. I said, "That must be important." And so, yeah, I got— I went to college and studied aerospace engineering there, and went into the Air Force afterwards and worked on space program things with the Air Force then. And so, yeah, that was really my passion, was to work on space flight stuff.

NATHANS: Will you talk a little bit about your time at MIT [Massachusetts Institute for Technology]? Did you spend a lot of time in the steam tunnels? [They laugh.]

SULLIVAN: I did not spend a lot of time in the steam tunnels. I might have been better off. I remember a lot of cold winters with the wind blowing, walking between classes. So, yeah, I came there in '82, and, you know, it was a fascinating place to go. [There were] a lot of very interesting people, and I had a lot of great professors and barely kept up sometimes and managed to do okay in some other classes, and it all evened out okay.

NATHANS: How did that follow, with your younger interest in satellites and then going to MIT?

SULLIVAN: You know, it just seemed— I can't say I had a grand plan when I was a kid, I just like—You're good at science and math, you know, study engineering, and when offered the choice of engineering disciplines, I decided to do aerospace. There were maybe a hundred kids, like, in my major in school when I was there, and about ten percent of them were women, so that was kind of interesting to stand out there. And, yeah, by the time we got to, like, senior year and we did some design classes and some project classes, you know, they did a pretty good job of making you feel more what a work environment was going to be like. So that was interesting, and I was maybe prepared to start professional life after that. [They laugh.]

NATHANS: So what was your first job?

SULLIVAN: So the Air Force sent me to Johnson Space Center where they had a contingent of Air Force folks that were there. And it was back when the plan was for the Air Force to have its own space shuttle. It was going to launch them out of Vandenberg Air Force Base, and the control center was going to be in Colorado Springs. But they needed people learning how to do that, so they sent a bunch of people down to JSC [Johnson Space Center], where they had people working in kind of all the roles that the NASA [National Aeronautics and Space Administration] people did down there, and so— So my first job was as a flight controller, you know, one of those Gene Kranz kind of people that sit on the ground and push all the buttons. But I was the flight controller specifically for the subsystem that was the robotic arm on the shuttle.

NATHANS: Oh, wow.

SULLIVAN: So I learned all about that, and learned how the arm was used to, like, deploy satellites. So I worked on the deployment of the Hubble Space Telescope. And so that was great, except that shortly before they even sent me down there, the Air Force had already decided it didn't like shuttles, and they blew up too often, and they were too expensive, and they didn't fly often enough. And so that whole program was dismantled over the couple of years while I was there. And so I went from there. The Air Force transferred me up to Colorado Springs where I worked on a program called Military Man in Space, which was still looking at military applications for astronauts and did a couple of experiments, shuttle-related experiments, working with different parts of the DOD [Department of Defense]. So that was interesting, if not ultimately resulting in the Air Force deciding to get back into space.

NATHANS: That is interesting. I am actually fascinated by the robotic arm because it must have been a really big arm to launch satellites. I never really thought of [that] then [they laugh].

SULLIVAN: Well, it was the length of the shuttle bay, which I should remember—something like fifty feet, that's not exactly right, but something like that. And so it's— Yeah, and so obviously it doesn't launch the satellites. The satellites kind of go in the, kind of the trunk, the back part of the shuttle. And then the shuttle bay doors open, and then the arm generally reaches in and grabs it and, you know, puts it in a place to release it. And it also grabbed— You know, when they did the Hubble servicing missions, it grabbed Hubble to bring it back to the shuttle so the astronauts could work on it.

NATHANS: That's really amazing. What did you do next?

SULLIVAN: Well, after about five years, I decided the Air Force was not going to be my career, and so I started looking around. And one of the interviews that I did was with a gentleman named Rick Obenschain who was the project manager for the GOES-I through -M [Geostationary Operational Environmental Satellite-I through -M] project at NASA Goddard Space Flight Center. And so he offered me a job, and I said, “Great, I need a job.” And that's where my career first intersected with weather satellites. [Laughs.]

NATHANS: Very interesting, and I'm going to turn you over to Jean now.

PHILLIPS: So you were in charge of the GOES-I through -M checkout?

SULLIVAN: My job on GOES-I through -M was instrument manager. So I managed the development of the imager and the sounder instruments that were part of that spacecraft.

PHILLIPS: Okay. And having had time at NASA, and then moving to NOAA—

SULLIVAN: Well this was still at NASA.

PHILLIPS: This was still at NASA, okay.

SULLIVAN: I was with NASA until last year, so most of my career.

NATHANS: Oh, wow.

PHILLIPS: Okay. My question was about the research-to-operations relationship that NASA and NOAA have, and now having been on, sort of, both sides of that. Can you talk about that process a little bit?

SULLIVAN: Maybe not. So, you know, the relationship that NOAA and NASA had—and still have, but had back in '91, it was, when I joined—was that NOAA, you know, secured the funding for the program, wrote the requirements, and then asked NASA to do the space flight pieces of it, so to build the satellites and launch the systems. And then after their launch, they're turned over to operations by NOAA. There wasn't really a research aspect to that, at that time. There had been prior to that. I'd heard, you know, the SMS [Synchronous Meteorological Satellite], I think, spacecraft and that were more of that model. But by the time they got to GOES-I series, NASA wasn't doing prototypes that then became NOAA instruments, at least not in the geostationary realm. It happens a little bit more on the LEO [Low Earth Orbit] side because NASA's Earth Observing Systems satellites, the EOS [Earth Observing System] Terra, Aqua, Aura, you know, those instruments are really the precursors for what's flying on JPSS [Joint Polar Satellite System] right now.

PHILLIPS: Right. Talk a little bit about your role as the systems director for GOES-R [Geostationary Operational Environmental Satellite-R].

SULLIVAN: For GOES-R? Sure. Well, I get to manage a great group of folks—probably more than a thousand people across the country—that are doing everything that brings GOES into operation. So we build the four satellites, R, S, T, and U. We— There's six instruments on each one of them, so we build the six instruments, we build the spacecraft, we work with Kennedy Space Center to procure the launch. We've built the ground system that's deployed that operates them, and we also are responsible for a fair amount of the software on the ground that turns the zeroes and ones from the spacecraft into products and does the dissemination out to our users. And so yeah, so that's— I'm happy, I'm lucky enough, I think, to be able to manage that whole group.

PHILLIPS: So this is, I mean, a massive collaboration among federal, universities, industry—

SULLIVAN: Industry, absolutely.

PHILLIPS: How— I mean, talk about the sheer scope of managing this.

SULLIVAN: So it's fairly big. The program is kind of headquartered at NASA Goddard Space Flight Center. That's been the practice for years and years, as the weather programs are located there. But we have partnerships with our developers, so Lockheed Martin does our spacecraft, L3Harris does our main instrument, the ABI [Advanced Baseline Imager]. Lockheed in Palo Alto builds two of our instruments, the lightning mapper and the solar UV imager. There's a company called ATC, Assurance Technology, in the Boston area, that builds our particle detectors. We've got a magnetometer that's built by McIntyre Electronic Design in Virginia. And then the University of Colorado, LASP [Laboratory for Atmospheric and Space Physics], builds our solar radiance monitor. And so those teams— You know, those are all fairly large developments—not the magnetometer, but the others are all a hundred million, the ABI is a billion-dollar development—and so those are big teams that build those instruments.

They all get delivered to the Lockheed Martin group in Littleton, Colorado where the spacecraft is built. Everything gets bolted onto the spacecraft there. We go through a checkout there. We go through environmental tests, putting the spacecraft through vibration testing and thermovac to make sure that when it experiences those things during launch and space flight, that we know it's qualified to withstand that. And when that's all done, we take it down to Cape Kennedy and put it on. At least the last two rockets have been launched on Atlas. We haven't bought the rocket yet for GOES-T, but GOES-R and -S were both launched on an Atlas. And so we do the launch site integration there. And then the controllers for the launch are actually located at the NOAA satellite office facility in Suitland, Maryland, so we've got all a bunch of folks there.

That's part of our ops team that really learns how to operate the satellites, learns, you know, the commands to send to get the satellite to do the things that it needs to do. And so that whole team, you know, takes years preparing for that. And then on launch day, they're sitting there, you know, waiting for the first commands to come down, or for the first data to come down from the satellite, and then they take over command of it after it's released from the rocket. And then that team does the "orbit raising," is what we call it. So the launch vehicle doesn't take us all the way to geostationary orbit. So it leaves us a little bit short of that, so the satellite itself, you know, is commanded to successfully raise its orbit through a series of maneuvers, and so our ops team does that.

Once we're at geostationary orbit, there's a team— all the instrument folks, all those companies that I talked about, they come back and they make sure the satellite's working right. They put the instruments through paces, they do some calibration activities, and so they get to see the instruments really working a little bit. Anyway, so that takes— it took about a year for the first GOES-R satellite, it took about seven months for the second one, and then after that all is done, we hand operations over to our [inaudible] teammates, they're at Suitland. And then they'll be flying the satellites, if all goes to plan, until the mid-2030s. So there are other parts of NOAA that are involved as well. There's the STAR (Center for Satellite Applications and Research) group at College Park. They did a lot of the algorithms, they do a lot of the algorithms, that turn the zeroes and ones, again, into the data products that are useful to people. And so that's kind of the development team.

You know, we've got relationships with the Weather Service, with OAR [Office of Oceanic and Atmospheric Research], fisheries, ocean service. You know, those are all folks that use the data. And so we have partnerships with them to make sure, you know, we're building the right things for them, that we're delivering the data in a way that they can use. And then we're involved in all these international partnerships as well. A lot of our data is used, you know, certainly the GOES data is used all through Central and South America. And so we have, again, relationships with the meteorological groups in those countries. And we actually do training. We actually train people how to use the new satellite data, and that's something we do as part of our participation in the World Meteorological Organization. And of course we've got the international partnerships with Japan and Korea in particular because they're using the same imager that we are, so that's kind of a unique partnership there. And with EUMETSAT [European Organisation for the Exploitation of Meteorological Satellites], obviously there's a long NOAA partnership on the low Earth side of that because we, you know, they share the command controls and most of the data there. On the GEO [Group on Earth Observations] side, it's not as a direct relationship, but, you know, we are— we do participate in— we have folks that participate in their development activities as well, as advisors and things like that.

PHILLIPS: So getting back to partnerships with international agencies and sharing data, talk a little bit about the importance of data sharing across agencies internationally.

SULLIVAN: It's been there from the beginning, right? It was conceived, you know, with that in mind. And, you know, a lot of the speakers this morning talked about, you know, the Earth as a system, and I think that's been understood from the beginning. It's been— It's, you know, gotten to the point where you can do more mathematical modeling of it in more detail, and it's extending not just from, you know, the clouds and the "where is it raining?" to, you know, what are the trace gases, what are the pollution, you know, a lot of different aspects. And it's understood that, you know, nobody controls the air or the weather. It's, you know— It's great that I think everybody that's involved in this endeavor really seems to see it that way and has policy set up, you know, so that, you know, by policy we don't charge for data, right? That's, I think, really important for— to make the data as useful as possible is to get it out to everybody.

NATHANS: I'd like to ask you a little bit about AMS. I'm assuming you're a member.

SULLIVAN: I am.

NATHANS: And did you become a member as a student?

SULLIVAN: No because like I said, the weather satellite stuff wasn't really on my mind until I got into it professionally. And so I've really— I think just in the past few years I can only really say I've really been a part of it, and my main interaction is through the conferences.

NATHANS: That was sort of going to be my next question because it seems like you work in a very cooperative way with other agencies and countries. How does being an AMS member and at a Joint Conference like this make a difference?

SULLIVAN: It provides a great forum, right, for the mixing, you know. So it's great. You know, we've heard from how many countries already this morning? I don't know, probably ten different countries this morning. You know, and it's recognized, I think, as the place that people come to, right, if they want to see the latest that's going on or talk about their research. And from, you know— From my side, honestly, from a manager or engineer side, it's really, for me, about what are the other countries up to, you know? Kind of it's a data-gathering from a trend kind of thing. I think for the scientists that are involved, including the folks that are on our staff, I guess you could say it's the same thing, but I think it's even more enlightening for them because, you know, in their area of specialties, they can really see and meet people that they would not have the opportunity to do otherwise.

NATHANS: What kind of impact on them and their work do you think that AMS publishing has?

SULLIVAN: We're getting outside my— [they laugh] outside that which I can reliably speak to. But I know, you know, people think it's a big deal to have a *BAMS* [*Bulletin of the American Meteorological Society*] article, and so, you know, that's really looked to as the— You know, if you're in there, you know, you're getting read by everybody. And they know that it's going to be good quality data because they know it's, you know, well reviewed.

NATHANS: See, that's what I was looking for. [They laugh.]

PHILLIPS: I want to switch gears a little bit. I know that you were featured not too long ago in a column about women in science. And this morning there was some talk about, you know, women in science, in this field of science.

SULLIVAN: Yeah, of course, it was interesting.

PHILLIPS: It was very interesting. Talk about, you know— You're a woman in science, how are we doing? How do we want to attract other women, you know, to this field of science?

SULLIVAN: I think we're doing great. Like I said, when I was in college, like I said, there was, you know, ten percent of the class was women. And I won't say it's fifty-fifty now, but probably a third of our workforce?

NATHANS: Wow.

SULLIVAN: About 30 percent, something like that?

PHILLIPS: Within NOAA?

SULLIVAN: Within—I'm looking within the project that I'm looking at, so our—you know, our flight project, the person that's responsible for, you know, for all the satellites and the instruments, that's a woman. Her deputy is a woman. You know, so business folks on both our flight and our ground side are women, you know. Our operations lead is a woman. You know, they're— what I'm trying to say is they're in very kind of important positions. I won't say there's no barriers, but, it's— you know, there's women in enough places, in high places, visible places, you know, doing jobs where I don't think anybody, at least in our work environment, blinks. You know, it's not a thing anymore, which of course is what you want, right? I don't know, so we're— You know, I'm happy to be, you know, visible myself and to do mentoring and to show people that hey, we're here [laughs].

PHILLIPS: So speaking of mentors, did you have a mentor?

SULLIVAN: You know, not in a formalized sense, but certainly my first couple of bosses that I worked for were just fabulous project managers. And just watching them, you know, how they handled themselves in situations and what they did in order to be successful and the standards that they set. And so I've been really fortunate to have a good string of bosses.

NATHANS: Was there a point as you progressed through your career where you didn't even think about being a woman in that environment? Was there kind of a turning point?

SULLIVAN: Certainly nothing stands out. When I— Let's see, when I was— My last job at NASA was being the flight project manager. When I got that job in 2012, there weren't any women managing a project of that size at Goddard. On the other hand, I don't think anybody— nobody made a big deal. Oh, like, "There's a woman now." It was just, you know, "Here's the person that's qualified to do this." So I was happy it was me, and some people were happy it was a woman, but I think it was— like I said, it doesn't seem like a thing anymore.

NATHANS: That's good. That's how it's supposed to be.

SULLIVAN: And I know it's not that way everywhere, you know. So I don't want to say that. But I think, you know, I think the federal government, you know, has policies and it tries to enforce them, and I think that makes a difference. They don't, you know, they don't tolerate behaviors that are going to obstruct getting the best out of their workforce, so that's a good thing for me.

NATHANS: That's great. Are you coming back to Boston to the January meeting?

SULLIVAN: I am, yes.

NATHANS: I was working with someone on speakers for the Women and Minorities lunch, and actually, Charles Brooks's granddaughter is going to speak. And she's going to talk about while Brooks was doing what he was doing at Blue Hill, she was taking all the notes, his wife [laughs]. So she was the start of things. And he did make his whole family become members of AMS when it began in 1919, so that's where some of the women came from [they laugh].

SULLIVAN: That's good. Yeah, I'm looking forward to it. The January meeting—

NATHANS: In January.

SULLIVAN: Like I said, I went to school here, I know what to expect [they laugh]. So actually, but I was going to say, at that conference we're actually, or I, for the first time, will get to talk about our next generation geostationary satellite system, so I'm kind of excited. We're already starting the planning for what may launch in [the] 2030-ish time frame.

PHILLIPS: Well we know the time period is in a decade or so for development, so what are we looking at for this next generation?

SULLIVAN: So we're looking at some new instruments. We're still— You know, we still need to have geostationary satellites, probably east and west. And nobody wants to go backwards, so we'll probably have all the capability we have now. We're also looking at adding things like a sounder, so an atmospheric sounder, we're looking at an auroral imager, we're looking at a low light imager like the day/night band imager that's on the low-Earth—

PHILLIPS: On VIIRS [Visible Infrared Imaging Radiometer Suite]?

SULLIVAN: On VIIRS, possibly putting that on a geostationary [satellite]. Let's see, we're also considering populating not just the GEO but also doing a highly elliptical geosynchronous orbit, a tundra orbit. So that would be designed to have a constant view of the pole, so that's one thing we're looking at. And then a recent addition, I think, to NOAA's portfolio is the space weather. You know, we've got Discover right now at the sun-Earth Lagrange point one, we're planning on the space-weather follow on launching L1, and so this program would also need to fill that gap. So after [inaudible] there will be a need to put something there.

PHILLIPS: I'm curious about the tundra coverage because right now, I mean, that is a gap. And—

SULLIVAN: Yeah. The LEO satellites see it, but not constantly. Yes.

PHILLIPS: Yes, right. Twice a day.

SULLIVAN: Yeah. I think a lot of people are interested in it. It's been, you know, thought about that that would be a good thing for a while. And honestly, with global warming and, you know, possible transportation lines and commerce, you know, having more of those northerly routes, I think there's more reason, more interest to do that. And so the concept— And this needs to go through like a value— We need to say that the value is worth the cost, and so, you know, that's ahead of us in the studies. We need to kind of do that assessment for all of the next-generation capability that we're talking about, and we need to make the case for it. But the concept would be that if you have two satellites that are in this highly elliptical orbit, it's actually an orbit that goes out, goes very high above the Earth when it's in the northern hemisphere, and as the orbit comes near the southern hemisphere, it actually gets very low. And so it goes really fast through that, and very, very slow when it's on the high part of the orbit. And so that gives it that opportunity for, like, extended hang time, if you want to think of it, where it's moving very slowly and it can image that whole time. And so if you put two satellites in that orbit, you've always got one that's kind of over the northern hemisphere there. So that will be interesting. We're looking at, you know, what communications capability you'd need for that. Do we need to have antennas in places that we don't have them right now? And the initial, you know, the initial look at that says we can probably do it if we plan on using, you know, Fairbanks. [We] might also have to use Norway, which is a partner with us as well.

But that— Yeah, that will be— It's different for people that are used to geostationary, where, you know, nothing moves. You know, you're back to the satellites moving, and, you know, the data processing is different. And, you know, the satellite's changing its altitude, so, you know, the instruments need to think about, you know, it's coming in, [the] geographic coverage is changing as it moves closer and further from orbit, and so it will be a lot more sophisticated data processing to make all that work, but—

PHILLIPS: And the sounder that's being proposed, is this a hyperspectral sounder?

SULLIVAN: Hyperspectral. We're looking at infrared. We're also considering microwave. That's a harder technology right now, but the microwave, I think, is a better instrument in the sense that it can see through a lot of the clouds, where the IR [InfraRed] cannot. But again, it's a harder, much harder, instrument to make as large as it would need to be for geostationary. But it's under consideration. The thing I like about the early stages of a program is it's a white sheet of paper. You know, you can do anything. And so we're trying to, you know, be very creative right now.

And it's a great time in the space industry. There's been so much [that] has changed, you know: CubeSats [miniature satellites made of cubical units, used for carrying small payloads] and SmallSats [satellites under 180 kilograms] and rideshare and hosted payloads, and the launch vehicles are getting cheaper, and that's really enabling a lot of new capability. And so the choices that we have to make in the next generation are really more sophisticated. It's not just, “I've got one satellite, and I'm going to put everything on it.” You know, it's how do— You know, there's this word disaggregation. You know, you might have one small satellite that does space weather, another one that's bigger that has your imager and your sounder on it. You know, you may not have to build your own satellites at all. You may be able to get, you know, commercial hosts to take some of your instruments up and, you know, give you more capability cheaper. And so it's really going to be an interesting systems engineering problem to figure out, how do you get all the capability you need at the best value while still, you know, maintaining the reliability and the data availability and all those kinds of things that we've kind of gotten used to. So it's going to be— Like I said, it's a harder problem, I think, a little bit, to design the architecture for the next gen, but like I said, it's cool, right now, because we can do anything.

NATHANS: How will that change the way you work now with all the different groups in all the dispersed places?

SULLIVAN: You know, it's just— I don't know that that's going to be the main factor for how we work with our users. To some extent, it may allow us to have a more direct— Okay you space weather people, what do you want on your satellite? You know, you can give them that kind of more direct role. But I think the real thing, the thing that I expect to be the game changer for the next gen on the ground, is the cloud, right? All the data is going to go to the cloud instantaneously, and everyone's going to be able to get it. You know, we give our data away for free right now, but you need to have either— you know, you need to have your own ground terminal, which is not cheap, you know, you and I can't afford it, so, you know, countries that have meteorological agencies can afford it, but, you know, the average person can't. And so once all that data is really in the cloud and you can pull it down on your PC, I think, you know, I think that's going to change like everything else. You know, the way the Gutenberg Bible got text out to the masses. You know, once this data is out, you can't even imagine what people are going to do with it.

So I think we're going to have our traditional users: you know, the state, local, national, you know, government agencies, the fire, FEMA [Federal Emergency Management Agency], you know— All of those people are going to be, continue to be, our users and continue, I think, to get that same quality. And then we're going to have a whole other ring of users. You know, the public that right now is kind of a secondary user, even though they generally get the data through somebody else, you know, they're going to be able to get the data themselves. And our challenge, less on the build-a-satellite part but more on the make-the-data-useful part, is going to be keeping up with the expectations, I think, of all of that.

NATHANS: That's really interesting, that's a big change.

SULLIVAN: It is, yeah. And that will probably happen before we launch, you know, in 2030. I think that will happen in the next couple years just, you know, with the GOES series data, just trying to get that out. It's a really cool time for technology to be influencing what we do.

NATHANS: Very, very interesting. And that sort of technology has been getting kind of a bad name lately, but that's something that I think would be a real benefit to individuals.

SULLIVAN: Yeah, it will.

[. . .]

PHILLIPS: Is there anything else you would like to add, or any other challenges that you would like to talk about, highlights of your career that we haven't talked about yet?

SULLIVAN: Well, let's see. [. . .] In '91, when I first came to NASA and first started working on GOES-I through -M, that was a period where we were at risk of having a data gap because the -I through -M series was actually a huge technology upgrade. It was the first time we did three-axis stabilized spacecraft. Before that, they were spinners. And so the big deal with three-axis stabilized is you can look at the Earth all the time, right? With the spinners, you only get to look every time the spacecraft spins around. So that was okay up until, you know, the '70s, but in the '80s, we said we wanted to do the three-axis stabilized where we can do the steering. And the problem with doing that, of course, is that now the spacecraft needs to get way more sophisticated. It needs to have attitude control sensors and actuators. It's staring at the sun, which means the instruments have to handle the thermal load that's coming in. The instruments have to scan their own mirrors now as opposed to spinning, so they got a lot more complicated. The cooling systems got more complicated. So everything got more complicated with three-axis stabilized. And so those things were hard. And it turned out that they took a lot longer than anybody thought that they were going to take, and it didn't help with the observing system that the GOES-G satellite had a launch failure. And so the old satellites were dying, the new satellites were delayed, and people had a real fear that there would be a data gap. And in fact, Europe loaned us a satellite there, for a while, to prevent that.

But anyway, so I came into the program kind of in the middle of that little crisis, and so— I mentioned Rick Obenschain was the project manager then. He was, I'll say, Goddard's best project manager at the time, and, you know, he got assigned from the other stuff he was doing and he came in. And then he brought on a guy named Marty Davis, who was kind of the best instrument person, and the instrument was really where we were having the problems. The—

And one of the complications was— To build the GOES-I through -M series of satellites, NASA had decided to issue one contract to a prime contractor. And that company went out and got a subcontractor to build the instruments. And so it was kind of a third-hand or second-hand relationship. And the prime at the time was Ford Aerospace which became, over time, Space Systems Loral, and the instrument subcontractor at the time was ITT, which over time became L3Harris. But the problem is ITT had never built instruments this complicated. They had built the smaller, easier instruments for the low-Earth orbit satellites. And so the GOES instruments were significantly more complicated, something they hadn't done before. And then Ford Aerospace had never built instruments before, and so when things started going wrong, the assembly team kind of didn't have the technological ability to actually fix things and get them back on track.

So anyway, so NASA brought in Rick, Rick brought in Marty, and then Marty basically moved to Fort Wayne, Indiana and was working hands-on with the ITT team there, and got into, you know, every technical issue they were having. They had, you know, they had mirrors that would warp when the sun came on them, they had, you know, mirrors with coatings that was, you know, peeling off, they had power supplies that caught on fire. Just, you know, everything that could go wrong was kind of going wrong. And so— But, like I said, Marty went in, brought in technical expertise, you know, fixed this problem, fixed this problem, fixed this problem, and eventually got things back on track. And obviously, it was a success in the end. And so the first of those satellites launched in '94. That was great. You know, it was great to see those satellites finally up and working and really game-changing, you know, for the time.

And so I left GOES after the launch of the GOES-J satellite in '95. So that was the first two of those satellites. And I went off and did other NASA things. Then I came back to weather satellites in 2008 when the NPOESS program was in almost the same shape that GOES-I through -M was. You know, everything was late, the contracts were overrun, and the VIIRS instrument was the critical path at the time, that's the main camera on the low-Earth satellites. And what was funny was that the contract structure was almost identical. It was really the Air Force, but it was Air Force-NOAA had formed NPOESS, and the contract structure that they had let was to a prime with the prime managing the subs on the instruments, and so there was— Again, I would say, you know, these companies probably had the technical wherewithal, but still, when they got into trouble, they were having a hard time getting out. And schedules were blown, and, again, people were talking about data gaps. And so it was kind of [an] eerily similar situation, and I was like, "Hey, I know what to do." I just pulled out Marty Davis' playbook.

PHILLIPS: Been there. [They laugh.]

SULLIVAN: And so I got to be the one who was, like, onsite in L.A. where Raytheon was developing the instrument. And, you know, same thing, just bring in all the best technical experts, and just solve the problems one by one, and, you know, eventually got that on track, and, you know, obviously that was a success too. It's, you know, now providing great imagery, great global imagery, NPP and J-1. So it's kind of funny how, what do they say, "History doesn't repeat but it rhymes?" [They laugh.]

PHILLIPS: So, fast forward to a year ago, and there was a problem with the ABI.

SULLIVAN: There was.

PHILLIPS: Talk a little bit about that.

SULLIVAN: Yeah, that was probably the worst experience I've had in my career. Because I knew, you know, it was obvious. Well, I should say, you know, we launched and, you know, things were checking out fine. We tried all the visible channels, they looked fine. The infrared channels require us to start up the component in the thermal control system called the loop heat pipe, and when we got to that stage in the checkout, you know, it was like flicking a switch. You know, we're, like, trying to strike a match, and it doesn't light. And, you know, we tried again, and we tried again, and after, you know— And for a little while there, for a few days, people were like, you know, "Loop heat pipes can be funny. Maybe we just need to get this right, that right." But after a couple weeks of that, we were like, these are not going to start. You know, this is not going to work. And without those loop heat pipes, the instrument overheats, and, you know, we cannot hold the infrared detectors at the temperature that they need to be.

And, like I said, that was probably the darkest time of my career because we didn't— it wasn't obvious how good it was going to be at the end, you know. We could just tell that we had this major failure, and, you know, everybody on the team knows the consequence of this. You know, they understand how important this instrument is, this mission is, and to have this major failure with the major instrument, you know, was really dark for the whole team. And, you know, a little bit of a challenge, a lot of a challenge, I should say, being, you know, the manager of the team at that time because, you know, you've got to pick yourself up, and you've got to pick them up. And, you know, I ended up using quite a few quotes from Churchill, you know. He's pretty good for— [They laugh.]

PHILLIPS: —for dark situations.

SULLIVAN: —for dark situations. And one of the ones I used in one of our staff meetings, again, a Churchill quote, it's like, "When you're going through hell, keep going." Right? And so that was, you know, just what we did. Anyway, so, you know, it took months to, you know, figure out what was wrong, and it took months to, you know, really figure out how we could make the best of the situation. And so that was, you know, interesting. We set up a team, and it was, you know, a little bit sophisticated figuring out, okay, you guys are in charge of what went wrong, you guys are in charge with optimizing it, you know, you guys are in charge of what can we do with the constellation, what are the other options that we have? And so, you know, it's been almost miraculous, I think, that we were able to bring it back, you know, to the level that it was brought back to. But it's great, you know, and I think people feel, you know, it's not a perfect satellite, but it's pretty good. And so I think that people are really quite relieved. It could have been so much worse. It could've been really bad.

PHILLIPS: Well, and the solution was also, I mean, distributed. I mean, there were lots of people participating, right?

SULLIVAN: Oh yeah. Yes.

PHILLIPS: Because we had folks from our Cooperative Institute and our NOAA scientists I know working on—

SULLIVAN: And they still are. Yeah, people are still working on— You know, we've kind of gotten [to] here's what we can do with the satellite, but where they're still working on a lot of the products on the ground, and how can we substitute if there's a channel that's missing during a certain time of night? And there's still people looking at, like, AI, kind of artificial intelligence solutions for filling in missing data and stuff like that. So that process will probably be ongoing for several years still.

PHILLIPS: But it must be very gratifying.

SULLIVAN: It is. Like I said, people understood the magnitude of this, and the fact that it's almost okay, you know, is really, really good. But that's what we do, right? When things break, you know, people find, yeah, every bit of margin that's in that satellite. We kind of just, you know, wrung it out. You know, here's the best we can do. And people were, you know, super creative in coming up with that. So anyway, it'll be a pretty good satellite.

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