NASA DISCOVERY 30TH ANNIVERSARY ORAL HISTORY PROJECT
EDITED ORAL HISTORY TRANSCRIPT

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INTERVIEWED BY SANDRA JOHNSON
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JOHNSON: Today is April 27th, 2023. This interview with Catherine Peddie is being conducted for the Discovery Program 30th Anniversary Oral History Project. The interviewer is Sandra Johnson. Ms. Peddie is at Goddard Space Flight Center today and talking to me over Microsoft Teams. I appreciate you taking the time to talk to me today and taking time out of your schedule. I appreciate that. I want to start today by asking you to briefly describe your education and your background and how you came to NASA.

PEDDIE: Thanks, Sandra. It's really nice to be with you today, and I'm grateful for you taking the time to speak with me also. Before I begin, I just want to say all glory and praise to God for my life and my NASA career and this opportunity to speak with you. But how I came to get to NASA, well, I graduated from the University of Hawaii at Manoa, so go Rainbow Warriors! Then I went into the United States Air Force and got lucky enough to go into at the time the Air Force Space Command. Now there's the Space Force, but at the time Space Command was a new entity and they had undergraduate space training, kind of like undergraduate pilot training. We were these hotshot space cadets walking around Lowry Air Force Base in Colorado, and we were supposed to take over the [Space] Shuttle operations, but then *Challenger* [STS-51L accident] happened and everything changed for us.

Instead I got reassigned to a couple of really cool space operation sites. They're classified, but everybody knows them. I got to learn about all kinds of space stuff, and global

space things. Then luckily, I came to NASA after my tour of duty was done and went to work at Glenn Research Center [Cleveland, Ohio] on the Space Station Freedom Program. I found it really interesting because one of the satellites that I had worked on in the Air Force, NASA had a similar—they're just different features as they call it, but they had it out in the open. In the military everything is [classified]—you don't talk about it. It's hush-hush. I remember walking in and going, "Oh my gosh, why is that out in the open?" Everybody laughed at me, like you're at NASA. I'm like, "Yes, but okay, no." It was a completely different culture. I went from top secret to Space Station was international, and everybody knew about it, and there was a lot of collaboration, and it was a real culture shock to me, to say, "Okay, we can talk to everybody about what we're doing."

I had a great first part of my NASA career at Glenn Research Center. I got to work on both the space side of NASA and the aero side of NASA, because NASA goes through reorganizations. When Space Station Freedom got changed to the International Space Station, and they did the centers of excellence, I got to go work in the Microgravity Sciences Division, and there's where I got to meet all these wonderful people called researchers and scientists. I'm like, "Well, coming from the military to NASA, well, what do you do?"

Then I found all these wonderful people that worried about things that I never cared about. The molecular structure of fluids in a spacecraft and how flames are in balls and why that happens. I'm like, "Wow, this is really cool." I got a great chance to work with so many scientists on the fundamental sciences, fundamental fluid physics, and all that. Never knew that stuff existed or anybody cared about it. But I realized how much NASA cared about it, because all our satellites, our spacecraft, all of our systems in orbit really care about it.

Little did I know that that would really help me later in my career. Then things shifted again, and I went to go work on the aeronautics side, and everyone's like, "Who works on aero? Airplanes fly. It's a mature industry." Oh no no no no. We were working on lower emissions at the time, and noise reduction. In fact I'm really proud of the programs I worked on. If you're on an aircraft today and you look out your window and you see the serrated engine nacelles, it looks like teeth on the back of an engine, and the little wingtips that are up, that came from the programs that I worked on. I'm like, "Wow, I got to work on fundamental research in the aeronautics industry that actually affects our current-day living."

At Glenn I got a lot of opportunity to work in different parts of NASA, because NASA has so many parts, as you know, and got to work in different positions with a lot of people. Then my husband had worked for a variety of contractors, and one of the contracts was novating, and he said, "Honey, we're going to have to find another job." I'm like, "What do you mean find another job?" Because I'm happy at Glenn. I'm really happy here.

We had to start looking for a job, and I just said, "Can I just stay at a NASA Center? I think there's 10 of them. Let's go to the coast." We were looking out at the west coast, but the earthquake happened, and so we're like, "Oh no, we're not going to go there. Okay, let's look on the east coast."

I applied to both [NASA] Headquarters [Washington, DC] and Goddard [Greenbelt, Maryland], and then came to Goddard. That's how I ended up at Goddard Space Flight Center. The first job I had here I was a deputy division chief in one of the divisions here, and I realized that was just not me. I wanted to get back into projects. LRO, the Lunar Reconnaissance Orbiter project, was advertising. They typically don't advertise for positions like that, by the way. They choose their project managers, and then sometimes they advertise, sometimes they don't. They

want to reassign people. The first time it was advertised I didn't apply because I thought well, I've only been at Goddard a year. You got to give your job a year. You don't want people to think that you're just moving around and not reliable. I thought oh, bummer. Hopefully a position like that will come up again. I really regretted not applying for it.

But then a couple months later, it came up again, and I'm like, "Oh, I think I'm going to apply for this." I applied for it, even though I'd talked to some of my mentors and I said, "I know I should wait for a year. But I really think getting back into projects and programs is best for me."

I went to the interview for LRO, and after the interview I wasn't sure what happened. But then all my friends at Glenn Research Center were calling me saying, "Hey, people are calling asking about you."

I said, "What?" Because sometimes when you apply you say, "Please don't talk to people." But they were calling everybody. I said, "Oh, okay."

They said, "Don't worry, we've told them how wonderful you are."

I said, "Okay, you can tell them who I am." I am who I am, it is what it is. I found out from Craig Tooley, the project manager, that he had to really fight for me because I was an unknown quantity here at Goddard. You know how it is in some groups. They only want to hire who they know. They had had some people that they wanted. Who's this Cathy? We don't know her. She didn't grow up at Goddard. But Craig was like, "No, I want her." He had to fight. Part of it was doing research. They were hoping that there'd be some dirt or something on me. I'm sorry, what you see is what you get. There's no dirt. They kind of held him accountable, and he's like, "Fine."

He was so cute. He offered me the job, and I was taken aback, but my whole life and my career, a good mentor told me sleep on it. Don't make any rush decisions in anything important in life. Look at it in the cold cruel light of dawn and see if you're not making an emotional decision. As I was leaving, I said, "Well, let me think about it."

He goes, "Hey, are you ready to follow me to the Moon."

I went, "Well, that's a really cute catchy sales pitch. But I'm still going to sleep on it." I talked it over with my husband and my family and then I decided to take the job.

When I took the job, Craig said something that has stuck with me, and it's true to this day. He said, "You will never look at the Moon the same way again." And I don't. Working on LRO and seeing what we've done has just changed how I look not only at the Moon but how we do business at NASA, because the cool thing about LRO was that we built it right here at Goddard Space Flight Center. I got to see the people and got to go over. Every day I would leave my office and go across the street just to watch it being built. I don't think people at NASA, unless they're at a big contractor like Ball Aerospace or Northrop Grumman or Boeing, the contractors that build most of our spaceflight hardware, get to see that kind of thing. I feel really blessed that I got to do that. It was amazing and it still is amazing.

JOHNSON: Had you heard about LRO before you applied? I know you said the job came up. But you hadn't heard about it at all?

PEDDIE: No. Of course when I took the job and then started getting immersed in what LRO is—I had no idea that it was part of this larger—I think at the time it was the Constellation Program that had been there. Constellation went away eventually. There were a lot of things that

changed for us, and I had no idea that we were part of the President's [George W. Bush] Vision for Space Exploration, until our launch date got threatened at one point in the later years. They were like, "Oh no, the President said you have to launch on this date." It's not that we're irreverent, it's like well, who cares what the President said, if it's not ready. Can we go talk to the President and say, "Listen, here's why"?

But yes, because of the President's mandate, and I didn't know this either till later, we were given high priority. In a way that was good, except it was kind of I guess devastating to other people because they wanted to use the facility or they wanted people. Craig and I had whatever we wanted whenever we wanted. I'm like, "Oh, that's not how it normally is around here?" I was so naive like oh, I'm sorry. I didn't know.

People are like, "We really have this against you." I'm a people person. I love people, right?

I'm like, "Can we work together?" No, you're LRO. I'm like, "Well, what's that got to do with anything?" It's how I got to know people around here at Goddard.

They said, "You're LRO, you're causing us problems."

I said, "What problems are we causing you?" My naivete, at least that got me where I got to meet so many people here at Goddard, and they realized that I honestly didn't know. Then I'm like, "Well, that's not right. What can we do to not impact you but yet get what we need done?" They go, "Do you really care?" I go, "Well, yes." Maybe that was stupid of me. But it ended up that's how I got to know so many people. To this day they're either good friends or we have good working relationships, because I would stop and say, "Well, I don't want to mess up your job. How can we work together?"

There are numerous times I would negotiate with people. I know LRO, you want to take this test chamber. I said, "Well, how long do you have to test?" A day or a week or whatever. I said, "Well, let's let you finish and then we'll come in. How about we help each other out?"

One of the project managers here, her name was Liz [Elizabeth] Citrin. She was head of SDO [Solar Dynamics Observatory]. She's like, "It's because of you, isn't it, Cathy?" I go, "What?" She goes, "You're the one that is helping us all like work together." I'm one of these people. Why can't we all just get along? It doesn't have to be a contest because we're all just trying to get our jobs done, and why can't we help each other?

That was a cultural change because again I didn't grow up here at Goddard. I just wanted to get our mission done, but I also wanted to help other people, especially when they told me these stories about if I can't get my job done what'll happen. I don't want people to suffer because of me. That just didn't sound right.

JOHNSON: What do you think there was that Craig Tooley saw in you or in your resume or in the people that had worked for you before told him? Why do you think he wanted to fight for you for that position?

PEDDIE: He did tell me later. There was a lot of pressure on him to take certain individuals. Luckily with all the changes that were going on he had an opening. He did say that he didn't want someone from Goddard, because he was afraid of the groupthink that was going on.

I thought that was really wise of him. Although later because he and I were two very different people, but it was very symbiotic. We formed a really good partnership. It was very wise of him to have someone who was an outsider because there were some practices here,

Goddard, we're very successful here but sometimes you get, I don't know, you get comfortable. Then it doesn't work for everything. Craig wanted someone who could have the courage to stand up and go against the grain a little bit. He didn't want a yes-person as his deputy. He wanted someone to stand up. But sometimes that created a conflict between Craig and I.

But I'm big on respecting, of course. My military background. Respect the chain of command. But I would take it offline or privately with him. Hey, do we really want to do that? Sometimes in the middle of the heat, because it can get really intense, I had to stand up. I had people just look at me and say, "That's just crazy."

For example from the military what I took—one of your questions was what helped you. From the military, there's a lot of checklists, so that when there's an emergency or an anomaly you can't google or do research. You have to react. I did that. We had a very inexperienced ground team, ops team. I said, "Oh, space operations." The Air Force does that really well. I brought checklists in, and they were all like, "No, we don't want checklists, we don't want all that stuff." I said, "Oh, we're going to have checklists just in case something happens."

LRO wasn't a standard mission. It wasn't just getting parked into an orbit. We were flying to the Moon, and then we had to get captured by the Moon. There was this lunar orbit insertion maneuver, so there was this five-day plus this scary time to get captured by the Moon, and then get it into orbit and commissioning. I said, "And during that time we're going to need to have checklists." So I had everybody do checklists, and they fought me, and there was a lot of grumbling. I had to put people in time-outs. I used to have a penalty box. But eventually when we did have issues—because I put them through some mission simulation and mission rehearsals that were really tough. But that team, they got so honed, they wouldn't freak out, because they had these checklists that they had created on what could possibly go wrong and what we could

do. Hence, we had a very smooth seamless mission. Look, she's working to this day. She wasn't supposed to survive this long. But the spacecraft is still there.

Afterwards people thanked me and said, "Thank you. I know I gave you a rough time." But that's what Craig wanted, was somebody who was different and who hadn't grown up here and who could bring something to the team. I didn't want to upset the applecart. But if I saw them going off into the south forty, like excuse me, can we take a time-out and talk about something else?

There was also softer voices in the room, because it's always the loud voices that get the attention. I was really big on can we hear from—Sandra has been sitting there and we haven't heard from her. Sandra, do you have something? I'm interested to hear what you have to say. There were some really good ideas that came out.

JOHNSON: That's interesting that you brought that to that team. When you first talked to Craig, did he already have in mind how he wanted to divide that work? Or is that typical of a deputy program manager for things to just be divided up? Was your relationship with him during this mission typical of other missions?

PEDDIE: I don't know how Goddard does it. I've heard that some missions the senior person does the outward and the deputy inward. I'd been a deputy back at Glenn. I just sat down. Craig had never had a deputy before either. I said, "How about you and I talk about what we would like to do? Play off our strengths and weaknesses."

The scary part about that is you have to be vulnerable. Here I am telling my boss my weaknesses. But as you can tell by me, I'm like, "Well, it is what it is." Craig once told me, he said, "Cathy, you have to look like you know everything."

I said, "That's impossible, Craig, because first of all I don't know everything. I can't. If I pretend to everyone's going to say, 'She's a fraud.' Everyone'll spot it. I would lose credibility." For me personally the best thing is for me to be up-front with everyone and let them know. First of all I am not an expert. I've never been to the Moon before. I've never built this kind of thing before. Here's what my experience is.

I found that when I opened that door a lot of people came to me to share with me, "Cathy, I've never done this either." They were all a little frightened because a lot of people had not been on missions before. Craig had been with a core group of these people, and they had done smaller missions, but this was a larger mission, so there was a little bit of fear. I'm like, "But we can all do this together."

Contrary to what we had heard other people doing, Craig wanted to still keep his hands—because he was a systems engineer at heart—he wanted to stay in it or go down into the mechanical stuff. I said, "Okay. I've worked in programs and projects at Glenn. How about I take on the project management stuff? Like all the processes." Because when you work at NASA there's 7120.5 and you have to do all that. I said, "Why don't I take that over? Unless you want."

He goes, "No no no, you do that, you write the project plan." He gave me all that stuff, configuration management, risk management, setting up all the systems to run a project. Then because of my military experience he said, "Why don't you do ops?" Because there's significant operations with LRO because of flying to the Moon for five days and that lunar orbit insertion

was scary to everybody. Then systems engineering, I worked on the side with our mission systems engineer. Craig ended up paying attention to—we had a lot of issues building things from the ground up.

He and I, we divided that way except we would back each other up, to play off our strengths and weaknesses that way. It made him happy and it made me happier. I think if he had had to write the project plan and run the risk meetings and all that he probably would have just—but instead he said, "I'll let you handle that, and I'll support you." Which was good because if he didn't support me, I told him, "If I'm not supported, the minute I'm not supported by you is the minute I can't help you." My whole job I believed was to help him as the project manager and then help my team members.

That's how I approached my team members. I'm here to help you. Not get in your way, not put something in your way, but we got to build this. It was a very short schedule. In fact again my naivete, four years. I came off a project, it took nine years to get it started, and it's still going, and I didn't realize you could take longer than four years to do a project. We were screaming. It was very hard to do something that fast. Very difficult.

JOHNSON: Talk about the rest of that team. Was everyone else in place when you came on? As far as the LRO team, not necessarily the instruments yet, but the LRO team.

PEDDIE: For the most part. Yes. I was brought on just at the start of preliminary design review or PDR. I missed all the selections. They went out to select the instruments, and by the time I got there they were significantly changing the design of LRO. Originally, I think it was like two or three instruments, and they were putting together the spacecraft. It looks nothing like LRO. I

should try to find you a picture, but it had this umbrella solar array. Then they realized we can't fit all the instruments, and also it wasn't closing with the loads.

One of our NASA associate administrators said, "Well, if I gave you a bigger rocket would that help?" Of course, yes. We got the Atlas V and it opened the door for us to design LRO the way that you've seen it, very modular, and then also to have a secondary payload, so we were able to have LCROSS [Lunar Crater Observation and Sensing Satellite].

At PDR it was this very significant design change. I was worried, and I told Craig and the team, "I'm the new kid on the block. I'm kind of late to the party." He goes, "Oh no, this is a brand-new design, we all don't know it either." So we were all moving forward with this new design.

We had all the leads together, the subsystem leads, the instrument teams had been selected. There were just a few people that needed to be hired, like in the programmatic, and I took care of that. But for the most part all the team members were in place. Craig had worked with most of them before. Then there were a few new people that he had not worked with, because this was a larger team than what he was used to, so we had to do some team building on top of that. But it was a great team. They're some of the best people that I've ever worked with in my life. A lot of them have retired, and some of them are still there. They're just NASA's finest, I think.

JOHNSON: Talk about that team building and how you accomplished that. The team is diverse to begin with because you have scientists, you have engineers, you have people doing different jobs. Plus you're overseeing this, you and Craig. But how do you get people from diverse

backgrounds to communicate with each other, to build that team feeling? Especially when everything's compressed like you said to a four-year schedule?

PEDDIE: Yes. At Glenn Research Center I got a lot of immersion in very big broad diverse teams, going from Space Station and then in aeronautics I worked with a lot of international [companies], the big GE, Pratts, Boeings, Allison/Rolls-Royce. I met a lady in the training class, when I went and said, "We really need some help with training the people." This was at Glenn.

She said, "Well, you need some training?"

I go, "What do you mean I need? These people need training." So she actually introduced me to organizational development, and then I was like, "What is that?" At Glenn Research Center they were very supportive, and I was very interested and got certified in organizational development and used it in some of my teams at Glenn Research Center, because like you said, there's all these diverse [team members]. How do you get people to work together and communicate?

When I came to LRO and Craig, he's used to very small teams. I said, "Well, you know what, Craig, I got trained in organizational development. Do you mind if I—?" He's like, "Lead. Take this on."

So I went to the training department here in HR [human resources] and I just asked around. I stumbled upon a couple of people. I don't think they're there anymore. I think they've been mapped or moved or something.

But back then they had not only training but coaching and stuff like that. I said, "At Glenn Research Center we had this bunch of resources. I think we need that at several levels." Because this was an in-house team, but even though it was in-house we were matrixed from

different directorates. Again, being new to Goddard, I didn't realize this until I ran head-on into these organizational barriers, and I'd be like, "Well, what's this?" Come to find out each of these directorates had their own way of doing business and wanted it done that way. I'm like, "I know they're matrixed but can we work with you? Maybe we needed to have some team building with them?"

I realized there was this complex multiple-layered thing going on. Luckily, I ran into a lady who was just so wonderful about it. She worked with me and I said, "I think we're going to need to do this in steps."

We started with our leadership team, Craig and me and the team leads. Then I said, "Well, then we need to branch it out to the subsystems and maybe the subsystems that have to work closely together. Then we'll have to talk with the science team." Remember there were seven of them spread across the world.

It took a lot of time, and a lot of people didn't want this touchy-feely stuff that Cathy was—Cathy, no, we don't want any touchy-feely stuff. I was very big on there will be no touching. We don't have to touch each other. But we do have to work together.

You start with roles and responsibilities and who's supposed to do what. But as a team and as a human being if you see your teammate fall down, you're going to run in and pick that person up. Just because that's not your job you're not going to say, "Well, that's not my job so I'm not going to pick you up." Nobody would do that. I said, "So even though we have these roles and responsibilities. If we need to pick up an oar, we pick up an oar and we row. We all row together. Help each other."

I think people really liked that, because who doesn't want to be helped or to help somebody? Most of the people that were on the team, they're just wonderful human beings. Big hearts. Always wanting to help each other. They really glommed on to this notion.

Now there were some that were still like, "Don't want to do this touchy-feely stuff, Cathy. I'm going to stay over here." Like okay, fine, the rest of us will try to work with you. There were a few people that we had to remove or replace and I try to let people know that not everybody is suited for a job. LRO was a very fast-paced very intense stress. I was trying to tell people. They would go, "Oh, well, so-and-so couldn't handle it so we got rid of them." Like no. You know what, maybe that's just not what that person was meant to do. Let's help them find where they belong, what makes their heart sing, and be happy for them and not look down on them. Just because we're crazy running adrenaline junkies that are okay with this, that doesn't mean that people who are not running with us are not worthy. They're worthy. It's just a different job.

It was a lot of work and it continued up until the day of launch, and even after launch. Like for example the science team, everybody was competing for time on the spacecraft. All the scientists compete. We had seven organizations. At the time we were doing that, we had pushed the instruments downstream, because our schedule was so compressed that we had to focus on getting the spacecraft built and tested and then ready to go. Craig and I, we divided and conquered. But we literally had to divide. He went down to Florida, we shipped the spacecraft, and I stayed here at Goddard to get the rest of—we weren't done with our operations, our flight software to run the spacecraft was not done.

I stayed behind, and the science teams were worried because we hadn't started talking about how we're going to commission the instruments, turn them on, run them, because I was so

focused on running the spacecraft. There was almost this mutiny towards the end. The science team confronted me and said, "Listen. You've ignored all of us." I go, "I haven't ignored you. I've been trying to get the spacecraft."

They were really pressuring. You need to get this done, and you need to get this done. I was trying to tell them my priorities. I finally said, "Listen. No Moon, no mission. You need to understand, I need to get you to the Moon. Once I get you to the Moon, then you'll be able to work. But we haven't finished trying to figure out how to get you to the Moon yet."

They went, "What? Is it that bad?"

I go, "Yes. We're not talking about how bad things could get but it's that bad. It's not that I'm ignoring you. I need to get you to the Moon, and then I will focus on you. Are you okay with that?"

They were like, "Yes, let's get to the Moon." It was like oh my gosh.

The Russian PI Igor [Mitrofanov] and Harlan [E.] Spence, they were the ones. They rallied. We're going to help you, Cathy. I go, "Please. Because otherwise this is going to be a disaster for all of us." It was so bad. But it took meeting and talking with them and me having to bear the ugly so that people would understand. But everybody was a good human being. I think once they heard it, the scientists, or even the teams, then they realized oh, it's not just about me. Gosh, if they don't work then I can't work either. Because we were all interrelated. You couldn't be selfish and be successful in this fast-paced mission. You just couldn't.

JOHNSON: That goes along with risk in a flight like this. You were talking about working on the configuration management and risk management processes for LRO. Talk about that for a minute and if that was different than what they were expecting, or if you changed anything, or

how you worked through that. How do you balance what is acceptable risk for a mission like this?

PEDDIE: When I came on board, remember, I told Craig, "Let me take that on." What I didn't realize was configuration management, it was hopelessly broken, and there was no risk management going on. I think there was no formal risk management process. People were doing their intrinsic risk management day-to-day, not hurting themselves or people. But to report up to management, and I was surprised, it was like a common practice around here let's just put together this cute little matrix that NASA does and just put stuff on there. As opposed to no, let's talk about what really is the risk.

There's all these processes, procedures. I sat down with systems engineering. What we kept getting was I'm too busy, this is too fast, I don't have time to do this. I was like, "Okay, I'm with you, we don't have time, you're right, to do some bureaucratic process. So let's make a process that will work for us. What is it that you're worried about?"

Each team member, whether it was a lead or guy working on the floor, had an issue, if we don't get this or that. We would just start to put that together. Then when I put that together, I started to show the team. Oh my goodness, this isn't just a make-believe matrix that we put dots on. This is actually something that I can use as a tool to help me.

Mechanical and thermal had to work together. There was a little bit of a warring faction between the two teams, like they would put in a risk to try to poke the guy to do something and vice versa. I'm like, "How about we work? What are you worried about? How can we work together?"

They actually started to use the risk management system as something to help us all track where we were, what materials needed to be. Because we were going so fast, it was really hard for all systems to keep up. Even the accounting system couldn't keep up. We were trying to figure out how do we help manage this thing technically. The money stuff, you could tell how much money was flowing out. But schedule and risk was really hard.

It took us a while, but we finally put in place a system that worked. I'd say it took us about six months to a year. You had to wring it out. We put in like this sucks, it doesn't work, but we finally got it working. What we found out was the Goddard procedure just didn't work for us. I said, "Well, let's change it."

The table has these percentages. What's the likelihood consequence? What's this percentage? It didn't work for us because we were so fast. Also money eventually was not an object. I'll have to tell you that story later. We got a blank check, which was shocking, I'll never have that again in my NASA career, but that was beautiful.

We had to tailor the risk management assessment table. That caused quite the stir because it's like a religion to some people. "Oh no, this is the way we do it at NASA." I'm like, "We're not saying we're not going to do it. We're just saying we're going to tailor it so that it gives us an accurate indicator of LRO. Because LRO doesn't fit in with these percentages because of its short timeframe and the money."

While my team was working it, I had to go run the political gambit here at the Center and say, "I'm not telling you to change it for every mission at Goddard. I'm just thinking for LRO, for this period of time while we have to develop this mission here at Goddard, can we accept this, and we report this to you." I had to walk everybody through it. Management did accept it, because they realized that if we used the traditional, no risk, no problem, right, no, there was a

lot of risks going on. But we wanted to have the right ones identified. Not the people put in some fake ones and whatever. No. We actually had the bona fide ones that were going in.

Then for configuration management there was a big war. Again it was like I don't have time to write a document. I don't have time to put my drawings in this. I don't have time. I was like, "Oh no." We fought, safety and mission assurance was with us, and we had a great [Safety and Mission Assurance Manager], Ron [Ronald E.] Kolecki, at the time. We fought with everybody and we finally got to the resolution where I said, "What I really want to see in the system though, when you look in that clean room and what we're building, that drawing better be in our configuration management system; the as-built configuration better be in there. We need to have some sort of work order so that people know when they come into a clean room what are we working on. We'll put some drawings in. But if you can't keep up with the revs, I understand. But that as-built better be in there. Before you walk into that room you better have that on the system and everybody better know about it. If we have to stop you and sit down, we're going to do it."

We finally got to that phase and boy, that got slammed home a couple times, because we had some mistakes going on. I put webcams in all our clean rooms for outreach. I took over the outreach team, and I put the webcams everywhere. At one time I was in a meeting and I saw one of my techs scraping on the LRO. I grabbed our mission systems engineer. I said, "What's he doing?" He goes, "I don't know." He runs across the street.

Again, people had not taken the time to write down what they were doing. They had left, and they didn't realize that they had left a plastic cover. Then they powered up the spacecraft and then oh no, the cover was on and melted. Thankfully, it didn't damage anything. But again that's why I didn't say, "I told you so. You should have listened to me." But again I said,

"That's why it's important that we—we as a team—know what's in that clean room where we are at all times."

We're not playing around. You got millions of dollars; you got people's lives at stake. So let's make sure. That's why we have configuration management. That's why we talk about risk management too. I think the team fought me along the way, because people, they don't want anybody to discipline them. But I think there was a lot of real-world examples where people got to see oh yes, you're right, yes, we should all know what's in there, oh yes, that could hurt me or that could hurt my teammate here, so I really need to take the time and write that down.

That's all it was. You spend five minutes writing something down, can save you what? If there was a failure review board, that's months and years. So yes, it was really hard. I thought I had taken on the easy part of the project when I came on LRO. Oh no, oh no. I had no idea that there would be such resistance to it.

The Center got on board. We had some good leadership. Because everybody wanted—they call it the dog and pony show. I'm like, "Can we not have the dog and pony show? Because by the time we make the charts to have the dog and pony show, we're already way beyond that." LRO was so fast. Can we talk about more of a roundtable type thing for our reviews? We couldn't get out of the monthly status reporting, that was still I feel like our punishment, you had to keep doing that. But at least the reviews, Mike [Michael] Ryschkewitsch was our head of engineering, and then he became our Deputy Center Director. He agreed. I'm like, "We can barely keep up with anything."

He said, "Let's do it like in the Apollo days, when we sat around the table and looked at the drawings." They didn't make them go through formal charts, but they worked through the issues.

I go, "That's what we need to do here. Like a Skunk Works kind of thing." We did. We didn't break rules or anything. Obviously LRO is working 14 years later. So we did pretty good with that.

JOHNSON: Yes, and it's interesting, because like Apollo, to do it that way, you both had a presidential mandate to go to the Moon. Did anyone look back at that as a way of running a mission or look back at some of that history?

PEDDIE: I think so. Craig and I and our team, we were considered rebels a little bit here at Goddard because the whole Skunk Works mentality, or like the Apollo, just trying to get it done, everyone thought we were going to be running with scissors or not following the procedures. No. It's just by the time the ink is dry on the PowerPoint chart we've already moved several weeks ahead. So is there a way to have you work with us or have us communicate with you?

Like I said, Mike Ryschkewitsch I think was very supportive. Ed [Edward J.] Weiler was our Center Director at the time. He was very supportive of that. Our Headquarters people, the Exploration Systems Mission Directorate, they were very supportive of that too. Many times we had them in meetings with us so they got to see the ugly. It does get ugly in these meetings. We talked about problems, and they—Headquarters and our program offices, we had four of them. We had seven. We had so many program offices. It was a high amount of turnover. Five of them. They would come to our meetings, but then we didn't want them in some of the meetings, because first of all they change the temperature in the room, but they might hear something and go, "Oh my gosh," and like Chicken Little run it up the flagpole.

We were like, "Hey, the first time you do that." That did happen to us once, and we had to talk with Headquarters. If you're going to sit in and watch the sausage being made—and it is ugly—then you can't be afraid of it. You have to move with it and see what's really the issue here, so that the team can do its work and not be afraid.

I'll never forget. Craig and I got called to the principal's office. Ed Weiler threw down a piece of paper and he says, "What the hell is this?" Someone had taken something Craig had said. I think it was about our programmatic risk because it was short. We had to tell people, "Look, it's short." They had turned it or changed it or edited it. I remember Craig going, "I didn't write this." It was basically pointing fingers at Goddard. Goddard can't do this. Ed Weiler is like, "Why are you saying this?" He goes, "I didn't write this." But that's what happened. We had so many people in our meetings and they would take our stuff and edit it and run it up the flag. There was all this politics going on at the same time. We're like, "We're just trying to get a job done here."

But Ed was a strong personality. He's like, "Listen, don't do that to my projects." It still happened, but we dealt with each instance as it came up.

JOHNSON: You mentioned something, it caught my attention when you said it, that you had a penalty box. What is that about? If you have any stories to share about your penalty box.

PEDDIE: I did it on my most recent team. I would always play with my team, I always threw parties and events, just to relieve the tension. We also worked through holidays and weekends, so we would bring the holidays and weekends to our team. Craig and I, we would feed our team a lot.

But people would get out of line. Only in my recent team did I bring in a football flag. On LRO I didn't have that then. But if people were out of line or not helping, then they would go in the penalty box. It was meant to liven up the—because when you have conflict in a team you want to do something to take down the temperature a little bit so that people can—you know the studies about your amygdala getting hijacked and people can't focus. Any way to add a little levity and bring the tension down so that people can get to the heart of the issue. Because many times it would get personal. You. You didn't do this to me. How dare you? Let's not go there.

I would reward good behavior and playfully punish bad behavior. You're on the naughty list. You got to get off the naughty list so that Santa can give you some gifts. This was around Christmastime. If you're not, you're off the list. Just to lighten the mood a little bit. That worked on most people. But there's always the few that just got to hold on. I got to win. I never wanted to make people feel they weren't heard either.

Some people, like our avionics systems engineer Phil [Philip] Luers was a sarcastic guy, but big heart. He always wanted to be on the bad list in the penalty box. He would fight to get into it. But him doing that, he helped lighten the mood too. He goes, "Wait a minute. No no. That's my job is to piss off management. Not you guys."

We needed that stress relief on the team. Anything we could do, whether it's a penalty box or parties. I did a lot of award ceremonies. I found these Moon lights, and I would have these award ceremonies where people would help me figure out who should be awarded. Typically so many people were working so many hours doing so many things. We all wanted to reward whoever seemed to be burning the midnight oil more than others. But everybody burned the midnight oil. Because I love people, I did a lot of team building and team stuff, people stuff, soft stuff.

JOHNSON: I would think in your position you would have to understand people. The way people react to different situations. You don't always find that in management that they necessarily are good at understanding.

PEDDIE: That's what I heard afterwards. A lot of people said they dubbed me the manager of the people. They said, "We're not used to having managers care about me as a human being." I would take the time to talk to somebody about what was going on with them. Because LRO was important, and I told them that. I said, "If you're not taken care of then you won't be able to do the job that we've asked you to do on LRO."

Consequently I heard a lot of stuff. There's a human cost to a project that goes this fast. People were burnt out. Families suffered. Marriages suffered. People's health suffered. I'm a bleeding heart. My heart broke every single time. What could I do to help them? Could we hire more people or could we help them? Sometimes people just wanted someone to listen to them. I went through a lot of boxes of tissues in my office, but I think that's important. I heard that most people had never seen management like that. I can't say whether that's true or not. I just know that that's just me. When you have Cathy Peddie with you you get me, the human being who cares about people.

But I feel like there was a complaints department thing above my door too because I heard everything. People didn't want to tell Craig things. He's the boss. They would come in and tell me. I'm like, "Why don't you tell him this?" No, we're telling you so you can tell him. I'm like, "No." I heard it all. Everybody's human and deals with stuff, but the pressure cooker of the four years I think really brought out, really heightened the stress response in everybody.

JOHNSON: Again, going back to Apollo, it wasn't unusual, because a lot of people had those same issues and family issues and marriage issues because of that pressure. I could imagine this would be very similar.

PEDDIE: Yes. In fact I got to meet Neil [A.] Armstrong, and I remember reading about what happened in the Apollo days. If it wasn't for LRO I don't think I would have gotten to meet my hero. He was my hero, and here he is, the first man on the Moon, and little Cathy Peddie from Hawaii got to meet Neil Armstrong. But realizing the pressure that they were under, yes. We went under similar—not as bad as them.

JOHNSON: Yes. The whole nation was watching. Although LRO—and that's one of the things I wanted to talk about. It did have a lot of attention for a NASA mission, because the public is fickle in the way they pay attention to things. But because of the destination and what was going to be accomplished and the whole thing with LCROSS looking for water ice, you did have that national attention more on you. Did you have to deal with the press a lot at that point? Or was it more once you flew?

PEDDIE: It was during. I think the reason we got a lot of attention was the Moon is very relatable. Everyone's seen the Moon. Everybody's seen the Sun. I got to work on a dark energy mission. Nobody knows. What's dark energy? Oh, is that on a movie? But at least everyone understands the Moon. I had to take over the education outreach team because within a year of me taking the job this press release went out. Headquarters hadn't sanctioned it or anything.

Again Craig and I were called to the principal's office. How dare you release a press release? And we're both, "What press release?"

They were like, "You need to get to the bottom of this. You need to stop it."

I said, "Okay, I'll take that over. You focus. I'll take it over." What I found out was NASA had all these different organizations. At the time there was public affairs and there was legislative affairs and there was education outreach and there was the scientific community. Everybody was doing their own thing.

When I went to go meet with them and said, "Can't we all?" Oh no, no. This is my organization. This is what we do. We need you to work with—and I'm like, "Time out." I called them all together and said, "Look. I can't do this because I have this other job that I'm trying to do. I would like us to have a team and come together on what the message of LRO is." I said, "Because it's one LRO." Basically I told them. I said, "You've got these different audiences that you're trying to take the message to. But can't we put the message together and get together?"

Again, I had to work between the political boundaries and talk to management. I appealed to their humanity. Please. You're killing me. I can't do this with all of you. Headquarters is spanking me for not having this. Can we all work together on this? Finally, people took pity on me and we started to meet. I said, "Why don't we hire a lead? Like a team lead. Make it like a subsystem lead. We'll call it the education public outreach team. It'll be composed of all these members. You all have a vote. We can all put the message together. I will always be there. Not the lead, but I will always be there."

They agreed to that, and we came up with these—once the specter of the politics—we came up with these wonderful campaigns to do. The one thing most public affairs at the time did

was they didn't do missions until after it launched. But I kept saying, "You have newsworthy stuff going on right now. You're building the spacecraft here. There's a lot of people. There's a whole bunch of stuff we could be doing. You're building SDO at the same time. Why don't we do some stuff?"

They kind of went, "No. No. We'll wait till your launch in a few years."

I was like, "I'm not going to." So I bought cameras for everybody. We didn't have smartphones at the time. Unfortunately. That would have been great. I said, "Just start taking pictures. I want to take pictures of people doing work. I want to start advertising."

I got on Facebook. I didn't know what Facebook was. I'm like, "Let's get on Facebook." I met Keri Bean from the Mars rover and said, "How are you doing this stuff?" She and I became really good friends and she taught me about Twitter and I got a Twitter account.

She and I just started tweeting to each other. LRO and the rover became BFFs and all this other stuff. Every picture I would post on Facebook or in my monthly status reviews I would. They're like, "Cathy, why are you taking all these pictures?" I said, "Because there's news. You've got all these wonderful people working."

I always had people. I said, "Can I take a picture of you?" So-and-so worked on the reaction wheel. Or so-and-so worked on the C&DH [Command and Data Handling]. I go, "Don't you realize all the stuff that's going on?"

They're like, "Okay. Well, but Cathy. You need an official photographer."

I go, "I asked. I got turned away. So I bought my own cameras and I put webcams in the clean rooms and we took footage from the webcams and we were putting up everywhere."

Everyone's like, "You can't do that."

I go, "Where does it say I can't do that? I went through the official channels. But the official channels turned me down." I said, "There's news here."

Then they came on board. Everybody wanted to do it. In fact when you see the time-lapse of LRO getting built up, that was from the webcams that we put in and everything. But we had all these wonderful campaigns. Everybody's like, "Oh. We're going back to the Moon."

We had this big advertisement campaign. We're going back to the Moon. Join us, come to the Moon. Play off what Craig said. Follow me to the Moon. We sent your name to the Moon. Boy, we just generated so much response. All the people on the team came up with Cathy, let's do this, Cathy, let's do that. Then oh, I know somebody at the *New York Times* or I know somebody at the *Wall Street Journal*. They just kept bringing all these in. It generated. I think we were visible, but we also used our contacts with all this team. They had all these contacts already. We generated all this enthusiasm. It was just this tidal wave of response.

Then of course tweeting from first person caused this media frenzy. Everybody's like, "Who's doing that?" LRO, I would have LRO go, "Oh, I'm on the spinner today. They're spinning me to make sure that things don't fly off or something." I got interviewed by this magazine. They said, "Oh, you're the voice behind LRO." Because it had gotten named by Twitter as one of the top five trends because it was just generating all this enthusiasm.

When I talked to these media outlets I said, "All this social media stuff is great, because we can get the message of LRO out to all these generations around the entire world. We don't have to go visit. We can use these mediums and people can connect with LRO, play games with LRO on Facebook and stuff."

It was just great. Then also highlighting the people here. This was again my way. A lot of these people didn't get recognition. The technician on the floor, the people ordering the

supplies, the people in shipping and receiving that got all our stuff. Can we talk about these people? Look at all these people that are helping us. Without them LRO wouldn't have come together. We were able to do that through that social media stuff.

That back to the Moon was so catchy. Everybody wanted to go back to the Moon. Then when we got to the Moon, I said, "How about we go have a party? We're at the Moon." We had a party afterwards. We're at the Moon, everybody, we're at the Moon.

But the send your name to the Moon—everybody's doing that now. But that was relatively new with the rover and LRO. We were telling everybody, "You can be at the Moon with LRO. Just put your name on LRO."

JOHNSON: I think we all did it.

PEDDIE: Your name is there.

JOHNSON: I know. My name, my kids, everybody.

PEDDIE: I did that. I did my parents, everybody, did my pets. Everybody.

JOHNSON: It does, it gets people excited, and working for NASA, it makes you feel like you're part of it just because everybody can be a part of that. Going back to Neil Armstrong, that's one of the things he told us in his oral history, was that it wasn't a few people that got to the Moon. It was all those thousands of people behind them. It takes a lot to get one of these missions up. I think it's interesting that you recognized that.

PEDDIE: I followed in his footsteps.

JOHNSON: Right, you followed in his footsteps.

PEDDIE: Got to follow in my hero's footsteps.

JOHNSON: Yes. But you recognize that people do need something to get them excited about what they're doing, and for the world to see what everyone is doing at NASA. Unfortunately the word doesn't always get out the way it should. It's interesting that you got away with it, I guess.

PEDDIE: Yes. I snuck it in. I did get my—but I'm like, "You're going to make me do this monthly status report? I'll just keep putting pictures in." It eventually caught on. But you're right. I didn't understand why. I kind of shamed them into don't you want to see who these people are. I would put their name on. Do you know so-and-so? They work on the floor over there. They're the ones that do this. Not me, not Craig. They're the ones that do this. I insisted on that. I just think it's the right thing to do, to give credit to the right person.

JOHNSON: Do you feel like it caught on by getting that started? With the rovers too. That that whole feeling caught on with some of the other missions?

PEDDIE: I think so. I think it always depends on who the people are. Ed Weiler once told me. He goes, "Oh my goodness, you get it." I go, "What do you mean I get it?" About the outreach

and stuff. I said, "Well, I just know that my parents, they don't work at NASA, how would they or my family, they don't care, how do you get the message out." Also there's all these professionals, the people on that E/PO [Education and Public Outreach] team, these people were phenomenal. Tell me how we do this. All these campaigns came out. It was hugely successful. We won all these awards. That's when Ed Weiler said, "You get it." I go, "Of course. There are these people. These are the professionals. We need to work with them and let them do their—I'm not the professional in marketing or outreach. But they know how to do it." I was just willing to go along.

JOHNSON: When you went through school and your choice of career, not a lot of women were doing it yet. It was starting to pick up in the '70s and '80s, more women were getting into engineering. Also science. More women were joining all that. But I know when I'm looking at these lists for Discovery there's not a lot of female names on these lists. I'm trying to make sure and trying to talk to the women that are on there, because I think it's important for NASA to be diverse and to be inclusive and all of those things. Maybe talk about that for a minute, being a female, going through the Air Force and into engineering and into these positions at NASA. How do you think being a woman has helped you or hindered you in this career?

PEDDIE: Wow. Yes. It's been tough. Even where I grew up in Hawaii, they always ask you, "What do you want to be when you grow up?" I was really good at math. I loved math. Math just came natural to me. People look at me like what are you going to do with math, going to be a bank teller or teacher or something. I'm like, "Well." It wasn't until I had two good high school teachers that said, "Math is the universal language and it can be used in everything." I

said, "Okay, well, then I'd like to work in space." I didn't know what that meant. A kid from Hawaii.

Then I got the oh, really, yes, why don't you get like a real job or something. It was really tough. I came from a military family. My dad was in the Navy, so the Navy raised me. I thought well, at least the Air Force had Space Command. Also I got the scholarship, the Air Force ROTC scholarship to go to college. Or else my parents could not afford me to go to college. I was able to go to college on that and go into Space Command. You're right, at the time the Air Force truly is an equal opportunity employer, and there were women and men. But women, it appears to be a little more of a hoop that you have to jump into. In fact when I came into NASA, at both Centers they were struggling. At Glenn Research Center and Goddard both centers were struggling at the time with their hiring practices.

The advantage for me being a minority woman allowed the door to be opened for me. But unfortunately that kept my husband out. He is now working at NASA but at the time the hiring practices really had to shift.

But it was very unusual. When I came into NASA there weren't that many women. One of my first weeks at NASA and even in my job interview, the way they asked me how I would categorize myself. I don't think that every new employee got asked that. In fact one of my good friends who was in personnel at the time, coming from the military to NASA, she goes, "Oh my gosh, you got asked that question? I'm so sorry. Are you offended?"

I go, "No. Should I be offended? If he wants me to identify, okay, I'm a woman." He was like asking me what ethnic background I was. I'm mixed. I said, "There's several."

He goes, "Oh. Could you check several?"

I go, "I'll check as many as you want. Would that get me the job?"

She was like, "Oh my gosh." She was horrified.

I said, "Is that not something we should do at NASA?" I'm not ashamed of my ethnic background.

This gentleman, he goes, "Oh. Welcome to NASA. Whose secretary are you?"

Nothing against secretaries. I went, "Oh, I work over there." I was real nice to him. This nice older gentleman. Oh, I work over there. What group is that? I was a cargo element manager on *Space Station Freedom*. You think oh, that's the early '90s.

Then when I came to Goddard a similar thing happened. My first LRO PDR. I come into the PDR. I hadn't been introduced yet. In all fairness nobody knew who I was. This guy said, "Excuse me, where's the copy machine and where's the coffee machine?" I helped him. I said, "I think—" I walked him. Here's the copier, here's the bathrooms, okay. People are asking me to help. I was trying to help people because that's who I am. You want to know where the bathroom is, so do I, let's help find each other. When I got introduced as the new Deputy Project Manager, the guy, I think he probably wished that he could just jump into a black hole.

Nowadays it is better. But there's still some room for improvement. At least on LRO I got to speak with a lot of people and I had a lot of people, especially younger ladies, say, "I didn't think this was possible." I got to go back to Hawaii and talk a couple times and where I grew up there's some disadvantaged neighborhoods. The kids, when they found out that I grew up there near them, they went, "Oh my gosh, you worked at NASA, you? From here to there?" Because it's a pipe dream for some people. How do you get that?

I always said, "Look, if I can do it, someone like me can do it, well, you definitely can do it. The sky is the limit." I do believe the attitudes are better at NASA. But you're right. There's

still this. I think I've had to jump through a little more hoops. I haven't been intimidated by that. I've been challenged by some people like what are your qualifications, can you tell me your credentials, why are you here. I'm like, "All right. Fine. Here's my credentials. If you want to have me jump through hoops, fine, I'll jump through the hoops. I'll just keep jumping through them." Should I have to do that? Maybe not. But that's the society we live in.

Like I said, I have a heart for people so to me maybe they need to meet someone like me to help them shift their perspective. Because people grow up in a certain culture, whatever. I don't know if it's right or wrong. But maybe they just haven't met someone like me. They certainly haven't. I think I'm very different than most people.

I've had people say, "You're so vulnerable." I'm like, "I don't view it as vulnerable." What you see is what you get. I don't feel I need to hide or put up a front. I am a woman. I'm glad I'm a woman. My husband is glad. I'm a minority. I never thought I was a minority until really coming to NASA, until I told you the little checkbox. But I don't think that that detracts from who I am and what I can do. I think I've shown that. There's been a lot of people who I've gotten to work with. But I do think women have faced unique challenges. I didn't even think about that going back 30 years, how many women were there.

I got to meet Neil Armstrong, but I also got to meet Sally [K.] Ride. Got to be an opening speaker for her. It's just wonderful to meet these other women who paved the way. Neil Armstrong paved the way for us to go to the Moon. Then she was able to show that a woman can be an astronaut and do stuff. We can do stuff.

JOHNSON: Yes. It took them a while but they figured out that women could do stuff.

PEDDIE: We can do stuff. Yes.

JOHNSON: Amazing, isn't it?

PEDDIE: It is. You might like us in the process too.

JOHNSON: Find out we're just normal people.

PEDDIE: We're just people. My goodness. Yes. We have to find the bathroom too just like you do.

JOHNSON: I have heard from a couple other people that Craig Tooley was an interesting person too and that as far as team building, he had his unique management style. Do you want to take a few minutes to just talk about him? Because unfortunately we lost him. But just talk about his management style and how you meshed together. I know you divided and conquered. But maybe some of what he brought to the program.

PEDDIE: Yes. He was such a wonderful person, just so unique. Like I said, when he said, "Are you ready to follow me to the Moon?" He just had this passion for the mission and the people. We were in lockstep in terms of making sure our people were taken care of. We would buy pizzas and food. I'm sure you probably heard we had great parties on LRO. Even though he was the boss, the project manager, we were the project management, we wanted to make sure that we worked side by side with the team. I believe we both got there because people were

never afraid to tell us the ugly, the truth about what was going on. We never punished anybody. When you do that, I don't understand. You want that open communication where people can tell you, "Look, this is messed up, or you're messed up with what you're trying to ask us to do and here's why."

We would walk around a bit. We had a division chief. Craig and I put in a lot of hours and I had this one manager call me up and say, "You have all these hours and I never see you in the office." I go, "Well, I'm rarely in my office." Because we were always across the street. Wherever the work was that's where we would go. Craig and I were never in our offices. We would be in occasionally. But then wherever the people were, wherever it was being built, that's where we were.

We would take pizzas to them so that we could hear what was going on. Like I said, we worked a lot of holidays and weekends, and Craig and I would come out on the holidays and weekends. We would cook for them. We would bring food. We brought Christmas to them. I mean we didn't work on Christmas Day but I forgot who dressed up as Santa Claus. It wasn't me and I don't think it was Craig. But we would let the families come in. Were there rules? We probably broke some rules. But it's like you're on a weekend, a holiday. People are away from their families, let's bring them in.

We both I think had a very unconventional management style. We could be the professional adult when we needed to be. But I think in general we preferred to—I guess they have language like that in the management books like management by walking around, or management by example. I can't remember what that was. But like I said we just picked up an oar and rowed.

I used to go across the street, and I know Craig did the same thing, and I would say, "Do you guys need any help?"

I had one guy say, "Do you really mean that?"

I go, "Yes."

He said, "Get a bunny suit on." I got a bunny suit on. Because one person was out for whatever. We need to test 150 thermistors. I went, "All right. I'll help you." But I didn't know that was like touching each one. He put me to work and I was sweating at the end of that but I helped him test 150 thermistors on a weekend.

Craig, we both were flight directors, because there weren't enough. We just jumped in and did it. We were both very open. Open-door policy. I felt like he and I could talk about anything. We could talk about anything. Even though there was conflicts, like I said sometimes we had conflicts, I would talk about anything. Even after we left LRO on my next mission I actually approached him and asked him to help me on my next mission. He was willing to do it, and he was going to, and then he found out he had cancer. He said, "I'm going to beat it, Cathy." I said, "Oh, I know you will." I was really hoping to work with him again. But we didn't.

LRO was the best team ever, I think, the best at NASA, the best team, the best people. It always starts at the top. Craig was the leader. He set this culture that was just the best for all of us. Too bad we lost him so young.

JOHNSON: But he left a legacy and that's important.

PEDDIE: Oh, he did, yes.

JOHNSON: One of the things I was thinking about, we were talking about outreach. We have maybe 15 minutes left. But as far as outreach and as far as communicating with people you mentioned that you got to go back to Hawaii. How important do you think outreach is? Especially for a mission like this but also just in general for NASA? How much have you been involved in it? Do you continue to be involved in it as far as like you said talking to kids and trying to get that next generation interested in doing what NASA does?

PEDDIE: Yes, I think that's really important. I often when I go talk say, "I'm getting old. If we're really going to explore the universe, we really need the next generation." I often look at the kids and go, "We need you." They go, "I want to go." I go, "Please. Because I'm old. I'm not going to be here to go to Mars. I need you to come."

I think it's really important to relate to not only just kids but everybody. Why should people care about what we're doing? What does it help? The beauty of NASA, like so many things came from our technology. I told you about the engines. But also to help our astronauts, you know this. The scratch-resistant lenses that I have in my glasses. When you tell people. Because I've had some people say, "Yes, so what? NASA doesn't impact my daily life." I go, "Can we look at your cell phone?" Thank you, NASA, that I can have all this wonderful technology and scratch-resistant lenses. Your fireman can come fight for you because we've learned at NASA about flame retardants and how to do all that. They go, "Really?" I go, "Yes, how about lightweighting? Do you like to golf and these race cars?" Thank you, NASA, for lightweighting things for us.

You may not think it's directly in your life but everywhere in our lives NASA has touched us. NASA does a great job of putting that information out there. Your group with the

history. It's great to help people with their research and books and things. But also all you have to do is look and see. NASA has a great website. I remember once seeing a race car where people could click on it and see how NASA technology flowed into that. I think that's important for people to see that. But also to dream.

Working 9:00 to 5:00 every day is a grind. There's a lot of amateur astronomers out there, Trekkies like myself, people that like *Star Trek* or *Star Wars* like me, or *Guardians of the Galaxy*. Whatever. People like that kind of stuff and I think it's good to connect with people that there is a reality to that.

I've tried to stay in touch. I think it's great to help the public. I always try to help people with their outreach or whatever mission I'm on I'm always trying to get people to have fun with what we do. I think you got to have fun too. LRO was a grind. But it was like can we have some fun with this. We had a lot of fun, in addition to the grind.

Now Artemis will get to use LRO's data. Who'd have thought? We were only supposed to be a one-year mission, maybe with a one-year extension, and there she is still going.

JOHNSON: Still going, still producing.

PEDDIE: Still producing. It's great.

JOHNSON: Part of that outreach is convincing people that NASA should exist and that their tax money is well spent. You mentioned the politics of dealing within NASA. But what about external to NASA? Did you have to take part in any of that as far as congresspeople and that sort of thing? Is that part of what at manager for a mission like this has to do?

PEDDIE: Yes. I did a lot of that at Glenn but on LRO I got to meet [U.S. Representative] Steny Hoyer. They brought a lot of politicians through. Of course they do it around certain times of the year. You know how it is. They bring them around certain times of the year. Steny at the time, he says, "Wait, you look too young to do this."

I said, "Are you asking a lady her age?"

He was like, "Oh." My Center management, they just—how did you?

I said, "I'm just kidding." I told him my age. But my management, they almost fainted like oh my gosh, yank her off the stage. Don't let her talk to any politician. But he was wonderful to talk to.

But yes. They wanted to see how their tax dollars go. At Glenn when we had our first government shutdown, I got to meet Sherrod Brown at the time. Now he's a senator. I remember calling his office saying, "You ought to get to know us NASA employees." But telling them, "Look at all the work not only do we do here in Maryland, but what we do around the world." Because LRO had seven instruments that was all over the world. There were scientists all over the world. Even though we built stuff in-house we brought stuff from other parts. Because we didn't manufacture the fuel or the electronic boards. We had to go out to get those and bring them in here.

Of course they want to hear that. Where are their constituents? Should they fund these missions? I think it's important the outreach component, because how do they know that it's not only getting jobs for their constituents but also helping schools? Helping the kids stay in school or go to college or something or say that I want to work at NASA someday, so I want to get educated and go work there.

LRO had over 100 interns that came through our program. Several of them got hired as NASA engineers. I think that's a big thing to do. Not only outreach, but seed that intern program. Give people a co-op or an assignment or something to work with us to see what really goes on. But also infuse that new idea, that outsider thinking. Like what I did. That will help us make a better product.

JOHNSON: Definitely. I'm trying to think of something we can talk about in another five minutes or so. But I think we'll probably definitely have to set up another appointment if that's okay so we can get into some of these other things.

PEDDIE: Sure.

JOHNSON: Just to start talking about some of the instruments, like you said it has an international component. One of them was a Russian PI. Different people from all over. You said the instruments had already been picked when you started, I think.

PEDDIE: Yes.

JOHNSON: They had their own teams, and you said they were asking you, "When are you going to start talking about us?" Talk about that for a minute, just integrating these teams that are made up of science and engineering. But it's more of the science part of it. Scientists don't always think the same way engineers do, as you had to explain to them that we have to get you to the Moon first before we can—

PEDDIE: No Moon, no mission, that's right.

JOHNSON: Exactly. Maybe just talk a little bit more about that whole communication. Some of them are academics. Which is a completely different world than a NASA world. So for a few minutes talk about those relationships and how that worked and how you kept people. I guess in my mind I would think it's like herding cats. How do you keep everybody working toward this one goal together as a team?

PEDDIE: Yes. Interesting fact. LRO was not a science mission. Even though the science has been spectacular, it was not a science mission. That really created a tremendous rub because most of NASA, we have science and the scientists. Like where I am right now, it's PI-led. They rule. But on LRO it was we're going to the Moon and so it didn't sit well. Craig and I, we had to present a different—we're not a science mission. But it's really important. We're not just your ride. Because that was it. We all want to go to the Moon and we want to make this successful.

I think the good thing we did was hired what we called the payload systems manager. In our project office we put a person in charge to help us with all seven instruments, and then hired a couple of people to help us, they weren't really instrument managers, but to work with those instrument teams to make sure. You want to make sure the instruments not only work but are suitable for the mission. Each instrument team was very interesting. We had a lot of very interesting, seven of them. First it was six. Because at the time Mini-RF was a tech demo. That was an interesting navigational minefield. It got promoted to an instrument, but it was a tech

demo for a while, and that caused a lot of politics and organizational stuff that happened. That was really tough to navigate. We'll have to talk about this later.

They were all competing for time on the spacecraft, because depending on where we were in our orbit and how much time and how much energy, power that they would consume, and mass and all this other stuff, it was not only herding cats, but it was being a mediator. We hired a really good person, and he did a great job. Arlin Bartels was our payload systems manager, and he did a really great job.

But at times, like I said, you had to come in and just be blunt with some of them. Like no Moon, no mission. In order to understand what was really going on. Because all it was was their instrument. They didn't care. I don't care about anything else. Just care about my instrument.

It was trying to get them to come out of that and work as a team. Whew. I think I saw your interview with Rich [Richard R.] Vondrak, our project scientist. He did a wonderful job of helping navigate the different scientists. John Keller was his deputy. Those two gentlemen were just wonderful human beings too to help. Because there were egos. I don't know how to put it more delicately. "But I am the world-renowned scientist in this area." Whatever area it was. It's like I'm not saying that you're not. I'm just saying that I have to get this done. Little old me has to get this done for you. It was a tough job. LRO was tough. It was a very tough project to do.

JOHNSON: It seems like it would be because of so many moving parts.

PEDDIE: It was. Whew. In fact it was so long ago, Sandra. I had a little bit of posttraumatic stress. Oh. I remember that.

JOHNSON: Hope we didn't cause you too much stress.

PEDDIE: No no no. It was so long ago. Like I survived that.

JOHNSON: I am going to talk to Arlin Bartels so that's good that you mentioned him. He's on the schedule, and Rich Vondrak.

PEDDIE: He did a great job. He did a great job.

PEDDIE: Yes. It's been several years now since I spoke to Rich Vondrak. Be interesting to talk to him again. But anyway, since we're pretty close to our time, I think this'll be a good place to stop.

PEDDIE: Okay, sure.

JOHNSON: All right. I'm going to stop today, I appreciate it.

[End of interview]