

NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT

EDITED ORAL HISTORY TRANSCRIPT

FRANCES M. NORTHCUTT
INTERVIEWED BY JENNIFER ROSS-NAZZAL
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ROSS-NAZZAL: Today is November 14th, 2018. This interview with Poppy Northcutt is being conducted in Houston, Texas, for the JSC Oral History Project. The interviewer is Jennifer Ross-Nazzal, assisted by Sandra Johnson. Thanks again for taking some time to meet with us this morning.

NORTHCUTT: I'm happy to be here.

ROSS-NAZZAL: We are too. We're excited. I wanted to ask you, because my son is a big fan of *Trolls*. I know this is a weird question, but I thought it might be fun because I read an article about your name. You go by Poppy, but your name is actually Frances.

NORTHCUTT: Yes.

ROSS-NAZZAL: How did you get that nickname and how did it stick?

NORTHCUTT: I have an older brother, he's six years older than me, and when my mom was pregnant he had a favorite Little Golden Book fairy tale. The name of the book was *Poppy, the Four-Inch Fairy*. It had two leading characters, Poppy, who was the girl fairy, and Pogo, who was the boy fairy. He decided that if he had a baby sister he was going to call her Poppy; if he

had a baby brother he was going to call him Pogo. My parents named me Frances Marian Northcutt and that's what appears on my birth certificate, but there is nothing more persistent than a six-year-old boy. So I've always been called Poppy.

ROSS-NAZZAL: Even your parents, do they call you Poppy?

NORTHCUTT: Oh yes, always. I sign my name, checks, "Frances M." But everyone calls me Poppy. If you were to say, "Hey, Frances," I wouldn't even know who you were talking to.

ROSS-NAZZAL: How did you find out about the opportunity to work for TRW [Thompson Ramo Wooldridge] in Houston?

NORTHCUTT: I was looking for a job. I went to an employment agency, and they sent me out for an interview. I had really no idea what I wanted to do. At that time, women weren't expected to be thinking about careers at all. I came out. It at least would use my math degree, and I thought it was sort of interesting, so I just went to work there.

ROSS-NAZZAL: What was your understanding of what you would be doing once you were hired?

NORTHCUTT: I was a tech aide. The job title was "computress," which I thought was curious at the time. I had no idea that that actually matched up with what I would later see in that movie, *Hidden Figures*. Those women were also called computresses. When I saw that movie I went,

“Oh my goodness, now I know.” That’s what they called all of us. We were female calculators, I guess.

ROSS-NAZZAL: What did you think of that term computress?

NORTHCUTT: At the time I just thought it was weird. I had done some work with computers in college. I’d taken a course in FORTRAN. I just thought it was weird. They’re calling me a female computer? How weird is that? Beyond that I didn’t think much about it. I had no idea about the history of it, that they were using that in other places as well.

ROSS-NAZZAL: What were your first days like out here at the Manned Spacecraft Center?

NORTHCUTT: I worked for a contractor. I worked for TRW Systems. It was a pretty small operation initially. I was basically running data, graphing data, doing calculations. We had a big computer in house. Using the big computer was not interactive at that time, not the way it is now, so you had to do punch cards. It was a process to get something done. You didn’t just sit down and pop something out.

That’s basically what I was doing. I was taking a lot of data and graphing it up for engineers.

ROSS-NAZZAL: You were working for MPAD [Mission Planning and Analysis Division], is that correct, at that time?

NORTHCUTT: The contract was with MPAD, yes.

ROSS-NAZZAL: Were there other women who were working in MPAD besides administrative folks and secretaries? Other computresses?

NORTHCUTT: I never saw any. There may have been, but I never saw any. At that point, when I first went to work, I didn't really see MPAD at all. I was just seeing the guys I was working with at TRW. I guess I got captured by the grand experiment that this was, that we were going to go to the Moon.

At that time they were flying Gemini, I guess, and there was some work going on where I was working on Gemini. I may have done a few things with Gemini, but basically I was working at the very very early stages of the return to Earth program, which was fortunate for me because it was the early stages. That was the time to get in. I was just fascinated by the craziness of this thing that we were going to go to the Moon.

ROSS-NAZZAL: Had you been following the space program at all before you were hired?

NORTHCUTT: Not really. Not really. I got intrigued by it. At first I was sort of overawed by all of the people around me and all these MIT [Massachusetts Institute of Technology] PhDs and Caltech [California Institute of Technology]. I had a bachelor's degree in mathematics, and quite frankly I majored in beer drinking and campus politics really. I had a math degree, but if you want to talk about the truth it was beer drinking and campus politics.

So I was a little overawed by all of this technical prowess around me. Then about two or three months in, it occurred to me that these people were not really any smarter than I was. They had better degrees than I did and paid more attention in class, but they weren't actually any smarter than I was. So I thought, "I think I could learn how to do a lot of this stuff."

ROSS-NAZZAL: Did you start taking work home? Were you taking classes at U of H [University of Houston]?

NORTHCUTT: I took a couple of correspondence classes. Primarily what I started doing was reverse-engineering the program that we were working on. I would take hunks of it home at night to try to figure out exactly what we were doing. Every day I'd come back in and I'd ask a few questions here, a few questions here.

Before long, I knew a whole lot about what we were doing, because nobody else really was reverse-engineering it. You do learn a lot if you do it that way.

ROSS-NAZZAL: You were working on the return trajectories coming back from the Moon. Can you talk about what that is for the readers?

NORTHCUTT: Some of what I was working on was aborts from Earth orbit, but fairly early on I started working on the return to Earth part of it, coming back to the Earth from the Moon. What do you want to know about coming back to the Earth from the Moon?

ROSS-NAZZAL: What did that involve? For someone who would pick up this transcript, how was that idea developed? What sort of things were you looking at?

NORTHCUTT: We had a starter program that somebody had developed. It's called the three-body problem that you're solving. The three bodies that are involved when you're coming back to the Earth from the Moon are the Earth, the Moon, and the spacecraft.

It's considerably more complicated than when you have a two-body problem, which is coming back to the Earth from Earth orbit, because you only have the Earth and the spacecraft. I used to tell people you could basically put your foot out the door of the spacecraft, create enough drag, and you would come home eventually. That's all you really had to do was slow the vehicle down a little bit, and you would eventually come home. Might be years, but you would.

Not the same thing if you're talking about coming back to the Earth from the Moon; it's a whole different kind of thing. How you solve the problem is you patch together conic sections. You do part of it by looking at a conic section where the Earth is the center of gravity, and then you do another part of it where the Moon is the center of gravity. Then you try to match these pieces together, and you have to iterate to do it. You need a computer.

I saw *Hidden Figures*, and I thought they could not have just gone and used a slide rule and a calculator to figure out how to come back from the Moon. That never would have happened. You just can't calculate that many times.

That's essentially what you're doing, and you're trying to figure ways to optimize that process so that you can get these two conic sections to match as fast as possible. And then you're trying to optimize so that you reduce fuel consumption on the one hand or flight time on the other, because those are the two key critical consumables you have. You don't want to spend

five days coming home. Sometimes you need to get home faster than other times because maybe you've got oxygen problems. Like on [Apollo] 13, they had some consumable problems with their environmental situation. Sometimes you have to worry about minimizing your fuel consumption. It's got a lot of factors in it.

ROSS-NAZZAL: This took you guys about two and a half, three years to actually come up with this trajectory?

NORTHCUTT: It's not that you're coming up with a single trajectory. You're coming up with the way you're going to find the trajectory. Because what we were tasked with doing was coming up with a program that could get you home, whatever your situation was. We were called an abort program initially, but we ended up being just the return to Earth, whether it was an abort or not.

There was another parallel program going, and I think the intent was you have these two parallel programs going out of MPAD. I think the intent was that they would then pick the one that was better at the end. But the parallel program, my understanding is they never got far enough along to even be competitive. That was shut down fairly early on, and we were it.

ROSS-NAZZAL: How many people were working on your team from TRW? Do you recall?

NORTHCUTT: On my team. Some of us worked on Earth orbital stuff, some of us worked on midcourse correction stuff, and then some of us on return to Earth stuff. We sort of moved between, so it's a little hard to say at any given time the return to Earth team from the Moon was

this number of people. We probably had maybe at one point maybe eight people. It would vary. Three to eight on a particular function.

ROSS-NAZZAL: Did you ever go over to MSC and brief MPAD on these ideas that you were coming up with and how things were moving along?

NORTHCUTT: We had regular meetings with folks from MPAD. It wasn't so much briefings. That sounds sort of formal. We had pretty informal meetings with people at MPAD fairly regularly. We would be delivering these intermediate programs and getting calls fairly often about questions about this or the other thing.

ROSS-NAZZAL: Did you ever go to any of Bill [Howard W.] Tindall's meetings on flight techniques?

NORTHCUTT: No.

ROSS-NAZZAL: Where was your office? Were you off-site, or were you located on-site?

NORTHCUTT: We were off-site. We were across the street.

ROSS-NAZZAL: Probably one of the buildings that Nassau Bay has now torn down?

NORTHCUTT: Probably. I don't recognize much of anything out here these days.

ROSS-NAZZAL: I know, things have changed. Were you living out here when you worked for MSC?

NORTHCUTT: Most of the time, yes. I started out, I had a little apartment, I think it was the Portofino Apartments. I had this little efficiency when I first took the job. I hated the fact that I was so far away from the city. After maybe three, four months of living at that little efficiency apartment here, I got an apartment in the Montrose area in Houston.

I hated the drive. I loved being in the city, but I hated the drive so I kept moving further out. Then I had an apartment on Old Galveston Highway. I hated that because it was like the worst of both sides. I wasn't really in the city, and I still had a long drive. So I eventually moved back down in here. I can't remember the address that I was at, but I had a pretty cool apartment, very close to TRW, just a couple blocks.

ROSS-NAZZAL: Did you walk to work?

NORTHCUTT: No, nobody walked anywhere at that time. What are you talking about? There was no such thing as walking to work. Nobody talked about exercise, or nobody I knew talked about exercise at that time.

ROSS-NAZZAL: Was there a dress code where you worked? If so, was there a specific dress code for women?

NORTHCUTT: Not that I know of.

ROSS-NAZZAL: You primarily wore skirts I think I've seen in all the photos.

NORTHCUTT: Sometimes I wore a skirt, sometimes I wore slacks.

ROSS-NAZZAL: Was that pretty common for women over at JSC to wear slacks when you were over there? Did you notice that? I know you said there weren't many women that you worked with. But maybe the admins. I'm just curious if they wore [pants].

NORTHCUTT: I didn't really see many women, so I don't know what they wore.

ROSS-NAZZAL: I'm curious what your daily work life was like when you started working out here. A lot of people talk about working seventy-, eighty-hour workweeks. Were you working those kind of crazy hours as well?

NORTHCUTT: Oh yes. I was working crazy hours most of the time. We were on what was called temporary additional compensation, TAC. Most of the time it seemed like.

So yes, that experience to a certain extent is part of why I became very active in the women's rights movement eventually. I discovered things that I didn't know. They don't tell you all these things in college. They don't tell you if you're an hourly worker the state is going to protect you against getting paid too much, but that was exactly what was going on at that time.

They had these wage-hour laws about women where it wasn't that I couldn't work more than that, it was that I couldn't get paid more than that. I couldn't get paid for working more than nine hours a day, fifty-four hours a week; nine, fifty-four I think is what it was. On the other hand I could have two jobs, I could have three jobs, I could have however many jobs I could live through. But I couldn't get paid for more than nine, fifty-four from a single employer. I really didn't like that, because I was part of a team. Our team was working enormously long hours, and my feeling was that you have to be part of the team. You can't be somebody who's different when you're on the team. So I worked really long hours. I worked much more than nine, fifty-four. I didn't get paid for more than nine, fifty-four. My employer was not making me do that. In fact, they would come by and say, "You know you can't get paid for all of this. You should go home."

I would say, "No, I'm staying, I understand I can't get paid."

I resented it for a couple of reasons. I resented it because first of all I should have gotten paid. It's not like I was rich. I could have used the money. The other part of it is that I think that that prevented other women from actually becoming part of the team. I think I was probably the only woman who did what I did. I think that was a big part of the reason why I got promoted and the other people didn't and why I got accepted as part of the team and the other people were just computresses. They were just tech aides. The guys that I worked with, they didn't understand why I was somebody different. They didn't understand that I was an hourly worker, because I was behaving like them.

ROSS-NAZZAL: They were all salaried, but you were hourly?

NORTHCUTT: Yes. That consciousness of how the state was protecting me, that's what they thought they were doing. They were protecting me out of making money. They were protecting me out of getting promoted. They were protecting me out of being part of the team. It really grated on me.

ROSS-NAZZAL: And you were able to do that because you weren't married, and you didn't have any kids.

NORTHCUTT: Right. Right.

ROSS-NAZZAL: No other obligations.

NORTHCUTT: It's not like anybody was forced to work all those hours, but it just irritated me a lot because it was just grossly unfair. I felt like it was hurting opportunities for other women.

ROSS-NAZZAL: Did you ever bring that up to TRW or anyone at MSC?

NORTHCUTT: No, because there wasn't anything they could do about it, this was a state law. What were they going to do about it?

ROSS-NAZZAL: That's true.

NORTHCUTT: That kind of state law was prevalent all across the country at the time, different forms, but that was a very common thing. Once I was promoted and made a member of the technical staff with a different title, I was no longer an hourly worker. I could work eighty hours a week. Does that make any sense? No, that doesn't make any sense. If they genuinely had to protect my ovaries, which is what I think they thought they were doing, that was their big excuse is we're somehow or another protecting you so that you can have babies. Why would it make any difference whether I was salaried or not salaried if my ovaries needed protection? It was just so irrational.

ROSS-NAZZAL: We can get into a whole debate about that, yes.

NORTHCUTT: Just so irrational. Also then these women were going home from work and doing the laundry and cooking and all that stuff too. All of it was just irrational.

JOHNSON: Protecting men more than your ovaries.

NORTHCUTT: That's what my feeling was. That was just the excuse for doing that. It was protecting me out of competing in the workplace. I hardwired around it. That didn't mean other women had the opportunity to do that, or the audacity, which is also present.

ROSS-NAZZAL: Yes, I can see that spark. When did you get promoted? You mentioned you got promoted.

NORTHCUTT: When I was there six months I had the first review. The guy who was the head of Houston operations told me that he was going to work on getting me promoted at the end of my first year. It's really more like a year and three months before it happened. What he told me at the time—and I thought that was very interesting too—is he said, “It would have been easier to have fired you and rehired you.”

ROSS-NAZZAL: Why is that?

NORTHCUTT: Because the pay increase to take me from being a computress to being at the bottom member of the technical staff was so great that everybody in Los Angeles at corporate headquarters was—it didn't meet the parameters for promotion. It was just too much. He said that he had to keep going and fighting about this, to try to get me paid what I should be paid. They had no mechanism for dealing with the fact that they had hired somebody at a lower level than they should have hired them in the first place.

He said, “I could have fired you and rehired you and had no questions. Nothing would have come up.” To do that kind of a promotion with that kind of a pay raise broke all these little rules. He was having to justify it here and justify it there. He said, “And still you were being underpaid, but this was the best I could do.”

ROSS-NAZZAL: It's nice to have an advocate at least.

NORTHCUTT: I thought it was fantastic that I had an advocate. He said, "I'm going to give you as many promotions as I can give you, as fast as I can give them to you, to try to get you up to what you should be earning. I really hate that I have to do it this way." That was the situation.

I think that to some extent that still exists. If women come in and they're underpaid at the beginning, it's really hard for them to ever catch up. I had a lot of reasons early on to figure out that there's gender discrimination in the workforce. I learned it quickly.

ROSS-NAZZAL: Right, it was quite apparent to you.

NORTHCUTT: I learned it quickly, and it definitely made an impression on me.

ROSS-NAZZAL: That's interesting. How did your position change once you became a member of the technical staff?

NORTHCUTT: It didn't really, other than I was taking home a lot more money.

ROSS-NAZZAL: You were still doing the [exact] same work?

NORTHCUTT: Yes. To a large extent yes. I was doing the same thing. Because as the group I was in could see that I could do more than what most computresses did, I started doing more. It didn't really change that much.

ROSS-NAZZAL: At what point were you brought over and told that you would be part of the flight control teams working in the back rooms?

NORTHCUTT: Before Apollo 8. I don't remember the exact timeline. We were working like crazy to get the return to Earth program flight-ready, do the final thing on it, because it had to be integrated then into the Real-Time Computer Complex. We developed our program on a UNIVAC 1108 I think was the name of it, our in-house computer. Then it went over to IBM [International Business Machines], and they would code it into the Real-Time Computer Complex. There was a big delay with that, and then everything had to be tested. So we were working real hard to do that.

It seems like it was the summer before 8. Started hearing rumors that they were going to fly 8 at Christmastime in December, which I thought sounded absurd to me. Sounded absurd to everybody that was saying that, because we were not ready to go. You can't go to the Moon if you don't have ability to come home.

I would hear these rumors and I'd go, "That's absurd, I know they're not going unless they got ability to come home. We're a long way from being able to bring them home reliably." I don't think they had anywhere close to finished in the Real-Time Computer Complex. They were basically accelerating the schedule. I thought that was crazy. Then maybe sometime around August it was confirmed. They really were going to try to do this at Christmastime. At that point we were just working crazy hours. Nobody had ever done this return to Earth stuff.

The Retrofire officers never really worked with the program. Actually the program was still being tinkered with. They decided that we needed to go in to help support the Retrofire officers. They could look at a return to Earth, they could look at one of those printouts, and they

wouldn't know whether it made sense or not because they just had never seen numbers that looked like our numbers. Never seen behavior really that looked like the behavior you have on a return to Earth.

There's places you can't come back from at the Moon; you just can't come back from there. You have to wait until you're at certain locations on the trajectory, either the lunar orbit or the flyby. You just can't come back from certain spots. You have to wait. Partly you have to wait because what you want is you want to do your maneuver on the backside of the Moon. You want to maximize—you want to do it while you're going pretty fast, because you want to use that as a slingshot to help propel you out of there. You try to do that maneuver other places, it's going to cost you way more fuel, and it's also going to be more unstable because the gravitational effects will be fighting each other. The gravitational effect from the Moon and the gravitational effect from the Earth, they'll be fighting each other instead of working to complement each other.

When you're doing a return from Earth orbit, none of that comes up. The Retrofire officers, they would run our stuff. They just didn't quite get, "Why is it this big a number here and then it's real small and then it's,"—the changes were just sort of incomprehensible to them because they'd never worked with it before. So that's why we went over.

ROSS-NAZZAL: So you were training but also providing that backup.

NORTHCUTT: Yes, to provide backup, to be able to explain why. "Just wait five minutes to do this maneuver." Things like that.

"Is this number actually good?"

“Unfortunately yes. It’s a bad number, but it’s accurate. You don’t want to fly that trajectory.” That’s why we were there.

ROSS-NAZZAL: Did you start doing integrated sims with the flight control teams?

NORTHCUTT: Yes.

ROSS-NAZZAL: Would you talk about some of those simulations that you might recall?

NORTHCUTT: All I remember—first of all, I was tired all the time, because we were still having bugs that we were finding in the program that we were correcting. We were still testing between us and IBM, trying to get stuff finalized in the Real-Time Computer Complex.

The main thing I remember about simulations is that the simulations were so much more difficult than the flight, because during the flight actually most things go right. During simulations everything goes wrong. That’s the whole purpose of them. You’re just sitting the whole time going, “Oh my goodness, what are they going to come up with to go wrong?”

ROSS-NAZZAL: Was there anything that was a gotcha for your team? A big malfunction?

NORTHCUTT: No, not really. They’re just always coming up with things to go wrong. Most of the time it wasn’t really dealing that much or stressing that much what we were working on. You’re also doing things out of order. One day you’re over there, and it’s at so-and-so hours. Then you go over there, and you’re the day before. Everything is out of order, not a lot of

continuity. It's just a strange kind of thing to go into simulations, but it really prepares you well to deal with the mission. As I said, by the time the mission comes you've been stress-tested, that's for sure. Mainly you feel relief. "Oh gosh, nothing went wrong here. We got through the whole last hour with no dramatic events."

ROSS-NAZZAL: What are your memories of Apollo 8? When were you in the back rooms? Did you get a chance to go sit up in the front room?

NORTHCUTT: I don't think I was in the front room during the mission. When we first went over to sim I would sit in there with the Retrofire officers in the front room. When we were actually flying the mission I was in SSR [Staff Support Room]-1. What do I remember about that?

The most dramatic memory that I have about Apollo 8 was that first time they went behind the Moon. That's when they would do the maneuver to go into lunar orbit. That's also the first time that there had ever really been loss of signal with the spacecraft for any prolonged period of time. They go behind the Moon, you lose signal, and you know when they're supposed to come out the other side. They're supposed to do a burn, and you know when they're going to come out the other side if the burn is successful. You know when they'll come out the other side if they didn't do the burn for some reason.

It's a pretty perilous time, or it was at that time. If they had overburned in particular, if something had gone wrong during that maneuver, they could be on a crash course with the Moon. You have very little time to react to that. You've got to acquire signal, get a little guidance information, and then immediately get them a maneuver read up to try to correct the situation they're in.

That was a very nerve-racking period on the team I was on, and I think it was a very nerve-racking period in general because of this thing with losing signal. You've got this big mystery going on there on the backside of the Moon. You do not know what's happening and there's not a darn thing anybody here can do about it until we hear from them.

You have this countdown clock going. We can see it. As we get close to acquisition of signal time, you can hear the CapCom [Capsule Communicator] calling out, "Apollo, this is Houston calling up." We get to the zero time, and nobody answers. The clock is going. It wasn't a huge amount of time, I'm sure, maybe ten seconds, I don't know. But it was like hours was what it felt like before they actually responded.

Everybody in that staff support room and probably everybody in the MOCR [Mission Operations Control Room] as well, other than the CapCom who was calling out, everybody was holding their breath, I think, just watching that clock and waiting for a response. Very nerve-racking.

Then of course you have to get the acquisition of signal, and you have to get your tracking data and see how did this maneuver go. Are they okay? Because they were late, you still don't quite know how it went until you get that data.

The numbers were wrong, because there were mass concentrations on the Moon that had not been previously mapped. When they went back on [Apollo] 11, our times were much better because the guidance people had now integrated the effect of those mass concentrations on the flight path of the craft. But that very first time was really nerve-racking.

ROSS-NAZZAL: Did you have contingency plans for your return trajectory? Did you have a number of ideas about how you might do a separate maneuver to make sure that the crew was on a safe return? Well, I guess they were circling the Moon at that point.

NORTHCUTT: The computer, you calculate that based on the data that you get. What you know is that you may have to correct in terms of the orbit. You may be able to stay in orbit, or you may have to immediately do a return to Earth. Just depends on what you're going to see. To a certain extent we did, but you basically are having to pour it into the computer to see what numbers are going to come out of the computer.

ROSS-NAZZAL: How long did you work in the staff support room for 8? Was it primarily just during the lunar portion or were you there for the entire mission?

NORTHCUTT: I was there for the lunar portion.

ROSS-NAZZAL: At the end of this mission I understand that Frank Borman mentioned your name. Did you do any work with the crew?

NORTHCUTT: Not directly.

ROSS-NAZZAL: How did he get your name? How did he know about your role?

NORTHCUTT: Probably the press. I don't know, but I had gotten a lot of press attention because I was the first woman. The women's rights movement was bubbling up across the country at the time, and I'm sure people were asking, "Where are the women?" I was the woman that NASA drug out.

"Oh, this is a woman."

ROSS-NAZZAL: And she's cute.

NORTHCUTT: Yes, "This is a woman; she's young."

ROSS-NAZZAL: I wondered if you would talk about that, because it seems like that would eat up a lot of your time with media interviews and requests. Were you given any assistance by Public Affairs? Was there any guidance?

NORTHCUTT: None, not any real guidance, no. There was a Public Affairs guy at TRW too. No, they just called and said, "Would you talk to so-and-so?"

"Okay."

ROSS-NAZZAL: No one said, "Be sure to talk about this great thing"? Was anyone encouraging you to say certain things?

NORTHCUTT: No, the only thing I remember was that at some point I said something about space trash, and they didn't want me to talk about space trash. I don't remember what the question was

and I don't remember who it was. Somebody asked me something about hazards up there. I think I said something about the thing that made me the most nervous and was really unaccountable was that we had this trash running around up there and nobody really was tracking every bit of it. They didn't like to emphasize that there might be real hazards out there.

They changed our name. We weren't called the abort program anymore because that suggested it might be dangerous. We were initially called abort support. They decided they didn't like that for PR [public relations] reasons, so we were changed to the return to Earth team.

ROSS-NAZZAL: Sounds a little more positive.

NORTHCUTT: Right, let's not mention the fact that we might have an engine that blows up on the way to the Moon.

ROSS-NAZZAL: How much time were you spending fielding all these interview requests from reporters at the time?

NORTHCUTT: I don't know. It's not like it was going on every day but several hours a week.

ROSS-NAZZAL: What were they most interested in other than the fact that here's a novelty, a cute girl?

NORTHCUTT: That's what they were most interested in.

ROSS-NAZZAL: No consistent questions or topics that they asked you?

NORTHCUTT: No, just the sheer amazement that a woman was doing this. It just was strange. I sort of felt like, “I’ve got two arms and two legs. I’m like everybody else down here. What difference does this make that I’m female instead of male.” It was bizarre.

ROSS-NAZZAL: I wanted to ask about flight control, because so many people have written about flight control, and how it was sort of like this brotherhood. Here you are, the sole woman. Was there much camaraderie in terms of including you in some of the pranks and antics and after-hours things that guys would do like meeting up at the Flintlock or going out?

NORTHCUTT: First of all, we were contractors, so we weren’t part of that. The MOCR itself, I think that’s primarily about the people that are in the MOCR all the time, not really the people that are in the support team. We had our own camaraderie so to speak.

ROSS-NAZZAL: Can you talk about that?

NORTHCUTT: I’m just saying that we would go—the Singing Wheel was a favorite barbecue joint. We’d go have beer and barbecue occasionally at the Singing Wheel. A lot of the guys that I worked with had sailboats. To me the whole sailing thing was a little strange, but they were very into sailboats. To me it was very strange because I think they really liked to work on the boats more than they liked to actually sail, which I didn’t quite understand. They were always tinkering with these boats; they were hardly ever sailing these boats. Just made no sense to me.

Why would you want to? As soon as they had gotten the barnacles off they were doing something else, they were painting it or this or that with the boats. They were never sailing the boats. I just didn't quite get all that. They loved to tinker with them.

ROSS-NAZZAL: It's a great place to have a boat, just right off Galveston Bay.

NORTHCUTT: Oh yes. Wherever we were going, a lot of times we would have to end up going by the boat. Somebody'd gotten a new boat, or more often they'd gotten an old boat that they were now tinkering with. We were always going off to see the boat, not to sail on the boat, but to see the boat.

ROSS-NAZZAL: Were the guys that you hung out with around your age at that point? Or was it more a variety?

NORTHCUTT: They were a little older than me. I was younger than most everybody. I was twenty-five, twenty-six.

ROSS-NAZZAL: I think that's around the age Gene Kranz always talks about, the age of folks in the MOCR. What did you think of working in such a hypermasculine space as the MOCR? Being a feminist and seeing what you saw?

NORTHCUTT: I was the object of a lot of attention, and that was not always comfortable. At the same time I think the Retrofire officers, I had the distinct impression that they were protecting

me. I think they decided that I was a useful asset, and they did not want me harassed. So I didn't experience too much harassment.

ROSS-NAZZAL: Did you experience some? You said "too much."

NORTHCUTT: We had all of these channels. We had these video screens, and then we had headphones. You could turn the dial, and you could listen to all of these communication channels. Throughout the building, they had cameras all over the place.

I remember hearing some chatter. I would hear this chatter occasionally about, "Look on channel whatever." I was always busy, so I wasn't looking on channel whatever. I was looking at what I was supposed to be looking at. One day I thought, "I wonder what the hell is on channel whatever?" I turned it on, and it was a camera that was pointed at me. I was on channel whatever.

ROSS-NAZZAL: I guess it was nice to look at you. Nice break.

NORTHCUTT: You sit there and you go, "Have I been scratching my butt, picking my nose?" Talk about making you feel self-conscious. You're sitting there going, "These people have been watching me all this time?" I had no idea that people were watching me like that. That was very off-putting.

ROSS-NAZZAL: Did you ever feel any sort of concern that you were the only woman and if you screwed up maybe in the future there wouldn't be an opportunity for other women to work in the room?

NORTHCUTT: I did feel some of that. I felt like I had to know my stuff. I had to do a good job, that's part of why I worked so hard. I've read about the syndrome too. You have the impostor syndrome.

ROSS-NAZZAL: Yes, I've read that.

NORTHCUTT: I think now that I know more about it, probably everybody over there had a little bit of the impostor syndrome going on in terms of, "Are they going to suddenly discover I don't know nearly as much as I need to know?" We all probably had some of that going on.

ROSS-NAZZAL: Who were the Retrofire officers that you were working with? You mentioned they were protecting you.

NORTHCUTT: John [S.] Llewellyn, Jerry [C.] Bostick, and I think the third one was [Charles F.] Dieterich.

ROSS-NAZZAL: John Llewellyn is kind of a legend.

NORTHCUTT: Notorious.

ROSS-NAZZAL: Yes. Can you talk about him and working with him?

NORTHCUTT: That's the thing is that he's the one that you would probably most expect to be giving me trouble, but he was the most protective.

ROSS-NAZZAL: Why do you think that was?

NORTHCUTT: As I said, I think he viewed me as an asset. I think he knew that he needed me to help him understand that program. He was sort of a legendary cowboy figure, but I didn't experience that from him at all. I knew of that reputation, but that was not what I experienced at all from him. He was, as I said, very protective.

ROSS-NAZZAL: You mentioned all this attention that you were given and that it could be off-putting to some of these guys I would think. Did anyone on your team from TRW ever make comments to you about all this attention, all this media, press?

NORTHCUTT: A little bit. Some people were a little concerned. They were concerned I might be exploited and probably to some extent I was. My feeling was that that was beneficial to women to see a woman in that job.

ROSS-NAZZAL: I understand you also received a bunch of letters from various men. Would you talk about that?

NORTHCUTT: All over the world. I wish I still had them. I had them in a storage unit, and I don't know what happened. It was not one of these temperature-controlled storage units. I went out to look at it one time, and it had all these bugs in there. It was scary. I disposed of that.

Yes, I had a whole box of letters from people all over the world, a lot of men, proposing marriage. I figured that most of them wanted to marry an American woman so that they could get citizenship. A lot of letters from little girls too, that they didn't know a woman could do this and were very excited.

Where I live now I think I have the world's worst post office. I may not. Everybody probably thinks they have the worst post office.

ROSS-NAZZAL: Sandra thinks she has the worst.

JOHNSON: I've got [the worst].

NORTHCUTT: I think I have the worst post office in the world, because letters that are properly addressed to me don't arrive, and that's not an infrequent occurrence. I get people calling me up.

"Do you not live at?"

"That is my address."

And yet, I got letters that were addressed to "Poppy, Space Center." That's it.

ROSS-NAZZAL: They somehow made it here.

NORTHCUTT: They arrived at TRW in my mail.

JOHNSON: It's like Santa Claus.

NORTHCUTT: I just found it amazing. They didn't even say USA sometimes, just Space Center.

ROSS-NAZZAL: That's how well-known you were. Wow!

JOHNSON: That's amazing.

NORTHCUTT: At the same time mail with my full address does not show up.

ROSS-NAZZAL: That's a problem.

NORTHCUTT: Bizarre things happen.

ROSS-NAZZAL: TRW decided, I guess you were so well-known, to create an ad that included your photo. What did you think of that when TRW approached you with that idea?

NORTHCUTT: I thought it was pretty cool. What they told me was that I was the only employee they had ever featured in an ad and that it had the highest readership of any of their ads that they had ever done. I thought that was cool.

ROSS-NAZZAL: No complaints from you about that idea?

NORTHCUTT: No. I thought it was interesting. They wanted to do that, that's fine with me. But remember, think of the asset that that meant. Think how hard it would have been to fire me. I had become this women's rights person who was now beginning to say things that were controversial. I viewed that as insurance.

ROSS-NAZZAL: I noticed that you became active in the women's strike in Houston while you were still working down here. Would you talk about that?

NORTHCUTT: I'd been looking for the National Organization for Women. I'd read about the women's movement. I couldn't find them. I didn't have a lot of time to look, but I just called directory information. That was as far as I went.

I saw some newspaper article they were going to be picketing at the Federal Building on August 26th, 1970, and I went, "I know where they'll be." I went in to my boss and I said, "I'm not going to be here that day." I went down to the Federal Building and picketed. It was the first time I'd ever picketed. Next thing I know, I was a member and head of the PR committee.

ROSS-NAZZAL: Did anyone else from the Space Center go with you to picket?

NORTHCUTT: No, just me.

ROSS-NAZZAL: Was feminism a big issue at the Space Center?

NORTHCUTT: No, no. I just knew that I knew there was discrimination in the workforce, and I figured if anybody could talk about it, I could. I didn't have to worry about losing my job. They'd run an ad with my picture. It would be a real embarrassment if they were to fire me for being outspoken about things like that.

It wasn't that I was attacking them. In many ways I was treated very fairly. The discrimination that I experienced was not so much that I felt like the company was discriminating against me as it was that the culture was discriminating against me. Like this nine, fifty-four thing. That wasn't TRW's fault. That was the state's fault. This thing of underemployment, this was systemic. It was a systemic thing. It was not something that was targeted at me individually. It was a systemic problem.

I worked for a very progressive company. First of all, they promoted me and I got to do all this stuff, which was incredibly unusual in the first place. So I was very advantaged, very privileged, in lots of ways. I also felt like I could probably speak out in ways that other people might not feel so safe speaking out. So I should, and I did.

ROSS-NAZZAL: You continued working. You worked on Apollo 10, 12, and 13. Is there anything that stuck out for you in terms of those missions? Were you doing different things?

NORTHCUTT: Thirteen obviously.

ROSS-NAZZAL: You were down there for the launch and didn't know what had happened till Jules Bergman got ahold of you, I understand.

NORTHCUTT: I was back in Houston by that time.

ROSS-NAZZAL: What are your memories of that launch?

NORTHCUTT: It was delayed because one of the crewmembers had measles. I'd gone down there, and I wasn't sure whether they were going to launch or not. Then they finally did.

It was really incredible to be there at a launch. The thing I most remember about liftoff of the spacecraft, you don't really have a sense of that when you're watching the TV, is that you can feel the vibrations. It's almost like being in a small earthquake. I'm not sure whether the vibrations are coming—it's like the sound, it's like your whole body is vibrating as they're lifting off. Very strange experience. That's what I remember the most was feeling these vibrations going through your whole body, and the sound that's coming out from it.

I flew home and sitting at home I see something on the TV. There's a problem. I get a call from Bergman. I think that was really funny. He had my home number, but the people at the Control Center couldn't find my number, which I thought was weird. It was sitting there under the glass right there, behind this glass. It was there. All trying to figure out how to reach me. They don't know how to reach me.

ROSS-NAZZAL: That's funny.

NORTHCUTT: Bergman calls. "Poppy, how much fuel is it going to take to get home from this?"

“I don’t know, tell me where they are.” He told me where they were and I said, “Well, they’re going to have to fly around the backside of the Moon. Sorry, can’t turn around from there. Got to go the rest of the way. It’s going to cost too much fuel. Try to turn around. You’ll be unstable orbit.”

I thought, “Well, if Bergman is calling me about this maybe I ought to go over there, see what’s going on in the Control Center.”

I walk in. “We’ve been wondering how to get you!”

ROSS-NAZZAL: Did you stay there till splashdown?

NORTHCUTT: I don’t remember. No, I wouldn’t have been there till splashdown. I would have been an unconscious body if I’d been there till splashdown, because they were still approaching the Moon at that point.

Worked on several approaches to how we were going to deal with the return to Earth. The flight controllers, they wanted to not do the maneuver on the backside of the Moon. They were worried about that. That would have been the most efficient way to do the maneuver but the concern was that they really didn’t know what had gone wrong. Of course they didn’t have much of a clue about that until they did separation right before reentry, and they saw that a big hunk of the back end of the spacecraft was gone. They wanted to do it while they had signal. The maneuver was really done, the return to Earth was done, while they had signal. We had the easy job.

ROSS-NAZZAL: Why would you characterize it as easy?

NORTHCUTT: Return to Earth worked just like it was supposed to work. We had simulated that. We had simulated using the descent engine, done simulations with the ascent engine. We'd done simulations with all those various engines. We were ready to go on all of that. The people that had the ongoing problem were the people dealing with the environmental stuff, with the overheating and the oxygen.

ROSS-NAZZAL: We're in the midst of restoring the MOCR right now, and one of the guys who was there, Ed [Edward I.] Fendell, often talks about what the MOCR smelled like after 13. What are your memories of that? Did anything stand out?

NORTHCUTT: You talking about the cigar smoke?

ROSS-NAZZAL: Cigar. Body smell. Pizza.

NORTHCUTT: I don't remember. I don't even know if I even walked in the MOCR during 13. I was back in the SSR. It always smelled like cigar smoke in there. It was not that filthy in the staff support room.

ROSS-NAZZAL: When the crew got back, you actually received the Presidential Medal of Freedom.

NORTHCUTT: The whole team did.

ROSS-NAZZAL: What did that mean to you?

NORTHCUTT: It came from [President Richard M.] Nixon, so it didn't mean a lot.

ROSS-NAZZAL: Do you still have it or was it with those letters with the bugs?

NORTHCUTT: I don't know where it is. It meant a lot, and it didn't mean a lot. I had really bad opinions about Nixon. It wasn't just Nixon; it was that I had pretty keen memories that when Apollo 11 lifted off they were handing out pink slips at the Cape [Canaveral, Florida]. I felt a little hypocrisy in all of this. At the end we were flying out missions where they were scavenging parts from other spacecraft. It was obvious that once we flew 11 they were going to chop the program tremendously. It wasn't just about Nixon being Nixon, it was about the whole thing, that they were really dismantling the program.

I had already done some work on going to Mars, real preliminary work for MPAD. I found it very disheartening that we weren't going to continue to explore space. We were all heroes, but we really weren't going to continue to explore space. Just the hypocrisy of all that.

ROSS-NAZZAL: Did you start working at all on Shuttle?

NORTHCUTT: I did a tiny bit of work on Shuttle, I didn't do much. TRW lost its major contract at NASA. I went out and built better bombs out in California. I hated that. I worked on antiballistic missile defense, just hated it.

ROSS-NAZZAL: I was wondering how you got to California. I had read that.

NORTHCUTT: Yes, I went out. As I said I worked on the antiballistic missile weapons system. That was such a disheartening thing as far as I was concerned.

When I was working on the Apollo Program, as scary as it was to think about what you were doing, flying, and what could go wrong, because I really was quite aware of what all could go wrong, you're working on this thing that you can really hardly wait for it to happen. You want so much for it to happen. You want your work to be used.

Then I went to working on a program where the biggest nightmare for the world would be if they ever used what I was working on. A true nightmare scenario where nobody survives except the roaches or something. It's just horrible if you think about what really goes on if you have antiballistic missile weapons systems being deployed and shooting nuclear weapons at other nuclear weapons coming in. As I said, you may have a couple human beings, a handful of human beings, down hundreds of feet underneath the Earth that survive. All the zebras are gone and everything else. I am convinced the roaches and the fleas would probably survive. They do seem to have fantastic survival systems. But other than that, what would be left? I didn't like working on something like that.

ROSS-NAZZAL: But you managed to come back to Houston.

NORTHCUTT: I did.

ROSS-NAZZAL: What happened with TRW? Because you were continuing with TRW, were you not?

NORTHCUTT: Yes. They had a contract, and I came back. I didn't actually get to do very much work when I came back because I got loaned to the mayor's office.

ROSS-NAZZAL: I want to ask about that, because that sounded like such an interesting position to be in, to be working for an aerospace contractor but being the first women's advocate in the city of Houston. How did that work out with your employer?

NORTHCUTT: They loaned me. The mayor's office wanted to put me in as the women's advocate but they didn't have budget to match my salary, and I was not willing to take a gigantic cut in pay. I don't believe any woman should take a gigantic cut in pay. TRW said they would fill the gap.

ROSS-NAZZAL: That's very progressive of them.

NORTHCUTT: I thought so, especially since they had had so much cuts to their budget. But they did fill the gap, and I was at the mayor's office for eighteen months, something like that.

ROSS-NAZZAL: You accomplished quite a bit during that time, hiring of women firefighters and police.

NORTHCUTT: I did. Police. Women on patrol. First woman firefighter. Put a lot of women on boards and commissions. We put somebody in to develop the testing on rape kits. They ended up being used as protocols on rape kit testing; I think pretty much ended up being the protocols all over the state, because we were really the first place that really devoted energy to that. Did the first equal pay study that was ever done in the city of Houston to find pay disparities. A real challenging thing to do down there. That was interesting. Again I got to have the experience of having microphones in my mouth a lot.

ROSS-NAZZAL: Who was mayor at that point?

NORTHCUTT: Hofheinz. Young Fred, not his father, Young [James] Fred.

ROSS-NAZZAL: When I was reading the interview [from the public library] I didn't realize he was mayor. I thought he was the county judge.

NORTHCUTT: Young Fred. That's what everybody called him, Young Fred.

ROSS-NAZZAL: You ended up leaving TRW though after a while to go work at Merrill Lynch.

NORTHCUTT: Yes, I worked at Merrill Lynch briefly. Then I worked at another division of TRW. That branch of the company developed software for big power systems. That was fairly interesting, but I really wanted to go to law school. I was paying my way through law school while I was working at TRW. The nice thing about working about computers is they don't really

care what you look like, and they don't care what time of day it is that you're working with them. I could go to law school and still do a lot. I was doing software testing mainly and making nice money while going to law school. Took a cut in pay when I became a lawyer. That was a great way to work through law school, have that kind of hour flexibility and a good paycheck.

ROSS-NAZZAL: Looking back, what do you think was your greatest accomplishment while working in the space program?

NORTHCUTT: We never lost a customer. They all came home. Can't get better than that.

ROSS-NAZZAL: What was your biggest challenge?

NORTHCUTT: Getting over the initial hump from being a computress to being a member of the technical staff.

ROSS-NAZZAL: Kind of a big jump. If you don't mind, I'd like to ask Sandra if she has any questions.

JOHNSON: Just about ten minutes. One of the things you mentioned was that the press was so interested in you. Were there any women's groups or women in the press or anybody that were commenting?

NORTHCUTT: The press was dominated by men at the time.

JOHNSON: I didn't know if there were any women's organizations, early ones, that may have been contacting you at that point.

NORTHCUTT: No. In the press at the time, we were just beginning to have a few women become anchors. I'm trying to think. In Houston we didn't have the first woman anchorperson till I think it would have been Jessica Savitch, and that probably would have been like '71, '72, something like that.

JOHNSON: I think I remember that. You seemed to have a lot of confidence in your ability early on, which sometimes women at that time period—because I wasn't really far behind you—sometimes you weren't always encouraged to go into things like math or science or engineering. I was just wondering if you had any early mentors, like teachers in school early on, or parents, or at college to pursue that math degree.

NORTHCUTT: No, really I think the only thing was I always tested really high on that. When we took aptitude tests I always scored really high on that. I guess I thought I was probably going to go into teaching, because that was the most acceptable thing that was out there for women to do. If you had a college degree you were expected to be a nurse, a teacher, or an executive secretary.

JOHNSON: I was going to mention that because we've spoken to a lot of the early NACA [National Advisory Committee for Aeronautics] computers, the women, and most of them that

went into math, they either tested well and had somebody that pushed them that direction, but they also had that same feeling that they would be going into teaching. That's what they thought, they would end up teaching. I thought it was interesting, just wondering if you had that same experience.

NORTHCUTT: In that sense I was encouraged to go into teaching. That was the only acceptable thing. "Oh yes, you can study math and be a teacher."

JOHNSON: It's just an interesting time. That's mainly what I was going to ask, just about whether you had any encouragement at all, because like I said it was at a time when most people weren't.

NORTHCUTT: I had encouragement at TRW in the sense that I worked for more open-minded people than were generally present in the population. I was super lucky in that. The guy that was head of Houston operations, for example. Looking back on that especially at the time, that he would fight so hard is pretty remarkable.

But his feeling I think to a certain extent was that he had gone out on a limb at that first six-month thing and said he was going to promote me. I think he was really irritated, that having promised something he wasn't going to not deliver. That was pretty remarkable, I think, that they were that open-minded.

ROSS-NAZZAL: You ended up working in an org that included people like Bill Tindall. I'm trying to think some of the other guys that were there. Anybody else jump out at you that you worked with?

NORTHCUTT: The people at MPAD were great. I can't even remember all their names but they were great.

ROSS-NAZZAL: Did you have any opportunity to work closely at all with Gene [Eugene F.] Kranz or Glynn [S.] Lunney?

NORTHCUTT: No. They were the flight controllers in there, but I was really dealing with the Retrofire officers. The MPAD people were the people that we worked with mainly, and I can't think of the name of the guy that we dealt with over there, but he was very good. I was very lucky, I think.

ROSS-NAZZAL: It's a great career, great start to it.

NORTHCUTT: Luck all the way. I had an employment opportunity, come down here to talk to somebody, never heard of the company, hadn't really thought of the space program. My main talent is that given a good situation I will exploit it.

JOHNSON: That's a great talent.

NORTHCUTT: That's my big talent. I do recognize opportunities when I see them. I was lucky. I had the opportunity to exploit some stuff that other people don't have.

ROSS-NAZZAL: Thank you so much for coming down today. We really appreciate it. We enjoyed it.

NORTHCUTT: Happy to do it.

[End of interview]