CONNIE EATON HARNEY
NASA ORAL HISTORY

INTERVIEWED BY REBECCA WRIGHT AND SANDRA JOHNSON
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WRIGHT: Today is June 12, 2001. This interview with Connie Harney is being conducted as part of the NASA Headquarters History Office "Herstory" Project. This interview is being conducted in Lancaster, California, by Rebecca Wright and Sandra Johnson.

Thank you again for allowing us in your home and taking time to meet with us to discuss your experiences while you were employed with the NASA Flight Research Center in California. We'd like to begin by gathering some background about you, and if you could start by telling us where you're originally from and how you began your career.

HARNEY: I'm from the Upper Peninsula of Michigan. I was born and raised on a farm in Stephenson, Michigan, which is between Menominee and Escanaba. I'm sure that makes it perfectly clear. The town had about 1,000 people then and now. It hasn't grown. I went to one-room country schools, one school, actually, for seven years with one teacher, until I went into town. I graduated valedictorian of my class in 1964. There were eighty students in my high school graduating class.

I went to the University of Michigan then, on scholarship, in Ann Arbor, and that was quite a transition, since there were 4,000 students in the freshman class. I was a National Merit Scholarship finalist, although I didn't get a full ride from them. I did get a nice scholarship from the university, so I studied mathematics and got a degree in mathematics in 1964. I was in the honors college, so I got an honors degree. I took math, really, because I was too shy to speak up in English, and mathematics seemed a lot easier from that point of view.

At that time, computers were just getting started, so I had gone to a summer science camp the summer before my senior year in high school, at Northern Michigan University

[Marquette, MI]—it was College then, now it's University—with thirty-nine other students from the northeastern part of the country, and that was my first introduction to computers. So I got a part-time job when I was in college, working for a professor in the geology department, just modifying a computer program. That was like 1963. This is an assembly language for some unknown computer now.

And then I also had a project with one of my math professors who was writing a book on computers, and so I went through and did all the problems. It's kind of like a red-team review, I suppose. Although I didn't know what I was going to do with mathematics, I just kind of fell into the computer programming end of it.

When I graduated, I decided I would work for a year, so I worked at the University of Michigan Institute for Social Research, I guess it was called, as a computer programmer, for one year, until June 1965, and I decided to go to graduate school at the University of Washington in Seattle.

I was accepted and was on my way there, but I took the summer to spend in Berkeley [California] where one of my college roommates was living with her husband, and I worked there for a summer as a computer programmer. But in the meantime, I decided to get married instead to the roommate of my former college roommate's husband that I had met at the wedding. He worked in Lancaster, so I came down here, but before I came down, I got the address of a couple of places to apply to and one of them was the NASA Flight Research Center. So I sent them an application.

This is 1965 and NASA was building up then, so they hired me sight unseen, which, in retrospect, that seems pretty cheeky of them, don't you think? [Laughter] So I showed up, I think it was September 7, 1965, at the Dryden Center [NASA Flight Research Center, later named NASA Hugh L. Dryden Flight Research Center] and met my boss, Mary Little [Kuhl]. I had worked for a female boss at Michigan, too, actually. She was a computer programmer in charge of the section. So I didn't think it was particularly unusual to be working for another

female boss. You know, I guess in retrospect that's probably unusual, but it wasn't for me then.

So from 1965 to 1973, I was a computer programmer, basically. I worked in assembly language programming. They were just installing digital data acquisition systems on the research planes, such as the X-15, and so I was doing the programming for the first reduction of that, and it was really quite exciting. I really enjoyed it. But then again, it was kind of a narrow world. It took me a while to really loosen up and get more involved with a broader area of the center.

I went off to graduate school, courtesy of NASA. I went to UCLA [University of California Los Angeles]. I think it was 1969. No, maybe it was 1970. But you can get a year of graduate study leave, so I ended up just taking nine months. I went to UCLA and got a master's in—it's called systems science. What it was was theoretical computer science. I really enjoyed it, but in retrospect, that was the wrong thing to be doing. I enjoyed it and it was good, but it didn't directly apply to anything I was doing at NASA. I mean, certainly NASA didn't need theoretical computer scientists. I really should have been taking, if anything, applied mathematics such as the engineers use because all my mathematics is more theoretical and I didn't have Fourier Transforms and the kind of the stuff that the engineers are really using at Dryden.

But at that time there was no real advising. There was no career advising whatsoever, and certainly no real, I'd say, evaluation or assessment of what people wanted to do when they went to graduate school. It was kind of like, well, somebody's turn again.

I got the master's in December of 1971, but it was because I had a master's paper to write, and I did that when I got back to work, just took off some annual leave.

Shortly thereafter, I guess it was 1973, my boss—by this time, it was John Smith. Mary Little was no longer a branch chief. She was in a staff position prior to her retirement, and John Smith—I don't remember if it was exactly a reorganization, but he had an opening for a branch chief for the programming branch, and I wasn't really considering applying for that at all. I

really didn't have any career path in mind. This is all willy-nilly, if you will. He said, "Gee, why don't you apply for that." "I don't know." So I did apply for it and he ended up selecting me. It was a big surprise, really.

When I first started working, I didn't really think of women as being—how do you say it? I knew I worked for a [female] first-line supervisor, as far as [women who were] higher in the organization, there were just no role models and it's almost like I didn't even notice [the discrepancy]. It wasn't a big issue then. It certainly became a big issue later and people became more aware of it. But once I got to be a branch chief, I was making more money than my husband, and one of the first things, just thinking about beforehand, I remember telling Mary Little, I said, when she was talking about promoting, we were promoted gradually, I said, "Well, I don't ever want to make more money than my husband. That might cause a problem." Of course, I quickly got rid of that idea, which is kind of crazy, but those were funny times, I guess.

It took a little while, I suppose, to get used to being a supervisor, but in retrospect, not that long. I think I was probably better as a manager than I was—technically, ultimately, I really did enjoy the technical part of it and I think I was very good at it, but when it came to broadening your influence, it was much better to be a supervisor, and so I was a supervisor until the day I quit, or took an early-out retirement, and through lots of different organizations.

There was always reorganization going on. So from computer programmers originally to include simulation engineers and electronics engineers and eventually the range systems like the mission control centers and the radar systems. Telecommunications became big. New telephone systems. Of course, the networks and all the ground systems. At one point I even had the facilities, the brick-and-mortar facilities, because they went through so many reorganizations, and always the ground facilities were not nearly as prestigious as the aircraft facilities, and so they'd kind of add strange things to the various organizations, because they weren't aircraft. If they have the only thing that isn't aircraft, well, it could go together, I guess.

Let's see. Maybe you'd better ask another question.

WRIGHT: Those first days that you were here working, were you with one project or were they asking you to go from project to project for those first years when you were here as a computer programmer?

HARNEY: For the first few years, actually maybe three, four, five years, I was primarily involved in this PCM, pulse code modulation, computer program, and I first wrote it for the IBM 360 Model 40 that they had, and that took a while. I wrote that assembly language, and then at that time, I guess right after that was a radar program to process radar data which was done in FORTRAN, but by this time they were also replacing the IBM computer and they replaced it with a CDC machine, a Cyber 73, which was a whole different programming language.

This is all still assembly language and so sort of rewrote it, you know, an improvement. By this time the instrumentation systems had evolved, too, so they have a lot more capability and then you had to prepare the post-flight processing system to handle all that. So primarily [I] just [worked with] research data direct from the airplanes and radar data, as opposed to, I guess, the programs that [processed] the data after it had been calibrated.

My software calibrated the parameters and separated them out and essentially created a database, and then the other software would take that data and do whatever manipulations the engineers wanted to do to, I guess, assess what was going on with the data, so I had the fundamental data processing part of it, and database creation, primarily until I became a supervisor.

WRIGHT: Did you work with a large group of programmers or was it just a few?

HARNEY: There were just a few and, primarily, my task was my own. I guess the interfacing

was more with the instrumentation engineers who were designing the instrumentation on the aircraft and then also some other computer programmers who had to access the data in the database. I would develop some subroutines for them to pull out the data they wanted, the way they wanted, but as far as FORTRAN programs do—I mean, they'll collect the data and create plots and those kinds of things, but I really didn't do that.

In our group at that time, we didn't have any of what we call business programming, the COBAL stuff for the financial management information systems or the payroll or those kinds of things. At that time, all the centers had their own system. And initially, too, at that time, everybody was NASA, even the janitors, and we had keypunch operators. These were IBM cards at that time, and apparently, before I got there, they had what they called—I think Sheryll's [Goecke Powers] paper talks about it—what they called [computers], which were women who ran Friedan calculators and used backlit machines to read strip charts and film, that kind of thing. They weren't doing that there when I got there. That's what the PCM replaced, but we still had a small army of older ladies who were doing the data input and data setup for these programs.

WRIGHT: You were new and your field was relatively new. How was it accepted by the engineers and by the rest of the team that you were working with?

HARNEY: I didn't notice any problems. It did seem to be a field that was acceptable for women, I guess, in retrospect. Elsie McGowan came about a year before I did, and I think she started with the data tech ladies, because those were all ladies, except for one or two men, and there was another computer programmer who was a lady, Beverly [Strickland] Klein. I forget her maiden name. Beverly—maybe you know her. And there were men, of course, but it was about maybe half and half. Maybe not that much. It wasn't that big a group of programmers.

Then simulation engineering. That was a lot of analog programming, and that was kind

of like another different world and those guys looked down, I think, on the digital programming types, and it took a long time for them to have a woman in that area. But after I was their branch chief, they were going digital anyway. Everything was going digital.

WRIGHT: How was that accepted? Were you one of the first females to be a branch chief? I know you mentioned Mary Little, but were you one of the few that were there at that time?

HARNEY: I think initially there weren't many. Of course, Mary was one and I can't think of any other at this time besides Mary. I think Lillian Holloman was head of research reports, and I think Katherine [H.] Armistead, she was in research, too. I don't know if she was a supervisor of any sort, but there were several women in the research side, which are pretty impressive. Bertha [M.] Ryan, she left not long after I was there, but I kept hearing all these wonderful things about Bertha Ryan. I knew Harriet [DeVries] Smith. We used to play bridge together. She was a real engineer.

WRIGHT: It's part of that history of change where women started to move into those positions, sometimes men felt not as comfortable as they did with a man because it was something new and a change.

HARNEY: There was one guy who wouldn't work for me. He was a simulation engineer and he told John Smith, "I'm not working for a woman," and [John] gave him a staff position. There's another guy who protested it initially, who was David Hedgely, but he backed off. But basically, except for those instances, it didn't seem to be much of a problem. There was only once or twice in several years would I get some sort of innuendo about, you know, "I don't really care to be working for you." It just wasn't prevalent as far as I was concerned. I didn't see it. I wasn't looking for it, either. I really didn't.

WRIGHT: There was lots going on during that time period. You mentioned the X-15 flights were going on. How were you and your group involved with those flights?

HARNEY: We were involved in processing the data for it, and so there would be pressure of data turnaround, and also, if there was some problem, if the data didn't look right, finding out why it didn't look right. Computers were so much more primitive then.

I remember there would be pressure to get the data turned around, and these would be like three-hour runs. It would take a long time to process, and if somebody screwed up in one of the input cards, it would be wasted. I remember standing and just watching the hexadecimal numbers go by on the screen. You actually almost watched the computer think at that time, it was that slow. So there's some pressure, mostly just from turning the data around and getting the engineers the printouts they wanted.

They didn't have computers to look at graphs, either. They were looking at reams of paper. It isn't like we had any of the hands-on [aircraft] experience, so we were all really peripheral to kicking the wheels and touching the metal, but we still felt a lot of pride in it.

WRIGHT: Did you find yourself working long hours during those years?

HARNEY: No, not as a computer programmer. I did as a supervisor, but I just don't remember doing it as a programmer so much. I guess a few times I remember, it was when we were converting from one computer to another, you know, where you're kind of in no-man's land, so I remember working some weekends then, but it was nothing like what you do when you're a supervisor.

WRIGHT: That must be history in itself, the technology that changed while you were at NASA.

Can you share with us some of those high points and low points of the technology that you've gone through?

HARNEY: Well, obviously, for me, the biggest thing is the change in computers, from being kind of an arcane science, doing things in strange codes, to using commercially available software where you did a lot of setup. Initially, there was no commercial software available, so you always started things from scratch. You'd use some of the same routines you did before, but like write routines for printing time out, the time of the day, pulling the time off the PCM [data stream], to write that out. Those things are now like firmware, or, you know, it's all inside. So all these little things we did then, nobody would think of doing that now.

Also, the telecommunications. The idea of sending data around [electronically], and also the security problems that came with that were pretty new, have become a big issue now, but initially, you had paper. You carted paper around, and after that, these floppy disks. Computers didn't have much storage. You were always running out of storage.

Actually, you'd do a lot of really weird programming just because you didn't have enough space to do it elegantly, so to speak, or simply. You spent a lot of time doing things that fit. I remember because it took a long time to assemble a program, that if there was an error and I knew where it was, I'd go in and change the punchcard. [I]'d figure out the hexadecimal symbol it should have been, so I can just change the object deck so I wouldn't have to go through another hour assembly of it.

So I guess computers have changed a lot and, I guess, the graphics displays. Now people don't look at raw data. They don't look at numbers; they look at graphical representations. I guess I hadn't really thought about all that, but it's several orders of magnitude different. They get so much data now. On the X-15, when I was processing it, it was like maybe eighty channels of data, at 200 samples a second. Now they have high-frequency data by the hundreds of channels. Plus it's flexible. You can turn it on and off [i.e., select parameters].

At that time, too, some of the data was onboard, recorded on onboard magnetic tape, and some of it was telemetered and you'd have to match those up and there would be lots of [data] dropout[s]. Everything was just kind of sloppy, if you think about it. Now it's sloppy, I suppose, in a different way. You just have to do a much better job of sorting it all out. Just because you have computers doesn't mean you have less work to do; it just means you have [more] information to deal with. Presumably, you're smarter because they've advanced the science. We never had laid off people because we got more computers. We just did more.

WRIGHT: What type of people were you hiring when you first became a branch chief?

HARNEY: Computer programmers. Simulation engineers.

WRIGHT: Were they easy to find at that time or did you have to recruit them, possibly even beg them to come to the Flight Center here, or were people anxious to work on aircraft?

HARNEY: It went up and down. It went up and down. It was a very attractive place for people who were interested in airplanes. Sometimes industry would be paying another 50 percent more, so it would be very, very difficult to get them, and also sometimes the government had a hiring freeze, and then in the seventies and eighties, they went through affirmative action and so they would do things like—that would be very disturbing. They would say, "Okay, we have an opening. We can hire so many people in the division right now if they're minority." And then it's kind of like a window opens [only for a short time], so you can't really go through and do a really good job, I think, of selecting people. We got some good people. We [also] got some people who are not great contributors.

I guess that's one of the things about supervising. Looking back, I got some real doozies, in fact, some real disappointments from people I thought were going to be the greatest

and others who turned out [just fine]. I don't know what the science [of selecting people] is.

Anyway, your original question is, is it hard to hire, and basically we always ended up getting somebody, maybe not always the person we wanted because of one situation or another. We couldn't pay the right salary or we couldn't get to them on the register or things like that. But nevertheless, we got some pretty good people.

One of the things that happened after I got to be branch chief is we ended up starting to contract out functions. In fact, that was something I [started]. And gradually, now the functions I had, just about all of them are contracted out. We have NASA people managing them but we don't have any NASA computer programmers per se. You don't need them. We shouldn't be competing with the industry in that.

WRIGHT: Does that help with the turnover, because if they're working for a contractor, then—

HARNEY: If they're working for a contractor, we don't hire them, and turnover is the contractor's issue. Of course, when we evaluate the proposal and we look at their work history, all that kind of thing has a bearing. For a long, long time, NASA itself had very little turnover. Very few people left. In the last ten, fifteen years, it's not true so much. People will use [NASA] as a stepping stone to other careers pretty well. But when I first went on, people started there and they expected to leave forty years later. A lot of them did that.

WRIGHT: Was that a plus, working on the projects, to know you had that continuity of people?

HARNEY: It was a plus and also a minus. I think with new people you get a lot more innovation. You can't become quite as settled and content in doing things, "This is the way it's done here" sort of attitude. I think an agency ages, and that's one of the things that happens to NASA, I think. When I started, it was kind of a young agency. Now it's kind of an old agency

and some of the problems it has had I think are because it's developed a culture and it's hard to operate outside the culture.

We went through a lot of training programs. The agency has these, every now and then they have the various things, or maybe the whole government, like zero defects or paradigm shifts. The whole idea is to try and get people to operate outside their comfort zone in the sense of looking for innovation and doing things a little differently, and I think that was probably the best part of managing, trying to get that to happen, and also trying to match people with what they could do, what they wanted to do, and with what needed to be done.

Some of the most frustrating things were having people who felt they should be able to do whatever they wanted [just] because they liked that. It didn't work that way.

WRIGHT: Some of the areas that while you were branch chief you mentioned were the radar systems. Can you share with us what some of those responsibilities were?

HARNEY: Well, at one point the organization I had included what we called the aeronautical test range, which includes a radar facility where we have two FPS-16 radars. Right now, well, let's see, I guess it's about eight or nine radar technicians. These are electronics technicians, so it became a whole other type of people that I was dealing with.

It also includes communications, where you have UHF-VHF radio, so this is where ground-to-aircraft communication and also within the range communications, it's kind of like an intercom, so within the control room, the control room can communicate with [aircraft and] the radar sites or with anything uprange. So the primary areas were the control rooms, and that included map displays, so you could track where the vehicle is.

It included a lot of displays of the parameters, so the control room crew, the Mission Control Center crew, could monitor the health of the vehicle and also determine if they're getting the data they wanted. It's a really active place, very exciting. It's a lot different than

post-flight processing because it's all real time and also the configuration control becomes a very, very big issue, and also kind of the pressure of the situation, too.

If the Mission Control Center's not ready or the radars are down or something like that, then you affect flight schedules and that's a big no-no, because it affects everything that's going on in the technical aspects of the center. You have overtime scheduled and [if] you're not ready, it's a big problem. I'm not sure I need to say anything else about the range, but it's a key part.

Also when I was doing it, it was heavily funded by, at that time, it was called Code T. No, it was Code O in [NASA] Headquarters. That involved advocating the budget for that organization. The budget for the post-flight processing and telecommunications came from kind of the institutional side of the organization, or as part of the project funding, but the range funding came from an area of Headquarters that was responsible for the deep-space network and other tracking organizations, and they were really very generous to Dryden.

So it was a matter of advocating and tracking the budget the way they wanted in doing that, so I really enjoyed that. It was a lot of show and tell and whatnot, but they were really so supportive. Now the deep-space network is handled in a different way and all that is geared down. They had TDRS [Tracking and Data Relay Satellite] and things like that, you know, the tracking satellites. That was exciting, working with that part of Headquarters. Because otherwise the part of Headquarters involved with Dryden was the research side, and [I wasn't] directly involved in that.

WRIGHT: Did you provide a lot of new area, or new phases? Did you phase in a lot of new things while you were in that area that you were just talking about, with the range, or did you monitor and maintain a lot that was already there? Did technology change so much while you were doing that as well?

HARNEY: Yes, the range as well as the other areas. It was changing a lot. We went from kind

of primitive control rooms to two redundant control centers. Actually, now there's four, including a spectral analysis facility for high-frequency data. I guess the biggest thing was instead of just strip-chart recorders you actually had displays of information, not just readouts of parameters, and also you could do post-flight feedback in the control room, so there would be quick-look sort of information available for the engineers.

Right now, actually, a lot of the information is piped via the network at Dryden, so the engineers can look at some of that from their desk, if they don't have to be in the control room for communication with the other people monitoring the flight. Of course, there's use of a GPS [Global Positioning System] system for some of the tracking. There's also mobile facilities, mobile range facilities, such that some projects which are not flown right at Dryden, but they're Dryden projects or NASA projects, can be supported remotely, using kind of like a big semi-trailer, with its own radar site and communication system and computers and display systems. It's really a station in miniature.

There's a lot of interaction with what we called the—now it's called the RAIF, the Research Aircraft Integration Facility, for combined systems tests. They have the actual aircraft systems there, or models of the aircraft systems. Before all that's completed, sometimes they will send signals back and forth to the range, and the range thinks it's getting data from flying aircraft, but it's getting data from aircraft on the ground that's getting computer inputs to make it think it's flying. So you can practice all your procedures in the control room so you can see if the systems are communicating properly and things like that.

All this was—you know, I didn't cause any of it to happen, personally. I mean, these are things that Dryden itself has evolved with, so I was involved with the range, keeping up with all that. Likewise, the post-flight processing. Initially, the computers I talked about that I worked on, we had a huge room with lots of cooling to keep those suckers from overheating, and now it's all distributed. It's just some small servers. I think they use the upstairs of this building, the data analysis facility, for archiving material or whatever, you know, or even some offices, I'm

not sure.

But things have evolved a lot. I suppose the big thing, too, is the Internet, just the way data is shipped around. It used to be a big deal, after a Shuttle landing at Edwards, or like the approach and landing test, ALT, before the real Shuttle flights. They'd ship tapes, magnetic tapes, back to [NASA] Johnson [Space Center], on a plane. They'd have a plane to take the tapes back. That was just a pretty expensive data transmission system. So all that's changed a lot. Also I think NASA's interaction with the public in the way information is shared with the public has certainly evolved a lot, the media that's used and CDs and the Internet.

WRIGHT: I would imagine that some of the first things that you worked on were very quiet, or not maybe talked about once you left the Flight Center. Were you working on some classifieds and secret information when you were working with the X-15 and some of those that followed that?

HARNEY: Yes. Some of the X-15, I guess, but there were some other projects which were black, and so we had to have black facilities. I, myself, did not have to have a super secret clearance, but some of the people who worked on it before me did. The only time NASA would get in that kind of situation is if they were working on a project with the Air Force, and the Air Force has designated it as black. Normally, NASA is a fairly open agency. Their research is open.

Now, of course, it's economic war and I think they're trying to control some of their access to some of the information since it's an economic advantage to have it. NASA's budget is kept level and I think Aerospace has certainly gone down if not kept level, so there isn't as much [pure] research as there was then . . . . There's no such thing as building a whole plane to prove concepts like they did then.

WRIGHT: We've talked about the technology, but from the day you walked into the Flight Center until the day you walked out, they had quite a change in facilities and people coming that it increased. Would you share with us some of the changes that you went through in possibly moving facilities or of you having to set up those facilities? I know you mentioned at some point you were in charge of all of that, and how that all came about.

HARNEY: Initially, there was one main building, Building 4800, as we called it, and it was flanked by two hangars, aircraft hangars. The loads lab was already there. It was a huge hangar-like facility which was used for heating and loading to apply heat in the form of quartz lamps and also loads, to simulate the loading and heating of aircraft for that in flight.

Other than that, they had converted part of a hangar to a computer room, built a mezzanine for a computer room, and they had done a lot of ad hoc work on 4800. It had been expanded several times, apparently, from the initial building. And so finally, some time after it was there, maybe it was in the seventies, they made plans for a brand-new facility called the data analysis facility as a place to hold the—I guess it was to hold the Cyber computer, the follow-on to the Cyber computer. It must have been the ELXSI computer.

So it was designed specifically for a second-floor secure area for a computer, big computer, mainframe, and that was the first new building, I think, in a long time. I wasn't involved very much in that building itself. I did advocate and push through a building they called the [Audio/Video Support Center]. It was for telecommunications. We, at that time, had contractors who were responsible for the video support of the Shuttle and also the video support of our research aircrafts, and also like the cable plant and the public address system and the hand-held radios and all those kind of communications, not specifically range communications, but more what I just described.

And so we had no real good place for that. They were using part of an old warehouse and whatnot, so we built the facility for that. What did they call it? Video—anyway. [Audio/]

Video Communications Center? I forget. But anyway, so that was a new facility that I had built, but it's not a major facility. It isn't anything like Chuck Brown . . . getting what is now called the RAIF [Research Aircraft Integration Facility] built. It was called Integrated Test Facility and he had that built. In the range we built a second radar building, so it was just kind of piecemeal.

There are a lot of little things that we did. The ISF, the Integrated Support Facility, some of that was done when I was head of the facilities engineers. Some of these organizations didn't last long, because that wasn't a real good fit. I think I only had that part maybe a year and a half or so.

WRIGHT: Did some of them overlap? Did you find yourself managing several pieces that just didn't go together?

HARNEY: Yes. At one time, not including contractors, I had the instrumentation engineers and the sim [simulation] engineers and the range stuff and the ground facilities, and all that just really didn't match. We had a major reorganization where the center director, Ike [Isaac] Gillam, and his advisors decided to separate engineering from operations, which is probably something that took a long, long time to recover from. Before that, you'd have instrumentation engineers and instrumentation technicians in the same organization. Now they're all separate and the technicians just became too remote.

But I did have some what we called super techs, para-engineers. Anyway, it really changed the culture of the place, but at that time they set up research engineers and operations engineers, the ones on the airplanes, and what was left was mine, and it was just too many different things. And so after a year and a half or so there, then they started breaking [it] off into the appropriate pieces.

WRIGHT: Did the change to move Dryden under [NASA] Ames [Research Center] for a while affect you quite a bit?

HARNEY: Oh, yes. Yes, very much so. It was some time after that that—let's see, at one point I just became head of a group of telecommunications. They made a new group of telecommunications people and it was just a few people, and I worked very closely with the telecommunications group at Ames. At one point, I was advocating briefly that, really, I should be part of the Ames group, the line management through Ames, because it was kind of an appendage here and it fit more there.

It didn't happen, which was probably a good thing, and then ultimately it turns out that there was a group of people supporting data acquisition from aircraft and data distribution at Ames that became part of our range. We consolidated the [Ames aircraft data support group and] the Ames-Dryden [range], and part of that was because we were having a lot of success getting funding support from Headquarters for that kind of thing, so [I] ultimately still ended up getting—although this was later and much more involved—having to go to Moffett [Field, California – NASA Ames Research Center site] to supervise people periodically, as well as the people at Dryden. We had a commuter aircraft, King Air, that [used to] go up to Moffett twice a week. I didn't go up twice a week, but still. So that was a little awkward, but it did really affect things. It was the people at Moffett, the range engineers up there, that really helped us get going on the mobile operations facilities for the range. I think there's still part of it.

WRIGHT: Did your duties take you on a lot of travel for NASA?

HARNEY: Not as much as some, but at some point probably four or five times a year, a couple times to Headquarters and sometimes to other centers. Like when I went to Johnson, it was because of the video support of the Shuttle landing, the approach and landing test. I guess I

went there a couple times, one time because of a Shuttle simulation. We were simulating the PIO, pilot-induced oscillation, problems that we had on one of the approach and landing tests, so there was some group at Johnson we were working with. The whole thing just really kept changing, which I guess is why it was kind of a nice place to work.

WRIGHT: When you were mentioning that it made me think, because you said that one of the first projects was the X-15 and then you were talking about the Shuttle and the landings and watching those. Can you share with us how that felt to watch from one piece of technology move or the evolution of when you arrived into different type of craft that you could see?

HARNEY: The X-15 was flying when I arrived, and it flew for the next four years, and that was always a big thrill, just the idea of it, you know. You would only see the end of it, per se, when it landed on the lake bed, but it came in very hot, over 200 miles an hour on these skids. It was kind of way up and you'd see this dust, but you knew that ten minutes before that it had been in northern Utah. Anyway, it was just a real thrill.

And then after that, we flew these lifting bodies, three different lifting bodies in different shapes. These were wingless aircraft. M2-F3 and HL-10 and X-24A. But these things were amazing. They landed like the Shuttle did, in a sense, like a rock. But then we proved that you could have a shape like that, but it got its lift from just the shape of the vehicle, without having the wings. So I saw those kind of landings.

I was there when we had accidents. You know, the feeling in the center after one of the three X-15s crashed, and reading the reports after the investigation, the long-term investigation, and then they simulated what must have happened. Also we had an accident on the M2-F2. This was when Bruce Peterson rolled [the M2-F3 on landing]. He lost his eye in it, but the coverage for the six-million-dollar man, that's from that.

And then we had the XB-70. We were just beginning some joint testing on that. This is

one of two hypersonic bombers. Anyway, one of them crashed, killed our—well, our chief test pilot and another fellow were in a chase plane, and they clipped the wing of the [XB-70]. The [XB-70] went down and so did our chase plane, an F-104. We lost our chief pilot and one of the people on the XB-70. Those things are always awful.

But it is exciting just to see these strange vehicles. Then to have the approach and landing test, that was very, very exciting. All these thousands and thousands of people who'd come to the lake, and I remember, as part of a group, we provided escorts for the VIPs who came to various viewing sites. I saw Prince Charles [HRH Prince of Wales]. He came to see one of those. It was just great stuff.

And also working with the engineers who work on the problems, like Milt [Milton O.] Thompson, he was one of the X-15 pilots and also flew the lifting bodies, and he and a couple of the engineers, the old engineers, Dick [Richard E.] Day and Joe [Joseph] Weil, I remember them working on the simulation for a Shuttle. It's not the moving-base simulation, it's just an engineering simulation where they just have the control stick and some displays and whatnot to figure out how to get rid of this [pilot induced] oscillation [PIO] that came in there.

It was just kind of neat to be working with these guys who solved these problems. In Houston, astronauts are God, right? In our place, the pilots were God. Then you get somebody like Milt Thompson who [served as Chief Engineer after he returned as] a pilot. By this time, he wasn't flying. You know, all the knowledge they had, all the experience. So it was exciting.

The SR-71, also known when we had them as the YF-12, the blackbird. The feeling you got when they flew, did a fly-by over or just as it's coming in or taking off was just—you know, you just feel it in your soul. They're just beautiful, they really are. You go out and see these things, and they're dripping fuel and whatnot, but they're just huge and they look otherworldly. They've been there for a long time. A lot of things come and go, but those were always special.

My husband worked on instrumentation for the SR-71s and the X-15 and some others,

so it's special for him, too. Then they had a lot of planes that were truly weird. You know, the forward-swept wings. We had the X-29 forward-swept wing. Before that we had some remotely flown vehicles like the HiMAT, highly maneuverable aircraft technology. You've got a 3/8-size model, which we flew remotely and that was pretty exciting, actually. That was where we began to develop a lot of our techniques for developing aircraft systems and testing them and doing this closed-loop testing, so this is a vehicle meant to test concepts, strictly concepts, like composite structures. Digital control surfaces, it has absolutely no hydraulics on it or analog systems (digital fly-by-wire technology). And you'd see that thing fly. It would be dropped from a—we have a lot of planes that were dropped from a mother ship like a B-52. They weren't expected to take off. They'd drop and then you'd see this thing do a turn. It must have been like a 12-G turn it could do.

WRIGHT: Must have been exciting for the team members on the ground.

HARNEY: Well, there's so much teamwork. At that time, we had fewer projects than they have now, and they would be more complete. Instead of one experiment, sometimes there would be multiple experiments, and it would be like the whole plane itself would be an object of study, as opposed to fitting a special structure on one wing of an existing production-model plane. But the teamwork was really special.

I don't think it's quite the same now. There's a lot of, as I understand it—I've been away seven years—but there are a lot of programs that we provide facilities for somebody else to bring in their program, and they bring in their own—you know, they have their goals, they have their data systems, they have their way of doing things and everything. We're just providing some facilities that they need. And so really all you need are a program manager and you need facilities that are operating, but you don't really need the kind of teamwork we had then.

WRIGHT: During all this time, when all these things were going on and you were having things given to you that were so totally different, did you find one aspect that seemed to be more challenging than the others that maybe just not necessarily frustrating, but you had to sit back and think a little harder than the rest of them? Something that was just more challenging than the rest that you were able to accomplish while you were there. Because it sounds like the variety that you had kept you pretty much prepared for whatever came your way. It seemed like you kept learning so many different things that maybe you weren't tied in, but maybe the same type of project management worked on each of the areas that you were given.

HARNEY: I guess the hardest part was always the people, really. You know, how to make an environment such that people were always excited, as excited as you were about it, who were challenged, who wanted to do what needed to be done and not always do it themselves, and also to get people to communicate because there were a lot of people—it's much easier to get your assignment, grab it, and then go in the corner and do it, but the projects always needed a lot more information [and communication] than that.

It didn't do much good to have somebody complain, "Well, I didn't get all the information I needed." It's very hard to know how to give all the information. You don't know. Somebody who's giving the information or has the requirement doesn't know all the information they have to give you. They don't know what you need, so to speak.

So I guess getting this teamwork to go. There's a lot of camaraderie and pride, but there's also a real trick. Not that I mastered it, but the thing was communication between people was probably the most important thing, to make it go smooth, to keep it a positive experience.

WRIGHT: Well, all that you've accomplished while you were there, are there one or two aspects that you find to be the most rewarding when you look back, that you're really glad you had that opportunity to work on that project or manage that area?

HARNEY: Well, I guess I don't feel like I would if I had been a researcher and had a report to say, "Okay, now I've proven this or I've demonstrated that, and now this concept or this philosophy is used on this plane that's flying." It's nothing at all that tangible. And I suppose that under my watch, so to speak, I guess all I can say is that I kept doing more with less, and also breaking this barrier of, well, what are the critical things that NASA needs to know how to do versus what are the things we can buy.

I can think of one of the biggest challenges of all, now that I think about it, was having engineers who wanted to design things themselves instead of doing systems integration using stuff that's out there. And also, when is good enough? You know, having some judgment about just how far to go with something.

The most frustrating situation, you have some guy who wants to do the same thing for twenty years, make it better for twenty years, move it from this computer to that computer, or whatever. So I guess one of the biggest things was actually starting off contracting out some functions and initially they were all kind of piecemeal and now having a large contract [to] do a lot [of the non-core functions].

In fact, I'm involved as a consultant somewhat now, and with one of the contracts proposing on the successor to—actually, it's the successor to the successor of the one I established, and it would be probably like 120 contractors doing various things, whereas originally those were solo (several separate contracts). All originally government, but it doesn't need to be. That isn't very much to be proud of, to say we turned [some functions over to] contractor[s], but I think it does [help] the agency—they shouldn't be putting their resources into those kinds of things.

WRIGHT: Well, like you mentioned, too, it brings in new ideas and you've got people.

HARNEY: Exactly, because presumably, with a contractor, you have an award fee and those kinds of things, and so you can look for innovation. Of course, the trick is to get the NASA people not to try to tell the contractors how to do it, but just be able to understand what is needed well enough to be able to describe what is needed, not how to do it. So I suppose that was always the balance. Balancing what NASA needed, what kind of core skills NASA needed, and doing it the most effective way within the boundaries that NASA's operating under.

WRIGHT: Well, you were certainly thrown many avenues to go. Did you have any regrets at any point in time that you came to Lancaster instead of going to Washington?

HARNEY: To Washington?

WRIGHT: Didn't you want to work on your master's up there?

HARNEY: Right, right. That's right. Well, I did get the master's eventually. But no, I have absolutely no regrets. When I first went to NASA I knew nothing about NASA. I just thought, okay, I'm going to work for the government and that'll be good for a year or so. Because I thought of the government as something like the post office. Not to pick on the post office, but at the time, I thought, well, you work with these gray file cabinets and that's it. But it was always very exciting and stimulating and really, really kept me busy, too.

I was mentioning I played bridge with Harriet Smith when I was a computer programmer because we actually took lunch breaks [then], but not for the last twenty years. I mean, you just do things all the time [as a supervisor].

WRIGHT: And just thinking about the social differences between twenty years ago, or during those twenty years that, for instance, you would take lunch and play bridge. Now people don't

play cards at lunch.

HARNEY: I think all those are gone, and at that time, I think, down in flight ops [operations] they had a Hearts game at lunch. It was all part of it. They had a [summer] NASA picnic and I think they still do but I don't think it's the same bonding thing it was then. Used to have a yearly Christmas dance and I don't think they do that every year now.

WRIGHT: Was it more of a family-type atmosphere during that time period?

HARNEY: Yes. Well, funding was all NASA and there was not as much turnover then. Now it's not all NASA. There's lots of contractors, too, and they're also coming to these same [functions], which is fine, but there's more turnover, too, because contracts change and a lot of people continue, but there's a lot of different people who don't. Even pilots change. Various pilots have changed. Are you going to talk to Marta [Bohn-] Meyer?

WRIGHT: We hope to at some point.

HARNEY: Because there are some people who have really caused an impact over the years. I've seen their role change a lot.

WRIGHT: I think it's another change for you, where I imagine you had mostly male pilots and now you're able to work with—

HARNEY: They still have only male pilots, test pilots, but Marta is their supervisor. She's a pilot. She flew or does fly the SR-71. Actually, [the SR-71 is] inactive now, but [Marta flew] as a flight test engineer, not as the primary pilot. But she is a pilot personally for pleasure, but

she's not a test pilot. Could be a flight test engineer. I'm not putting her down. She's outstanding, and she's been everywhere. And people like Harriet Smith, who became the first program manager.

In my area, it wasn't nearly as innovative. I mean, computer programmers. It was an area for women that had already been established somehow. But [when] Harriet became program manager, there were all men before that. So we have, I believe—I don't know exactly what the mixture is out there now, but I know Marta is probably our most accomplished female.

WRIGHT: We hope to get to her. Part of our project is based on funding and the direction on this project is given through the history office at Headquarters, but we always give them suggestions and hopefully they'll march on and do more.

HARNEY: Well, they probably have a lot of her history anyway because she's been a poster girl, and rightly so. She's very, very effective with young people. I'm involved with the American Association of University Women and also the junior college now. They have a science odyssey in January and a special program for sixth, seventh, and eighth graders, and Marta has always been the featured motivational speaker, and it's terrific.

And a lot of the Dryden folk come out, like people from the range come out and they fly a mission and they set up a control center at the college so the kids can talk to the pilots and they see what he's doing and talk to him and ask him why he's doing this and that and the other thing, so it's pretty neat.

WRIGHT: What else do you do? You mentioned you were consulting for some other companies as well.

HARNEY: Well, yes. That's just some this year. It's just a little bit of consulting. I haven't

generally been doing that. What I do is I work part-time at the college, teach English as a second language, which is a complete change. Yes, it is, and I really enjoy it. I admire the—this is all adults, these are all adult immigrants. Terrific work ethics. These people have worked so hard. They've raised a family. They have kids, the kids are already fully bilingual and now it's their turn. Anyway, I enjoy that. I've been doing that for five years.

WRIGHT: Have you been back to Michigan very often since you left the very small town of a thousand that's still a thousand?

HARNEY: I still have my mother there and one of my sisters and a brother, so I go back at least once a year, sometimes twice.

WRIGHT: Quite a climate difference from there to here.

HARNEY: Right. I'm not moving back.

WRIGHT: You'll take the sand over the snow.

HARNEY: Right.

WRIGHT: Do you have other plans in the future to possibly do more work with NASA or some of the contractors to kind of keep in touch of what the changes are going there?

HARNEY: Probably not. Right now I can be of use to this particular contractor because they're competing for this contract, which I was the mother of, so to speak. But other than that, I'm not strong technically anymore. I'm not current in a lot of the things, which is fine. It ended up

being stressful and also, even though it sounds like a lot of variety, there was a lot of repetition as far as the management. It may be different people but it's similar personnel things and there's just so much bureaucracy. The agency gets older and there's just more and more bureaucracy.

I guess I was pretty idealistic, too, in the beginning, and by the time I quit I wasn't nearly as idealistic, and I didn't think people could walk on water. I was always very deferential to my leaders, so to speak, and then after a while you see all these silly things, sometimes. Not all these silly things, but things. Or why did they do that?

So I think I was ready to go, and I do enjoy the complete change. So many people go back and do the same thing they did, but from the contractor's side, I'm not really interested in that.

WRIGHT: Well, if you'd like, what I'd like to do right now is just take a small break and we can stop for a few minutes and then come back.

HARNEY: I guess a real highlight for me was my retirement flight. The pilots have proficiency flights they have to do, and currently, or at least when I was still at NASA, they flew F-18s primarily as the support aircraft . . . and they used them for proficiency flying, and it seemed like it often happened when somebody from Headquarters retired or somebody retired that they got a ride, and so when I decided to take an early out, and this was a sudden decision. It was kind of like a two-week window and I said, "I'm going to go."

So I went to our chief of flight ops and I said, "Okay, I'd like the ride." He says, "Okay, sure. No problem." So they fitted me up with a suit and I flew backseat F-18 with Tom [Thomas C.] McMurtry, who was head of flight ops. Mach one and a half and he let me fly rolls and he did [a loop] over the top and actually, I guess it's called the Dutch roll, some sort of roll, so that was great. I have to say that I, myself—maybe I was talking about what I was doing not being glamorous before, [but] I liked the glamour part of NASA. That was the part that

really made you feel good, that ultimately, whatever you're doing fed into those planes, those activities.

WRIGHT: How long were you up on your retirement flight?

HARNEY: About an hour.

WRIGHT: Oh, how exciting.

HARNEY: Yes, it was great. Let's see, so as far as pure thrill, that was it, and then also the other things I've already talked about, just fly-bys and things like that. So when it came right down to it, the real thrills did have directly to do with aircraft, or the Shuttle landings. One July 4th, Ronald Reagan was there, President Reagan, and we had Enterprise, which is the approach and landing test vehicle, and one Shuttle had just landed, and another one was just taking off to go back to the Cape, and the President and half a million people, or whatever it was. It was just like, oh my God, who wouldn't want to work here?

WRIGHT: I imagine when the media came, too, for the landings in the early days of the Shuttle system, it must have made almost a chaos at the Center because it's such a small group that you were and then all of a sudden you have all these strangers on base.

HARNEY: We would drive in early to work so we wouldn't get caught in the traffic and things like that.

WRIGHT: During your time, I guess, in the early years that you were there, I know some of the NASA budget changed, and a lot of the funding was going toward the manned space flights.

Did you feel that in your work as well? Were you impacted by that decision?

HARNEY: Yes. We weren't able to expand things or do all the things we wanted to do. In some cases, some of the facilities we were going to build were delayed or canceled. Some of the flight projects were canceled and some experiments were canceled. That was generally hiring freezes and those kinds of things.

So for a while, in the late sixties, I don't think we were even recruiting people, or very minimal. Because there was one period, early seventies I think, where we went years without hiring anybody.

WRIGHT: But were there new projects introduced at that time?

HARNEY: Yes. There was always a joke, in the sense of well, being more efficient. And you'd have some of these engineers, you know, they'd be assigned to three or four different projects, and you can't—like 10 percent of the time on this and 10 percent of the time on that. Time doesn't go down to 10 percent. You can't really be very efficient on 10 percent. So a lot of people worked really hard and in very difficult circumstances. I'm talking about people all across the Center. A lot of overtime.

WRIGHT: And that wears people down physically and mentally sometimes.

HARNEY: But then there are some people who thrive on it. One of my bosses, Archie Moore, the guy just loved being out there. I mean, working was his hobby. In retrospect, just being there doesn't necessarily mean you're getting good work done, but he was always there. There early and whatnot.

JOHNSON: I was wondering, you started there in '65 and you were there during relatively turbulent times, as far as the country was concerned, with Vietnam and, of course, everything that was going on with the protests. Some of the people we've interviewed that were working at Johnson during that time period have talked about how they were so focused on what they were doing, they weren't even aware of the outside world, and every once in a while they'd stick their head up and realize some of the things that were going on. Was that the same way at Dryden, since you were doing pretty focused work there, too?

HARNEY: I think it was, to a great extent. I mean, when I think of those years I don't think of [world events] directly. I think of, okay, that's when we were flying this and that's when we were doing that. Those were not wrenching years. That's pretty hard to say, isn't it? Vietnam was a terrible time, but I don't remember [those years] particularly being terrible or otherwise.

I remember coming in to work—I mean, we carpooled, obviously, since everybody lived generally remote, but discussing things like the assassinations of [President John F.] Kennedy, the second Kennedy [Robert F.], and Martin Luther King, [Jr.] things like that. Those kind of events truly got through. But I don't remember any real carpool discussion or other discussion, really, about the Vietnam War, for instance. At home, I'm sure, there was awareness, but at work, generally you'd be talking about what was going on at work. Really, it was very, very focused. That's a good point.

JOHNSON: And also you were talking about your flight for retirement. Did you ever have any desire to fly yourself or to learn how to fly, since you were out here in this area?

HARNEY: Yes, I'm always interested in everything at that time. I did go skydiving before I came out here, when I was still at Michigan, just for that experience. When I was here I went gliding in a glider. But I guess as far as flying itself, it was a real big commitment financially

and time-wise and at that time I was more interested in hiking and rock-climbing and other things so it just didn't make the cut.

But in retrospect, I don't really miss not having been a pilot. There's just so much time you can do things. For the first ten years I was here, I spent most of my weekends gone in the mountains, usually hiking or climbing or skiing or something like that. Became more of a homebody after that and started doing things that kept me here, tennis or whatever.

I did not have my own children. When I married Paul, he had two daughters, so I'm a stepmom. I think that happened to a lot of women, too, who were working at that time. A lot of people who didn't have large families or didn't have any families, as far as their own children, because they were just wrapped up in what they were doing at work.

WRIGHT: Looking back at when you went to the university and left your small town, you mentioned you really didn't have an idea what you wanted to do with mathematics. Did you have any idea in the world you'd be working on all this future technology and things that would be touching space?

HARNEY: No. If I had I would have studied applied mathematics and probably engineering, and maybe I wouldn't have gone into it. I really like art and literature. [Laughter] You know, just as an avocation. But then again, no, I really did like the technical part, but I think I would have felt more confident if I'd had more applied mathematics training and/or engineering training.

So in some sense, I felt remiss for not being, you know, understanding electronics per se. Not just the logic of computers but where the electrons are going. So in retrospect I suppose if I had known I was going to get involved in NASA, I would have done that.

WRIGHT: That probably was kind of a hard crystal ball to look into since you were moving into

a whole field that wasn't even there yet.

HARNEY: Well, I had no idea. After that summer science camp I mentioned that I went to before I was a senior in high school, I thought I wanted to go into chemistry. At the camp, besides getting involved with rudimentary computers, I was doing something with organic chemistry and the idea of how these molecules are constructed, I said, "Oh, I'm going to get into that."

But when I got to the university and got into a unified science program, a unified science program in the sense that the calculus and the physics and the chemistry—it was physical chemistry, not organic—were all integrated, because the universe doesn't just stop here and go into another, you know, this is physics, this is chemistry. It is all tied together and you need mathematics to understand any of it. And so it all kind of went that way, and mathematics seemed to be the most straightforward way to go.

One of my mathematics professors was really a snob when it came to applied mathematics and engineering. He went so far as to, when I was taking a topology class, it was being held in one of the engineering buildings on campus and he refused to hold it there. He says, "We're going back to Angel Hall," where the mathematics [department was.] He wouldn't even have a class in [an] engineering [building]. I'm young and impressionable and coming from the farm, I think all these educated people are God and so I think, "Oh well, I certainly don't want anything to do with applied stuff," and I truly, truly regret that. I think I would have had more insight and would have been even more effective if I had that background.

So in some sense, I was a little bit of a fish out of water, I think, in areas that I was working with and so it had to just be kind of, use a lot if intuition and being able to understand what they're saying, being trained by my people, so to speak, and understanding what they're saying and using logic and intuition to figure out if it made sense or not instead of actually having had the same education they did. Because the people I was hiring were engineers.

WRIGHT: It seems like it has worked out well and you have had a variety of experiences. I know that you've left quite an impact there. It may not seem so but it sounds like you have just done so much that is still making things work well. We feel very fortunate to be able to talk with you and appreciate your time to do that.

HARNEY: Well, thank you and I appreciate you coming.

WRIGHT: Are there some other things that you would like to share with us before we close this afternoon?

HARNEY: No, I think that pretty much covers it. I guess, I did get an exceptional service medal. That was one of my proud moments.

WRIGHT: Oh. Well, tell about that before we close for the day.

HARNEY: It was just one of those NASA medals. But every year, they have Dryden awards and they have NASA-wide awards, and so in [19] '92 I got an exceptional service medal and I was very proud of that. It was for [providing] data systems, flight test range facilities and teams to support experimental aircraft and the Space Shuttle.

WRIGHT: Is that given here at Dryden?

HARNEY: At Dryden, but they have Headquarters people come out. It wasn't the administrator. Who was it? I forget, but anyway. So that made me feel good.

WRIGHT: And it was not too long after that then you retired?

HARNEY: Yes. May 3, 1993. So I was early out. I guess I was just getting tired of the people management part but that was certainly the only thing I was qualified to do at that point, too. So I said, "I want a change while I'm still young," so I did.

WRIGHT: It sounds like you're keeping very busy with a new variety of assignments for yourself.

HARNEY: It's easy to keep busy. And I do enjoy teaching, teaching the adults. They're so appreciative. I guess that's one of the differences. When you're responsible for people, you hear about so many bad things, and people are always having trouble. You keep fixing things and doing things, but there's always somebody who's got a problem. But with the people in teaching, they're there because they want to be. They don't have to be there. And they're so appreciative, my God. So I guess I like that.

WRIGHT: Well, we wish you well with that and wish them well because I'm sure you'll open a lot of doors for them with your teaching, and I know that's very rewarding for you to be able to see them blossom and take off and have such wonderful futures ahead of them. So good luck with it all.

HARNEY: Thank you.

WRIGHT: Thank you.

[End of interview]