NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT
EDITED ORAL HISTORY TRANSCRIPT

RICHARD W. NYGREN
INTERVIEWED BY REBECCA WRIGHT
HOUSTON, TEXAS – 9 MARCH 2006

WRIGHT: Today is March 9th, 2006. This oral history is being conducted with Richard Nygren in Houston, Texas, for the NASA Johnson Space Center Oral History Project. The interviewer is Rebecca Wright, assisted by Sandra Johnson. This is a continuation of the oral history that we began on January 12th, 2006, with Mr. Nygren.

Thanks again for coming back and talking with us and continuing the information about your long career. We start today by talking about your involvement with the Apollo-Soyuz Test Project [ASTP]. How and when did you learn that NASA would be involved with the Soviets for this flight? And tell us about how you became involved with it.

NYGREN: Thanks for having me back. I looked forward to coming and wrote up some notes to help remind me.

We finished up the Skylab program, and Apollo was obviously phasing down, and there were discussions about what we were going to do in the Shuttle arena, but Shuttle hadn't progressed far enough. They needed what was called the Flight Crew Support Team to support ASTP, and I volunteered for it because I didn't have anything else going on at the time.

The Flight Crew Support Team for Apollo-Soyuz was headed up by a guy by the name of Dave [David A.] Ballard. I did the command module work. [R.] Terry Neal did the docking module and actually did the crew integration for the Soyuz spacecraft. So there were three of us that pretty much worked ASTP from the beginning.

It was really fascinating, in that it was the first chance I ever really had to work with anybody from the international side, so the Russians were my first encounter. Right away, the first thing that you get into is the language barrier. Everybody needs an interpreter and translator to communicate, so it slows the process down. Where we used to think we could do training in thirty minutes, it would take an hour and a half, so we were way off scale as far as the time it took to get things done. Just our schedule and what was reality just hadn't balanced out yet, so we had to work on that.

The other thing that became pretty apparent pretty quickly was that they work on personal relationships as opposed to actual goals and job assignments. If they have a good personal relationship with you and they know you and they know that you're going to be working in their behalf, so to speak, they'll give you the data that you need to do the job and you can go off and go get it done. But if you haven't taken the time to establish the personal relationship, they're very reserved.

I don't think I picked up on the reason for that during the ASTP, because I never traveled to Russia. I did all of my work with them over here. During the NASA *Mir* program [Shuttle-*Mir* Program, Phase 1 of the International Space Station], when we started working with them again, we did a lot of travel to Russia. [We learned] that their culture and the communist society that they had just moved away from was such that everything was compartmentalized and information is power. They didn't share information with people unless there was some return or some protection for them. They got into that particular situation, I suspect, more from a fear factor involvement.

Therefore, it was more of a strain to work with them if they didn't know you personally, know how you reacted, both I would say sober and slightly inebriated, to whether you would

now say something you shouldn't say or embarrass them. Once you had been out and had dinner and partied with them, and you'd even go to lunch, and they'd order a bottle of vodka, and you'd go through a bottle of vodka at lunch, and then you'd try and figure out what you were doing in the afternoon—once you had established that personal relationship, the working relationship really just blossomed.

They were great people to work with. They were very friendly, they were cooperative, they were helpful, but it did take that up-front work to get started with them.

They were always interested in the hardware that we had. I was fascinated at how interested they really were in the hardware and how we trained and how we did our procedures. Again, because I didn't actually have the opportunity to go to Star City [Russia] and see the training that they did and how they performed it, I couldn't have a real comparison at that point in time of how much difference or how much similarity there really was. But they were very, very interested in how we did business.

The other thing I thought that was fascinating, and we had all these thoughts and rumors about it, I can't confirm any of them, but they always had a lot of hangers-on. Every place that they went, there were three or four people with them. No matter where you took the astronauts, the trainer, whatever, there were always three or four people that seemed to go along with them. We always wondered, "Well, which one's the KGB [Komitet Gosudarstvennoy Bezopasnosti, Russian State Security Committee] guy and which one's the communist party guy. Probably this is the training guy and this is the procedures guy and they were just trying to learn as much as possible." It was always an item of conversation for us, trying to figure out why we had so many people that were wandering around with us.

WRIGHT: On more of a personal note, what were your thoughts when you had worked so many years with the Apollo Program, where we were in a space race to get to the Moon before the Russians, and now, just a few years later, you're working with the Russians to do a joint space project? Can you share with us what your thoughts were?

NYGREN: I really didn't have any problem with that. I didn't serve in the military, so I didn't have the Vietnam experience—a lot of the people that were my age had been in the military, had that same experience. I thought it was a fantastic opportunity, because I thought this is where we're going to end up in the future if we can figure out how to make it work. And it is working now. It's just that I'm not sure that it's the way I thought it was going to turn out, but at the same time, it was really an interesting opportunity for me.

I had never traveled to Europe, I'd never been to Japan, and to the other places that were doing space work. Working with the Russians and their space program to me was really a fantastic opportunity. I wish I'd had an opportunity to go to Russia and actually see what was going on back in those days, but I didn't have that opportunity, but we learned a lot from it.

And one of the things that you'll note is that in the U.S. system, a lot of people change. We move jobs. When we started doing the NASA-*Mir* program, there were a number of the Russians who had worked Apollo-Soyuz. A few of them I knew that had come over with the astronauts, but not very many of them, but just talking to them, a large percentage of their people had worked on ASTP that worked on NASA-*Mir*. When they got in their jobs, they stayed there and retired. Where in NASA, you're in a job for a few years and then you change off and go someplace else in a lot of cases. But they had a lot of experience that they could reference where, "We did it in ASTP like this," or, "You guys used to train like that."

It was neat to talk to the guys that had been there before on their side and to say, "Well, I was over in the U.S. working with your crew guys over there, too." I had an opportunity to see [Alexi] Leonov when we were there for NASA-*Mir* at one of their Space Day holiday activities, so it was good to be able to do that.

WRIGHT: Share with us how you were able to work through those barriers, the cultural barriers, the language barriers, in order to get these crews trained on the systems that you needed to train them on when they were here for ASTP.

NYGREN: In general, and I don't know whether it was the PAO [Public Affairs Office] guys or some of the program guys that went over there originally or not, but it appeared to me that they had done a pretty good job of learning the culture. Maybe they got the insight from the [United States] State Department, but they did a fairly good job of creating social opportunities for us to meet with the guys. We'd have group luncheons with the translators sitting at the tables. We'd go out for a beer after work and socialize. People would have parties at their houses, and we would go over and get a chance to meet them and socialize with them in that particular environment.

I know the [NASA] Kennedy Space Center [Florida, KSC] Public Affairs Organization set up a visit for them over at [Disney World, Orlando, Florida], and it was fascinating from two aspects. One, watching the Russians in [Disney World] was something. That was something they obviously had never encountered before in their lives, but at the same time I learned a lot, because [Disney World] is set up to handle VIPs [Very Important Person] through underground tunnels and through back corridors, and so we never had to wait in line anyplace. You went to

wherever the event was, the dancing bears or whatever, and you got a showing right there on the spot.

And we broke up into three or four teams. Dave Ballard went with one group, I had a group, Terry had a group, and I think there was one other group. We went all the way through [Disney World]. And then they had a social hour on the boat on the lake, where we all socialized.

Then we had dinner at Frontier World. It was a barbecue dinner, and they had square dancing on the stage, and they invited the Russians to come up and dance. I thought this was just not going to work, [but] the Russians jumped up there. They thought it was the greatest thing going. They got up there and had a great time. So there was a lot of social interaction to get the rapport established with the guys.

The technical piece really wasn't that difficult after we realized how long it was actually going to take to do the training and get the guys involved. You just said, "Okay, well, we used to spend an hour, we're going to spend two or three," and you extend your calendar and your timelines to accommodate that activity.

But as I said, they were very eager to learn, very interested, and they were really, really good participants. They were good partners in it as far as I could tell. I really enjoyed working with them.

They came to Kennedy a couple of times, and we got to take them out to look at the real flight hardware. They were just absorbing it, and it was fun to watch them do that. Of course, we'd have probably been doing the same thing if we were at Baikonur [Cosmodrome Launch Facility, Kazakhstan]. [Laughs]

WRIGHT: What were you doing during the mission itself? Were you providing support effort?

NYGREN: Generally, my real-time mission support was pretty minimal, unless they couldn't find something that I'd stowed someplace or they had a question about one of the decals I'd installed. There really wasn't much to it.

In post-flight there wasn't much either. We landed, brought them back, did the physicals, for our guys, and they landed their own spacecraft, and we really didn't see them again. There wasn't much of a post-flight activity that I was involved in.

But I remember one of the favorite places that we used to like to go to down in Florida was a place called the Mouse Trap. I don't know if you ever heard of the Mouse Trap in any of the other guys' stories, but it was a steak house and bar that was down there on [Highway] A1A, down in Cocoa Beach [Florida]. It was the local hangout. Everybody hung out down there.

Dave Ballard had his family down there, and Dave and Terry and I stopped there one night after work, and Dave had a "kitchen pass." We always talked about having kitchen passes. So we stayed there, and it was probably ten or eleven o'clock when we left, but Dave had a place, an apartment, right behind the Mouse Trap. Terry and I were about a block and a half away, but we had to drive by it every morning to go to work.

Well, the next morning Terry and I got up, and we were driving to work, and all of the firemen were standing out there spraying it down, and guys were on the roof chopping it with axes and everything, and the Mouse Trap was burning down. It was a Florida landmark. It was just unbelievable. From the traveling, the TDY [temporary duty] guys, the NASA guys, there was never a place that replaced the Mouse Trap, because the Mouse Trap, you could find

everybody at the Mouse Trap at some point in time if you went down there and stayed there for a while.

We had to watch it burn down, and we were going, "Jeez, it's not going to be good to be TDY in Florida. Without the Mouse Trap, this is going to be a bad place." [Laughs] We had a good time with that kind of stuff.

[ASTP] was a very good experience, a learning experience. It helped me, I think, with NASA-*Mir* to some degree, and it was a good step for the nation, too, in trying to establish a technical working relationship with the Russians.

WRIGHT: ASTP also marked the ending of the Apollo era. That was the last group that you trained for that type of a capsule. Was there any thought in your mind of knowing that that was the last crew that you'd be doing for that program? Any feelings of knowing that all the work that you had done for that program was now ending?

NYGREN: I would have to say I was looking more forward than I was backwards. I didn't have any real feelings about it was over with and that was too bad. When they ended up canceling the flights, that was a downer because we, at that time, didn't have the Shuttle coming along. We really hadn't gotten the Skylab far enough along that we knew what we were doing, so that part of it was a downer.

But I would say rolling off of ASTP, since my entire career had been in Flight Crew Support and we didn't have any follow-on missions or follow-on vehicles, I was wondering, what is Rick going to be doing? So I was trying to figure out where I was going to play into the

picture. Back in those days they were having RIFs [Reduction in Force], so it was always a question of whether I was going to be playing into the picture.

WRIGHT: When did the transition, or your transition, to the Shuttle program begin?

NYGREN: Essentially as soon as ASTP was over with, I was moved into a Training Division. The job that I had at that point in time was really one of working with the training organization in establishing what the requirements were going to be for simulators and mockups, how many simulators were we going to have to have, what kinds of simulators, moving based, fixed based, how many mockups we were going to have. Then, as you look at all of those different vehicles, there's a lot of items: cameras, suits, and even food, things used as a consumable. I'll just pick on cameras because they're pretty easy to think about. For each one of the simulators, you're potentially going to need a camera in there, so if you've got four simulators, you've got to have four cameras. Well, if you've got four cameras, how often are you going to have to refurbish them? Or one's going to break, so you've got to have some in the storage, and you've got to have some kind of a pipeline coming through there.

So starting with things like cameras and then working with CRTs [cathode ray tubes], [we think about] the displays that go on there, or the eight balls in the simulator, and all the systems kinds of hardware that actually has a service life on it. [We] had to start working on what's going to have to be ordered, how are we going to maintain it, the contracts. A lot of the original displays are military aircraft kinds of displays, and do you send that stuff back to the military to get it refurbished because the military has depots for refurbishing that stuff? Or do you have contracts with the original hardware provider to refurbish these? A lot of decisions on

the simulator and trainer maintenance activities [have to be made] based on what simulators do we really have to have, and then how are we going to actually maintain them throughout the years.

I spent probably two years working on these types of things before Shuttle got far enough along; then I started working on the Shuttle designs and then the follow-on to testing activities.

WRIGHT: Share with us that whole transition and that evolution. What were some of the earlier phases that you worked in and then how that detailed into more.

NYGREN: We worked on the simulators and the trainers and all of the hardware—that took me a couple of years. [After] the Shuttle program [development] got past the systems requirements reviews and into the preliminary design review category, I started supporting some of the preliminary design review activities in a similar fashion to what we used to do in the Flight Crew Support world.

The way preliminary design reviews work is that the government publishes a bunch of specifications and what the contractor is supposed to go do. Then the contractor produces a preliminary design review data package, and it has all of their system specs [specifications] in it, all of their ops [operations] concepts, all of their design reference missions, and all of the stuff that they use as their top-down requirements for how they're going to build a spacecraft. And they provide that back to the government and to, actually, their subcontractors. It's a huge event.

Everybody reviews all of that documentation, and they write what's called a review item discrepancies [RIDs], where they think that there's a problem with that particular document. It

could be anything from an editorial comment where this system is not compatible with some other system that's documented in some other book.

What I did for the Astronaut Corps or Flight Crew Support was I made sure that all of the documentation in the TDR [Technical Design Review] data pack got reviewed by the appropriate Astronaut Corps. They were broken up where some of the guys were systems guys, some were software, some of them were aero guys, some of them were booster guys. I got the data pack to the right guys within the Flight Crew Operations world. They would write up the RIDs. I would work the RIDs back with the PDR [Preliminary Design Review] systems team.

For each one of the systems at the PDR, they'd set up a team with the NASA and contractor guys. I'd take the RID back to the team and work it and make sure that it was logged in and that everybody understood what the RID said. If they had a duplicate RID or if there was something wrong with the way that it was written, I'd go back and work with the crew guy to make sure that we were getting exactly what he wanted articulated into that activity.

Then I would keep a complete log of all of the RIDs that we submitted, and I'd follow them through the screening board. They'd go through the systems team, then they'd go through what's called the screening board, then they'd go through a pre-board, and then they'd actually go to the board. I would follow those RIDs as they progressed up through the system and the different boards and reviews.

I'd go back, and different people, the Chief of the Astronaut Office or Deke [Donald K. Slayton] or whoever was there at the time —John [W.] Young was the head of the Astronaut Office—and they'd sit on the higher level boards as it went through the PDR. My job was to make sure that they knew which of the RIDs that we had written, how they were dispositioned, how they were going to come up, and what issues might be associated with them.

The flip side of that was that I'd sit down with all of the different teams and look at all of the RIDs that were written by everybody and make sure that the RIDs that were written by different people didn't affect the stuff that we were doing. If it looked like there might be some kind of a conflict, I'd take it back to the crew guys that were working in that area and say, "These other RIDs are being submitted by these guys. Do we have anything we want to add or any issues with it?"

It was a combination of being a technical liaison at one level, and at the other level it was more of an administrative, managing all of the RIDs and how they were being dispositioned and keeping track of them to make sure we didn't lose any of the stuff that we were trying to get accomplished.

That went on through PDR and essentially through CDR [Critical Design Review]. Then post CDR, they started doing a lot of sub-system level testing on hydraulic actuators for the elevons and the APUs [auxiliary power units] because they were power units for running the different systems , the software and avionics packages with the displays. I started getting involved in some of the sub-system level tests that were going on.

Then this is where—it's like the Apollo, but it was an expanded role also, in that we wanted to get involved as early as possible to just make sure we knew what was going on. We also knew that we had a real problem with when our simulators and trainers were going to come on line with respect to where the vehicle was supposed to be coming on line. We needed to make sure that our simulators and trainers were working the way that they were supposed to work and that everything was doing the things that were supposed to be done. We'd work with the sub-system level guys in writing their tests.

Where we had crew procedures or training procedures, we'd take those procedures and we would compare them to the test procedures that were being run against this particular piece of hardware. [We would] see if there was a comparison there, so we could understand how they were running it and whether our procedure would work and it would operate in the same fashion.

That's pretty sketchy at the sub-system level, because most of the stuff that the crew guys train on and operate isn't at the sub-system level, it's actually at the system level. You really have a little bit of buffer there. You're a little out in front of yourself, but that was the intent. We'd get the sub-system test procedures from the contractor or the vender. We'd send them to the flight controllers and say this is the set of procedures that these guys are using, and this is the data that they'd like.

Then after the test, we'd try and get a copy of the as-run procedure, where all of the values were actually recorded that says when we did this it read this, and when we did this it read this other number. [We'd] get those back to the guys in Houston to make sure that they understood that this actual system performance was like this and whether that was really what was in the spec and how they were going to deal with it.

Time progressed, and they actually got to where they started assembling OV-101 out in Palmdale [California] and started doing systems level tests on the vehicle out there. At that point in time, Don [Donald R.] Puddy was the head of the Flight Control Division. I was in that organization, and he asked me and Al [Alan C.] Glines to be the two-man team that followed OV-101 through the Palmdale factory test-and-check-out activity. So Al and I became the first part of a new Flight Crew Support team or what would eventually become the vehicle integration test team.

Al and I just did rotational assignments. We'd go out to Palmdale for two weeks at a time—he'd be out there for two weeks, I'd be out there for two weeks—and essentially doing the same thing. We would sit down with all of the systems guys, the hydraulics guys, the electrical guys, the avionics guys, and we'd work with them on the procedures that they were running for their particular systems. We'd have our little roller bag, the equivalent of the roller bag today. We had a little roller thing that we ran around with that had all of our flight procedures and all of our flight controller handbooks and the schematics that the flight control guys use. We'd sit down and compare their procedures with our procedures, and we'd look at their schematics versus our schematics and talk to the guys about it.

I remember it was always interesting because we had this Polaroid camera, and it had a cone shape on it. We'd sit in the cockpit when we were running OV-101 testing. In fact, we used it through all of the vehicles, practically. They have the CRT displays, and it has different systems parameters, and we'd have our camera , and put it over the screen and pull the trigger on it to take a Polaroid picture. Then we'd have a picture of what was actually on the screen at that particular time for that particular systems configuration. We could send it back to the Houston guys and the simulator guys and say, "Does your software work exactly like this, because this is what the flight software is working like." It was amazing how many actual differences we discovered in there, but it was a good check and balance activity, and we continued to provide this kind of support.

They ended up doing some integrated testing on the OV-101 before they actually took it over to [NASA] Dryden [Flight Research Center, Edwards, California], and we did essentially a simulated mission. The software goes through a landing sequence, 301, 302, 303, that takes you through the different software sequences for landing. We could configure the vehicle so that it

was running that particular software. The elevons were actually working the way that they were supposed to with the simulated input for air speed and attitude. Writing those procedures was very rewarding, in that that's really where you got to look and make sure that the flight procedures and the test procedures were really going to come together.

We had a good time doing that. I remember one time we were out there doing it, and we used to stay at a place called the Lancaster Inn. A German guy owned it, and he was great. He loved all of the aerospace guys that were out there. We got up one morning and had fourteen inches of snow on the ground, and we couldn't go anyplace. We couldn't go anyplace. So we were calling the plant and said, "We're not making it in this weather."

They said, "Well, just stay in the lobby. We'll figure something out."

And I don't remember how long it was, an hour later or something like that, here comes this four-wheel-drive pickup with snow blowing all over it. It's got a camper in the back, and they come in and say, "Okay, you guys." We all run out and jump in the back of the camper, and away we go. We get out to the plant in this four-wheel-drive truck, and went to work.

[Richard H.] Truly was there, had flown his T-38 [Talon, training aircraft] out there, and they parked their T-38s right at North American [Rockwell International Corporation] plant. Well, the Palmdale Airport guys, they had cleaned the runway, and the airfield was working great, but from the Palmdale plant in to the airplane, they didn't clean that. That was up to North American to do that.

So we were out there with a forklift with a wood pallet on the front of it trying to move fourteen inches of snow, and we weren't getting anyplace. It was crazy, because it was one of those forklifts that is used in a food warehouse so it has smooth rubber tires. It doesn't have treaded tires. We weren't getting anyplace.

Finally, they got some guy with a road grader to come in and move the snow, but we thought, well, we're not going to move anything for three or four days with fourteen inches of snow around there. So it made it interesting to figure out how you were actually going to get the testing done. But instead of saying, "Well, yes, the weather's bad; we're going to quit," when the regular work force came in, they checked and saw how many people had four-wheel-drive vehicles, then sent them out to the different hotels that had people that were in them, picked people up and brought them in to work. We managed to get done. At the end of the day, we found the guy and his four-wheel-drive truck and jumped in the truck again and headed off back to the hotel.

There were good times to be had out there as well, and I think we did a really good job of getting the crew guys integrated early on. Fred [W. Haise] and Gordo [C. Gordon Fullerton] were the first ones going to fly ALT-1 [Approach and Landing Test]. Truly and Joe Henry Engle flew the second one. They just alternated ALT-1, 2, 3, 4. The crew guys were out there quite a bit and I got a great opportunity to get to know them real well.

I had known Dick Truly pretty well from the Skylab days. He was one of the guys I interfaced with all the time, so he and I got along really well. Joe Henry's a really great guy. I had a good time working the Palmdale activity, got a good chance to meet most of those folks, a lot of which ended up having to go to Kennedy later on when we shipped [OV-] 102 down there with a lot of open work. A lot of the engineering and technician folks had to shift to Florida for several months to get some of the work done.

WRIGHT: Were you there when the [Space Shuttle] *Enterprise* rolled out?

NYGREN: I was there when *Enterprise* rolled out, yes. All four of the crew guys were kneeling down in front of the orbiter and took the pictures. Yes, I was there then. I was there when we put it on the dolly and took it on our newly-built road across the desert to get it up to Edwards Air Force Base [Edwards, California] and up to Dryden.

Al and I split off on a routine basis, rotating two weeks on and two weeks off. There was a lot of times near the end when there was testing going on that was 24-7 [twenty-four hours-a-day, seven days-a-week]. We'd both be out there at the same time because there wasn't any way to cover all of the testing with just the one of us, so we'd go out, and both of us would be there. I spent a lot of time out there when we were finishing up [OV-] 101 and getting ready to roll it over to Dryden.

WRIGHT: Was there one area that seemed to be a little more challenging than the others to get finished, that gave you a little more trouble than others to get the issues worked out?

NYGREN: I would have to say that, to my knowledge, not really. If you asked me to really pin one down, I'd say it was the software. But I think if you go look at the programs today, software is always the problem because you have to write your requirements first and then you go write your software. It starts off somewhat behind the power curve from the get-go. But the software seemed to be the area that I recall having the most problem with. For 102, when we got ready to ship 102, that's a different story, because there were some problems with 102 that were the long poles which were holding us up. But with 101, I don't think we had anything that really stuck out as this was an area that we were really that concerned about.

WRIGHT: Talk to us about being at Dryden and working with the ALT.

NYGREN: ALT turned out to be one of the really, really neat programs in hindsight, and any time you're doing something and you're working the hours that you work, you go, "God, this couldn't possibly be right, there's got to be—when are we going to get back to normal?"

But it was really good in that it was a small group of folks doing ALT. The Orbiter group was almost extensively Kennedy engineering team that came out and supported from a NASA perspective, and then a lot of the engineering staff from the contractor was at Dryden. They had set up a facility, what they called the North Base, which was in somewhat of an abandoned complex north of the Dryden-Edwards area, a couple of miles, not very far. They had renovated it, and that's where the NASA team was at, so we had office space essentially up there.

Then the operational and logistics support was all provided by Dryden, and the Dryden Flight Operations guys were responsible for the [Boeing] 747 and flying the 747. They provided all of the buildings and trailers and everything that we needed to actually get things done. They were the ones that built the mate/de-mate device up there and put it together so we'd have some way to put the Orbiter on top of the 747. We established a really good relationship with those guys there.

The Johnson Space Center talks about being an operational center, but to a very large degree they're not what I envision as a real operational center. Dryden is an operational center. Kennedy is an operational center. And what I mean by that is that they don't get to train and simulate on what they go do. They just have to go do it.

At Johnson, although the mission is operational, and certainly if something comes up, you have to deal with it, but they spend months and years training for that ten days or fifteen

days or for what we're doing with the ISS [International Space Station] continuous ops. They do a lot of simulation and a lot of training. When you ship a vehicle down to Kennedy and say, "We're going to go turn the hydraulic system on," they don't have a bunch of mockups and simulators over there. They write the procedures and go turn it on and see how it works, and if it doesn't work, they fix it.

It had a really good bunch of guys that came out from Kennedy. A number of them I had worked with in Apollo, so I got to reestablish some good working relationships with them, and the whole operation, I thought, went really well. I got involved not only with the Orbiter stuff but all of the flight crew activities out at Dryden. Regarding bringing our T-38s and the Shuttle Training Aircraft out there, I got really involved with the Dryden Flight Operations folks who were making sure our planes had services. We had places to store our spare parts for our aircraft that were out there.

With the facility kinds of people, we had a crew trailer out there for the crew guys to spend the night before we actually flew the ALT vehicle. We had them put in a physical area so we could do post-flight and pre-flight physicals. Both of those were spiffied up a little bit from the ALT time frame, because when we first started flying the Shuttle, the landings were at Edwards. When they came back, the crew guys needed a place to clean up and a place for post-flight physicals with the doctors.

I was the guy for ALT that was responsible for getting the crew guys from the Orbiter back to Edwards. I had a little Jeep station wagon that Dryden gave to me with a little radio on it that I use to transport the crew after they landed. We got the steps up to [the Orbiter]; they'd walk off and take a look at the thing; I'd drive up in my little jeep; and we'd get in and drive back over to Edwards.

I'm always the last guy, because I didn't have to be pre-staged out there and I could drive out as long as I knew what I was doing on the lake bed. I remember one time I'm out there—I get out there, and it turns out that the tug didn't have enough motor oil and it had an oil leak. So I had to drive back to Dryden to get a case of oil. I'm driving around out there on the lake bed when the 747 is circling around getting ready to drop the orbiter. I'm driving around on the lake bed trying to go back and get a case of oil and bring it out.

Some other stories—the Dryden guys had white vehicles with the NASA "worm" on them. You couldn't get on the flight line unless you had a government vehicle, and they didn't have government vehicles. So I went over to their hobby shop one day, and I said, "I need a bunch of cardboard placards like this here with those little rubber magnets on them."

They wanted to know why, and I told them why I needed it. I said, "Well, I'm going to stick it on the side of my car. Then it'll look like it's a government car. When they look at me from the tower with a pair of binoculars or something, I'll look like any other government car." So they made me up six or seven—probably six or eight, because you need an even number for both doors—and we kept those in the back of our cars. Every time we wanted to go to the flight line, we'd just go out and stick that on the side of our door. Then you could go up to Security, and they'd look at it and say, "okay," and you could get on the flight line.

I remember one day we were out there, Dick Truly and I were running, and we were running down the ramp, and the security guys came out. They told us that we probably shouldn't be running in this particular area because they were doing some classified stuff. They didn't say, "classified," they said stuff that we weren't supposed to be around, so we should run in the other direction. So we ended up running—

WRIGHT: So you reversed?

NYGREN: Yes. Yes. I had a similar experience to that when I was running down in Florida on the beach one time. The security squad came out with their four-wheelers. Back at that time they were actually three-wheelers. They came out of the palmetto brush and wanted to know what I was doing on the beach in an area that was supposed to be restricted. I'm going, "Hmm, I didn't know it was restricted. I'm just running."

"Well, you probably ought not be running here."

So I had to go back. I was actually running at what's called the Beach House in Florida. I don't know if you've heard about the Beach House, but I can talk about that a little bit later.

Anyway, out at Dryden it was a little bit of everything, working on the Orbiter, making sure that the Orbiter was ready for the actual drop tests. We did a couple of active-captive tests where we flew the 747 with the Orbiter *Enterprise* on top of it just to make sure that it was stable and went through all of the maneuvers that we'd go through for actually dropping it. Then we had captive-active flights, where we had the Orbiter activated and the crew guys in it but we didn't drop it. Then we actually did the drop tests themselves.

It was an interesting experience. I enjoyed most of it. A great, great, great team, and the tests really came off phenomenal, the drop tests and the landings. Everybody, I think, was just astounded at how well that came off.

One other story that was really interesting is [about] the morning of the drop test. The crew guys would stay in the trailer out there and the trailer was one that we'd set up. It had a little conference room at one end, and it had a bunch of bedrooms, like four, and had the showers at the other end. The first morning for ALT drop, Fred and Gordo were there. Because it was so

early in the morning, we had to have some of the Dryden cafeteria people come in early and actually cook some food so we'd have some breakfast. They had set it up so there was a TV in there so they could have the TV pumped back to Houston.

So we're there, and Fred and Gordo were there, and George [W. S.] Abbey's there, and John Young's there, and I'm there. We're all eating breakfast, and we've got these standard white Styrofoam boxes with our scrambled eggs in them, and we're eating away ninety to nothing. The flight goes off great, no problems or anything.

Right after the flight, I get this phone call from Dick and Joe, "Hey, we need you to help us with something."

I go, "Okay. What is it?"

So they start their scheme. Well, for their flight, ALT 2, same thing: we get up, get ready to have breakfast; go over and get the breakfast; come back. But I had worked with the owner of the Lancaster Inn to borrow all of his crystal, his china. We had flowers. The food from the cafeteria's Styrofoam boxes—we dumped it on the plate, so the food was exactly the same, but they had it set up to where it was a gourmet meal, a gourmet breakfast for them. So Joe and Dick got the gourmet breakfast, and Fred and Gordo got to eat out of Styrofoam boxes. It was all for show. [Laughs]

WRIGHT: But fun.

NYGREN: Yes. Yes, how these guys get their treatment and everything. So we had a lot of good times out there.

The place out there that was the big hangout was a place called Casa de Miguel's, which was a Mexican restaurant there. They had an upstairs room, and we had a lot of our pre-flight and post-flight parties there. It was a great bunch of guys, great program, and looking back on it, [ALT] was one of my real highlights in my career. I really enjoyed doing that.

In fact, another story was—they have a little triangular patch, you've probably seen it. [It is] the little triangular blue Shuttle patch that was the first actual Shuttle patch. There were certain people who weren't real fond of that particular patch, but it's pretty common to fly patches on flights and then give them out as momentos. So Rick, on his own initiative, got 5,000 of those and took them out to Dryden and put them on 101 so that we could fly them and we could give them away as mementos.

Well, Deke Slayton was the Program Manager, and Tom [Thomas U.] McElmurry was his Deputy. And Deke found out about it and told me that there was no way that we should fly those, that wasn't something that had been approved. So I took them off, and I ended up giving a few of them away, but I gave them away as flown *to and from* ALT. [Laughter] I couldn't give them away as flown *on* ALT, but I could say I flew them to and from ALT. So that was another way where we were trying to get the best out of the way things turned out; it was fun.

Deke and Tom were two really great guys to work with. In fact, I worked with Deke for a long time. He was the boss at the Flight Crew Office when I got hired on, and until he retired, I worked with him pretty extensively. A phenomenal guy. I really enjoyed working with him on ASTP. He and Stafford and Vance [D. Brand] were really good to work with.

WRIGHT: What were Slayton's strengths as a manager? So many people talk about what a great guy he was to work with. What did you admire about him?

NYGREN: The two things that I admired most about him, and they go into leadership, was he'd done everything and was willing to do most anything. He wasn't somebody that said, "Go do this," or something like that. He'd go with you if it needed his support. He'd done it before. He knew what he wanted. He was technically on top of the way that things needed to be done.

But the other part of it is that he did a great job of essentially telling you, "This is the job that I want you to go do," or, "This is what needs to be done. We've had this kind of a problem. Go off and go work on it." He had a vision of what it was he wanted, and he could articulate it in such a fashion that you knew what he wanted. Then he didn't come back and micromanage you. He was very trusting, but he was also very articulate in telling you what it was he wanted done to begin with. He could also be real demanding.

WRIGHT: Articulate in other ways?

NYGREN: Yes. Yes, if you didn't do it right, he could come down on you, but I really enjoyed working with him. He was always there to support you. When he said, "I'd like you to do this," he could describe what it was he wanted you to go do. I really enjoyed working with him.

And McElmurry, he's one of those guys that everybody just loves him. He has a personality that—as soon as you meet the guy—he's got a good smile, he talks really well, he's a conversationalist and makes you feel right at home, and he was a tremendous asset to the program, because whenever there was a issue between JSC or Dryden or something, Tom was a great guy to put on it to figure out where the common ground was and make it work. He did a good job.

WRIGHT: In 1979, the Shuttle arrived at KSC. Were you there when it got to Kennedy? Were you involved in it moving to Kennedy?

NYGREN: I'm pretty sure I was actually there when it arrived, but I wouldn't swear to that. I know I was there when we actually rolled it into the OPF [Orbiter Processing Facility]. There wasn't much time between when we demated it and towed it over there (to the OPF).

But there was a fair amount of controversy about actually moving the Orbiter from Palmdale to Kennedy. We had the established launch dates that we were trying to make, and it was pretty obvious that we weren't going to be able to get everything done at Kennedy that we needed to get done if we kept the vehicle at Palmdale. It was also pretty evident that there was a lot that still needed to be done at Palmdale that, just from an efficiency factor, it would be better to do it at Palmdale than it was to ship it to KSC.

In the contract requirements for delivery to Kennedy—this is what the contractor was supposed to have completed—there was a lot of discussion at very senior levels about what needed to be done, where it could be done, how they were going to go about doing it. I'm sure that there was a certain amount of political push on it also. We were always under congressional scrutiny, and it's better to have the vehicle at the launch pad than it is to have it in the factory.

There was a fair amount of avionics work that wasn't done. Probably the biggest pole was tile. The tile was by far the biggest long pole that we had. When they finally decided to ship it, we shipped it with a bunch of holes in the tile, or in certain cases, we went in and put Styrofoam in place of the tile so we had something to keep the airfoil consistent and it would

look the same and we wouldn't end up tripping the boundary layer when we were flying it down to Kennedy.

Once a decision was made, there was an enormous amount of effort put into identifying what the open work was that needed to go to KSC to be done, so that Kennedy could make sure that their procedures were written to pick up this open work and that time was put into the schedule to do that work.

The flight down, I don't remember. I know that on a number of the trips when we took vehicles down there, we always ended up worrying about the weather. But there was a big push to get it off of the mate/de-mate device and the SLF [Shuttle Landing Facility] and get it into the OPF. I was there watching them tow it in and then hook up the attachments so they could lift it up and retract the landing gear and get all the GSE [Ground Support Equipment] under it. That started a fairly long process of trying to get the work that was shipped as "open work" from Palmdale completed, then get the Kennedy testing done that needed to be done and get ready for launch.

In this time frame, over the number of years of finishing up 102 and shipping it and before we actually launched it down there, I used to go elk hunting with two guys, one from [NASA] Marshall [Space Flight Center, Huntsville, Alabama] and another guy from here. The guy from Marshall, John [P.] McCarty, was the Lab Director for Propulsion at Marshall. We'd harass each other on our elk hunt every year—I'd give him a hard time about the fact that his engines kept blowing up, and if he could get some turbine blades, maybe we could go flying. He'd tell me if we could ever get our tile to stick, maybe we'd have an Orbiter he could lift. It was a good jesting, but the two long poles were tile and main engines in the front end of the program. So it was fun to tease each other a little bit about it.

I remember in the summer of [19]'80, I guess it probably was, we had a big management meeting at Kennedy to determine what was really our realistic launch date with the tile situation that we had. At that point in time, Bob [Robert F.] Overmyer had been named the tile czar, and he was overseeing all of the tile work at Kennedy, trying to get it ready. We were talking about how many tiles we had to go and what our rate was for getting them done, and they concluded that they could probably launch in November.

I'm not sure why I decided this was one of the meetings that I should make a comment, but I opened my mouth and said, "I've been watching them for a long time put tiles on this thing, and based on what I think they can do, we're probably going to launch in March. That seems more realistic to me."

Everybody didn't want to hear that. We pressed on with the date that they had selected. When we really got ready to go launch, it was in March. We ended up with a few delays, launching in April, and I thought, "Well, that was pretty good. I should have stood up a little harder." [Laughs]

Again, I would suspect that there was probably a lot of political pressure to pick a date that was still close to the end of the fiscal year we were in so we wouldn't have to worry about the funding. Things at that point in time were way above my pay grade. I was just sitting there looking at the tile and going, "This is about how long I think it's going to take."

We actually created the vehicle integration test team when [OV] 102 was really starting to get into the integrated testing at Palmdale. About this time, Al left NASA and started working with TRW [Incorporated], but we formed up an integration team: Olan [J.] Bertrand, Steve [Stephen P.] Grega, Ted [Newton T.] Buras, Buddy [Ralph H.] Culbertson all came on board.

We had a five or six man vehicle integration team doing essentially the same activity that I had been doing on 101.

We followed 102 through the factory checkout and took it down to KSC. When the vehicle actually showed up at KSC, the Astronaut Office essentially assigned a group of astronauts. Support crew guys, is what they're called. We ended up calling them "Cape Crusaders." They came down and were the astronauts' hands-on folks, and that group was headed up by Bo [Karol J.] Bobko and some of the other guys. Dick [Francis R.] Scobee was in that group, Ellison [S.] Onizuka, Loren [J.] Shriver. We had a number of support astronauts that worked with us and then our Flight Crew Support guys. Then again, we, the Flight Crew Support guys, spent most of our time in supporting the vehicle checkout.

The astronauts had a little bit broader spectrum. Like Fred [Frederick D.] Gregory was named as the Recovery Operations Director down there, and he got involved with all of the search and rescue activities. As the team lead, I got involved with the Security guys, the Search and Rescue guys, some of the Air Force Search and Rescue down at Patrick Air Force Base [Cape Canaveral Air Force Station, Florida], and involved with the Range Safety guys. We did meetings with Range Safety.

We ended up with a fairly significant contingent of folks coming in and out. Loren Shriver was responsible for what we call the ASP checklist, which is the Astronaut Support Pilot. He created a checklist that configured the spacecraft, the Orbiter pre-launch. He would be the guy that was in the spacecraft up until the time they put the crew guys in the vehicle.

The other ones, we would have pre-flight briefings, and they'd work that kind of stuff. And then they were the hands-on guys if there was some testing that we thought that they should participate in and see how the system actually works. They'd go sit in the Orbiter and actually

throw the switches. That took a little bit of negotiation at the very beginning, because the contractor and NASA KSC had established the training requirements for the people who actually operate the spacecraft, called spacecraft operators. There's certification requirements for welders and solderers and everybody else, and there's certification for spacecraft operators, too. We had to make sure that we could demonstrate that the astronaut training that they'd done in their simulators was adequate to do what we were doing on the ground. There are certain differences, but not so much on the vehicle but certainly in the case of an emergency, [such as] how you do the egress.

In fact, that was one of the things that seemed to fascinate everybody. Onizuka really enjoyed this. On the emergency egress [procedures], we got involved in how the crew was going to be egressed if there was a problem on the pad. They had all of the technicians that were putting the crew guys in there, the suit techs [technicians] and the spacecraft operators, and the guys that ran the hatches. I'm not sure if you've ever seen it, but out at the launch pad, near the top, there's a bunch of wires that go all the way out to the perimeter fence. It's several hundred yards out there. At the top of that wire is a basket that's about two and a half feet wide and about four feet long. It's a mesh basket, and you're supposed to run over there, and you jump in that. Then you cut a little lanyard, and you go down on this cable, and it takes you out to a bunker at the perimeter fence. Then you get out of the basket and go on the other side of the bunker, and there's a big concrete door out there, and there's a big room in there that's got supplies in it. There's also an M-113 personnel carrier that's sitting out there. If you decide that getting in a personnel carrier and running off across the palmetto brush is better than getting in the bunker, you need to do that.

Well, if you're going to do that, you need to know how to run the tank, so they had to be trained in how to drive the tank. Onizuka loved to drive the tank. [Laughter] Whenever there was a training exercise, he liked to go out and be the one that got to drive the tank. So, lots of things got involved with all that.

[Also] I got involved a lot with the Kennedy PAO folks, because there was always media activity going on. The crew guys would fly down there and stay in the crew quarters. The Flight Crew Support guys from the Cape Crusader team, [they were] a fantastic bunch of guys. Bobko was just a really great leader, and the rest of them were phenomenal.

Although the group that I had for the VIT [Vehicle Integration Test] was an odd mix of people, we all really enjoyed what we were doing and worked really well together. It set a tone for the Vehicle Integration Test guys that has lasted essentially up until today, that they're a real can-do bunch of folks. No matter what it is you ask them to do, they make it happen for you.

WRIGHT: Were there many differences between the Shuttle astronauts compared to the Apollo astronauts that you had worked with?

NYGREN: I don't think so, and that may be a legacy, in that a number of the guys flew in the front end. John [Young] flew Apollo, and I worked with John. [Robert L.] Crippen was on Skylab, and I'd worked with him on that. Truly was on Skylab. Joe Henry [Engle] was on ALT and was a backup in the Apollo days. Fullerton and [Jack R.] Lousma, [Thomas Kenneth (T. K.)] Mattingly, they had all been backup guys. To me, it was the same guys. They were support guys before they were the actual crew guys now, but I had worked with them and established a rapport with them.

WRIGHT: I guess then the only difference that would be in the next years would be the fact that the Shuttle class included female astronauts for the first time.

NYGREN: Yes. Yes. When the "Thirty Five New Guys," the [19]'78 group, came on board, it was a different dynamic, but they really melded in really well. The senior guys did a great job of working with them and bringing them on board, and I thought it was really good. Loren Shriver and Mike [Michael J.] Smith and a number of those guys, they came in and became the Cape Crusaders down there. Bobko, who'd been around for quite a while, was the leader and mentored them.

It was also somewhat rewarding, I thought, for me and I think probably for the other VIT guys, too, is we did have these new guys. They hadn't been around that long. They didn't understand the NASA culture, and they did rely a lot on us to help them get up to speed and learn the ropes and used us really well. Again, that makes you feel good so you work harder to make things happen for them.

WRIGHT: Let's talk about STS-1. You had gone through so much in preparations everywhere from the factory to Kennedy. Tell us about those days leading up to that. Plus you mentioned the delays, how you worked through that, checking and rechecking and up to the launch time.

NYGREN: Well, it was just a case of you'd work hard, you'd try and get the job done. You'd be working towards the scheduled launch date, and we'd get so close to it, and then we'd have another management review to look at whether we could make it or not. And we'd pick another

launch date, and then we'd all start off again and say we'd have to do it. We'd get up to it, and we'd say, "Well, not quite," and we'd pick another launch date.

It was interesting, because Truly created this chart, he called it a saw-toothed chart. It showed we started here and we worked towards launch here. Then we decided we weren't going to get there, so we started back down here, and it was a days-to-launch chart. We'd say, "Okay, we've got 100 days to launch," and we'd count down. We'd get closer to launch and go, "Oh-oh, we're not ready for launch." We'd go back down to 100 days from launch, and we'd go back there. So we created this saw-toothed thing that was a joke, "Are we ever going to get to where we're going to go launch this thing?"

But the morale of the guys was always high, although there were a lot of slips in [the schedule]. Everybody knew that it was the right thing to do to make sure it was going to be done right, so that didn't seem to really get to anybody. There's a lot of stuff about the pressure of today, launch pressure, launch fever, "we've got to press," [maybe] don't make the right decisions. We had that same pressure back then to try and get it done, but then and, I believe, now, that everybody wanted to do the right thing. They tried to make the right decisions. There was nobody that was going to go say, "We're going to go launch because the news media says," or Congress says or anything else. We're going to launch when we're ready to go launch.

When we went through STS-1 and the preps [preparations] for the first time, we did a lot of stuff for the very first time. We did a flight readiness firing on the pad, and then we had to pull the engines out and look at that.

We did the flight readiness firing, and we found out that the pad didn't operate exactly the way we thought it was, so we had to do a lot of pad mods [modifications]. We did our terminal countdown demonstration test to demonstrate what was actually going to happen for the

two or three days before launch. We had a lot of problems with that, in that at T minus twelve seconds there's a thing called a ground launch sequencer that had been counting down. Then you hand over to the flight onboard computers, and you have to make sure that all of the data is handed over, everything's looking exactly the same. We had a lot of problems with that particular software as it was being developed, and the only time you could actually simulate it was when the vehicle was counting down very close to the launch.

There were a lot of things that we found. They were the right things to find, the right things to go solve. It was time consuming getting up to the launch, but when I was doing Apollo 9, we did the same things, had the same problems, had the same issues with launch dates. I don't think that there was anything really unique in that.

The new systems, new hardware, new facilities, there's just a growing pain that's associated with it. We were a little too optimistic when we first put our first schedule down, and we didn't get the vehicle out of Palmdale the way we thought we were going to get it. There was several months' worth of work that had to be done at Kennedy that should have been done at Palmdale before we ever shipped it.

But the countdown, when we finally got there, really came off pretty well. We had to practice it a few times. We got up in the morning, and we got suited, and we went out to the pad, and we got to come back, but we finally got it off the ground, and it worked pretty well.

There were a lot of other things, ancillary kinds of things that I mentioned, in the same time frame that we had to do. We had to worry about if we did have an incident, what was going to happen at the Cape [Canaveral, Florida]. If we had a transatlantic abort, going overseas, we had landing sites in Northern Africa. Later, we ended up with some in Spain. But we had to be prepared to go over there. If the Orbiter was over there, we had to have people that were trained

to safe the vehicle. In my particular case, I was on the rapid recovery team to go over and actually bring over the crew's passports and gear that was needed so we could actually get them back out of wherever we landed.

If we had a Return to Landing Site, an RTLS, we had to make sure that we had our chase aircraft and our training aircraft available. We had to make sure that we had a weather aircraft that was operating. And we had weather aircraft for launch, but we needed to make sure we could keep him up there long enough to support an RTLS.

There was a lot of logistics from a flight crew, not the astronauts-on-board crew, but from flight crew operations with the aircraft, the training aircraft, the T-38 aircraft, the support at TAL [Transatlantic Abort Landing] sites. We had an astronaut that was sent to the TAL sites. We had the operations director for recovery, who did the search and rescue lead at Kennedy, and that was Fred Gregory who was in charge of that for the beginning.

Along with getting the Orbiter ready to go fly, there were a lot of ancillary things. We had the transport van to remove the crew guys from the crew quarters out to the launch pad. The van was originally configured to hold the Apollo astronauts, and the Apollo astronauts and their suits used the oxygen ventilator. We had to make sure that it was configured [for Shuttle astronauts]. We didn't have oxygen ventilators, so there was a redesign that had to be done.

They've changed it now, but for most of the Shuttle program, you saw a silver Airstream [trailer] that took the crew guys out to the launch pad and brought them back from the launch pad or picked them up at the Shuttle landing facility and brought them back. I was intimately involved in the design of the Airstream, laying out how it was supposed to fit, how many people were going to be in it, because we need to haul a doc [doctor], we needed suit techs, we needed

support people, we needed a security person. So I worked with the Kennedy guys on designing the crew transport vehicle.

Then for the later flights we had to worry about how long they had been up there. There were some medical experiments that the medical guys wanted to try, [so we needed to] keep the crew guys supine so that they could get good data off of them. I had to work recovery of the crew guys in a supine condition. A lot of other things, other than just trying to make sure that the Orbiter was ready to go fly.

WRIGHT: A lot of days spent down at Kennedy, or were you coming back and forth to Houston?

NYGREN: I spent an awful lot of time at Kennedy, not necessarily for STS-1, but in the early part of the STS days. I'm talking about me now; the vehicle integration guys were about the same, but the vehicle integration test office was in Building 4 here in Houston. I was on the directorate staff, so I had an office in Building 1. We had an office in the O&C [Operations and Checkout] Building, where the crew quarters is at KSC. Our technical team's office was in the Launch Control Center at the LCC. We had the crew quarters at Dryden for the landings. Then, we had the crew quarters and a launch pad facility at Vandenberg [Air Force Base, California] when we were working there, and we had an office at Palmdale.

So there were eight or nine offices for the organization scattered around the country; I was on the road a lot. Two thirds of the year for a number of years, I was on the road. I ended up staying in the crew quarters at KSC as opposed to staying in hotels because I was down there so much. It's a forty-minute drive in [to the KSC] from the hotels, so I just stayed in the crew quarters down there.

WRIGHT: That's a good way to try to check out those quarters and make sure that they were—

NYGREN: Yes, but I've been down there since I left, and they redid them, and they are Hilton [Hotel] class now. [Before] they were Motel 6 class. Not that they were that bad. They just built them for the Apollo days, and they extended them.

But it was always fun. I can remember one time that the person that was responsible for the crew nutrition was a woman by the name of Rita Rapp. She had been around forever, was a legend at NASA in the nutrition and in the crew [meals areas]. One time, Paul [J.] Weitz and I went out fishing, and we caught some bass. We came back with our bass, and we cleaned our bass in the kitchen in the crew quarters, our stainless steel kitchen. I thought Rita was going to have a heart attack. She came in there, and we had fish fillet and scales and innards all over the place, in the typical way guys clean fish. [Laughs] Rita comes in there looking at all that stuff, and she's supposed to be keeping the crew guys healthy, and we had this stuff. I thought she was going to shoot us. I really did. She was not a happy camper. She had to get meals ready for the crew guys, and they had to have a clean kitchen, and we're in there cleaning our fish.

We brought the crew folks down to pre-launch. Talking about prior to STS-1, the crew timeline from the time that they left Houston—or actually the time they landed at Florida—until we actually launched was the timeline that the VIT guys put together. As the lead, I did a lot of that but it involved everything. [There is always a] ceremony when they arrive at KSC, they give a speech and then get in the vehicle and are transported down to the O&C building. They generally had their own vehicles, and this is when health stabilization goes on. I don't know if you're familiar with health stabilization or not. I'll go back and pick up on that.

The crew guys get to their quarters. Then all of the meals are planned for when they're going to eat, and that's all synced to what time of day they're going to launch so we can get their circadian rhythm synced up. That actually starts back in Houston when they go into quarantine in Houston, so we need to stay on that particular sequence.

And then, for the three days that they're down there, we have a systems briefing so that the flight crew guys and the Kennedy guys and the crew guys all have a set of briefings [to cover] what the systems look like, are there any discrepancies on the system, is there anything that we're going to see when we're on orbit that's going to be different than what we think we're going to see on the ground?

We have weather briefings for what the weather's actually supposed to look like at the launch site, at the landing site, at the abort sites, those kinds of activities. We have family visits where the family comes out for a meal with them and have the pre-flight physicals. We schedule exercise time for them in the gym. So it's a script, a three-day script, of exactly what they're essentially going to be doing, and then we throw in some free time.

And the quarters is a fairly nice place, and it's really nice now. Back then, it had a couple of lounge areas with some TVs in it and a conference facility with a TV where we conduct the briefings. Right outside the back of the crew quarters was where the flight data file guys were that managed the flight data file. We had flight data file briefings where the flight data file guys would come in and "walk" each of the crew guys through their particular checklists and any changes that had been processed recently. The crew guys could write any personal notes that they wanted in their particular checklists.

So it was a three-day exercise, and every time you scrubbed a launch, you got to redo it and try and come up with the right stuff. In the middle of that, the crew guys really didn't ever

go to it, but they would do the flight readiness review, the L-minus-2 flight readiness review. We would go down to participate in the flight readiness review, and we would stand up to say, the crew's upstairs and they're still healthy. And at the other side of that, you'd listen to what all the other guys said about their systems and if there was anything that we wanted to get briefed on during the systems briefings activities.

The crew guys would go out and fly the STA [Shuttle Training Aircraft]. They'd get at least one, if not two, Shuttle Training Aircraft flights in, and if they could, they'd go fly the T-38 one day. You had to figure out, "what's going to happen" during that three days, put it down on a piece of paper, and try and get it all worked out. Then you have to go work it with Security so Security would know where the people were and when they were going to be at different places.

If there was a public affairs event—there was always one of those, and launch morning, the PAO for NASA would be in there taking pictures during breakfast. On occasion they had artists that would come in and actually take some pictures or do some sketching. I know there was a person by the name of Linda Richards that came in and did that for STS-7 with Sally [K. Ride]. She did some really good, really good work.

PAO tried to do a good job of working with the media and the art world to capture some of those activities. I got in the middle of that because they wanted to be at breakfast, they wanted to be in the suit room, they wanted to be in different places. Some places we could allow them to be, other places we couldn't, but [I worked] with PAO and with the individual artists, [determined] where they would be and what they could do, what they couldn't do.

You got to meet a lot of different people, and you were the target all the time, though. If something wasn't working, it was—you were the guy. You were the messenger responsible. You had to try and make it work. But it was good. I really enjoyed doing all that. And the crew

guys, to me, I always had a really good relationship with them. I tried to bend over backwards to help them, and they did the same with me. I had a really good rapport.

WRIGHT: How much of the scheduling and the preparations procedures were you able to modify from your Apollo days to the Shuttle days, or was everything from scratch?

NYGREN: It was pretty much from scratch. The concept that the crew was going to be down there pre-launch and you had to script the last three days, the concept was there. In the Apollo days, there was a complete training facility at KSC, there were simulators at KSC, the flight data file guys were at KSC, a tremendous amount of the stuff was done at KSC. Shuttle was all done back at JSC. We had Shuttle Training Aircraft that the crew guys would fly, they had chase aircraft. We didn't have those kinds of things for the Apollo environment.

The flight data procedure was pretty much the same. I remember doing the decals and the flight procedures with the crew guys for Apollo, and that piece of it was pretty much the same. A lot of the system stuff, the worrying about weather, and Shuttle Training Aircraft and things like that was new and unique. The crew guys were down there, they had to be under health stabilization, there were going to be family visits, they had to eat—that part of it was probably pretty much the same.

WRIGHT: Give us a really full explanation of the Vehicle Integration Test team, how that team came together, and how then, of course, it evolved and its primary function and the components of your whole office and team and what your full responsibilities were.

NYGREN: When I first picked up the team, we were at Palmdale. At that point in time, we were all focused on the Orbiter and the Orbiter testing and the Orbiter systems and making sure that, as the vehicle got checked out, we were linked up with the crew, linked up with the flight control team guys, and worked with the subsystem managers out of the Engineering Directorate at JSC.

It was, again, a rotational assignment, in that we'd have two or three of the guys out there all the time looking at the different systems during the systems tests. There were a lot of systems being tested. You could be running the electrical system. If you were running the electrical system, you were probably either powering avionics or the hydraulics. We were looking at the different procedures, and it took two or three people because there were multiple systems that were being tested.

Everybody got a fairly good command of the vehicle and the systems, but as we evolved to Kennedy and we started getting more mission-focused as opposed to vehicle-focused, we started dividing up so we would have representation at different places. Shortly after that, because we had multiple Orbiters flying, we had to have multiple teams, but the responsibilities pretty much stayed the same. The team was broken up into three or four major components. We had a couple of the guys that worked on the Orbiter all the time and followed the Orbiter and the systems; what open work was shipped from Palmdale and how that got closed; how the terminal countdown demonstration tests were done; the flight readiness firing and when they were firing the engines; how the countdown was going to be just like it would be for a launch. We made sure that the information and the procedures that were at KSC got back to the guys in Houston who were doing the monitoring from a flight control perspective and that the data links were all set up. So we had a couple of guys working the Orbiter pretty much full time.

Then we had a guy that was responsible for the landing site preparations, because the landing was going to be at Edwards for the early flight. A person was assigned to go out to Edwards and work with the guys at Edwards and get ready for the landing there. And that contingent was very similar to what we had for ALT, in that we had the convoy operations; we had the convoy commander, a guy named Roland Norris at the beginning of the program.

Our guy was responsible for going there for the vehicle that was going to transport the crew off the lakebed, making sure the little crew trailer was ready, that the physicals and the flight docs [doctors] were out there and the docs were supported, that they were with the crew when they came off the vehicle, that the T-38s, Shuttle Training Aircraft and weather aircraft [were at] the landing site. So we had a guy that was responsible for the landing sites.

We had another person that was responsible for more the contingency operations and worrying about return to landing site so somebody working landings at KSC, TAL. He worried about, if we were going to abort to a landing site, what all, from a flight crew operations perspective, did we need to do in support of the crew guys and also in support of the flight control team, because once you have a TAL , you essentially lose sight of the vehicle. There's no satellite to communicate with or anything like that so they don't know what's going on.

We tried to work with the Kennedy guys that were going to be going over there to make sure that they could provide the information that they were finding back to the guys in Houston. If you get in that situation, if you have an abort scenario, they lock down the data so that they have it secured, and you want to make sure that the two teams are sharing that information. So we had somebody that was responsible for following the contingency activities.

Then we had somebody who was responsible for following the payloads for whatever we were going to be putting in the payload bay. [For example] in the early days they had flown a

DoD [Department of Defense] flight. The first Spacelab flight, we deployed some satellites. So we did the reviews with the payloads.

If there was an EVA [Extravehicular Activity] planned for a particular flight, we worked the procedures for EVAs and determined the translation path. We did what we called a "sharp edge inspection," where we, as the flight crew guys' representative, would actually go out in the vehicle and inspect the translation path for sharp edges. If there were any sharp screw heads or pieces of metal or anything that could damage a suit, we would work with the Kennedy guy and the contractor guys to clean it up so that we were confident that the EVA would go well. [We wanted to be sure] that they wouldn't have any hinges where we'd pinch a crewman or scratch a suit.

We had one guy that was pretty much responsible for working the pre-launch activities to make sure we had all of the things needed to track for the pre-launch. Did we have the right checklists; did we have the right suits in the suit environment? [This guy worked] with the suit techs and the weather briefing guys, the Air Force weather side, the systems briefings and when they would occur.

Over a period of time, the team lead pretty much picked up the role as trying to orchestrate the items real close to launch and the launch countdown. I know I was named as the Rapid Response Team representative from Flight Crew Operations to go to wherever the Orbiter landed in the world. Wherever it landed, you had to go there. I had to work with the Kennedy guys that were also on the Rapid Response Team, and they had a chartered aircraft that they were going to get. Actually, I think in the first part, they ended up using military, contracted with the military to have an airplane on standby.

I'd never traveled out of the United States, but as part of the Rapid Response Team, a lot of the countries that you were going to in Northern Africa required that you have a visa. Visas are good for ninety days, so every ninety days you had to get a new visa. Well, I had this passport that was probably three quarters of an inch thick, because it had all of these accordion foldouts for all of these visas. It looked like I was a world traveler by the best stretch, but I'd never been out of the country. I had, visa after visa after visa, to go off and to go to wherever the Orbiter actually landed.

They had a good contingency plan for sending a team with all the right technicians to safe the vehicle, inspect the vehicle, get the crew guys back, and put security on the orbiter. There were negotiations with the local countries to provide military security around the vehicle, and at the same time, we had to brief those folks on the hazards of hydrazine and other hazardous materials that were on that vehicle. Yes, you want to protect it, but you also don't want to be real close to it either. Because there's no systems data coming off of it, you don't know what the situation is around it.

The team was basically broken down into the Orbiter guys, the payload guys, the recovery guys, and then more of the logistical support activities. Originally, we had four or five guys that would go down for each launch. The team eventually grew to about seventeen people, and we also picked up some contractor people at Kennedy that were there full time that could help us with some of the routine kinds activities. They could help us get the procedures, and they could follow discrepancies, and that saved a fair amount on having to travel quite so much. It worked out pretty good.

Then we just basically rotated teams across the different vehicles when we were flying more than one vehicle.

WRIGHT: Let's talk about STS-1.

NYGREN: STS-1. I mentioned Dick Truly, and the saw-toothed chart, and how we were working on that. We had counted down a few times and practiced it and it was working pretty well. The plan was that right after launch the recovery team, a number of folks from Kennedy that had been working the launch and had also worked the ALT program, were going to fly out to Edwards. This would bring their convoy and the recovery team up to full strength, so we had made arrangements to charter an aircraft to fly us out to Edwards Air Force Base.

The flight was relatively benign from a payload perspective. [We] did a lot of systems monitoring for instrumentation, but didn't have much in the way of a payload. We didn't have to worry about deploying a payload or worrying about payloads when they got back, just worried about the vehicle.

The trip to Edwards after the launch was interesting, because the plane they had planned to fly out there was a United [Airlines] flight, and it was going to leave from the skid strip, which is a short runway over on the Air Force side. Because of the shortness of the runway, they had said that there was going to be no food or booze on the airplane when it left the skid strip. But they were going to land at Tampa [Florida], and then they'd put the food and drinks and everything on the airplane. Then we'd fly from Tampa to Edwards Air Force Base. As you watched all of the guys walking onto the airplane after the launch, the briefcases all seemed to be dripping, and it was a BYOB [bring your own booze]-to-your-airplane environment.

So we had a great start-off and landed in Tampa. Then one of the interesting things with me is I was sitting up in the front of the airplane, and I don't know how I got to talking to one of

the stewardesses [flight attendants], but I had told her that I looked like a shaggy dog and I needed a dog tag because I hadn't been able to get to a barber for so long that I really needed a haircut. It turned out that she says, "Well, I cut people's hair."

I go, "You're kidding me."

She says, "No. I've got all my stuff in my little travel bag, too." So I actually got a haircut at 30,000 feet by the United stewardess. Now, if you don't think that didn't get a lot of harassment from the rest of the people on the airplane.

And this is not on the technical side but interesting from a program perspective—one of the traditions that the Kennedy guys (along with Norm Carlson, who is a launch director down there) had established was, after a successful launch, they served pork and beans to everybody on the launch team. You'd be over there for the launch in the Launch Control Center, and if you were walking down the halls, you'd see all of these turkey roasters filled with pork and beans. There'd be twenty of them lined up there.

If you had a successful launch and you got relieved from your console position, the launch team would go back and get a bowl of pork and beans, and it was a great social for everybody. You'd get yourself a bowl of pork and beans and a spoon and some bread and just wander up and down the halls eating beans and socializing. That was a Kennedy tradition.

I hadn't been down to the Cape and watched a launch since the late eighties, but I would be willing to bet you that they still do that. You get in a Launch Control Center, and the smell of beans is everyplace. [Laughs]

One of the other duties I had as the team lead was a lot of family support. A lot of family support during pre-launch and making sure that [the family was] hooked up with the PAO guys,

knew when they were being picked up, where they were going to be moved to, and where they were watching the launches from. I did a lot of that activity.

WRIGHT: Let me ask you about the eighties as they progressed. You got more responsibilities, becoming the Assistant to the Director of Flight Crew Operations. Can you tell us what more duties that you were having?

NYGREN: Yes. When you're out of sight, you're out of mind. Things generally don't necessarily happen the same as if you're there. I was working flight crew support, VIT. I got a lot of support from the guys, but I didn't get any promotions. I was at the same level for next to ever. And it turned out that Mike Smith became one of the Cape Crusaders. He was down at KSC, and his kids were the same age as some of my kids, and we got to know each other fairly well.

Mike got an appreciation for what the VIT guys were actually doing at KSC and the level of work that they were doing with respect to the Kennedy management, and the Dryden management, and the level of managers they were interfacing with, and with the payloads that were being developed. Mike became a real mentor, so to speak, for the VIT guys and me in particular. He worked with George Abbey, and he actually was on George's staff for a period of time as a Special Assistant. During that time, Mike really promoted what the VIT guys were doing, and he was, I think, responsible for me actually getting promoted and getting some recognition. I credit him a lot with getting that started.

The VIT stuff was pretty much the Orbiter, the KSC, the landing site, etc. When I moved up to be the Assistant Director, I picked up the responsibility for the Flight Crew Operations

Directorate budget and that included the budgets for the T-38s, the Shuttle Training Aircraft, the Super Guppy, and the [Shuttle] Carrier Aircraft, so there was budget responsibilities, and the certification of those assets for Shuttle launches.

We had to certify that the carrier aircraft was within all of its service life for carrying the Orbiter back if we landed at a different site or even if it was a scheduled Edwards landing activity. Shuttle Training Aircraft—we did a lot of work with the Shuttle Training Aircraft and how long it was going to last and how many of them we actually needed for the flight rates that we were doing. I was involved in the procurement of additional G-2 aircraft to convert into Shuttle Training Aircraft and the negotiations with the contractor to actually do the modification work to become Shuttle Training Aircraft.

Probably from a global perspective, I got much more involved in the Aircraft Operations Division, their pilots, and their aircraft and activities since I picked up the responsibility for the directorate's budget, which included all of the airplanes as well as the support for the astronauts.

WRIGHT: I have to assume additional meetings and reports as well?

NYGREN: Oh, yes, lots more meetings, lots more visibility, I can tell you, because everybody's interested in where your money's going. I became the representative to the Flight Readiness Reviews for Flight Crew Operations. I went to all of the Flight Readiness Reviews, to the L-minus-2-day briefings, and presented our material from Flight Crew Operations. Made sure the crews are ready to go, the airplanes are ready to go, all of the stuff that we were responsible for, for status and for flight readiness. I was responsible for building that material and presenting it when I was on the directorate level.

WRIGHT: What was your involvement with the Vandenberg Air Force Base, the launch site there?

NYGREN: Yes. We got a long way along in launching at Vandenberg and then at—I wouldn't say the last minute—they decided that they weren't going to launch out of Vandenberg. When they first started talking about launching out of Vandenberg, we realized that we were going to have the same operations at Vandenberg as we were going to have at Kennedy, so we needed a facility for the crews to stay in pre-launch. We needed something equivalent to the KSC crew quarters out there; we needed to get a facility where the crew guys could be housed.

We were going to be doing Shuttle training aircraft approaches and landings out there, so we needed to work with them on air space requirements and how to get into their air space. They do a lot of stuff out of there for their own launches, and the Navy does work in that particular area, so we needed to work aircraft operations in and out of there.

We were going to be involved with a lot of their pre-launch testing with terminal countdown demonstrations. They were going to end up doing a flight readiness firing. We were going to be involved with a lot of their ground procedures.

Vandenberg had Martin Marietta as their primary contractor. We needed a way to transport the crew guys from the crew quarters to the launch pad; we were going to need some kind of a vehicle for transporting the crew guys, a carbon copy of what we had at KSC or something else that they'd design.

It was similar to what we did at Kennedy when getting ready for the activities. We were going to need to work with our test team on the procedures. We were going to have to have a

place for the flight data file guys to operate from. We were going to need a place for the crew guys to be housed when they were out there for pre-launch activities and the Cape Crusaders that were going to be out there. We would need office space. We were working the logistical buildup for when the Orbiter got there and started doing the testing, so we'd have all of the infrastructure in place to make things come together.

While we were working that, I had a guy that was assigned to the Vehicle Integration Test Office that was an Air Force officer, Will [Wilbur J.] Etbauer. That really paid off well, because I tagged him with working the details for us. Being a colonel in the Air Force, he knew how to get things done at Air Force bases and who to talk to. He was a tremendous asset, and he worked with us on that for essentially the whole time that we were working at Vandenberg.

When he left NASA, he went to the Blue Cube [Onizuka Air Force Station] in San Jose [California] and stayed in the military for quite a while. He now works for a small company called Dese Engineering in Huntsville [Alabama]. I still see him whenever I go to Huntsville. He's a great guy. He and his wife are really neat people.

WRIGHT: Tell us how the [Space Shuttle] *Challenger* [STS 51-L] accident affected so much of the operations, especially at Vandenberg, and then, of course, how it changed the culture.

NYGREN: Well, 51-L was at that point in time, probably the worst day of my life because, as I mentioned earlier, one of the things that I ended up doing was being in charge of the immediate family activities on launch day. I worked with the PAO folks to pick them up at the different condos or hotels where they were staying, and they escorted them to the Launch Control Center [LCC].

At the Launch Control Center, we had set aside one of the managers' offices. There's a suite there that had a secretary's office and then two administrators or management offices. They were set up to have the family in there and had a television in there. They had some sweet rolls or whatever if it was a morning launch, something to keep the family relatively occupied and happy, because here's a bunch of people that are thrown together, so to speak, in a tight area.

The Cape guys did a good job of that, but the plan was that at the T-minus-9-minute hold, all of the family members were escorted up to the roof of the LCC, and they actually watched the launch from the LCC. They had a little speaker set up there so the PAO announcement could be heard. Then they also had the launch director loop piped in there so you could actually hear the launch director and the crew guys talking about the countdown, so you're right there watching it.

I was the senior NASA guy on the roof that morning, and so I was there when *Challenger* blew up. And immediately, it was the family wanting to know what happened. They didn't have any real appreciation for it, asking, "Is the crew going to be okay?" You basically know what the answer to that is, but you don't want to just say there is no hope. You're trying to console them at the same time you're trying to tell them we need to go find out what the real story is, we need to get back into the office area so we can listen to what's happening and keep up to speed on it.

We tried to get them back to the little office suite that was there, and then from there, we moved them back over to the crew quarters where the crew guy has been staying s. We had mentally written all of this out, so everybody knew what their plan was, and we had a contingency plan to go move them, but the little things that you don't think about really start biting you right away when you don't simulate that kind of stuff.

We got them down in the office area, and they had the television on, and the television had all of these pictures. And they've got zoom lenses. You can really see a lot of detail, and you could tell that as the families watched the television, it was upsetting them. So I had to call down and get them to pull the television feed for in there, get it off onto a different channel. Actually we pulled the feed on it.

Then we were getting ready to move the family over to the crew quarters. The crew quarters is loaded with com [communication] loops and televisions, so I had to call over there and tell them to get all of that disconnected so that they wouldn't be looking at that kind of stuff, get some food for these people, and those kinds of things. Well, we got them back over there, and, rightfully so, they wanted their friends and other relatives to be as close to them, the extended family.

Then the plan was for the extended family to be moved to the auditorium in this kind of a contingency event. Some of them had decided not to be with the rest of the extended family but had driven with other friends. So then the nightmare occurred, how do you find these people? They want somebody, and how do you find them?

Then the entire Kennedy telephone system was overwhelmed, so you couldn't make a call anyplace. You know, it's like 9-11 [September 11, 2001, terrorist attack on New York and Washington, DC]. The telephones didn't work. We didn't have cell phones. We didn't have pagers. It's basically, you pick up the telephone and the telephone was down.

We tried to gather up all of our resources, which were the Cape Crusaders that were down there for the launch, the aircraft operations pilots that were down there, and the rest of the VIT guys, and turned them into essentially runners to either go over to the auditorium and ask for specific people that the crew['s families] wanted to be brought over.

We knew that we couldn't keep these people in the dark. It wasn't fair to them to be kept in the dark, but at the same time, we didn't want them to be getting a bunch of speculation. We wanted to give them the facts as we knew the facts. We started assigning people to go to certain meetings where the contingency events were being talked about. They'd rotate out and come back, and they'd say, "This is what we're hearing," and we'd talk about it on the NASA side. And then, at that point in time, Abbey and Young and those guys were back over there, so they would be the ones that would actually address the family members and tell them what was going on.

Then we needed to figure out—these people had all their personal belongings in apartments and condos and hotels. We didn't want to send them back into town to the hotels, knowing that the media would be all over them, so we had to start working on the logistics of getting keys and access to where they were staying, what was the stuff that they wanted brought out, because we were going to keep them out there.

And then we needed to think about how were we going to get them to wherever it is that they wanted go. We wanted everybody to go to Houston, and we felt we could set up a hub there, but a lot of the family members; they wanted to be at home, in their homes, with their friends. So we needed to start looking at the logistics of flying different people different places and what ways we could use government airplanes, and when we were going to have to use commercial flights and how we could best work all of that. It turned out to be quite an endeavor to work all of that.

The Vice President [George H. W. Bush] came down, and we had to then start dealing with the Secret Service guys and all the things that come along with Secret Service and Vice

Presidents and getting him in there. He did a great job of addressing the family and told them how proud we were, the country.

That twenty-four hours was really, a really bad scene for me in particular. That was a crew that I had gotten really close to because Scobee was the commander, and he was one of the original Cape Crusaders. He and I have a weakness, and our weakness is for chocolate chip cookie dough, so we used to harass each other about the fact when we were at KSC, Rita and folks would make us chocolate chip cookies and we'd just eat the dough. One year I gave Dick a Christmas present, and it was a pound of chocolate chip cookie dough. [Laughter] So Dick and I were real close.

Mike, as I mentioned, was really close and had been a real mentor to me, and Jane, his wife, I knew her real well. The kids, our two daughters played basketball on the same team.

Ellison was one of the original Cape Crusaders, and he was always such a joy to be around because he always had a smile and was always into different things, so I knew him really well.

And Judy [Judith A. Resnik] was—I tried to figure out when I was thinking back and reading over my notes [before I came today], I can't remember exactly when it came about, but it was when she was in the early stages of training for the flight. We got to talking about something, and going back to my flight out to Edwards, I got to talking about haircuts, and she says, "Well, I used to cut my husband's hair when I was married." She says, "I'll cut your hair." So we got to giggling about that and nothing happened.

Well, one time I was running around looking shaggy, and she decided I should get my hair cut. We went over to her place, and she cut my hair. I thought, this is interesting. I've got an astronaut that's cutting my hair, that sidelines as my barber. So anyway, I go home that night,

and my wife makes a comment about how great a haircut I got. I said, "I'm sure glad you think it's a great one, because when you hear how I got it, it's going to be something," because running off to some single woman's apartment to get your hair cut in the middle of the day—but anyway, she took it in stride. [Laughter] She knew I was working real hard and knew Judy a little bit, and so I didn't have any problem. But here I am, and Judy was cutting my hair. So I knew Judy real well in that environment.

I knew [S.] Christa [McAuliffe] a little bit from when they first came with the Teacher in Space program and she and Barbara [R. Morgan] first came down to the Center. I was in charge of setting up and integrating them into the activities, so when they came down, I met them and showed them where their office was going to be at and told them where the admin [administrative] help was and what went on in the Astronaut Office. At that point in time, they weren't immediately integrated into the Astronaut Office. They were given office space that wasn't in the same building, so I tried to get them up to speed. I only did that for a couple of months, and then it was given off to some other folks to manage, and I didn't have to worry about it anymore. But I knew Christa from that and got to know Barbara also.

And then Ron [Ronald E. McNair] and Greg [Gregory B. Jarvis] were probably the two that I knew the least from that perspective. Ron had never been a Cape Crusader and hadn't flown before, so I hadn't really worked with him. And Greg, being a commercial guy, a payload specialist, I got to interface with him when he came down for TCDT [Terminal Countdown Demonstration Test] and some training on his payloads but very little personal contact with him or Ron compared to the relationship I had with the rest of the crew.

That was a tough time for the few days right after that, working with the families. And they came back and assigned an astronaut to each one of the families to help them out. Once

they got to that point and they had gotten that established, I was more back into the routine and wasn't that involved with the family. But knowing those folks as well as I did and being on the roof with the families and going through their pain with them was very difficult.

WRIGHT: Did you have a chance to grieve at all, or were you pulled right into the Rapid Response Team or any of those other duties that you had?

NYGREN: I would say I probably got wrapped up into the working part of it and didn't do that much grieving right off, and like I said, that was the worst. My parents were alive, and I hadn't had any real deaths in the family for anybody that I was close to. Yes, my grandparents had died, but I'd been away for a long time when that happened, so I really hadn't experienced that.

So the grieving part—where I really came apart was when they had the Memorial Service and the fly-by [missing man formation]. That was when I lost it. But up until then, I was either too busy or wasn't smart enough to know that I should be concerned about it. But, when you're standing there and somebody like Lorna Onizuka is asking, "Is he going to be okay? Is he going to be okay?" and answering, "We'll have to see, but it doesn't look good." How do you work them up to that without just saying, "No, they're not going to be okay? This is not something they're going to walk away from. No."

We got through that, got them on track, and then we started trying to figure out what went wrong, how to not do it wrong again and get on with flying STS-26.

WRIGHT: How were you involved with the investigation?

NYGREN: I really wasn't. By the time I finished doing the family support activities, the investigation team membership had been established and folks were off working. I had a couple of guys on my team, Jim [James S.] Voss—he was assigned to the VIT back then as an Army detailee. I had him and Bill [William S.] McArthur [Jr.], Jeff [Jeffrey N.] Williams, a number of them that were assigned to the VIT at that point in time. Jim got involved with the [Roger's] Commission [Presidential Commission charged with the investigation of the *Challenger* accident] a fair amount, but me personally, I really didn't get involved with it much at all. I shifted away from that and started looking at what we needed to do in preps [preparations] for STS-26 and basically started working that.

WRIGHT: Tell us about the interim between *Challenger* and STS-26, what were you looking for, and how you were able to get everything updated and back in line again to be ready for that launch.

NYGREN: It was more like doing STS-1 over again than it was the next Shuttle flight in a sequence. It was like going back to square one. And part of the Rogers Commission's recommendations was that all of the Shuttle systems had to be recertified. Everything had to be recertified before we were going to go fly again.

From a flight crew operations perspective, that included we had to go back and do a new design certification review on the Shuttle Carrier Aircraft. We had a design certification review on the Shuttle Training Aircraft. I got involved in setting up the certification for both of those. We had to go back and review all of our documentation and go back, in the case of Boeing, and work with the Boeing guys on all of the drawings and the design that they did, and all the

analysis that they did, and the tests, and look at all of the discrepancies that had been written, and how they were dispositioned to make sure that everything on the Shuttle Carrier Aircraft was done the way it was supposed to be done. That all the service records and maintenance had been done the way it was supposed to be done.

The Shuttle Training Aircraft was a similar thing, where you had to go look at how it was converted from a G-2 and all of the special design requirements. All of the avionics that they put in to simulate the Shuttle had to be certified that the avionics was compatible with the flight avionics. It was an intense exercise, a necessary exercise. I wouldn't necessarily say that it was challenging, other than trying to make sure that we got it done in time to be ready to say at the Flight Readiness Review, "Yeah, verily, we've done our design certification, and these are the things we found." Then we were ready to go fly.

But it certainly kept me busy, and I got to go back and look at some stuff that I hadn't been involved in previously with the Design Certification Review. In that time frame, we were working the second Shuttle Carrier Aircraft. I had been involved in that, trying to identify the aircraft we were going to buy and who was going to actually do the modifications and where they were going to do the modifications. We were pushing really hard to get Boeing to do them in Seattle [Washington] like they had done the original one, but Boeing was so overwhelmed with work there that they wanted to do it at their Wichita [Kansas] facility, so I got involved in some of that activity.

But it wasn't a dull time Then the pre-launch activities, trying to figure out what we might need to do different for making sure the crew guys got the right briefings or if their training flights needed to be done differently. Weather was now paramount in everybody's

mind, so the weather aircraft and making sure we always had weather aircraft to launch aloft and [knowing] where they were became an issue.

So lots of things had to be done. It was again more like STS-1, where you paid a lot of attention to the detail, where up at 51L, a lot of it had been routine and you knew what was going on and became, I guess I would say, maybe, more laissez-faire in the aspect of, "yeah, I know how this is going to work out, and I can deal with it," where in STS-26, you started paying a lot of attention to it. I can tell you, when I was back on the roof with that family and that SRB [Solid Rocket Booster] was lit, I was holding my breath.

WRIGHT: So you had that job again?

NYGREN: Yes, I did, for [STS]-26. Twenty-six was my last Shuttle flight. I did twenty-six, and then I rotated out and then picked up with my assignments in doing [NASA] Headquarters [Washington, DC]. I got my Headquarters assignment at that point in time.

WRIGHT: Were you a part of changing the contingency, the after-the-flight? You mentioned that you had procedures that if there was something that happened, that if it had been simulated, you would have had different things happen. So were you very much involved in making sure all those things were implemented?

NYGREN: We actually got a good procedure, we got it written down, and we gave it to all the support team. Yes, I was intimately involved in that. We had a number of folks that started working at—in fact, they created a family escort guru to start pulling that stuff together, and

they'd have family meetings before the launches. They had where everybody was going to stay. We started assigning astronauts to families pre-launch so that if something came up, they already knew who was going to be assigned to them in. We worked with the Kennedy guys so that we had direct communication with where we were moving people. We started getting radios so we didn't have to rely on the telephone lines. We had hot lines to different places, point-to-point, where we knew we were going to have people that we needed to talk to.

There were a number of changes that were made at Kennedy in the facility world. They learned themselves that the phone system was dead. They also learned that they didn't have the right plan, and they went to radios and put in point-to-point phone lines. We built a family support plan that said these are the kinds of things we're going to do and how they're going to be done. We made a more concerted effort to make sure that they all stayed at the same place so that they were easily gathered up.

So yes, I was involved in the development of what I would call the contingency plan and the family support plan, but also, as a result of it, I became less integrally involved because we identified a family support lead. We had astronauts assigned that were on the roofs with the families during the launches.

So my role changed significantly, in that for 51L, I was the senior NASA person, up on the roof, and the families were up there, and there was a couple of security guys standing around with us, and that was essentially it, to where we had a team of senior NASA people that the family already knew and were comfortable with their families. That took a large load off of what I would have had to do in the old scenario.

They walked through the plan with the families—here's what the plan is, here's where you're going to be staying, here's how you're going to get to transportation—to a much more

detailed degree than what we had done in the past. It was more of a case of, "well, you're down there, meet at this place, a bus will pick you up, bring you in, we'll take you back out there, get in your car, go do your own thing." We put more rigor into it than what we had before.

WRIGHT: What about the Vehicle Integration Test Team procedures? Were there any significant changes made from the time of *Challenger* to STS-26?

NYGREN: Not really. What we were doing was pretty consistent. We needed somebody to be watching the Orbiter when the Orbiter was going through the checkout. We had to do landing support, so we had guys doing the landing. We were launching satellites, so we had somebody working the payload aspects of it. I wouldn't say that there was a lot as far as the team itself in changing the activities. And the three days or so before launch, the routine pretty much stayed the same.

I think if there was anything, I would say there was more attention paid to the family aspect of it, of making sure they got out to have a meal. There's a place at the Cape called the Beach House, which is an old house that's on the beach that they've renovated into a conference facility that the Kennedy guys use as a retreat periodically, and during the launch time, they turn that over to the astronauts to use. They have a place to go kick back and relax, and the families are invited out they have a barbecue where everybody gets to socialize a little bit. More attention is paid to the interpersonal and family aspects than before, where it was systems, weather, procedures, more cut and dried. We backed off a little bit and paid a little bit more attention to the personal aspects.

WRIGHT: When you were there for STS-26, did you know that was going to be your last Shuttle mission?

NYGREN: No. , I really was caught a little bit off guard by my next assignment, so to speak.

WRIGHT: Would you like to talk some about that assignment? I know that we're watching the time to get you out of here on time this morning, or do you want to pick up later?

NYGREN: No, we can talk for another twenty or thirty minutes, and then I have to leave.

Let's see. I was in Flight Crew Operations, and Dick Truly was the Associate Administrator for the Office of Space Flight, and he had Don Puddy working as a right hand man for him, helping him out up there. Puddy was due to come back to Houston, and Dick was looking for somebody to replace him. So Dick called me up and asked me if I'd come up to Headquarters and do a one-year rotation helping him in the Office of Space Flight.
And it turned out that just a day or two before that, my daughter Kristen had been playing basketball at Clear Lake [Texas], and she had torn her ACL [anterior cruciate ligament]. So she was going in for surgery and was going to be in for a long recovery, and basketball was her life. I told Dick, I said, "I just can't do that right now."

He said, "Okay. Well, let me think about it."

We went on, and a few months later, he called back up and says, "Has the situation changed any so maybe you could come up here?"

I said, "Well, yes, it looks more realistic. Let me talk to the family and let you know." So I went and talked to the family and I called him back up.

And he says, "There's a couple of things going on up here right now." He said, "Let's not make any decisions for a couple of days, and we'll see how this works out."

Well, like two days later, he's named [NASA] Administrator, so he's no longer in the Office of Space Flight. Now he's the Administrator, and George Abbey was at Headquarters at that point in time. So George moved in as the Acting Administrator for the Office of Space Flight.

A few days later, I get this phone call from Aaron Cohen—actually, I get a phone call from—who was it I got the phone call from? It wasn't Aaron. I can't remember right now who I got it from. Anyway, they said, "Aaron Cohen wants to see you. You need to go see Aaron." Well, Aaron's the Center Director.

I'm going, "What the heck does Aaron want?" I haven't been talking to Aaron recently. So I go over to see Aaron, and Aaron says he'd been on the phone with George, and George is saying I was supposed to be up there two weeks ago, where am I, so what's going on?

I'm going, "I haven't talked to George in months. I don't know what's on George's mind."

So he says, "Well, you'd better find out what's going on."

George is pushing on this thing where I'm coming up for this one-year rotation, because I'd been working for George for ten years. So he wants me to come up there on this one-year rotation.

I said, "Okay. I'll go up for a couple of weeks and see what's going on." Well, I go up there, and George is acting in this particular capacity, and Truly is the Administrator.

And so I show up, first trip to Washington. Nobody in Washington has ever heard of Rick Nygren. I'm up there, and I go, "What am I supposed to be doing, and where am I sitting?" and everything.

George, in his typical way of setting me up, he says, "Just go sit in that office over there. Nobody's in that office right now."

So I go over there. The secretary's name is Pat Robinson, and I've never met her, and she's never heard of me either. I go over there and say, "They said I'm supposed to sit in here, and I'm up here for a while."

She's going, "Okay. Okay." She ushers me in the office. I've got this palatial office, huge thing.

I'm going, "Holy smokes." Well, it turns out that it's the AA [Associate Administrator] for the Office of Space Flight; it's Truly's old office. Well, now the rumors are out that the new AA for the Office of Space Flight has arrived on the scene, because I'm sitting in his office, and I'm totally oblivious to what's going on and the politics inside the Beltway. The rumors are out there, everybody thinking that Nygren is the new AA, and who is this Nygren guy?

Anyway, I ended up going up there, and then shortly after that, Bill [William B.] Lenoir was actually named as the Administrator for the Office of Space Flight, and at that point in time, Crippen was the Shuttle Program Manager. When I first got there, Lenoir asked me to go off and do a special study on the Orbital Maneuvering Vehicle, the OMV, which was a TRW [Inc.] contract. I spent six weeks or so working with Dave Bates, doing an assessment for the OMV, and came back and gave Lenoir an assessment and a recommendation on what to do with the program.

Then I got named as the Director for Shuttle Operations and Utilization, and I'm sitting there going, "Let's see, I started in NASA in [19]'66, and Crippen and Truly came in out of the MOL [Manned Orbiting Laboratory] program, and Lenoir came in as a science guy. I trained all three of these guys, and they're my chain to the President." I thought that that was pretty neat, that I had those guys in there and they were really supportive of me and everything.

I came in and started working as the Director of Shuttle Operations, and basically that was the Headquarters element that did the Shuttle operations oversight. They weren't in the nuts and bolts of things like that, but they were particular about the money and the budget and the congressional interfaces and making sure that they interfaced with Headquarters. But it basically covered all of Kennedy. Kennedy was all operations and it also fed back to Mission Operations and Flight Crew Ops. That's where they got their money in Houston. So I got to work with a number of the folks at JSC that I had worked with previously, and the guys at KSC.

It was a great assignment for me. I really enjoyed it. It was a real opportunity to learn a lot of the NASA Headquarters guys, had opportunities to talk to the Office of Personnel Management, the Office of Budget, congressional staffers. I went to a couple of committee hearings where we had to present. So it worked really good from that perspective.

Having the rapport that I did with the senior management up there at that time—the Deputy for OSF [Office of Space Flight] turned out to be Tom [Thomas E.] Utsman. George was up there for a lot of the time, then Crippen and Lenoir and Truly, so I got to do a lot of things that probably a guy at that level wouldn't have gotten to do if he didn't have that history with those folks. But I really enjoyed what I had as a job up there and the people I got to know and work with.

So it was a good year. Tough on the family, in that my son was a freshman in high school, so it was tough to be away. I had the family come up during the summer when I was up there, and we toured around. I had two of the kids come up for the entire summer. My wife came up a couple of times, but she didn't stay, but the kids came up, and my daughter Kristen actually got a job up there for the summer.

We had a great chance to tour a lot of the Civil War battlefields. We drove up to New York. Off line some time I'll tell you about a two-day trip to New York with the family. But it was a great experience for the kids, too, because in Texas, you don't see any Civil War battlefields. Growing up in Nevada, other than talking about all the gold and silver we sent to the East, there are no battlefields out in Nevada either. So getting to go to Gettysburg [Pennsylvania] and Antietam [Maryland] and places like that was really neat, and I did that a lot with George Abbey.

There was a guy by the name of Ed Pickett that went with us all the time, and it turns out Pickett was related to General [George Edward] Pickett from Pickett's Charge [Battle of Gettysburg]. George and Ed were both Civil War buffs, so they could tell me all about all this stuff. It was like having your own personal guides. We did that on a number of the weekends. And by the time the kids showed up, I had been to a bunch of them, and I got to do it again with the kids So a great opportunity. Had a great time. And it worked out pretty well for me in that respect.

WRIGHT: You want to share any more information about your review of the Orbital Maneuvering Vehicle?

NYGREN: It was right off the wall. I didn't know what an Orbital Maneuvering Vehicle was, other than it was supposed to be some kind of satellite. So I didn't have any idea what it was, what it was supposed to do, or anything.

But Lenoir asked Dave Bates, who was a budget analyst, and I to do an independent assessment of the status of the program and bring him back a recommendation as to what they should do with the program. And the Orbital Maneuvering Vehicle was a vehicle that was intended to be able to stay on orbit and change orbits and bring logistical supplies to satellites.

TRW was the contractor, and when the concept originally came along—Star Wars, all of the space technology, and we were going to have a Space Defense Initiative, SDI, n—TRW and the Air Force envisioned that there was going to be a lot of satellites up there that were going to need servicing by this Orbital Maneuvering Vehicle. NASA had envisioned that it was going to need this capability, so there was a big effort to build this thing.

Well, shortly after the contract and everything was signed, SDI just died. There was no more Air Force involvement whatsoever. So now TRW had to build this thing. NASA was interested in one, maybe two, but no more than two of these. And TRW had envisioned that they were going to build multiples of these things, so they were way out of line in what they had originally bid and what this thing was going to cost. Where they had previously been willing to absorb within the company some of the development costs, because they knew that as they sold the other ones they could ask for a price and they'd get a payback on it, now they realized they were only going to sell one of these for sure and possibly two, so they had to start recouping their development costs. The costs were just going out of sight.

Bates and I went out there, and I could look at this stuff and say, "Well, that's a neat technology," but it was gee whiz to me. But Bates, he was phenomenal on numbers. He could

make those things stand up and dance, and he could look at what they were saying and how much it should cost and what they originally bid. He just could do phenomenal things with budget data. I was totally impressed with Dave. There's no doubt about that.

We'd sit down and listen, and the TRW guys were really good about giving us all the data. It was the first time I ever actually met Dan [Daniel S.] Goldin. Fortunately, he probably doesn't remember that. We worked on it for several weeks and went back to Lenoir and basically said, "The concept is sound, all requirements for it are minimal, if nonexistent, and the costs are going to continue to rise, because they're going to have to recoup [recuperate] all of their development costs. And NASA's paying where the Air Force isn't anymore. So unless you're willing to spend several billion dollars more on it than what you planned, you probably ought to cancel it." They took the recommendation and did it.

Now, I'm sure that they had a lot more recommendations than Rick's and Dave's, but our recommendation was that as great of a concept as it was, that the need for it wasn't there from our perspective, and the way that the contract and the contractor had originally set out to go do this, NASA was going to get stuck with a lot of development costs that just wasn't worth it.

So here's an unmanned vehicle. I'd never looked at unmanned vehicles before. I'd never dealt with TRW before. I'd never been in that kind of a budget review before. If it hadn't been for Bates, I don't know what I'd have done. He was good. He ended up being the CFO, the Chief Financial Officer, at Marshall for a number of years, and when he was there, I'm sure they had a good one, because he was good with numbers.

WRIGHT: Like you said, it was a good learning experience.

NYGREN: Yes.

WRIGHT: So you went back to Johnson Space Center after a year at Headquarters?

NYGREN: I went back to the Johnson Space Center. It was interesting, because when I was at Headquarters, I was a Johnson employee. When I went back to Johnson, I became a Headquarters employee, which is an interesting scenario, but they were looking for where they needed some help and where I could possibly do something meaningful.

At that point in time, the Space Station [Freedom] was coming along and they had a systems engineering and integration effort within the Level Two Program Office that was headed by Dick [Richard A.] Thorson. He had his SE&I [Systems Engineering and Integration] group broken down into, guess what, Engineering and Integration. He had an Engineering Manager by the name of Larry [James L.] Crawford, and he didn't have an Integration Manager named, so that was the position that I actually moved into. Dick and Larry Crawford were both up in Reston [Virginia], and I was actually stationed down at JSC as the Integration Office Manager.

WRIGHT: And how did that work?

NYGREN: It worked okay from our perspective, because the Freedom Program was basically broken down into four work packages. Then there was an integration contractor, which was Grumman [Aerospace Corporation], who was supposed to be doing the SE&I integration work for the program. And as it turns out, because of a lot of different reasons, that structure didn't

work. It was probably a large part of why we ended up having to go to a different space station contract and contracting mechanism.

From an Integration Office, I managed the Power Integration Office that was at [NASA] Glenn [Research Center at Lewis Field, Cleveland, Ohio]; I managed an Element Integration Office that was at Marshall; and I managed the Software Integration Office that was at JSC. So most of the integration work that I was involved in wasn't at Reston anyway. The engineering support that Grumman had was pretty much in line with what Larry Crawford on the engineering side of the house did, and they also had the group up there that did the Ops concepts and development and designed reference missions.

But the integration work that I was involved in, in trying to get the integrated vehicle working, was distributed through the Software Office, the Element Office, and the Power Office. Basically what we were responsible for doing was taking a look at the different architectures as you were building the Space Station for when we would say you're going to mate two elements.

The Element Office was responsible for the requirements for interfacing, the equivalent of an interface control document. They called them BCDs, Baseline Control Documents. But they were responsible for the interface: what was the mechanical interface, what was the data interface, what was the electrical interface. They worried about the orientation angles, did you have the right attitude controlled jets and thrusters to keep control of the spacecraft in the right attitude? And then, as you put another module on it, did you have the same kinds of thing.

The power thing was the same. You had power batteries, and you had solar arrays, and each time you added a new module, that put more demand on the electrical system, so you had to make sure that your electrical system would, in fact, provide power to those particular elements at that point in time. And when you were doing things robotically and had to turn the power off

in different modules, did you have the right redundancy that you could isolate particular areas. That office was responsible from an electrical perspective at looking at all of the module electrical wiring diagrams and how the power was fed in there through the primary and secondary feeds, that as we were building it, you could in fact continue to provide power.

Then the Software Integration was doing the same thing from a software perspective, in that the avionics, we needed to make sure that each module came up, it had *avionics* and *caution* and *warning*, and that the software that was on board was capable of taking the new module avionics, integrating it, and providing the services that were supposed to be provided. What you were trying to do was develop software packages that were not just one element launch at a time but would cover a block of three or four and then you'd have a new software drop.

My job was to try and make sure that those three offices were working with the different work packages and making sure that what they were planning on building for hardware was something that we figured we could actually operate when we got it on orbit and that the flight control guys would have some chance of having something in space.

But it was really a great job. I really got to like Larry Crawford. Larry was another guy that was phenomenal. He came out of Kennedy Space Center, just a phenomenal guy, and I really got along well with him. I think it really worked out real well just because he and I got along so well from an engineering and an integration perspective. We never had any issues about who was supposed to do what.

Then because we had international partners, Dick split it up so that he was the European Space Agency Representative and I was the Japanese Space Agency Representative, so I worked with the Japanese on their module and he worked with the Europeans on their activities.

WRIGHT: Gave you yet one more culture to learn about.

NYGREN: Yes, another one to learn about, yes. I got to meet with them a lot in the States but seldom there.

WRIGHT: How long were you in this position?

NYGREN: Oh, let's see, '90 to '94, so I was there for about four years. They canceled Freedom and said we're going to go off to Alpha, and they started the redesign team. And the redesign team was headed up by Bryan [D.] O'Connor, and I was still involved in that. I was asked to work on the redesign team, and I did that for a short period of time.

They wanted people who could work on—it was a dedicated thing, so everybody had to get on board. They had to work on it full time. Well, I had my twenty-fifth wedding anniversary planned in the middle of this, and we were going to Europe for three weeks. I didn't think that it was a good idea for me to tell my wife that we weren't going to Europe for three weeks because I was tied up in this team. So they actually replaced me on the team, and I went off and did some other trivial stuff on the side and went off to Europe and had my twenty-fifth wedding anniversary. I'm still married, so that must have worked okay.

WRIGHT: Probably a good decision. [Laughter] And the redesign team came and went.

NYGREN: Yes, they came, and they did the redesign. But in the middle of that, because the original work package managers and everybody had kind of all been put out to pasture, so to

speak, because we knew we weren't going to do that design again, I was without a job. Carolyn [L.] Huntoon, who was the Director of Space and Life Sciences, came to me and said, "We've got this flight we're trying to do with one of our crewmen going to the *Mir* Space Station, and from a scientific perspective, we're trying to build some medical experiments to fly on *Mir*. I'd like to have you come over and lead up our Russian interface. So how about coming over as an Assistant Director for Russian Programs?"

So with no other opportunities around, I said, "Sounds good to me." I went to work for Carolyn, and we started working on Norm [Norman E.] Thagard's flight to the *Mir*.

And shortly after that, they announced the NASA-*Mir*, where we were going to have multiple Shuttle flights going up to the *Mir*, and we were going to have crew rotations on Shuttles and on Soyuzes. And the entire scope changed significantly, because where we were originally just trying to do some stuff for Norm Thagard and make sure we had some experiments for him to do so we could get some good data from long duration that we hadn't had since the Skylab days, we expanded that.

It turned out to be about a $400 million contract where we were going to put a lot of our experiment hardware in their *Spektr* module, and then we were going to almost essentially completely outfit their *Priroda* module with U.S. scientific hardware. Where originally we were talking about a few insignificant experiments from an integration perspective—significant from a research perspective but not difficult to integrate, soft bags, simple little things to go do—this was an extensive integration effort, where we were putting refrigerators and freezers and centrifuges and things like that in Russian modules.

The Russian power systems and the U.S. power systems are different in how they operate, and not only on the spacecraft but they're different on how they operate on the ground.

And I probably covered that in my NASA-*Mir* oral history [7-23-1998], but we blew up a lot of hardware, fortunately GSE most of the time, and computers by hooking into the Russian ground power system and not being grounded properly and not having it working right. It turned out to be a significant effort on our part to build up all of that hardware on a very, very tight schedule, get it to Russia, get it integrated into the Russian vehicle, and get it through all their ground tests so that they were happy.

I moved into that, and I worked with Tommy [W.] Holloway, who was the original Program Manager, in setting up the program structure and how he wanted to do it. [The structure] was through working groups as opposed to a program structure that you would normally do, because he realized it was a three or four year program. It wasn't something that was going to be a long haul, so why go to the trouble to build this huge infrastructure that we could do through working groups and special teams.

I worked with him on that, and I supported, or I was a coach, on one of the teams. And on two of the other ones, I interfaced with the Space and Life Sciences Medical Ops and Science, so I oversaw those two and chaired one of them. But that's in my NASA-*Mir* interview. We'll just not talk about that a whole lot and let them read that one, too.

WRIGHT: Okay. Well, we'll certainly reference that.

Is this a good place for us to stop today? We can come back when you have another hour or so and finish up your work with the station and the areas that you're doing now.

NYGREN: Why don't we do that?

[End of Interview]