NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT
ORAL HISTORY 4 TRANSCRIPT

RICHARD O. COVEY
INTERVIEWED BY JENNIFER ROSS-NAZZAL
HOUSTON, TEXAS – 28 MARCH 2007

ROSS-NAZZAL: Today is March 28th, 2007. This oral history with Dick Covey is being conducted for the Johnson Space Center Oral History Project in Houston, Texas. Jennifer Ross-Nazzal is the interviewer, and she is assisted by Sandra Johnson. This is our fourth session with Colonel Covey.

During the last session we ended by talking about training for STS-61, and you also talked about Story Musgrave's injury in the vacuum chamber and attempts to remove him from the crew. I thought we'd begin today with launch and then sort of work our way through the mission and some of the awards that you won for the flight and things.

COVEY: Okay, great. Well, let's see. Because we were going to rendezvous with the Hubble Space Telescope, then our launch window was determined by the orbit of the telescope, and it just so happened that in the time frame that we were supposed to launch it was crossing over Kennedy Space Center [Florida] at night, and so therefore we launched at night. I had night launches on my previous mission and then close to one on my first mission, so launching at night was not a big deal to me. It's always a big deal for people watching, because it's pretty spectacular and that.

But launch and ascent were very nominal. By my fourth time I pretty much knew what to expect and would have to say that there was not anything unusual about it that I recall, which was nice. Basically, the great thing for us about the whole mission was that we didn't have any

significant problems with the Orbiter at all. That allowed us then to concentrate on the very complex mission that we had and the operational tasks without having to worry about an Orbiter that had problems and how do you change your plans to go and accommodate that.

So as I recall we launched relatively late in our crew day, and so our first day on orbit wasn't very long, which was planned that way. Kind of got on orbit, got squared away, knew we were on a good track for a rendezvous, knew we had flight day two to do a lot of the checkout of the RMS [Remote Manipulator System] and the spacesuits and things like that in preparation for the work that we would have.

One of the things that was very interesting is this was the first time I had flown with a crew of seven. Not only were there seven of us, but we had four spacesuits plus assorted parts. So that made the flight deck and the middeck area extremely crowded. Everybody was always looking for a little bit of their own space, but we gave up a lot of our middeck space to be able to accommodate loose stowage, I'd say, because of all of the supporting gear and tools and things for the EVAs [Extravehicular Activities] we were going to do.

So overall during the course of the mission what I found was seven people is a lot harder than five people, but there's also plenty of room for seven people. You just have to know how to deal with having a lot of folks around, and we did that. Other people had flown with seven, were used to that; I wasn't. It was a little bit different for me, and just managing your time, you know, more people getting through the limited resources like the bathroom, and the ability to when do you go and clean up, and when do you brush your teeth, and when do you—you know, all those things, which are serial to a large degree, just are more complex.

So the first day, pretty uneventful. We got on orbit without any real concerns. Second day, went in and primarily focused a lot on checking out the RMS and having the EVA crew

members starting to pull out all their gear and tools and stuff and get them configured and check them out and being ready for the things we would have to do on subsequent days.

Flight day three was our rendezvous day. As I think I told you earlier, I had planned on flying the rendezvous and I did that, supported by "Sox" [Kenneth D. Bowersox] and Claude Nicollier. One thing about having seven people is that when you're doing a rendezvous, you get an awful lot of help. [Laughs]

ROSS-NAZZAL: A lot of backseat drivers? [Laughs]

COVEY: A lot of people taking pictures and trying to look out the windows and see what's there and stuff, but that was okay. The rendezvous went very much like we expected it to. At that time the Hubble Space Telescope was the largest structure that we had flown the Shuttle up to, and that was not a big deal; it wasn't anticipated to be a big deal. We were nervous about things like the solar arrays, which we knew had some problems to start with. We were going to be replacing the existing ones, and you're always concerned about making sure that you don't inadvertently or even in the course of nominal operations have the reaction control jet plumes impinge upon the solar arrays and the spacecraft.

But it was a beautiful sight when we finally could really see the Hubble, and it is as bright as anything you can imagine because of the silver-colored insulation, and the gold of the solar arrays just made it spectacular when it first came into visual range, in sight, and tracked on in.

Now, one thing that I'll talk about because it happened during the rendezvous, and this gets back into our training, and maybe I mentioned it; I can't remember it. But our training team

was—I think of the five people that were full-time on the training team, three of them were Aggies, Texas Aggies. So we had a lot of give and take during the training. At that time my daughter was being recruited by a Texas A&M [University, College Station, Texas] volleyball coach, and they knew that, and so they were always giving me grief and bumper stickers and things; "My daughter goes to A&M," and things like that. They'd given me a hat, a Texas A&M hat, and I thought, well, in recognition of the contributions that the Aggies made to our flight, I would take that hat with me in my crew clothing, and I wore it.

The main reason I took it was because it wasn't just for looks. It's very functional when you're doing a rendezvous with the Sun and everything, and actually doing anything where you're looking outside and you want to be able to shade yourself from the Sun. Just like going outside; it's practical, too. So I was wearing my Aggie hat during the rendezvous, and someone took a digital picture, and later in the mission or sometime in the mission that digital picture got downloaded and it came back down, and it wound up in the newspaper here in Texas during the flight. There it was clearly, A&M.

Well, everybody thought I was an Aggie, and I got a bunch of mail, including one from John David Crow, who said, "Wow, congratulations. You're really doing the school wonders." [Laughter] I hated to break his heart and write back and tell him I wasn't really an Aggie, but I was honoring Aggies.

So that was just a little thing that took place there. People still see me occasionally with my Aggie hat and say, "What's that all about?" So that's the story there.

So the rendezvous went well, very nominal from the performance standpoint of getting in position. Claude captured the telescope, and we got it put away in the back of the payload bay,

and that pretty much was our flight day three activities, and positioned us then to be able to move into the five spacewalks that we had, which we did over the next five days.

Now, one of the things that we had known beforehand was that there was concern about one of the solar arrays on the telescope, and that there was concern that it may not retract correctly. So in doing that and in showing us, there was a concern that if the bistem, which provides the support but also is what rolls up, if it was kinked like they thought, then it might not retract normally, and they were concerned that if we continued to try to force a retraction that things would break off of the solar panel and be debris around this telescope, which you don't want to have any junk around.

So the solution was our call on the retraction. If we saw something that looked like it was starting to jam, just to call it off, and instead of retracting the solar array, we would jettison it. Okay, so that was the game plan. We were briefed to do that and we were very much in a mode of being very conservative relative to our call on whether it was retracting normally and starting to jam, because we had been told the big fear was all this stuff coming off, and so we didn't want to be the ones that polluted the telescope environment by doing something dumb.

So the first day was Story Musgrave and Jeff [Jeffrey A.] Hoffman's. They were—and I may have told you this before, but we had four EVA crew members, Jeff and Story were EVAs one, three, and five, and Tom [Thomas D.] Akers and Kathy [Kathryn C.] Thornton were EVAs two and four. So we called Jeff and Story the "odd couple," EVAs one, three, and five; Kathy and Tom the "even couple." There probably was other reasons we could have called Jeff and Story the odd couple, but nevertheless they were our odd couple because they had the odd EVAs.

They went out the first day. I probably could have been better prepared for this by reminding myself of what we did on each of the EVA days, but I don't recall the specifics of

each day, other than the first day the primary concern was the gyroscopes on the telescope had been failing, and so in case we had to redeploy the telescope, they wanted to make sure we got the gyroscopes replaced. So a lot of focus was down on getting the gyroscopes done and then preparing for the retraction of the solar arrays, which actually was all commanded from inside the Shuttle without any EVA crew involvement in the actual retraction.

So as I recall, everything went very nominally. The crew was ahead, pretty much on time, everything they needed to do the first day. At the end of that period we were to retract the solar arrays. The first one, it retracted nominally and was fine. The second one, however, which was the one that we suspected had the problem, as it was coming in, got to a point where the bistem kinked up, and slack went into the solar array, and I called a halt to the retraction which was controlled from inside the crew module. Claude or Kathy or Tom, whoever was doing that, stopped it, and at that point the decision was made that we're not going to try to retract it again now. That changed the EVA timeline for the second day. We would have to jettison that solar array.

Now, the interesting thing was that the very people who had given us all these concerns about the debris and what might happen and to be conservative relative if it looks like it's not retracting normally and stopping, after the mission were critical of us for not having continued the retraction. [Laughs] It sort of was a funny story. I mean, not that they needed to get that solar array back, because we did bring one back, and they got to extend it on their water table, and we got to actually see it after the mission. They got that. They didn't really need that other one, other than to try to understand the failure mechanism of it.

But, you know, it was always interesting that people take one position. There's a theme here in some of my other stories, where they have one position, and then you follow them, and then they say, "Well, you know, you probably could have done something different."

So, "Okay, yeah. Well, we didn't." But that was interesting.

So we got through the first-day EVAs, and like I say, the biggest deal was the failure of the solar array to retract completely. We went into our planning on the next day, which basically was for us to go out, and for Tom and Kathy to disconnect the solar array while it was still partially extended and then to have Kathy stay on the end of the RMS and hold the solar array, and then we positioned her up over high above the payload bay, well clear of the telescope. Once she was there then we had her release it, and then Sox flew the Orbiter away from the solar array.

Well, the neat thing about it was this same thing about hitting it with the plumes. It wasn't a big a deal now, because we weren't going to have to reuse it. But the separation maneuver had us fire the jets for a while, so Sox did that, and as it drifted away, then fire them again. Boy, after the solar array got out about forty or fifty feet or so, whenever we had fired the jets, the solar array just looked like a bird flying, because it would start wagging its wings. Then we watched it go on, and it eventually reentered the atmosphere somewhere and probably not too long after our mission, I suspect. It's pretty high drag and low weight, or low mass, so it will come down pretty fast.

So that was the way we started that one. Tom and Kathy then went about the business of their EVA, and on flight day two I think their primary focus was getting the new solar arrays in place. So jettison one, took the other one, took a new one and put it on, took the other one off, put the other new one on, and by the end of the day, along with some of the other tasks that they

had, we had the two new solar arrays in place, ready to be extended. We didn't extend them until the end of the mission, primarily because of the other work that we had to do and we didn't want to have them hanging out there during that time period.

So by the end of day two we were feeling pretty good, again, our EVA two still accomplishing everything that we needed to. Everybody was staying very much up ahead of the timeline, and we were getting better and better. Our learning curve on orbit was extraordinary.

Normally when you would get up each day there's a time period that's called post sleep, from the time that the alarm goes off to when your first activity is scheduled. Because of the EVAs the first activity we always had scheduled was the EVA prep, basically. What we started doing, even on the first day, was before the beginning of the official time the EVA crew members would start getting ready to go. I mean, they weren't waiting around. So by the third day we were getting really good at that, and actually getting out the door a lot sooner than was planned in the timeline.

Well, that was good, because, one, it built margin into the end of the day; but it also provided the opportunity to have a longer EVA if needed. Each day the crews just got better and better at it, so it was a real steep learning curve. By the time Story and Jeff got around to their third EVA of the mission they'd wake up, do their stuff, and man, they'd be ready to go. I'm sitting there still brushing my teeth, saying, "What do you mean you're going outside?" [Laughs]

The division of duties is probably important here, and I'll go back then, because on all of the EVAs this is pretty much the division of duties. There was five of us inside, five of us on the flight deck, so it provides a lot of support. It's crowded, too. My main job was stay out of the

way, I think, most of the time. But Claude Nicollier was our primary RMS operator. Ken Bowersox was our secondary operator.

So, you know, the EVA crew members then on their non-EVA day when they were IVA, they did the IVA, the intravehicle activities type of thing. They would be the one that would go through the checklists and follow everything. They'd be the ones that did the commanding to the telescope through the control panels.

So they were very much coordinated. It was such a coordinated effort between the people inside and the EVA crew members outside that really was required to facilitate the complexity of the mission, and the interaction between the things that may have had to have been commanded to the telescope and the things that were actually physically being done.

That's not unlike what happens today on every one of these missions that we fly to the Space Station, where we're doing these complex EVAs. But at the time it was relatively new, particularly for the number of EVAs that we had.

Everybody worried about that. Now it's accepted as you can do that plus more, and that's great. We've continued to expand the capabilities and the utility of the Space Shuttle and its crew members over the last twenty-something years as we've learned more about it. With what we do now, I don't think anybody really envisioned being able to do as much as we do on a single mission with the crew. So that was good stuff, and we were starting to break some new ground back in 1993. It's paying off big-time now in both the way that people look at it and their ability to go off and plan and execute.

We had a lot of maneuvers, and I'd make sure that the Orbiter was in the right attitude at the right time to protect either the telescope or to protect the crew members from the worst environments that they might see relative to thermally or exposure to micrometeorites or

whatever, and we would do all that by programming in and executing maneuvers at the appropriate time, making sure the systems were all supported.

Then during those days, one of my jobs was to be the IMAX photographer. The IMAX, of course, is a large-format movie camera that has become almost synonymous with some Space Shuttle activities and Space Station activities now. But we had two IMAX cameras on board. One of them was hard-mounted in the payload bay so that, like on our approach to the telescope and for those things that took place, it was back there and we could record those activities. It was set up, and whatever it got, it got. We could turn it on and off, and that was about it.

Then we had a handheld one, which was internal, and of course we unstowed it, and then each day then I would bring it up and strap it into the commander's seat, because I wasn't ever going to sit there, and it was a good place. It was kind of out of the way. But we had three different lenses, and these lenses go anywhere from being eighteen inches long to being six inches long; they're all about six inches to eight inches in diameter. The camera box itself weighs forty pounds, and the film canister weighs forty pounds.

So we had to be able to go and preconfigure the canisters, the film canisters and stuff, and get it there and put it together and have it ready so that—and we didn't have any specific targeted "get this" or "get that" type deal. It was pretty much, "Gee, does the lighting look good? Are they're doing something neat? Can I get the camera to a window, guys?" You know, spread them apart. "Everybody get away from the windows. Can I get this big camera up to the window and take some movies?"

I had intentionally made sure that not all the crew members spent their time getting trained on it. Basically for most of the IMAX photography inside, if I got it, they were going to get it. If I didn't get it, then it wasn't going to get done. Because our crew members had too

many other things to train on. I didn't want to have to worry about training to use this very unique, complex camera; it had manual settings, light meters, all this stuff, and do all that. I said, "I'll learn how to do that, because I'm just the commander, and during the high-intensity EVA operations, I'm mostly standing back watching for trouble, anyway. So I can make the judgments on when we can get the camera up in the window."

But it turned out to be a lot of fun, actually, doing that, and it was fun as much as anything because some of my most vivid memories of that mission were from the IMAX footage that I shot. That's because usually if I saw something, I said, "Oh, we need to get that," and I tried to get the camera in the window. So it worked out pretty well from that standpoint.

But it was one of those things, every day bring all this stuff up; strap the camera into the commander's seat; Velcro the lenses all over the place. And then be prepared to yank this eighty-pound mass up and get it in the window with the right lens and start making settings and shoot stuff. Not incredibly complex, but just a lot of overhead to get that done.

It was similar every day for all of our other imaging capabilities. I mean, Hasselblad cameras, 35-millimeter cameras, the video cameras, everything was all positioned around where people could grab it and take pictures as they had an opportunity to during the course of the activities. That's not unlike most Shuttle missions, whereas any type of complex operations, those cameras area always around. You've always got to make sure they're positioned right, and everybody knows where they are. Fortunately, every crew member is trained to use those and can pick most of them up in a short period of time and get some good images, and there we go.

So in addition to the IMAX photography and making sure that the ship was running well and pointed in the right directions, my role was more supervisory. The specifics of the integrated operations resided with the RMS operator and the IV [Intravehicular] crew members, and then

the coordinating with the others. So it was a five- to six-member show most of the time there, because if there was RMS operations going on, and Claude was flying the arm, then Sox was sitting there backing him up, checking, and making sure Kathy and Tom were working the procedures with each of the crew members and the payload stuff. Or Story and Jeff were, if they were inside and Kathy and Tom were outside.

So you start with the crew getting into the airlock, and you go through the EVA until they get out of the airlock, get it closed back up, and repressurized. Nominally it's ten hours; could be up to ten hours, maybe somewhat less than that. The time outside was set to be six hours, but with the front end and the back end, it's a lot of time. During that six hours, six or seven hours, when they were actually outside, very intense; hard for people to break away. So, lots of times—somebody has to eat. I'll go down and fix their meal for them and bring them their sandwich or whatever. So that was another chore that I could help in in making sure that the crews were all set up and able to do their job.

But that was pretty much it, all five days, the way we did things. Everybody was on the flight there. There wasn't anybody that was chilling down on the middeck. Everybody was up top working. There was concern about whether we could sustain that tempo. You know, they were trying to figure out when do we get a day off or a half a day off or something, and we had asked to have the flexibility to figure out when that was.

As it turned out, we went five days straight doing EVAs, and that was the right answer. Everybody felt good about that. Nobody was getting excessively fatigued. The EVA crew members, because they were getting a day off in between were okay with that, and so that facilitated us pressing on with five straight days of spacewalks.

The third day was the "odd couple" went back out, and their primary task on that day was to replace the Wide Field/Planetary Camera. The Wide Field/Planetary Camera was able to, because we were putting a new instrument in, was able to have its own corrective optics for the telescope. So getting it in was a big deal. So it was the Wide Field, the WFPC, the Wide Field/Planetary Camera 2, replacing the Wide Field/Planetary Camera 1. That was basically a pretty straightforward operation.

This thing's about the size of a baby grand piano. It was in its own storage container, and that storage container also could take the one that was coming out and bring it back. So we were able to take the—I think the way it went is they take the new one out, and they stashed it and stored it over on the side in a fixture. Took the old one out, slid it into the storage container, took the new one, slid it in, get everything tightened down wound up, and there it was. It was installed. That was the primary activity on that day.

Let's see. I think on that day, also, there were some concerns about—no, that would be after the next one, after the fourth EVA, yes. I was thinking back; there were some concerns about some of the insulation on some of the instrumentation. I think it might have been some of the sensors that are up near the top of the telescope. After having some close-up looks at it, there was a decision that was made to bring in some of the multi-layer insulation, the MLI, from out in the payload bay, the support equipment; to bring that in and have us fabricate some covers that, on the fifth EVA, that Story and Jeff would install on the sensors.

They had known for several days in the control center that this was needed, so they went off and worked up, saying, "Okay, if they bring this piece of MLI and it's like this, if they cut it this size and this size, and then they fold it this way and that way and do these things, then we can attach it just like this." So they basically built them on the ground and then developed the

instructions for us to build them on the Shuttle, and we did that. Actually, the people that built them were Sox and Claude Nicollier. I supervised, but they were the ones that actually made them, fabricated them and put them all together, and then we put them down in the airlock so that the guys could take them out the next day.

But one of the things we did was all the crew members went in, and we signed our names on the inside of the insulation. [Laughter] So they put those things on there, and we say, "Okay, so our signatures are going to be up here on the telescope for however long." I think they replaced them with some real covers sometime along the way. I don't know if they brought them back and said, "Look what these guys did." [Laughs] I never heard if they did. Sox, I think, went back up to the telescope, so he may have known what they did with those. Another—just a little—you know, another stupid—

ROSS-NAZZAL: No, those are great, great tidbits.

COVEY: —stupid astronaut tricks, you know. [Laughter]

So primary purpose of the spacewalks on the third day were, like I say, to replace the Wide Field/Planetary Camera, and then on the fourth day Tom and Kathy went out to install the COAS, which is Corrective Optics Actual?

ROSS-NAZZAL: I want to say COSTAR [Corrective Optics Space Telescope Axial Replacement].

COVEY: COSTAR. Yes, yes. Right, COSTAR, and a COSTAR—yes, COAS [Crewman Optical Alignment Sight] is what we used for our rendezvous. COSTAR, and that had the corrective optics for the rest of the instruments on the telescope, those instruments that were installed actually as opposed to radially, like the Wide Field/Planetary Camera.

So that also was a similar operation in that we had to take the COSTAR out of its storage container, put it over on the side, go in and pull out the instrument that it was replacing, which was the same size; put it in the storage container, latch that all up, and then put the COSTAR into the telescope itself. Get it in there; have the ground or through the panel in the Orbiter, have it go through what it needs to do to deploy all its mirrors and everything.

It was a very, very interesting concept of how they fixed that, but basically, there was a correction for each one of the light paths, and there it kind of flopped out into the different light paths with a little deal.

That was, to me, it was one of the great moments in spacewalking, because COSTAR weighed about 800 pounds, and Kathy Thornton was the one that was moving that guy around. She was the one that had to—you know, manually held it and took it into the telescope. Kathy was the smallest of our spacewalkers and maybe one of the smallest spacewalkers ever, and 800 pounds was nothing to that woman. [Laughs] She did wonderfully with it. It just shows that zero gravity is a great equalizer for people of all sizes, and it was kind of neat seeing her get to do that.

As I recall, on the fourth day we did have some complexities in one of the replacements that we made. I believe it had to do with some of the computing systems, and they were not originally designed to be serviced on orbit. All the other things that we had done primarily had been designed to be serviceable or replaceable on orbit. This one had not, which meant that then

there were real small connectors that were not necessarily designed for easy access by an EVA crew member. The cables and stuff were not designed to be disconnected in zero-G. We learned all kinds of things about that.

This actually must have been—it was either EVA three or five, because Jeff Hoffman and Story were actually doing it. What happened was there was screws that were actually in either straps or fasteners, and they were retained in it in one gravity. But in zero-gravity these screws, which everybody thought would just be retained so the crew didn't have to worry too much about it—I mean, they unscrewed them from what they were screwed into, but they were held by this other thing, a strap. Then they'd just have to take it and go back. Well, what happened was the screws on their own started in zero-gravity got a motion going which actually caused them to back out of these retainers, which they were screwed into, but once they were free, it wasn't a hard-tight retainer, and so they would back out.

Well, they were little gold screws—I can remember them—and we saw one come out from the work area. It was kind of drifting around, and to show you the beauty and precision of RMS operations and the human eye and human hand, I think Jeff was on the end of the arm. We saw this thing floating away, and Claude says, "I'll fly you to it." He flies him over there, and this thing's drifting away. He flies him up there, and Jeff goes out and he just grabs this screw out in the middle of space out there, and I said, "Okay, that's cool."

So anyway, what we learned, that was a lesson there, which is that even though we had devised ways, because we had high-fidelity trainers, to break these connections that had to be broken and to remake them, even in one-G, you know, one gravity here on Earth, you didn't get the dynamics that zero-gravity and the vacuum of space puts into it. Because even in the neutral-buoyancy lab these things wouldn't back out, but once you got into a vacuum and once you got

into true zero-gravity, where there's no resistance to this screw from an atmosphere or water of any kind, it just backed on out.

So that was a lesson learned that you have to—and we get surprised. Every time we come up with something new relative to doing it in zero-gravity, we either resurprise ourselves or we learn something new about the environment and the behavior of materials and objects in zero-gravity, and that was one that we learned there.

Now, it didn't keep us from getting everything done. We got everything securely fastened with two out of three screws or whatever was required, and that got checked out and was all fine, but it was one of those things we learned. I just can't remember, it may have been the third day; it may have been the fifth day. I can't remember.

So with all of that done, then I think the last day was primarily the last EVA—by the time we got through with the fourth EVA all the really critical stuff had been done. We had replaced the gyroscopes. We had put the new solar arrays on. We got that WFPC in, and we had the COSTAR. So if you think about the major chunks—and in addition, we had added additional memory or whatever it was to the computers. We had replaced some other things. We had positioned some other stuff.

The fifth day, as I recall, was a shorter EVA, and it was mostly because it was pretty much cleanup type of activity, putting those little covers up on the top end of the telescope and then getting the telescope ready for redeployment. Because once we had finished all the work on it, then we sure didn't want to keep it sitting in the payload bay any longer than we needed to.

So as I recall, while they were still out on their EVA, we brought the solar arrays down. I can't remember if we extended them while they were out, but we may have just to have them out there in case they didn't extend properly. But once that was all done, they came back in, and we

went through that day the last checks on the telescope, and basically everybody was ready to go with the planned redeployment the next day.

So from the start of the mission, that was through flight day eight, the redeploy was like on flight day nine, and that may have been when we got our half a day off, too, was on flight day nine. Everything went exceptionally well. We were fortunate in that the Orbiter performed extraordinarily well. We were fortunate in that we didn't have any major breaks from our planned activities, spacewalks, you know, with the exception of having to jettison the solar array. That was a major disconnect. The rest of them were things that we overcame either within the course of the EVA or added on and took care of.

I don't think anybody thought we would get through all five EVAs with as little I'll say grief and as little diversions caused by either the telescope, the instruments, the EVA equipment, which all worked really well, too. RMS worked great. All these things facilitated us marching through and being done in a relatively short period of time compared to the length of the planned mission. So that was good, and we still see that today.

I look at even the last Space Shuttle flight, and the Orbiter just was, you know, nothing. It was just cranking along. Orbiters, we know how to fly them now, and it's very rare that we have anything that causes us problems in operating them, which then provides an ability to focus on the mission and all of the complexities of the mission operations, as opposed to trying to take care of the Orbiter. That is a big deal, and it's one of the reasons that I worry that we are going to stop flying the Space Shuttle now that we have demonstrated and proven what a terribly capable platform it is for space work. It really is, so it's a tribute to the maturity of the system and doing that.

So to redeploy, Sox got to fly the redeploy; very nominal there, nothing unusual. A little nostalgic seeing the old telescope go over the horizon, but also a tremendous sense of pride and relief in having been able to do all those things and, at least without seeing the proof through the testing that they had to do over the next couple of months, knowing that when it left our place that everything was working the way it was supposed to, and that we had done everything we needed to do.

The real proof would be were these guys as smart as they thought they were on the ground to come up with the corrective optics and the way to deploy them into the light stream and be able to make the instruments perform to the level that they were expected to. Of course, we found out within months that yes, they did, and then for years now it has continued to provide extraordinary science, enabled by the ability of Space Shuttle crew members to go and service and repair the telescope.

Of all of the programs that I have been associated with, it's the one that was best planned and has been best executed, in terms of using astronauts and crewed vehicles to be able to support, enable, and enhance the scientific mission of space. I mean, there's just not anything—we hope someday we can say that about Space Station, but I doubt that it will ever prove to be the true marriage of human spaceflight and scientific spaceflight as the Hubble Space Telescope has been, so that's a very unique thing about this mission, and we all realized it at that time, basically.

If the Hubble Space Telescope had been deployed from an expendable launch vehicle never designed to be serviced or repaired, and it got on orbit and they found out it had this aberration in its mirror, it would have been, "Well, let's go built the next one." And that never would have happened, because it would have been too expensive. I mean, it would have been

years. I mean, we're still trying to get the follow-on up there, but it would have been years to do it, and so the ability to come up with a plan and go and instead of having to build a new one, go and fix it three years later, and then be able to continue to service it and find the extraordinary science we have. It wouldn't have happened, so it was a unique program from that standpoint. That's Dick Covey's perspective; I'm sticking to it. [Laughs]

ROSS-NAZZAL: Were you happy when Mike [Michael] Griffin reversed Sean O'Keefe's decision to go to Hubble?

COVEY: Yes. One last time. I'm all for it. The reasons that I think—I have a personal concern that we have gotten too conservative in our Space Shuttle operations now with this idea that if you go to anywhere other than Station, then you put the crew at extraordinary risk. I don't think that's the case, and I think the merits of particularly going to Hubble far exceed the marginal risk that's associated with not flying to the Space Station on a Shuttle mission. I've felt that all along, so I still feel that today about the semi-official requirement to have a rescue capability. I think the cost of that exceeds the risk that really exists. Shuttle crew members are willing to take risks. They wouldn't be doing what they did if they didn't, so we don't have to eliminate all risk.

So we got our half-day off; took a lot of pictures; got ready to come back. One of the things, we were, if not the first crew, one of the first crews to take a new landing training device on board. I think they called it PILOT [Portable Inflight Landing Operations Trainer], but it was a supersized laptop computer that had basically a simulation of the Space Shuttle, the landing simulation of the Space Shuttle on board, so that after ten days in space, I could hook up a control stick to this thing, sit in the pilot's seat, and put this thing up there and fly a landing. It

was a computer game, basically, but it at least got us the sight picture and got to see the dynamics of it. We could simulate a night landing, and we were going to do a night landing, and we could fly it. So we practiced on that thing.

Now, the interesting thing was that this was at a time when computing capabilities, as they continue to do, are just always evolving. So the whole idea that you could even get a complete simulation, an accurate simulation of the Space Shuttle landing phase, on board the Shuttle was phenomenal, and it was because more and more capabilities were becoming available in laptop, so you finally got there.

I don't know if they even still use that thing or not, but if we had as capable a computing machines as we should on board the Space Shuttle, that simulation would be resident on the onboard computers, and you could run the simulation with the commander sitting there looking at all the real instruments and everything. But we're not there. Those computers are really, really limited, and so you have to do it on the side with a laptop, and I suspect they may do that. They were still on an evolutionary path relative to the development of rendezvous and proximity operations tools, and we utilized some of those new ones.

One was a laser range finder, which was relatively new in its application. There were some new computer programs that allowed you to take data and enter it into another laptop that would then compute closing rate and trajectory and give a little display of it to you that the basic Shuttle had no capability of doing. If I think back about the first rendezvous that Joe [H.] Engle and I flew back in 1985 even, even there, in order to do range finding we were using little parallax scopes and stuff where you have one lens that looked out one overhead window and the other one out the other one, and that two feet of distance between them would go out and would help you get some ranging so you had some.

By the time we flew—and this was primarily ranging when you can't use the rendezvous radar anymore—but when we got out there on this mission, we had laser range finder. We had some other range finders that we were using. So we had all kinds of data that we didn't—plus this little display kind of show you what was happening, and you could say, "Well, what if I give it three pops in this direction on the RCS [Reaction Control System]?" and it would show you what happens to your trajectory, and it was pretty cool.

Those tools, I know, have continued to evolve even over the last fourteen years where now you can hook them into different systems, and it's all automatic, where we might have had to enter data manually. It's very sophisticated now and a much better tool than we had.

But again that goes to the whole thing of the evolution of the Shuttle from where it was, and the supporting equipment, to where it is today. It's been an extraordinary evolution. I suspect that people that train for rendezvous now, if they went back and said, "Okay, this is all you had in 1985?" they would be very concerned about their lack of data. So that's another interesting evolution that has occurred that has enabled the ability of the Shuttle to do its work.

So that gets us to landing day. We were planned to land at night, and we did at the Kennedy Space Center. My recollection, I don't remember where we actually went into the dark on entry, but I know that when we came across Mexico City [Mexico] it was at night, because it was like, you know, the horizon-horizon lights. I suspect we put on a pretty good show for them that night, because we were right at our maximum, maximum heating, going over Mexico City. The Orbiter was fully enveloped in the ionization plume, and in fact, one of the things that I found very interesting was as we banked up into a left bank coming over Mexico City and the windows were white because of the plume, I could look out and I could still see all the lights

through the plume. It was not washed out at all; it was very bright through that. So we had to be giving them a great show.

Landing went pretty much as expected, not anything terribly unusual. A right-hand approach—yes, a right-hand approach to Runway 33. The weather was great. The landing was wonderful, and we finished. But not anything; entry was not anything unusual; I don't remember anything unusual about our preparation for it at all. Pretty much with flown people, everybody was ready, other than drinking too much water and stuff like that.

ROSS-NAZZAL: There were a few things that I wanted to talk about, some interesting things. Your crew won the Collier Trophy. How did you find out about that?

COVEY: To be clear, it wasn't just our crew. It was the Hubble—I think they called it the Hubble team, and the actual named people on it were folks like Randy [H.] Brinkley, who was the Mission Director, and Brewster [H.] Shaw—he may have been the Shuttle Program Manager at that time—the guys from Goddard [Space Flight Center, Greenbelt, Maryland]; the Hubble Telescope folks from Goddard; Milt [J. Milton] Heflin, who was our Lead Flight Director; plus the seven crew members. So I think all in all there may have been thirteen of us. So I always like to make that clear it wasn't just the crew. The crew was part of the team that was recognized.

I don't remember how we found out about that. It was in the spring of '94, as I recall, that they actually made the presentation. We went to the ceremony for it. That type of recognition is always nice, but it's an artifact of the fact that a whole lot of people put you in a

position to go off and do neat things, and you get recognized for it, it's really recognition for the whole team.

ROSS-NAZZAL: Okay. Same thing with the Goddard Trophy as well?

COVEY: The Goddard Trophy—well, I do remember the Goddard Trophy. That was an interesting one. Now, that was an award to the crew. In fact, this last Friday night I was at this year's Goddard Memorial Dinner. This was their fiftieth anniversary, and they were re-recognizing all of the people who had received it previously, and I got to represent the STS-61 crew in that.

But in 1994, I think about a month before the dinner, we got word that the crew was going to be recognized with the Goddard Trophy. Well, it also happened to be spring break week for the Clear Lake [Texas] schools, and all of the crew members, and of course, we also had just finished all our post flight reporting. Everybody was going to the seven winds. The only person that was available and would go to the dinner was Tom Akers, so Tom actually went and accepted the trophy for the crew.

We didn't even think about it. You know, it wasn't even—so they said, "Hey, you know, you need to send some someone to the Goddard dinner," or, "You all need to go to the Goddard dinner to accept your award." [Laughs]

Everybody was saying, "I don't think so. I'm going to be skiing." We were going to be in Hawaii.

I said, "Sorry, you know, my family's been planning on this." So we all went on our vacations. I think Tom was just going to be back, and he flew up on the Friday and got the award and came back, and that was it.

But that was, again, nice recognition; probably not appropriate for the crew to get it alone. There were too many people that were involved in successfully making that mission what it was, and they deserved all the recognition. The crew didn't, but in the meantime, you know, it's the STS-61 crew, so that's like the space club of Ellington [Field, Houston, Texas]. [Laughs]

ROSS-NAZZAL: One of the other things we found out was that after you had flown this mission you were invited to *Home Improvement*. Can you tell us about how you were invited and what that entailed?

COVEY: Well, actually, it started, … [when Stephen S. Gauvain began] listening to a lot of our stuff about the tools, all the tools that we were going to have, 150 tools or whatever, and the power tools and the special tools. So he made the connection with Tim Allen and *Home Improvement*, and he actually wanted to see if Tim Allen would do something on the show relative to the mission before we flew. Well, there wasn't time, and it didn't happen, but what did happen was as we were going into crew quarters in quarantine, he got a copy of a Tim Allen standup routine called *Tim Allen Rewires America*. It is adult-rated, definitely. [Laughs] But we took it into crew quarters with us, and we watched it. Most of us had not seen much of *Home Improvement*, okay; not familiar with it. But we watched Tim Allen in this, you know, he "rewires America," and we just loved it.

So during the mission there were several occasions where we'd be out there and be working, and Tom would say something like, "Yep, guess we got to rewire it," and this was all from this tape, okay? Then at least one time we decided, "Hey, we've got to give the Tim Allen grunt, you know." So somebody was saying, "Yeah, that probably deserves it," you know, and the whole crew, the EVA crew members and us on our mikes, are all sitting there going, "Arrh, arrh, arrh, arrh [imitates Allen]," you know. We did that, and it got captured on video somewhere. But we were just having fun with it.

Well, then when we got back, there was an invitation from Disney Studios for us to come be guests on *Home Improvement*, and specifically as they wrote the script was to be guests on *Tool Time*. So that's how it came about.

We went out in early I want to say April, because we were all going to go, but Kathy Thornton didn't go, because when she went on her ski trip, her spring vacation, the first day one of her daughters broke her leg and was in a half-body cast, and so Kathy said, "I can't go." So Kathy didn't go, but the other six of us did. We went out and spent three days at Disney Studios with the *Home Improvement* gang, a great experience. They loved having us there.

The theme of *Tool Time* that week was basically, hey, these are tools that you won't find in your neighborhood whatever, you know. We were in the second segment. They opened with a segment of *Tool Time*, and then we came in the second segment of *Tool Time*, and the premise was not only won't find—these are tools from out of this world or whatever. They had sent a bunch of tools out, and we brought them out and went through a little bit of a dialogue with him about the mission and with Al [Borland]. Then the tools disappear. One of the tools is missing, and we're all trying to find it. It was in Tim's locker, and he's all embarrassed and stuff. That was kind of the script on it.

But that's how it came about. I mean, it was very ad hoc and, again, not anything that we expected. Now—Stephen Gauvain. Steven was killed in an automobile accident five or six years ago.

He was—you know, when the Ford Explorers were having their rollovers, he was coming back from an assignment up north of town, and one of the tires blew, and he was killed in the rollover. …

But anyway, he was really the one that kind of got it started. Now, Sox wound up going out there twice more, I think.

ROSS-NAZZAL: Did he really.

COVEY: Yes, after every mission. He developed a real relationship with Tim Allen, and so every time after his flights Tim would have him back out there, and he'd do another segment on *Tool Time*. A funny thing is how often this segment of *Home Improvement* gets played and shows up.

I have a great story. A guy that worked for me at Boeing retired about three years ago, and he and his wife were in Poland over Christmas holidays. He said, "Yeah, Dick, we came back to our room, and we turned it on, and there you were on *Home Improvement*." He says, "I didn't know you could speak Polish." [Laughter] So it's worldwide now. Anyway, that was that story.

ROSS-NAZZAL: That's great. Yes. No, I wanted to ask about it. I thought that just sounded like a really unique story.

COVEY: It was a wonderful experience. It's interesting to see how they do that. I said, "You know, this is lot like doing a Space Shuttle mission, in that everybody's got to do the right thing at the right time." They've got a very structured sequence of how they prepare for dress rehearsal and go into the actual final production and stuff, and it's very structured.

ROSS-NAZZAL: Was it filmed live?

COVEY: Yes. Yes.

ROSS-NAZZAL: Okay, interesting.

COVEY: It was. In fact, the audience, the live audience for the *Tool Time* segment, did not know we were going to be guests on it when we showed up, so for them, I mean, their reaction was just outstanding. It was really neat.

ROSS-NAZZAL: Yes, I can imagine. Did they all stick around wanting to get autographs or anything after the show?

COVEY: Yes.

ROSS-NAZZAL: When did you start thinking about retiring from NASA, at what point? Was that before the mission, after?

COVEY: Actually, I had gone through a—after my third flight, had gone through a process of looking at whether I was going to leave NASA or not, and decided at the time not to. Some of that had to do with the opportunities that I was afforded in management in between the two flights, and not even knowing that I was necessarily going to fly that other flight. But I knew that once I had made the decision that I was going to leave management, go back and fly as a commander, that when I came back I was going to be leaving pretty much.

My wife confirmed that, because I read where she had talked to a reporter and was quoted, when asked, "Is your husband going to fly another flight?"

Her response was, "Not with this wife." [Laughter]

I said, "Okay, I get it."

One of the things that I saw was each flight that I had, and I think it's probably true for every crew member, it's harder on the families each time. It was harder on my wife the last time than it was. Now it was eleven days in orbit, too, so before I was up and down in three or four or five days. But it was still harder, and that was very obvious to me. So I had reinitiated some of the activities that I had, looking for what I might do after the flight. I started doing that, and even got approached about running for Congress in Florida, and came within ten minutes of getting on an airplane and flying to Florida to file before I said, "Boy, that's probably really dumb." [Laughs] It was my hometown, and they wanted me to come back and do that.

But decided that the right thing was to stay here in the Houston area where my wife had a business, so I narrowed my search to look for aerospace opportunities primarily here within the local community. Decided that, knew that before the flight; worked it after the flight; and left in June of '94.

ROSS-NAZZAL: And you started working for Calspan?

COVEY: Yes. Actually, it was Calspan for a very short period of time. We were involved in a competitive procurement, and we lost. So when we lost, then I went over to one of the teammate companies, which was Unisys at the time, as Deputy Program Manager supporting the space operations contract. Unisys was a subcontractor to Rockwell, who was the space operations contract prime, and we had a group that provided software and sustaining engineering support to Rockwell.

ROSS-NAZZAL: Then you went on to work for McDonnell Douglas?

COVEY: I did that for two years, one of the few jobs in my life that I absolutely hated. So it didn't take me long to start being receptive to and even looking for other alternatives. Given the chance to go and lead the Houston division of McDonnell Douglas, I left in August of '96 and went on to McDonnell Douglas, which became Boeing a year later through the merger. And have been with them up until January of this year or February of this year when I transitioned over to USA [United Space Alliance] on behalf of Boeing.

ROSS-NAZZAL: Tell us about that transition and why you decided to—you were in Colorado before this, correct?

COVEY: That's right. You know, in 2000 I basically left the NASA business world and went off for Boeing and was working in the Department of Defense, the intelligence community, and some commercial space work. That was fascinating. I really liked that. I actually needed a break from working with NASA. It was okay. And had assumed that I probably would not come back to being part of the NASA contractor community; did not expect that I would get asked by Boeing to come back and join the United Space Alliance in a leadership position.

So when that opportunity was offered to me, I had to look at it closely. And decided that I felt it would be a great opportunity to get back into the Space Shuttle business, primarily, but also to come back and work with a company that is trying to become something other than a Shuttle contractor. There's some real challenges in that, and I thought that my background and experience off in another part of the government contracting world but not with NASA might help in that. So that was a large part of the decision.

ROSS-NAZZAL: You serve as the Executive Vice President and the COO [Chief Operating Officer]?

COVEY: Right.

ROSS-NAZZAL: What does that entail?

COVEY: That's basically a Deputy to the CEO [Chief Executive Officer]. So I'm the Deputy. I'm Mike [Michael J.] McCulley's Deputy at this point, and the way that we're structured and the way that we operate, it's pretty much just along that line.

ROSS-NAZZAL: You mentioned that you're moving away from just focusing on the Space Shuttle Program. What are you moving toward?

COVEY: Well, sure. Sure, you know, we have been sustained by the spaceflight operations contract and now the space programs operation contract, but that ends when the Shuttle stops flying in 2010. Eighty percent of our work is supporting the Shuttle, so how do we become relevant and how do we play into the Constellation world, the human-rated systems of the future, the plan, train, and fly aspects of the JSC operations for Constellation as well as for Shuttle and Station? How do we become relevant and make sure that we can participate in those activities as they replace the Shuttle and those systems replace the Shuttle as the focus of NASA's human spaceflight activities? So that's primarily what we're doing.

ROSS-NAZZAL: Yes, very interesting. I wanted to ask you about your work with the Return to Flight Task Group. When were you appointed to that group?

COVEY: Let's see. The Return to Flight Task Group was formed up in the summer of 2003, and our direct task on the behalf of the Administrator was to make an independent assessment of the actions that Space Shuttle Program—actually, that the agency was making in response to the recommendations made by the Columbia Accident Investigation Board. So, you know, the CAIB said you ought to go consider doing these things, and they had like fifteen of them. They said, "You ought to do these things before you fly again."

Our charter was to go and say, "Okay, these are fifteen things that the CAIB said NASA should do. What's NASA doing and how well are they doing in responding to each of those?" So at the time we thought that was going to be a one-year type of job. It turned out to actually go two years. It largely was a group of people who were assigned before I became the Co-Chair. I was able to add a few people that I thought had appropriate backgrounds and technical experiences that we needed to do some of the assessments we were going to do, but largely it was a group of people that were predetermined and kind of—here they are. [Laughs]

Fortunately, General Tom [Thomas P.] Stafford, who was the Co-Chair with me, had some say in who those people were, but not all of them. So that made for an interesting management task, because when you have a lot of people with diverse backgrounds, which is good, and a lot of very senior and strong-willed people, then trying to keep them all focused and headed in the same direction was a different task for me.

So we, over the course of the two years, I think gained the respect of the Congress, who also called upon us to provide them with insight as to what was happening relative to the implementation of the CAIB's recommendations and with the Administrator. There was a change of administration, NASA administration, during that time period. Even though we started under Sean O'Keefe, Mike Griffin heartily endorsed our activity and supported us in doing that.

It is a type of activity that I used to cringe when I'd hear people say it was being established, you know, for something I was involved in, an activity I was involved in, because it always meant more work for the NASA folks to be able to respond to us as well as to themselves and their own management and leadership relative to the things that were going on. Our demands kind of came in on top of that. It added work, and I always worried that we weren't

necessarily adding value, because when you're just doing an assessment, that means you're really just looking at what somebody else does.

You're not doing any—I mean, and so is there value in trying to say, "Well, I don't think they did as well as I might have done it," you know, or somebody else might have done it? That's counterproductive. It wasn't the purpose that we had, but there were some people on the committee that felt that that was their job was to not necessarily just say, "Hey, they did this, and this is how successful they were or weren't," but to put it in light of how they thought they might have done it, basically. That was the shortcoming of the committee.

In the end it was interesting, because our final report and our observations were that they did not comply completely with the recommendations of the CAIB, mostly because it was not technically possible. But that was not an easy decision to come to, and not everybody agreed with it, although they supported it and they all signed a report that said that. Some people felt that if it wasn't technically possible, then the intent of the CAIB had been met. Others felt, "Hey, we don't have to try to make those judgments."

But that was a role I will always question of whether we were any value or not, or just more work. In the end maybe it was better having people like Tom Stafford and me leading that than someone else. As much of a pain in the rear as we were, somebody else might have been more, and from that standpoint maybe we did serve a purpose.

ROSS-NAZZAL: Had you worked with Stafford before this time?

COVEY: Well, I worked for him. [Laughs] I actually worked for General Stafford before I became an astronaut. My last Air Force assignment, he was technically my boss, and so I'd

worked with him. I knew him through other things, but we hadn't worked in this particular type of environment before.

ROSS-NAZZAL: How did you determine if the recommendations had been met? Did you tour the facilities, or did you just simply interview the Program Manager?

COVEY: It was a combination. We understood a lot by physical presence. We participated either as observers of some of the technical interchanges or some of the decision-making processes where much of the data were presented, and we asked for specific presentations and then were able to question those things ourselves to get a feel for, you know, is this just the story or is it real, and if it's real, to what extent does it meet the intent of the recommendations.

So it was a multifaceted approach. We were broken into teams. We had subteams. Everybody had a set of recommendations that they were responsible for, each of the three teams. One was ops [operations], one was technical, and one was management, so it revolved around those types of focus. We divided and tried to conquer that way.

ROSS-NAZZAL: What impact did your STS-26 crew experience have upon your involvement with the Return to Flight Task Group?

COVEY: Actually, if anything, it was probably more sympathy than it was any real technical value that came out of it. Having been a part of the process from the NASA standpoint, I understood what they were going through relative to trying to work through the issues, trying to overcome the rigid conservatism that was a knee-jerk reaction to an accident. In both cases that

reaction, that overconservatism, made it so it took longer to get back to flight, because now you're got to get it perfect, and proving that it's perfect is hard. Very few people are willing to take any measure of risk that they think they can overcome by doing something else a little bit longer, and so those two things were resident in that.

There were activities that were taking place that were, in most cases, parallel, but in my mind were not necessarily required in order to accomplish their goal of getting back to flight, okay? So they took time and effort of people, and they were not adding the capabilities that were really going to be required to fly with a measurable amount of risk, trying to drive that measurable amount down to something that was nothing, and so both times there were those types of activities.

Early on when I heard that they were going to consider having this contingency Shuttle crew system survival or whatever capability, an ability to launch a rescue Shuttle and stuff, I warned them that they were going down a path that once they had set, even if they said, "We're just going to do this for a couple of flights," that eventually they will decide they have to do it for every flight. They did, and it's an incredible overhead to go and do that. Now, they'll say it's not, but that's just because they've built it in.

But, you know, if they didn't have to do that, it would, one, it would have made flying to Hubble a whole lot easier decision. But again, a lot of activity that paralleled the real activity that added marginal value to the real task of returning to flight and doing the things you had to do to be safe to go fly. That's the thing that I see, kind of a real parallel.

ROSS-NAZZAL: Did you have any contact at all with the crew and give them any sort of recommendations from your experience for RTF [Return to Flight]?

COVEY: Yes, every once in a while we would meet with them and tell them what we thought we were seeing. Then they would tell us the things they were concerned about, which weren't necessarily artifacts of recommendations but some of the things that they observed and the things that they were being subjected to that bothered them. So we'd find out some things there and factor that into the questions we asked and the way that we conducted our assessment.

ROSS-NAZZAL: Were there any similarities between your return to flight and their return to flight after the *Columbia* accident that you noticed? Anything common?

COVEY: Well, yes, of course there is. After a team has sat down for two and a half years, it's a ratchety start back up. Processes have changed, because they were deemed to be inadequate before, so now the new processes are there, and trying to—so everything that leads up to the decision that, yes, we're going to go fly and launch is harder than it used to be, and I saw that. I saw that. The idea they'd go to two-day flight readiness reviews, two-day long, and I mean, that was very much like after STS-26, in that the conservatism built in required that you listen to a lot of things that may not really have to and could have been dispositioned outside of a formal agency-level activity but weren't, because we want to make sure we all talk about this, not just, you know.

ROSS-NAZZAL: Before we close today we have two questions that we just like to ask everyone. What do you think was your most challenging milestone while working for the space agency, or today perhaps?

COVEY: Challenging—well, in my mind there's no doubt that preparing for STS-61 was the most challenging thing.

ROSS-NAZZAL: Why is that?

COVEY: Because of the complexity of what we wanted to do and gaining a constituency that believed that the crew could go and do all those things that had never been done before. You know, expanding from three spacewalks max [maximum] on a mission where two was nominal and three was exceptional, and going to five; the number of complex operations that we had. It wasn't that there was resistance. It's just that we were pushing the bounds, and so the way you have to demonstrate, prove, that you're ready to go do that, not just the crew but the agency, was, I thought, a major accomplishment.

ROSS-NAZZAL: Conversely, what do you think was your most significant accomplishment?

COVEY: Conversely—now, maybe I answered that one wrong. [Laughter] Overcoming challenge sometimes is the most significant accomplishment. There's no doubt that having commanded STS-61 and what we did on that mission was the greatest accomplishment that I was able to make and contribution I was able to make to the agency and our nation. No question about it.

ROSS-NAZZAL: One of the proudest moments of your career.

COVEY: Oh yes. Yes, still is. It's way up there.

ROSS-NAZZAL: I can imagine.

COVEY: Other than babies and grandbabies. [Laughter] Getting married and things like that.

ROSS-NAZZAL: It's funny, that you mention it, I think Bob [Robert A.R.] Parker told me something like that. You know, getting to be an astronaut, you know, pretty good; but getting married, having a kid, you know, a little higher.

COVEY: Yes, you've got to balance those things. If you put them all together, you're going to fault over to the family stuff, there's no question about it.

ROSS-NAZZAL: Well, I'd like to ask Sandra if she had any questions for you. No? Do you feel like there's anything that we may have overlooked that you want to talk about? We have a little less than a half an hour if there's anything that you think we might have—.

COVEY: I'll be honest with you. I can't think of anything right now. I'm trying to think if there's anything I could add that would be of value, but outside of the context of just what we talked about today or earlier, I'm probably done. [Laughter]

ROSS-NAZZAL: Well, we thank you for your time. We've really enjoyed all the sessions.

COVEY: Sure. Well, I'm glad we finally got through it all.

ROSS-NAZZAL: Yes.

[End of interview]