NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT
ORAL HISTORY TRANSCRIPT

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INTERVIEWED BY REBECCA WRIGHT
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WRIGHT: Today is March 1, 2010. This oral history with Bill Reeves is being conducted for the Johnson Space Center Oral History Project in Houston, Texas. Interviewer is Rebecca Wright, assisted by Jennifer Ross-Nazzal. Thanks for coming in again today to visit with us and making this your third session. We appreciate all the time you're giving to the project. We ended our last interview with your sharing experiences working with the Shuttle Program. During that time you were also involved various ways with the Space Station Program. I thought we could start today with the focus on Station and ask if you'd share details of when you served as one of the 13 members of the Source Evaluation Board to select the contractor for Space Station Freedom.

REEVES: Okay. I was selected as a flight director in 1983 and went over to the office then and was in the training process and already into supporting flights as a flight director when [Space Shuttle] *Challenger* [accident, STS 51-L] happened in 1986. When the *Challenger* accident happened, everything stopped for about a year and a half while the agency recuperated from the accident, did the investigation, and to get back on track. It was during that period of time that those of us in operations that normally supported Shuttle flights, since there weren't any, were looking for various things to do. Tommy [W.] Holloway was head of the Flight Director's Office at that time. It just happened that the Source Selection Board for Work Package 2 for the Space Station Freedom Program was about to start. They needed a representative for MOD

[Mission Operations Directorate] or for operations to be on that Source Board, so he asked me if I would go over and do that.

It was [to] be a six-month job, which turned into an 18-month job, so I went over. We were in an offsite building. It was a 13-member board but then you have a whole lot of people involved, a lot of separate technical panels and operations panels. The first task of the Source Board is to write the RFP or the request for proposal, so you're pulling all of the requirements together for the Space Station and documenting the requirements in the request for proposal that's going to go out for the contractors to bid on.

Now the way Space Station Freedom was set up, four Centers were the main work packages, they called them, Work Package 1, 2, 3 and 4. Work Package 1 was [NASA] Marshall [Space Flight Center, MSFC, Huntsville, Alabama], Work Package 2 was JSC, Work Package 3 was [NASA] Goddard [Space Flight Center, Greenbelt, Maryland], and Work Package 4 was [NASA] Kennedy Space Center [KSC, Florida]. Each of the four Centers that represented a work package were to let a prime contract to a prime contractor to do their part of the Space Station Program, with Kennedy, of course, being the launch operations, JSC the operations part of it, and was also the design Center for the Station.

I served on that Source Board and drew on the operations organization to bring in people to help write requirements and document them in the RFP. Then when the RFP went out, the contractors that wanted to bid on the contract would bid on it and write their proposal. They would respond to the requirements in the RFP, and then they would cost how much they would do it for. It was the job of the Source Board to take all of the proposers, the contractors that were proposing on the contract, and go through their proposals and score it and rate it and make a selection recommendation to the Source Selecting Official, who was in Washington [D.C.] at

[NASA] Headquarters. They would make the ultimate decision, but it would be based on the Source Board's recommendation. Seldom does the Source Selecting Official ever go against the Source Board. They're basing their decision based on the Source Board.

The two contractors involved for Work Package 2, [North American] Rockwell [Corporation] and McDonnell Douglas, were the two bidders. There were several others that originally proposed, but they didn't make what's called best and final, so it got down to just those two, and we had two main proposals to evaluate. As I remember it they were significantly different design concepts that Rockwell and McDonnell came up with that they were proposing. There was a really broad spread on cost between the two. I can't go into a lot of details on it, because I think even today a lot of that is restricted or proprietary information, and I doubt if I could remember it anyway. At any rate we went through the whole process and we wound up selecting McDonnell Douglas as the Work Package 2 prime contractor.

So everything was off and running. We got through the *Challenger* down period, we got back to return-to-flight [STS-26]. Once we finished the Source Selection Board exercise I went back to the Flight Director's Office and started supporting Shuttle flights. The Space Station Program was a totally separate program. It was headquartered at Reston, Virginia, where they moved the Program Office. They were off designing and building Space Station Freedom. We knew one of these days we were going to have to start building it, but it takes years to do that.

I went back to the Flight Director's Office and that was when my first lead job was the Hubble Space Telescope deploy mission. I went back to working on that and supported several other Shuttle flights. Then in about 1990, when we successfully deployed the Hubble Space Telescope, STS-31, we flew that mission and at the end of that mission I went back to the Flight Director's Office. I may have already covered this in the prior session but I don't know if I did

or not, but I had decided that it was time to go do something different. I'd been a flight director already for seven or eight years. That's usually about the time that you like to stay in one job before you get the itch to go do something different. I had an opportunity to go over to the Space Shuttle Program Office. Leonard [S.] Nicholson was the Space Shuttle Program Manager at the time, and he asked me to come over to the Space Shuttle Program Office. I went over there and I started as a branch chief in the Cargo Engineering Branch under Larry [E.] Bell, under Leonard Nicholson. That was just to get my feet wet in the Program Office. Leonard told me right up front, "I just want you to spend a short time here and get the feel of the Program Office and learn the ropes."

What he had in mind was they were creating a new office called the Space Shuttle/Space Station Integration Program Office. He wanted me to go to work in that. He wanted me to help set that office up. Jim [James L.] Smotherman was over there, head of the nucleus of that office. It was an office of one at that time basically, so after six [to] nine months I went to work with Jim and we started trying to set up the Space Shuttle/Space Station Integration Program Office. What that was all about was everybody knew that coming down the road was the Space Station, and all these pieces of Space Station, and assembly of the Space Station [had to use] the Shuttle.

It was something totally new and totally different than anything we'd ever done before, so we were trying to define the basic requirements and the design changes that we would have to make to the Shuttle in order to be able to build a Space Station off of it. So my experience on the Source Board really paid off because I had intimate knowledge of how the Space Station was going to be designed and how it was going to be put together, and how many flights it took, and basically what it really meant to go build this.

If you remember in some of the earlier exercises we went through, I said several times it's always amazing how you just constantly keep building on your experience and your knowledge as you learn things. The other thing that really paid off was my experience in the development of the robotic arm for the Shuttle and all of the robotics because robotics was a major player in building the Space Station.

The other thing that worked out really well was the fact that I had started in cargo engineering under Larry Bell, and I learned a lot from Larry Bell in a very short period of time. He was one of the greatest, smartest engineers I've ever met. He's an incredible guy. I learned a lot from him real quick, and then we started looking at the Shuttle payload bay and said, "How are we going to do this?" There was one big issue that was unresolved, and that was how the Shuttle was going to attach to the Space Station on each flight when it would go back.

There were two camps. There was a camp that said we want to build a docking interface on the Shuttle where we fly up to the Station and we dock to it. There was another camp that wanted to fly up to proximity to the Station and have the robotic arm reach out and grab the Station and pull the two vehicles together. It was an engineering challenge to figure out what was the best approach. I was working on the berthing option, which was using the robotic arm to berth the Station and the Shuttle together. The Engineering Directorate over here at JSC was championing the docking interface, which was to use a Russian-derived docking mechanism on a docking tunneled in the payload bay.

Each method had its own set of pros and cons. The people that were against the robotic option said if the arm doesn't work you're out of business. Well, you were out of business anyway because you had to have the arm to pick up all the different pieces and put it on the Station, so that argument didn't stand up. The problems with the docking approach was that you

would have to take the airlock, which was at that time in the crew cabin of the Shuttle, and you would have to move the airlock into the payload bay into what was called the external airlock and put the docking mechanism on top of it. But the problem with that was it took up a significant portion of the payload bay that would no longer be available for putting payloads in, so it would use up part of the capacity of the Shuttle. If you went that approach, it influenced the design of the segments of the Station, because they could only be so big and so long or else they wouldn't fit in the payload bay.

I'm going to get off on some tangents here but they're all relevant. It was during that process, since I was working the berthing option, that we discovered a problem with the robotic arm in terms of its original design. The original design of the arm requirements were that it could handle a payload up to 60,000 pounds' mass. Of course in orbit it doesn't weigh anything, but you still have to move the mass around. That was the design requirements, and that's what it was designed to. That was the maximum size payload that a Shuttle could carry.

But the problem was that as you built the Space Station and it started getting bigger and bigger and bigger, once the Station exceeded 60,000 pounds, basically, or the size of the orbiter, which was around 240,000 pounds, when you got up and grabbed hold of the Station to berth the two together you're essentially handling up to a 240,000-pound mass. If the Station is bigger than the Shuttle, instead of pulling the Station to the Shuttle you're pulling the Shuttle to the Station. The whole point was the arm had to have the capability to handle a 240,000-pound payload, which it wasn't designed to do.

We started working with the Canadians and the Payload Deployment and Retrieval System Program Office and found out that there was a way to fix that problem, and a fairly simple fix to it. It just so happened that the arm was starting to get old, if you can believe it, but

this is in the 1992, 1993 timeframe, so the robotic arm at that time was already coming up on nine years old. The design itself was 10 or 15 years old. The technology that it used was old technology and already starting to become a potential issue in the future. Since Station was going to go out into 2010, 2015, who knew what time period at that point, the robotic arm, which was absolutely necessary to build the Station, was going to start becoming obsolete. You couldn't even get spare parts for it.

We worked up a joint program with the Canadians and I funded it out of my budget in that Shuttle/Station Integration Office to go spend a whole lot of money with the Canadians to bring the robotic arm up to state of the art technologywise. We would send each arm back to Canada. They would tear it apart and upgrade it. At the same time they would upgrade its capability to handle larger and larger payloads, up to the size of the orbiter.

It started out if the berthing technique was the way we decided to go you would have to do this, but even if that wasn't the way you went, this was something you needed to do anyway, so we went ahead and did it. It turns out it's a really good thing we did, because the arm has just been incredible through this whole thing. It hasn't had a single problem. It's a single-point failure in the entire assembly of the Station, and it's just been a beautiful piece of equipment. Not only that, they designed the Station arm off of the upgraded Shuttle arm and took that same design technology into the new arm for the Station, so it was a good deal all the way around.

We had several big meetings with all the powers that be on the berthing versus docking issue and it was decided to go with the docking mechanism. The primary reason was you had to have a tunnel anyway. Once you hooked the two vehicles together the crews had to be able to crawl through the tunnel and exchange between the two spacecraft. You had to carry stuff through the tunnel from the Shuttle to the Station and vice versa, so since you were going to have

to have a tunnel anyway, just go ahead. The engineers were able to solve all of the technical issues with docking the two vehicles together. That was a concern. You [have] two massive vehicles coming together, and the interface has to tolerate the loads that are generated when the two vehicles come together. They figured all that out.

We moved the airlock out of the mid-deck, which made the mid-deck bigger for the crew. We moved it out into the payload bay, then we generated all of the interface control documents that basically defined how much of the payload bay and where the center of gravity had to be, and how much mass, and how big a volume was available to Space Station to design their Station off of. We fed all that information back to Station, and that influenced their design.

Everything was off and running and all this stuff was working real good and we were headed down that road when they canceled the Space Station Freedom Program. There was a lot of politics involved, and I don't even know all the ins and outs, but there were budget issues, there were technical issues. I can interject my own opinion in a lot of it, but it is my own opinion. Part of the problem was the Freedom Program never—up front when they did the four work packages, they never put in place an integrating contractor or a mechanism to integrate the four work packages. NASA was going to do that themselves at the Program Office level at Reston, and they just didn't have the capability to do that.

They discovered late in the game that they needed an integrating contractor, so they let an integration contract. Grumman [Corporation] won that contract and came in as the integrating contractor, but unfortunately it was too late. By then the four independent work packages with their primes were off and running with their designs. The contracts were all in place. There weren't any hooks in those contracts for the prime [contractors] at each of the four work packages to talk to this integrating contractor because they didn't even exist when their contracts

were signed. The whole thing just really came apart, so the agency decided to cancel the Space Station Freedom Program. They went into this big redesign effort where they were going to redesign the Space Station and try to fix all of the brokes in the program and get it back under control. That was all to take place up at Crystal City, [Virginia]. That was the center of control of all this. It was close to Reston, which was where the Freedom Program Office was, and it was close to Headquarters.

It was about that time several things happened that affected me personally because I was in the [Shuttle] Program Office at that time. There was an Assembly Office over in Mission Operations Directorate where I had come from originally, that had been created to try to define the operational assembly sequences and how you would operationally fly each flight and put the Station together, which piece goes up when and what has to go first and how do you put this thing together.

Phil [Philip L.] Engelauf was in MOD and he set up that office. Much much later Phil became a flight director as well, but he set up that office and then something happened. I don't remember where Phil went, but Bill [William H.] Gerstenmaier wound up taking over that office, so he was managing the Assembly Office. Of course you know Bill Gerstenmaier now is the deputy AA [Associate Administrator] at Headquarters, but Gerstenmaier decided about the time of this Crystal City effort and this redesign, he decided that he wanted to go back to Purdue [University, West Lafayette, Indiana] and get his PhD, so he was going to take a sabbatical and leave the agency for a while and go back to school.

The Program Office over where I was was reorganizing and doing a lot of things. They needed this Assembly Office really bad to support the Space Station redesign in Crystal City. Since Gerstenmaier was leaving they needed somebody to head that office and to work with

Crystal City and all the folks up there to do this redesign. I told them I had the experience. I was familiar because of my Source Board experience and the Shuttle/Station Integration Office work that I had done. I was real familiar with everything going on. I told them I would go back over there and take Gerstenmaier's job and I would manage that office, and I would go to Crystal City and support the redesign, on one condition. The condition was that as soon as the redesign effort was over I would return back to the Flight Director's Office and go back there. They agreed to that and I agreed to all of that and so that's what I did.

I went over there and I headed that Assembly Office. I spent a lot of time at Crystal City. As the designers would come up with the different designs we would take their designs and we would say, "How do you put this in the Shuttle, and how do you put it together, and how does it affect us operationally, and what does this mean to EVAs [extravehicular activities], and to robotics." So our product was to provide the assembly sequences and here's what would go up on each flight and here's the primary task that you would accomplish on each flight. Every time they would change something we would react to that change and would change the assembly sequences, so that's what we did.

It was very interesting. When we were at Crystal City we were in one tower of the building working on this. Astronaut Bill [William M.] Shepherd was the lead person that was managing that for the work that we were doing. We kept hearing rumors and knew just through the grapevine that there was some activity going on in a different tower at Crystal City with the Russians, but we didn't know what it was all about.

So we came up with this design that we were going to present as the design we were going forward with. In fact we had pretty much wrapped it all up and had come back here to JSC, and we were putting the spit and polish on the presentation, getting it ready to go forward to

Headquarters, when we got a late-breaking input that by the way, whatever design you all come up with has to include the Russian FGB tug [functional cargo block] as part of the design. We said, "What's a Russian FGB tug?" because we didn't even know what it was.

They provided some information on it. We were up here one weekend, we virtually redesigned the assembly sequence and the Station interfaces based on this late input that we'd gotten. All this time they were off negotiating with the Russians. The [NASA] Administrator was trying to pull the Russians into the program, but all that stuff was way above our level and we didn't know anything about it, at least I didn't. Maybe I'm naive and maybe somebody did, but I sure didn't know anything about it.

We came up with a new design that was presented, and that's what we wound up doing. NASA wound up novating, which is buying out all of the work package contracts that had been let. There's a process in the government called novation of contracts where the government can terminate existing contracts if it's to the advantage of the government. They basically just buy out the contract, so they novated all of those prime contracts for the work packages. They did away with the work packages, and they brought Boeing in as a single sole source prime contractor for the new Space Station design. They did away with Reston, and they centered the Program Office here at JSC. They put it all back under one Program Office under one lead Center under one prime contractor, which was exactly the right thing to do. If they hadn't done that I don't know if they'd have ever gotten there. But they did, and it was very successful. We now have a Space Station on orbit because of it. Boeing did an incredible job. When you look at how well this has all gone together, it's pretty amazing.

We came back from Crystal City. The Program Office got reorganized. The contracts got reorganized, and I went back to the Flight Director's Office. It turned out fortuitous. Like I

told you earlier, every move I've ever made I really had nothing to do with, I just fell into it. I went back to the Flight Director's Office to get ready for Station while the Station was being redesigned, and there was a gap there before we'd actually start getting any hardware in the door to start flying. Since they had brought the Russians into the program they wanted to start working with the Russians, so this Phase 1 Program got defined, which was flying the Shuttle to the Russian space station Mir, which was already up there in existence.

I think we already covered this. I'm not sure.

WRIGHT: You talked about working with the Russians and setting that up.

REEVES: Okay, but I had gotten in on that. We had several goals, the goals being fly the Shuttle to the space station Mir to prove and to establish the relationships and the procedures and everything we needed to do work with the Russians in space, so I got to be the first flight director that went over to Moscow with the first team of flight controllers the first time we flew the Shuttle to the Mir. I went over early with this group to set up operations in their control center. They gave us a couple of rooms and we established the consoles over there that we were going to use. They were Russian consoles. We started putting in place all the documentation we needed and trying to define all the primary contacts on both sides that we needed.

Then we came up with the concept that we wanted to have a small flight control team in Moscow during the mission so that you had this face-to-face because of the language barriers and the communication barriers and everything else that we hadn't established yet and were establishing as we went. So I stayed over there during the first flight of the Shuttle to the Mir

and several flights after that and managed the flight control team from over there, the little group we took. Of course the big flight control team [was] over here.

Then the Russians decided this is a really good thing and a good idea, so they put a few Russians over here in our [Mission] Control Center, the same arrangement. All that evolved from those early days. That worked out really well. That was just a lot of fun working that program. A very successful program.

What we did in Phase 1 went a long way toward making Space Station as successful as it has been, because I shudder to think how it would have been had we not done that. Whoever came up with that concept was really thinking straight, because that was the right thing to do.

So then we did the Phase 1 Program, then we got closer to Station. Station hardware started coming in. The first flight of the Station was to fly the FGB tug [Zarya].

WRIGHT: Now you knew what that was.

REEVES: Yes, now I knew what that was. The first node. In fact Bill Shepherd was on that first crew that went up and crewed it.

WRIGHT: We found it very interesting that you were there for the first flight for the Shuttle-Mir Phase 1 Program and then yet you got to go back for the first flight.

REEVES: Yes, I was there for the first flight.

WRIGHT: Of course there were differences because you had all that set up, but tell us about being there for that, because it's such a historic time of launching a whole new program with an international partner.

REEVES: Yes it was. You knew you were starting something really big that was going to last a long time. I had gotten to know the Russians so well, and gotten so involved in their program, that it was almost like losing a family member when they had to get rid of the Mir. The decision was made to get rid of the Mir and we hated to see that go, but everybody was on board with going ahead and building the Space Station. So I got to go back over there and lead the flight control team for the first Space Station flight. I was over there for the first couple.

WRIGHT: Did you have new members of your team?

REEVES: Yes, it was constantly a different team. The very first team that I took over there was in late 1994. The head of the Flight Director's Office told me just to take a team, put together a team and take it over there, so I just tried to figure out how many I needed and what disciplines I needed. I figured well, one of our biggest problems is going to be timelines and flight plans and crew schedules and the stuff the flight activities officers [FAO] do, which is put together the timelines and orchestrate the operational timeline.

I said I [have] to have an FAO, so I picked an FAO, and then I said if we're going to have any problems technicalwise on the first flight it's going to be communications. So I took a communication officer, somebody who understood all the different communication modes. I said we're liable to have some control problems docking to the Mir. If we got into any kind of

control issues between the two vehicles fighting for control, or controlling the masses, I wanted an expert in guidance, navigation and control [GNC], so I picked a GNC officer to go with me. The team was only five people, four people and me. The other one was a mechanical systems officer. If we had any problems with the docking mechanisms or anything like that I wanted a mechanical person there.

So that was the team that we took over there. I think of all of those people the busiest was the FAOs. Gail [A.] Schneider was the FAO that went over there on the first mission with me. She deserves a lot of credit for laying a lot of the initial groundwork. She got to know her counterparts over there extremely well, and on a personal basis, which was something that we learned early on, that in order to be successful with the Russians it all relied on personal relationships. Forget politics, forget protocol, forget all that other nonsense, you had to develop trust in certain individuals and they had to trust you or you wouldn't get anything done, so we learned that early on and we established some really good relationships that still exist today and still benefit the program today. Gail did a lot of that with the flight activities folks, so that worked out good. It's been nothing but a huge success.

Like I said, I think I already covered the Phase 1 Program and all the ins and outs of it.

WRIGHT: Were you over there for Shepherd's flight?

REEVES: Yes, I was there for Shepherd's flight.

WRIGHT: What were your thoughts about him going up in a Russian rocket?

REEVES: I knew Bill very well and had gotten to know him over the years. It was great to see Bill get that crew selection and go up. He was the right guy to go up early on and get things started. It was a historic moment, it really was. One of the things you look back on, I can go to my grave and you start thinking about footprints you left behind, well, that's one of the footprints I left behind. I'm proud of what I did and proud of that whole team. That was just a really good team effort.

It was the start of something really big. We got this thing built now. This last flight just finished it. It's hard to believe here it is 2010 and all this was back in the 1990s when we started all this.

WRIGHT: Before you left the Flight Director's Office you were able to serve as a flight director for STS-97.

REEVES: Yes, that was my last flight, which was also another significant event, because that was the flight that took the first big solar arrays up to Space Station. Up until that time the only power on Station was from the Russian modules that had some small arrays and limited power, but before we could start adding the bigger modules and the labs that consumed a lot of power, we had to start getting some power systems up there. As part of the assembly sequence we were to take up eventually four big sets of arrays, but STS-97 was the very first set.

I had already decided from a career standpoint that—I don't know if I said this or not back in the very first session we had—that when I was in college I had put together a career plan that said—before I even accepted the first job at NASA when I got out of college—that I was going to go get a government 30-year career job, and then retire from the government. At that

time I thought I was actually going to teach and just get a teacher's job to supplement my retirement and work nine months out of the year and live happily ever after. Of course now I wouldn't teach. There's not enough money in the world to get me to teach. I had done my 30 years and I had a full career with NASA, a full wonderful career with NASA. I had done just about everything at NASA that I thought I could do. I'd been with them 31 years, 32 years, somewhere in that timeframe. I was starting to think about retiring from NASA and decide whether I wanted to do anything else or just retire.

But I was working 97 as a lead flight director job, and I wanted to go out on that flight. That's a good flight to go out on. One more major accomplishment; get the first set of arrays up there, then call it a day. Well, 97 kept slipping. There were slips due to various reasons. It slipped out, so I wound up staying probably almost two years longer than I had intended to. I stayed with NASA for 34 years. I had 34 years' civil service in when I retired in 2001. The last couple of those years was getting ready for 97 following the slips.

So we did STS-97. The minute the flight was over I knew it was time to hang it up. It turned out again just fate. I had become aware of a really good job available over at USA, United Space Alliance, as a Deputy Associate Program Manager for Orbiter, which was dealing with the orbiter, which I was familiar with, but it was a hardware job. I always had been a hardware person. It was just very appealing, the kind of thing I'd really like to sink my teeth into. I'd spent my whole career basically in operations. This was an engineering job. This was hands-on engineering and hardware.

I thought that would really be fun, so I decided to retire and I retired on a Friday and I went to work for USA the following Monday.

WRIGHT: Not much of a break.

REEVES: I took the weekend off for retirement. I went over to USA as the Deputy Associate Program Manager for Orbiter. I just couldn't imagine how much fun it was. Working over in that world was so different than what I had always done, because in the operations world that's a tough job. I mean a really tough job, because you are operationally integrating everything and you have to be knowledgeable of everything going on. It's like being a pilot or driving a car or operating a vehicle. You know somebody built this vehicle, but you don't know all the ins and outs of how they built the vehicle and how they designed it and what all they tested and what all to worry about, but you know how to operate it. That's the way we were in operations. We know how to operate the Shuttle; we know how to fly the Shuttle. We know what it takes for all of these different systems to integrate together and operate. We have to understand its limitations and you really have to know a lot about it.

But when you go over into the contractor side, into the hardware side of it, all of a sudden you find out there's people worrying about things that you never knew people worried about. It's unbelievable. You'd run into M&P people, which are materials and processing. These people are experts on the materials, the metals, the paints, the solvents, the glues, everything that goes into building a Shuttle that has any materials or processing involved. These are the experts on it. You run into these guys that are just unbelievably smart in terms of their very narrow little world, but they know everything there is to know about what kind of glue to use for what and what its limitations are and what kind of metal to use on this screw and what kind of metal to use on this bracket. It's just amazing. Then you find out there's people that worry about nuts and bolts and washers. Every little teeny part of this monstrous vehicle. Just millions of parts. The

specifications and the requirements and the test requirements and everything that goes along with all that stuff.

Then the integrated systems. There are specialists on each integrated system. There's testing constantly going on all over the world on all of this. These people are the ones that are following and managing all of that and keeping track of it. They're the ones that tell the Program Office and the operations guys—and I use guys as a generic term—that tell them what to worry about and what not to worry about and what you can do and what you can't do. It's invaluable. It is a new world every day you come to work. You can't make this stuff up. It's amazing.

You come in one day and all of a sudden the first thing you do, we'd have a telecon every morning, and we're tagging up with KSC and with the Rockwell plant that built the Shuttles originally and with all of the various vendors. I woke up this morning and went to work and there's a problem with an APU, auxiliary power unit, valve or something that failed in some test somewhere in the world. Now all of a sudden you [have] to worry about it. You [have] to figure out [if] this [is] a generic problem, does it affect the entire fleet, is this an isolated problem, it only happened to this one particular valve, it doesn't even affect the fleet, and then you're off and running. There's a new topic every hour every day coming up. Very very busy. Very busy time.

These are the folks that have to come in and certify the hardware is ready to go fly every flight. You have to sign a COFR, certification of flight readiness, for every single system and interface and environment and all that.

Well, I did that for about three years and supported Orbiter. I could still be doing it today and be the happiest person in the world. I still am the happiest person in the world, but I would

have been happy doing that from then on, but within the company there was a series of events that happened.

One of the associate program managers of one of the departments became critically ill and terminal, and had health issues. Program integration was headed by [H.] Neal Hammond as the Associate Program Manager at the time, and the individual that was having the problem was over in flight software. Neal Hammond's deputy in program integration had come from the software world and they had some immediate problem they had to fix. In fact this happened over the Christmas holidays. The Program Manager, Howard DeCastro, called me at home over the holidays and said this problem had come up. They said that what they really needed to do was move Neal Hammond's deputy, who had software experience, over to manage the software department. They wanted to know if I would be willing to come over and be Neal's deputy in program integration and help out with program integration. I said, "Sure, whatever you need."

So after the holidays were over they moved me over there and I became Neal's deputy in program integration. Program integration was again a totally different world. It's a more analytical world as opposed to a hardware world like Orbiter is. One of the biggest responsibilities program integration had is systems engineering and integration, SE&I. These are the people who define the environments that the vehicle has to fly through and has to operate in, and then they have to certify that the vehicle you're going to fly and the vehicle you just flew met all of its requirements and stayed within all its limits. You're talking about everything from the launch environment, the winds, the weather at the Cape [Canaveral, Florida], the winds all the way up during ascent, the loads on the vehicle, the thermal environments, the electromagnetic field environments, the structural environments. When it docks to Space Station

the structural loads and environments between the two vehicles. All that is what SE&I in program integration[PI] does.

Of course Boeing is the prime subcontractor supporting that office, so you manage that subcontractor. That's where a lot of the skills exist, the hard-core engineering skills are in the subcontractor. Then also in program integration we have configuration management which are all of the people who take care of all the documentation on the Shuttle Program and make sure all the requirements are updated, and support all of the boards and panel meetings and get the presentations together, the agendas, the minutes, the actions that come out of the board meetings, and make sure they follow up on them. If any documents are supposed to be updated you get those updated, so that's a very busy world.

We also have a cargo engineering office, which is responsible for the design, fabrication of all of the interface hardware for the payloads that we fly on the Shuttle. That [is] under me in PI. Every flight is different. There's interface cables required--different kind of cables—for each payload that plug into the Shuttle and then plug into the payload while the payload is in the Shuttle. We design those cables and get them built, and we even build some of them. We make sure the payloads fit into the payload bay. We're the ones that determine what order to put payloads in the payload bay and where everything has to fit.

Then we have a management and integration office that is in charge of all of the master schedules for the Shuttle Program, for the manifests and for all the master scheduling. We have a department under us that is responsible for all the packing of everything that goes inside the Shuttle for each launch in the crew cabin, and everything that goes inside the MPLMs, the [multi-purpose] logistics modules that fly up to Space Station, all the stuff that's going to Station. We pack all that and manifest it. [Everything] that goes in the Russian Soyuz or

Progress vehicles that goes up to Station, we pack that from the US side and ship it over there. Everything that comes back from Space Station on the Shuttle we're responsible for demanifesting it and making sure it gets to where it's supposed to go.

We have another department under me that's the IT [Information Technology] office, where we do all of the sustaining engineering for all of the software applications for the Shuttle Program. They've got all these different applications that take care of PRACA, which is the Problem Reporting [and Corrective Action] system, or just multiple applications that it takes to run a program. They're on different machines and systems all over the world or all over the country. We have a department that's responsible for sustaining that software and the equipment interfaces to keep those systems and applications up and running so that the program can function. Have I left anybody out? IT, CM, SE&I, cargo engineering.

I have an office in Huntsville [MSFC] and I have an office in KSC, and then most of our people are here. After I was Deputy APM [Associate Program Manager] for Neal Hammond for a few years, the company moved Neal Hammond over to business development. I took over as Associate Program Manager for PI about three years ago. That's what I'm doing now, so I still run that organization, and will until we run out of Shuttles, so that's my plan right now.

I was here when STS-1 flew and I'd really like to be here when the last one flies.

WRIGHT: Do you have specific processes that you are following now to start to close the program out?

REEVES: Yes, there's lots of discussions going on about how to do that and when. The course we're on right now is to fly the manifest out and terminate the program in September of this

year, which would be the end of fiscal year 2010. Now that's a really success-oriented schedule. To be able to fly the remaining flights in the time we've got left is going to require a lot of luck. That says we can't have any major systems problems that cause slips, we can't have any hurricanes at the Cape, or in Houston, that cause us to roll the vehicle back at the Cape or cause us to have a lot of personal damage in the area that affects the people to where we have to stand down for a while. There's just so many different things, external factors that could play into that, that you just don't know for sure how long the program is going to last.

Fortunately Congress took the language out of all of the legislation that had a termination date for the program and said when you complete the manifest. We have contract options that allow us to renew the contracts at the stroke of a pen, to exercise options to keep the program going to the end. But the end is in sight. There's no fuzz on that. The limiting thing that determines how long you can fly the Shuttle is how many external tanks you have. They've stopped production on the external tanks. The last few tanks are going through assembly at MAF [Michoud Assembly Facility, New Orleans, Louisiana] right now, and as soon as that last tank goes through assembly and gets shipped to the Cape, that's it. That's all we've got to fly, unless Congress were to turn everything back around and say go build some more tanks and fly some more Shuttles. That could be done.

It would probably be an interruption, a small or some interruption, until you got production back up and running and got things going again. The longer you wait to make a decision like that, the longer the gap is going to be, but it could be done. I have no idea what's going to come out of Washington. We have our marching orders with the budget that's been laid out. Congress is doing battle over the budget now as to whether or not to go along with it. Constellation Program is funded through fiscal year 2010, so they're not shutting anything down

right now. They're still pressing on, but the 2011 budget and beyond says no Constellation money, so Constellation is dead unless Congress turns that decision back around.

It's a terrible time. Our challenge is to keep our workforce focused on flying Shuttles and doing it safe, every flight has got to be as safe as the last one. The last flight has to be as safe as any of the flights. Keeping a workforce focused that knows the program is going to be over is tough, but I'll tell you everything we hear, you talk to these people, they are so dedicated to this program that they want to stay here right to the end, and they want to make sure that it's safe, so I think we'll be able to do it just fine.

WRIGHT: I know their dedication was shown returning the space program back to flight after [Space Shuttle] *Columbia* [accident, STS-107]. You were in a different role, you were no longer a civil servant. You were at USA when it happened. Can you share with us where you were when you learned about it and then what you did to help?

REEVES: Yes, that was when I was in Orbiter. Like I said, I was deputy APM or Associate Program Manager for Orbiter with USA. We had learned during the flight, from the imagery that a large piece of foam had struck the wing of the Orbiter. We looked at it, but we didn't have any test data or any history or anything to fall back on and say here's what kind of damage a piece of foam this big could do to the RCC, the reinforced carbon-carbon, leading edge of the wing, so we really didn't know what it could do to it. The feeling was that it couldn't hurt it too bad.

But we also knew that you couldn't tolerate any damage on entry. We worked it as best we could with the data we had, which was very little. There was just not much we could do.

And then the other part of the issue is even if you had known there was a gaping hole in the wing, there was nothing you could have done about it. The crew's fate and the fate of that vehicle was determined at liftoff, the minute that piece of foam came off going uphill, the script was written for the end of that flight.

I was at home on entry day. I didn't come in. I learned a long time ago if you don't have a specific role in what's going on in the Control Center, the last place you want to be is in the Control Center. Even though I was a manager, I had delegated the responsibility to Doug White, who was one of my managers in Orbiter. He was over there. I knew he was in the MER [Mission Evaluation Room]. He's perfectly capable of handling anything that comes up. I'm available by BlackBerry and telephone. It's just part of a manager's job to learn how to delegate, so I was at home. I didn't come in for the entry. I didn't come in for a lot of the entries, I still don't. Number one, having been a flight director and been in the Control Center, the last thing you want is lots of people in there that are extraneous and they don't have a role. It just makes the whole job harder. So I stayed home.

Doug White called me at home. This was just right after it broke up. He called me at home. "Bill," he said, "we just lost the vehicle and the crew."

I said, "You can't be serious."

He said, "Yeah." So that was tough. That was really tough. Of course I immediately went in, because I knew it was just going to be chaotic. I went in, and I went into the MER, the Mission Evaluation Room. Everybody was really down and wringing their hands and it was a pretty sad time. I remember going into a room with Ralph [R.] Roe, who was the NASA Orbiter Vehicle Manager, and Jim [James] Wilder, who was my boss, he was Associate Program Manager for Orbiter for USA, and me. There were several others of us in that room. We just

started talking about where does this go. We've got to start putting a plan together as to where we go.

So we started diagramming on the board. There's going to be a big investigation board. We're going to need this kind of expertise. We're going to need a panel to go look at this. We're going to need imagery experts to go collect all of the imagery that you can get and look at every camera view that you've got. We're going to have a test team. We're going to have various teams to go look at different things, so we started right then that day designing the architecture of the investigation team, if you will.

Then I guess it was a couple days later before we started having some meetings over at the Center with the program managers, and started trying to put some meat on the bones of the skeleton we'd created. Of course everybody was coming in with their own ideas of how to go do things. Finally got some structure put together for the investigation team, then we also knew that there was going to be a team required to go out in the field and collect as much of the vehicle as you could possibly get. What to do with the pieces, and how to reconstruct the vehicle, and see what you could learn from that.

That was an amazing effort. Amazing effort. Large contingent from KSC went up there. Some folks from here went up into the piney woods of East Texas and started setting up all the contacts with all of the different state and local governments and get their assistance and organize search parties and volunteers and get them all together and manage them. They just got help from everybody. Everybody wanted to help. There were people bringing in meals and drinks and water and stuff for the teams so that they wouldn't have to worry about that.

We had to have a plan for how to handle all the pieces you find, how to document them, how to package them, where to send them, how to ship them, get them back to the Cape, set up a building down at the Cape to start bringing the pieces in, start putting this thing together.

WRIGHT: Were you still a part of the team that helped design this? You said initially that day that there were three of you mapping it out. Were you still part of the team doing that?

REEVES: Yes, I was sitting in all the meetings over at JSC along with a cast of hundreds. There were managers from all over, from all of the different contractors, from NASA and all the different departments that were involved. They all had pieces of the problem. For Jim Wilder and myself, our main customer, our NASA government customer, was Ralph Roe, in the Vehicle Systems Office for Orbiter. So we basically were there to do what he wanted us to do and help him any way we could. We'd make suggestions to him and then he would direct us to go do what we did.

We actually figured out what had happened. Out of that is where we are today with inspections and repair techniques and improvements to the foam on the tank and redesign of a lot of the tank. The big piece of foam that came off came off of what was called the PAL ramp or protuberance air load ramp. It was a foam ramp to keep airflow off of some lines that run down the outside of the tank. It was through the analysis and work that SE&I along with our government counterparts did that convinced everybody that you don't even need this PAL ramp, so we took it off. None of the tanks that have flown since have this ramp even on there, so we decided if this foam wanted to come off so bad, just take it off. You don't need it.

We even found the original guys that designed it on there originally. They had legitimate reasons for thinking that they needed this on there, but a lot has to do with the technology that existed at the time. When they designed the tank back in the early days the technology they had for doing what today we call computational flow dynamics, CFD, where you understand airflow over surfaces and at different Mach numbers and different speeds, you do that with computers now. Back then you did it with wind tunnels and slide rules and calculators.

With the technology they had back then, they had determined to err on the side of being conservative and saying we don't quite understand this flutter phenomenon with these lines, so let's build a foam ramp here to block off the airflow and not have to worry about it. That was the logic they used, which was sound logic at the time, then it just turned out that you don't need it and the foam couldn't take the loads and it broke off.

To this day, you look at it and you think all of the things that had to line up to take that vehicle and crew out are just incredible. It had to be exact size piece of foam come off at the exact right time and it had to hit at exactly the right spot at exactly the right orientation. All that had to line up to cause that problem, but that's the way all accidents are. It's never one thing, it's always a whole series of things. You always go back to try to figure out where you can break the chain and stop it before an accident happens.

WRIGHT: There were a number of recommendations from the Columbia Accident Investigation Board that were pertaining directly to the Orbiter. Did you have any that were more challenging than others to implement?

REEVES: We implemented everything they told us to do. We wound up building the OBSS [Orbiter Boom Sensor System], which is the new short stubby arm or rigid arm for the other side of the payload bay that had a bunch of sensors on the end of it where you could take the robotic arm of the Shuttle and grapple that, and then you can inspect the bottom side of the Shuttle and the leading edge of the wings and the nose. All that had to be designed and integrated into the Shuttle.

We did a lot of work on eliminating every possible source of debris on the Shuttle itself. There're little ceramic plugs that go in holes where you bolt stuff down through the tile and then you have to plug the hole with a plug that can stand the heat. We had to do a lot of work on those things. Seals around the windows. The edges of thermal blankets. Redesigned a lot of that. The attach points. We were involved in a lot of the testing that was done over at Southwest Research over in San Antonio [Texas] where they had an air cannon over there and they shot unbelievable number of shots of different materials at both tile and RCC to build a damage map of what this material can and cannot tolerate. Out of that, the program developed a document that documents what is allowable and what isn't. That's what the whole program works to today, is trying to keep any debris that's released within acceptable tolerances.

You're always going to have something come off. It's pretty difficult to build a rocket this big and have it accelerate from zero to roughly 18,000 miles an hour in eight minutes and not expect something to come off somewhere. Your problem is making sure that whatever does come off doesn't come off in pieces big enough to hurt you, or at times or in places big enough to hurt you.

Then you have ground debris. We were involved in that investigation too, where as the main engines light up and then the exhaust goes in the flame pit, and then the solids light up and

it kicks up ground debris and it gets caught up in the recirculation of the exhaust plumes. Can any of that hit the vehicle before it clears the tower and gets far enough away where you can't hit it anymore? We had to do lots of analysis along that line.

This is just a difficult business. That's why some of this future stuff about the commercial industry getting in there I personally, and I'm not alone, worry about—I don't think they know what they don't know. Because of the years of experience that we've had to work our way through and lost a few crews in that learning process and vehicles. They're going to also. They're going to have their growing pains. This is not easy. This is not an easy business.

WRIGHT: Did you have any issues transitioning from a longtime civil servant to a contractor employee?

REEVES: Actually no I didn't. I was surprised. Of course my whole life as a civil servant, including the first day I walked on the job until the last day when I left, you're working arm in arm with [contractors]. It is truly a badgeless community. You hardly know the difference. When I went over to the contractor side, I did learn some things that I wish I had known when I was a civil servant. I was so naive as a civil servant. I had power as a civil servant I didn't know I had, until I got on the contractor side and found out how subservient you were to the civil service side. I didn't realize it when I was on the civil service side, but it's a team thing. Everybody's trying to get to the same goal line. I have never ever in my nine years now with a contractor, I have never had anybody say don't do that because it affects the profit of the company or something like that, or don't do what the government is asking us to do because

that's against our bottom line. Those kinds of conversations have never taken place. I'm glad to see that. It's all about accomplishing what we're trying to accomplish the best way we can.

NASA on the civil service side has limitations. They can only have a certain number of civil servants. You can only be so big. You can only have so much expertise. The government has to rely on the contractor community and the expertise that the contractor community has. It has to be a joint effort. The government can't do it alone.

Now the pendulum is swinging in the direction of can the contractors do it alone, can the commercial sector do it by themselves. Well, maybe they can. Maybe it's time to do that. I was philosophizing the other day with a couple people. I told them when you think back to Charles Lindbergh, Charles Lindbergh's flight across the ocean was a privately funded venture. It wasn't government-sponsored, it was privately funded. There was a government prize, just like today there's a government prize for launching vehicles, which back then was I think $25,000 or something like that, which was a lot of money. But the venture that he did was privately funded. What that did was it proved a concept. It proved that humans could fly across the ocean, and it was within our capability.

Then from that people started saying well, goodness gracious, there's all kinds of things you can do with this. You can fly people. You can [fly] mail. So out of that developed a complete industry, and we have what we have today.

NASA has proven all of the concepts for spaceflight, especially for low Earth orbit, even going to the Moon. Maybe it is time for the commercial sector to step up to the plate and do it. The thing that's missing is the profit motive for the commercial sector. Here in the beginning a big part of the customer for the commercial sector is going to be the government, but sooner or later the commercial—and you see it now some. Ariane has been successful in launching

commercial satellites for commercial satellite companies and commercial communications companies. The Russians have launched commercial stuff, so it's a fledgling industry but it's off and running.

Exploration, to do that commercially, or scientific research on orbit in a space station, there's a lack of what's in it for me for the commercial sector. Where's the return on the investment? That's the difficult part.

WRIGHT: So you don't see yourself venturing off to another adventure.

REEVES: Well, never say never.

WRIGHT: You may end up working a little bit more retirement on this one.

REEVES: Well, you never say never. My entire life has been dedicated to the space program. I still own a piece of it. If there's anything I could do to influence or help in the future I would probably have trouble saying no to something. I would like to have a little longer than a weekend off for retirement, just to do a few things, before I get too old to do it.

WRIGHT: Looking back on all the years that you spent with the space agency, is there one in particular time or something you consider to be your greatest contribution?

REEVES: Oh my goodness. At a personal level I've contributed—if you talk about self-actualization and self-satisfaction—I've contributed to me so much in different areas. Maybe

nobody else recognizes it, but I don't care. It makes me feel good. I was a small piece of the Apollo Program and landing humans on the Moon. My experiences in flying in the high-altitude airplanes, I contributed a great deal to the development of a lot of the scientific capabilities we have today for studying weather and crops and land surveys, because we developed a lot of those techniques, even the sensors that are still used today, and proved a lot of concepts.

Shuttle, involvement in Shuttle from the get-go. The development of the robotic arm, I was a major player in that. At least I consider myself a major player in it. The involvement with the Russians. I even wrote myself a note on my first trip over there. I remember sitting on the airplane going over there. I thought here you are, a kid that grew up in Arkansas, never went anywhere, never did anything. Now here you were on an airplane going over to what used to be our bitter enemies to help establish future relations in the human spaceflight program. I thought this is pretty mind-boggling, so that's a lot to take, but anyway, that contribution, big contribution, and helped lay a lot of the groundwork for Space Station that we've got today.

What I'm still waiting to see, and what I would be most happy with now, is to see some major discovery from Space Station. That's missing right now. We've got the laboratory built. We've got the laboratory staffed. Let's see some results. That would make it complete, it would complete the circle.

WRIGHT: Well, we hope to hear that soon. In the meantime we'll keep you busy.

REEVES: I don't think I'll live long enough to help get us back on the Moon or Mars, but I sure would like to see Station produce something.

WRIGHT: Before we close today, I was going to ask Jennifer, did you have any questions that you thought of to ask Bill?

ROSS-NAZZAL: I was curious. I didn't get to sit in on the interview where you talked about the arm. How closely were you working with people from the '78 class who had that assignment like Sally [K.] Ride and John [M.] Fabian? Stopped here. 1:30:10

REEVES: Oh, I was right there with them. John Fabian and Sally Ride were the first two astronauts that were assigned to that project that I remember. They got involved about the same time I did. In fact John Fabian may have been a little bit ahead of me and started working with the Canadians before I got involved with the program, but I remember working with Sally quite extensively, and Judy [Judith A.] Resnik. We did a lot of work together on the arm. They were the pioneers. They were the first crew folks.

ROSS-NAZZAL: What was it like? Had you had much contact with other professional women before you had a chance to work with Judy and Sally?

REEVES: Oh yes, over the years. In fact when I was flying in the high-altitude aircraft out at Ellington [Air Force Base, Houston, Texas] during the '70s, toward the end of my time out there in the late '70s, George [W. S.] Abbey wanted to get some of the new women astronauts, and new astronauts, some experience in the pressure suits and flying high altitude, so Kathy [Katherine D.] Sullivan came out there. We trained her and got her into the airplane. That's where I first met her and got to know her, and then wound up working with her on the Hubble

[Space Telescope] deploy mission where she was one of the crew members. Kathy is great. In fact I saw her not long ago. I hadn't seen her in a long time. I worked with Judy Resnik. We were dear friends, and I knew Sally really well. I worked with a lot of the managers and engineers over in the Program Office and MOD.

ROSS-NAZZAL: How long in advance had you been working on the Hubble deploy mission? You mentioned that you were the lead flight director for that flight.

REEVES: Well, when you go into the Flight Director's Office—and I got selected in '83—the first year you spend in a training program where you're learning everything about everything. Then after your first year of training toward the end of that year as part of your training you start sitting sidesaddle with some of the other flight directors on missions. Then your first assignment, at least back then, I don't know how they do it now, but your first assignment for a shift, one of the eight-hour shifts to manage the Control Center and the ops [operations] team, is the planning shift, which is while the crew is asleep. Instead of one of the high-activity periods while the crew is awake when everything's happening, they put the new people on the planning shift, which turns out to be where most of the work is done, on the planning shift planning the activities for the next day and all the changes. It's a very busy time, but at least you can focus on the plan and not have to deal with the crew awake and changes as they're happening real-time, so that's probably a good plan.

After you do that, you serve a few flights pulling shifts as a flight director, and you've earned your wings, if you will, then they assign you a lead job. Every flight has a lead flight director who is the single point of contact for operationally integrating the flight. It's the single

point of contact with the commander and the crew and the Program Office to pull the operational part of the flight together.

I got assigned to Hubble probably around late ’84, early ’85, somewhere around there was when I was told that I was going to be lead on the Hubble deploy mission, start getting familiar with Hubble. At that time Hubble was supposed to fly in around 1987 or somewhere around there. Usually you get assigned a lead job about a year and a half to two years before the flight. A year and a half I would say roughly, so Hubble was supposed to fly around ’86ish, ’87ish.

But then *Challenger* happened and everything got put on hold for about a year and a half, then Hubble started having problems. There were some redesign issues. It kept bumping down the road, so it was 1990 before we actually flew it, so I’d actually been working on it for five years. In fact I said in the earlier interview that it was during that downtime for *Challenger* that Bruce McCandless [II] and Kathy Sullivan were the two EVA crew members on the deploy mission. They spent a lot of time out on the west coast where the telescope was built, and influenced design changes on that vehicle that had they not done that the servicing missions would have never happened the way they happened. They forced changes to the design based on their experience. They were major contributors to the success of the telescope. To me, they never got their just desserts.

ROSS-NAZZAL: It’s interesting you mention that. We’ve done a series of interviews with Kathy, and we’re going to write an article with her about that mission and her role with Bruce McCandless working out there in California.

REEVES: They would go in there and they would tell them all these clearances are too tight. You've got to open this up, or these latches, it'll never work this way. You [have] to change these latches. It was just that kind of stuff all the time. They took ownership of that telescope and they made them make it like it ought to be made and did a great job. Great job.

ROSS-NAZZAL: I just have one other question for you. That's Charlie [Charles F.] Bolden [Jr.] was on that flight.

REEVES: Yes. Charlie was on that flight. That's where I first got to know Charlie, one of the best human beings on the planet. Charlie is just a great guy, a great guy to work with. Interesting to see how things happen. Now he's the [NASA] Administrator. I saw him about two or three FRRs [Flight Readiness Review] ago. The first joint FRR we had down at the Cape after he got named Administrator, I bumped into him in the hallway. I was kidding him about you've really done it now.

WRIGHT: He's a big-time commander now.

REEVES: Yes, he's got his hands full, that's for sure. I'd be more than happy to help Charlie any way I could. All he's got to do is call or ask.

WRIGHT: I'm sure he'd be glad to know that.

REEVES: Well, I already told him that.

WRIGHT: That's good. Is there anything else that you'd like to add? Is there anything that we didn't get to cover that you thought about?

REEVES: Gosh, I can't think of anything. I've pretty much told you my whole life or all that I'm going to tell you.

WRIGHT: [Share with us] what you're doing to help prepare the Shuttle [for retirement].

REEVES: Yes. Our main focus is flying the program out. I have a deputy, Bill Hollister. I basically divided the work with him. I said because of my experience, I've been in the Shuttle Program forever, I will focus mostly on trying to fly the Shuttles out. I've split the workload with him to start focusing on the future, because he will be here in the future and I won't be. He's working the new business aspects and trying to figure out what new businesses we can get into and how we can evolve into future work, so that's how we're preparing. It's going to be tough. We've told all of our people that there's a cliff out there. When the program ends, a bunch of people are going to fall off the cliff, because right now we don't have the work. Until contracts get put in place, that's the thing you learn on the contractor side real fast, is no contract, no work.

WRIGHT: No funding. That's right.

REEVES: That takes time. Takes a long time. That's the scariest part of this whole upheaval, is the timing. They waited so late from the time this Administration started to pick an Administrator, then to come out with what they wanted to do with NASA. They waited so late now that there's so little time between now and the end of the program and the end of this fiscal year, there's not enough time to get redirected and get new contracts in place. So there's going to be a big disruption in the agency.

WRIGHT: A lot of challenges before you move on to your next adventure.

REEVES: There's a simple solution, but I don't know that anybody'll do it.

WRIGHT: Do you want to share that with us?

REEVES: My answer is to stretch the current Shuttle manifest out. It would be real easy to do, just to keep the workforce in place, and keep the expertise in place, before you lose it. It would be a pretty simple matter to stretch the manifest out for like another year and buy the time you need to get this new vision focused and get contracts in place. It could be done with the stroke of a pen by just extending the current contracts. There's mechanisms already in the contracts to do that. If I was king for a day that's what I'd do.

WRIGHT: Well, we'll watch for that.

REEVES: But I'm not king.

WRIGHT: Yes, but as you mentioned, you've had really good fate, so you just never know what's going to come around the next turn.

REEVES: Never know. Never know. Yes, it's true.

WRIGHT: Well, thank you so much for coming in as often as you have.

REEVES: Glad to do it.

[End of interview]