NASA HEADQUARTERS ORAL HISTORY PROJECT
ORAL HISTORY TRANSCRIPT

CHARLES F. BOLDEN
INTERVIEWED BY REBECCA WRIGHT
WASHINGTON, DC – MARCH 18, 2016

WRIGHT: Today is March 18, 2016. This oral history session is being conducted with NASA Administrator [Charles F.] Charlie Bolden in Washington, DC, for the NASA Headquarters Oral History Project. Interviewer is Rebecca Wright, assisted by Sandra Johnson. We want to thank you once again for finding time on your very busy schedule to talk to us.

BOLDEN: Thank you all for doing it. This is really important.

WRIGHT: Thank you, we really have enjoyed meeting with you. Earlier this week you attended a meeting with the Senate Appropriations Commerce, Justice, Science Subcommittee for a NASA budget hearing for FY 2017. Attending also was longtime senator and longtime friend Senator Barbara [A.] Mikulski. She's retiring, and this was her last NASA budget hearing. How has her support through the years impacted this Agency?

BOLDEN: The date was actually [March] 10th. I'll tell you—she has had an incredible impact on the Agency itself, but particularly in the area of science. She and former Senator [Charles M.] Mathias, they *are* the Hubble Space Telescope. Hubble would not be what it is today were it not for Senator Mikulski.

I think you all may know because even after I had left NASA and retired from the U.S. Marine Corps, I got an opportunity to come back to lead the independent review board for the final Hubble servicing mission. That would not have occurred had it not been for Senator Mikulski rejecting the decision by one of my predecessors, Sean O'Keefe, not to fly a servicing mission. She didn't say, "Do it," but she challenged the National Academy [National Academies of Science, Engineering, Medicine] to put together a study, and I had a chance to serve on that. She didn't know what the answer was going to be, but she was convinced that if reasonable people looked at it, then the answer would probably be good, and it was.

One of the first things that happened to me as the NASA Administrator, during the first few months, we were looking at the data on the James Webb Space Telescope [JWST] that was scheduled for launch in 2014. We determined that we were in real trouble. It was probably worse than Constellation as a matter of fact. We were way over budget; we were not going to launch in 2014—that was out of the question. We were not going to be able to do it at the amount that was budgeted.

We put together an independent study team, and they came back in and made recommendations as to what we should do. We took that to Senator Mikulski. Boy, let me tell you, we got royally chewed out, but in the end she said, "Okay, this is really important to the nation, but this has got to be right. You can't come back in here again. I won't even bring you in, as much as I know that JWST is important. I won't support it anymore if you don't do it right this time." We did. We went back in with a revised budget request, a new launch date of 2018. It was satisfactory to her.

Today the team has a seven-and-a-half-month cost and schedule reserve. I brought the project into the Office of the Administrator and said, "This is going to be mine" with [Christopher

J.] Chris Scolese out at Goddard [Space Flight Center] and Robert [M.] Lightfoot [Jr.] here. You don't have very much more senior leadership looking at it than the three of us. It's going very well, and I feel really good about being able to make sure that when the Senator leaves, she'll be able to look back on that and say, "I did that."

She's been great. Just great. She asked me to come over a half hour early before we had the budget meeting. It's usually for her to chew me out so that she doesn't have to do it in the public hearing. But, this time, it was phenomenal—we sat there and talked about the times we'd had. I got emotional, just like I'm doing now, because for both of us this is our last swing through NASA. She really was like a real friend. I had shared a lot of my experiences in NASA being a Hubble guy with her, it was really special. Just talking about what she wants to do in the future. It was great.

WRIGHT: That leads me to the next question because noted during that hearing was a comment from you that that hearing might be your last time you sat before that Subcommittee.

BOLDEN: I did.

WRIGHT: If that is the case, share with us what you'd like to accomplish before you move on to your next adventure.

BOLDEN: A lot. We have I don't know how many months left; I don't even count them really. But before I walk out the door, I really want to make sure that we are still on track to fly the test flights for SpaceX and Boeing's [commercial] crew vehicles. Unfortunately, we won't get it done

before I'm out of here, but it will happen next year right after I leave. I'll know by the time I walk out whether or not we're going to be able to make what we say. Right now, we're pretty much on track to do that. That'll be really important. I'll feel really good if we're still on track when I walk out.

We'll be really close to James Webb [JWST] that I just talked about. [Space Launch System] SLS and Orion will be well down the road; we will be within two years of flying the first flights on SLS and Orion. I can go down to the Kennedy Space Center [Florida] now and look at the transformation that [Center Director Robert D.] Bob Cabana and his team have done there to convert it to a multiuser spaceport where we have NASA, private industry, the DoD—all working together at the Kennedy-Cape Canaveral complex. It is in fact what people envisioned a long time ago. That's going to be really good.

Perhaps the thing that I'm going to enjoy the most is being able to see—provided we get funded at the level that the President requested for aeronautics—it's just going to be incredible to see that NASA is working again to produce X-planes, experimental airplanes. Some flight demonstrators for things that are really critical to the nation both from an economic and a strategic perspective. We worked on that really hard for the past six years and we finally managed to get some significant funds in the budget. We've got the whole aviation community supporting us – industry and particularly colleges and universities, because they now see a way to bring students back into the campus who want to be aeronautical engineers. People who want to work in the field of aeronautics.

It was getting pretty grim for a while because the nation just wasn't spending very much money on aeronautics research and development. We're now going to have an opportunity to do that. As a pilot, that'll be one of the biggest thrills for me is to walk out and see that we're actually

talking with industry, talking with Lockheed [Martin Aerospace Company], because Lockheed is going to build the first demonstrator of a quiet supersonic aircraft. That'll be really important. I could go on and on and on, but there's a lot of work left to be done.

WRIGHT: Not enough days to get it all done.

BOLDEN: Not enough days in which to do them all. When I walk out, I'll probably give somebody a list of stuff titled, "I really did want to get this done but I failed. I didn't get to."

WRIGHT: Former Johnson Space Center Director [Michael L.] Mike Coats gives you credit for saving the nation's human space exploration program.

BOLDEN: Time will tell.

WRIGHT: He believes your first years as Administrator were full of working behind the scenes, and not giving up, and arguing to redefine Orion and SLS. Would you agree with that? If so, how do you hope those programs will evolve in the next years? What do you think that NASA has already learned from those programs?

BOLDEN: Mike is right, but it wasn't just me—it was Mike, me, it was the whole leadership team really trying to work with the administration more than anybody else. We had full support from the Congress, but it was just the thinking in the administration at that time was—everybody had the "New Space" mentality—that was that NASA should actually get out of the spaceflight

business and turn it over to civilians, to entrepreneurs and industry. "Don't worry about it, they'll take care of it. They can do it much cheaper than NASA can, much more efficiently. NASA should go off and do other things like write grants," we were told.

I think the biggest thing they wanted us to do was to fund and develop a new rocket engine to replace the Russian RD-180. Like Mike says, we all quietly went off and worked everywhere we could with people. Finally, actually we got the President [Barack H. Obama] to lead the charge. As he said, "This is my responsibility. I'm the one that accepted the recommendation to terminate Constellation and fly out the Shuttle. I need to go and talk to people and explain why I did it and what we're going to do."

He went down to the Kennedy Space Center and gave what I tell people all the time a major space policy address. This was April 15, 2010, and he said, "By 2025 NASA is going to send humans to interact with an asteroid and in the 2030s we're going to Mars. Not just to go but to stay, because we're going to continue to expand human presence in the solar system." That was critical, because once we got the President to vocalize that, then people around him in the White House could no longer say, "But the President doesn't want to do this." When the President says, "I want to do this," then the argument is over.

That was what we went through for the first year and a half. Everybody saying, "No, the President doesn't want to do that, here's what the President wants to do." I knew that wasn't true based on my 20-minute conversation with the President when I came up here to talk to him about NASA prior to him deciding that he was going to recommend me to be the NASA Administrator. In that period of time, it was obvious he was passionate about STEM [science, technology, engineering, mathematics] education. He was passionate about human spaceflight and

exploration. It just didn't make any sense that all of a sudden he would change his mind and decide that NASA should go away somewhere.

WRIGHT: Every day for you can be an exciting one.

BOLDEN: Every day *is* an exciting one, not *can* be.

WRIGHT: But what befuddles most of us is how you have managed to not only balance but advance every part of NASA's portfolio—the aeronautics, the science, exploration, technology. We'd like for you to explain how do you manage to move all these forward and not leave something behind?

BOLDEN: For me I think the reason I have met some success in doing that is that I don't have a part of it that I consider to be mine. If you look at [former NASA Administrator Michael] Mike Griffin, human spaceflight was Mike's; the design of every vehicle in Constellation—he was the Chief Engineer.

One, I'm not that smart. But I pride myself on being able to try to be a leader to people. I'm what they call a participatory leader. I really like to push things down to the lowest level possible for decisions. I was blessed to have Chris Scolese up here first as the AA [Associate Administrator], and now it's unbelievable having Robert Lightfoot as the Associate Administrator; then Dava [Newman, PhD] came in as the Deputy [Administrator], it was like magic—now all I need to do is go out and be the face and voice of NASA to the outside world.

I can talk about our four major mission areas. I can put emphasis on aeronautics on one day and human spaceflight the next day, because I'm not here in the trenches trying to do [Human

Explorations and Operations Associate Administrator, William H.] Bill Gerstenmaier's job. As the Chief Operating Officer for the Agency, Robert Lightfoot looks at the day-to-day operations of what's going on from people to programs. He and I talk all the time. He and Dava and I talk. We meet one way or another every morning, whether it's in a big meeting with others like with the Chief Financial Officer and the General Counsel and the public affairs and legislative affairs—we do that on Tuesdays and Thursdays. Monday, Wednesday, and Friday—it's a very small group of the Administrator, Deputy, AA, Deputy AA, the Chief Financial Officer, and the Chief of Staff. We just talk about where we are and what we should be doing.

Then I've got [Michael] Mike French, the Chief of Staff, who is an attorney. There's one thing about attorneys that I have learned. Attorneys are incredibly smart people who can just absorb information. They don't have to know anything about what they're absorbing; they don't need to understand it or anything. They just have a way of grasping it and saying, "Okay, here's what I think you just said you want to do." That's what Mike French does. He works with public affairs, he works with legislative affairs, and the directorates, and says, "Okay, Charlie wants to push aeronautics this week." Two weeks ago, we were at Reagan [Washington] National Airport having a press conference on the aeronautics budget part; just the aeronautics part of the budget, which for me was really fun as a pilot.

Other times we'll say, "Okay, we really want to push the science missions. We want to talk about outer planets. We want to talk about Earth Science." We had what we call the Year of Earth in 2014. We launched five Earth Science missions in one 12-month period of time. That was unprecedented. I didn't have anything to do with that except pushing it and being the voice of the Agency to do it. Then human spaceflight keeps you going all the time. Bill Gerstenmaier is absolutely incredible. He's the guy that has so many balls up, all in the air all the time.

The way I've been able to do it is because I don't get into their knickers, I don't tell them how to run their programs. I ask questions when I think they need to be asked, particularly questions about safety, things like that, because I think that's where I need to keep my focus. For me it's just fun.

WRIGHT: What are you hoping that they'll learn from your leadership and your management style that they'll be able to take and use for their leadership and management style after you leave?

BOLDEN: If there's nothing else that the leadership of the Agency does, my hope is that they'll gain confidence that they don't have to do everything, that at every level they can push decisions down one level lower. It makes no difference how far down in the organization we go. We can get decision making pushed down one more level. That's one thing.

The other thing is the critical importance of knowing your people and caring for them. I talk to them all the time. I say, "You take care of your people, and they'll take care of you. If you're worried about you and your career, your trajectory, you're in the wrong business. You're just not going to be very successful. You'll leave bodies strewn behind you. You'll come out and you'll be able to say, 'I did this,' but the bodies lying behind you, there won't be anything to do down the road." That's the second thing—just getting people to understand that they really need to take care of the people.

The third thing, and these are not necessarily in order of importance, is the critical importance of diversity and inclusion in the Agency. They are two big words. Everybody thinks about diversity. Diversity is numbers. That's the law. The law says we have to have X percent of this and all that. But I think the most important part is the inclusion part where after we select

them and bring them in, women, minorities, and everybody feels comfortable that they can give their opinion, and right, wrong, indifferent, they get a voice. People consider it and discuss it. In the end they feel like their position has been heard. They will know, "I may not have convinced them that my position was right, but I can't question the fact that I was allowed to give my opinion." Those are the key things that I would like to do.

I think that's why we're the number one place to work in the government, because when you talk about empowerment and employee engagement, from Robert, Dava, and me, we have pushed it down over and over and over again to our subordinates and then told them to do the same thing with their subordinates, to take care of your people. Then don't worry about the other stuff. Those are things I hope they will continue to do. That would be great. If I could come back in 10 years and not even recognize that I left because it seems like I'm still here, that would be awesome.

WRIGHT: That would be. You have been around for a while, and human spaceflight exploration has changed from your first days with the space program. Shuttle is gone. Station is built. Commercial companies are delivering cargo to space and building transports for future crews. We are working daily with Russians. What if any of these has been the most surprising or maybe even most rewarding?

BOLDEN: All have been rewarding. One that's been surprising to me—I was in the Astronaut Office as a Shuttle guy, when we first started talking about space stations, not an International Space Station but just space stations in general. As the Program matured and we started looking at how we were going to do this configuration, even before we got to the very complex International Space Station, when we were talking about Space Station Freedom and the truss

structure that [Robert F.] Bob Thompson talks about all the time, they were going to be very EVA-intensive.

Our experience at that time in the Astronaut Office was that that's really challenging. I don't think there were any of us except maybe [F.] Story Musgrave or some of the guys that just thought you could do everything with EVA. Most of us didn't think we could get it done. We just thought that in time the human body wouldn't be able to do it. The systems would not be able, they wouldn't be resilient enough to go out and do eight-hour EVAs several times on a flight, like we did over the course of 10 years of building the International Space Station.

A proving point for us, believe it or not, was STS-125 which was the Hubble [HST] SM4. The final Hubble servicing mission, when we had no confidence—maybe John [M.] Grunsfeld did—we had no confidence that we could accomplish all five spacewalks that were scheduled for that mission in the time allotted for it. It was too intense. It was too demanding on the crew and the equipment, like expecting that the suits were going to survive.

During the last few weeks leading up to the mission, I was chairing the independent review board. We spent a lot of time working with NASA saying, "We really need to work on our communication strategy because we're going to have to explain to the American public and the world why this was still a very successful flight although we only accomplished three successful EVAs, maybe if we're lucky four." That was the way we went into the flight. We were not at all, not anybody I talked to, we were not at all optimistic that we would get everything done.

And yet the crew went out and the very first outing—I don't know whether that was when [Michael J.] Mike Massimino had to break the handle (to the HST science instrument compartment) off—but things went wrong on the very first EVA. They worked through them and got through everything that day.

Then just in rapid succession day after day after day, which we had never done before, they got all five EVAs done, accomplished everything they wanted to do on that mission. For the people waiting in the wings and watching Space Station, I think a lot of them said, "Wow, maybe we really can do this thing. It's going to be hard. But nobody believed they could do that."

When we lost the *Columbia* and her crew, I wasn't here then. But I was on the ASAP, on the Aerospace Safety Advisory Panel. I heard the leadership say, "Okay, we don't even know if we [NASA] are going to survive. This is now the second accident." That was what led Sean [O'Keefe] to say no on the final Hubble servicing mission.

But a critical decision was made and that was that we got to finish Station. We've got to start flying as quickly as we can We're going to turn to the Russians in a different way; we are going to make them our primary source of transportation for crews to Station. Shuttle is not going to be used for transporting crews. Whenever we start flying shuttle again, we'll rely on the Russian Soyuz to get our ISS crews up and dedicate the shuttle to get the maintenance crews, the construction crews to the Station.

I think every mission was a seven-person crew with usually at least four if not five mission specialists dedicated to EVA. They did it and we managed to finish Station. We probably would not have done it had it not been for the—it's horrible to say—but I think had it not been for the *Columbia* accident we definitely would not have finished Station in the 10 years that we did. It gave us a definite goal, an end point.

Then when President Obama came in, man, now, really a definite end point because he said, "Okay, enough is enough. Back in 2004 the President [George W. Bush] said we're going to retire Shuttle. The [*Columbia*] Accident Investigation Board said you need to retire Shuttle. We're going to retire Shuttle. We're going to invest in American industry."

Those were really hard decisions, but again that's what the President said to do. I agreed, and that was very difficult for me, I mean it was emotional for me. I was a wreck until I got home from the Cape [Canaveral] after the landing of [STS] 135 – the final shuttle mission. It was like losing a child or something. In spite of the fact that I was devastated I knew that I couldn't possibly sit back and mope because if I did it, there was no hope that the Agency was going to push through.

We had again some absolutely incredible people with that last flight. [There were two leaders for STS-135 – both women – Angie Brewer, NASA Flow Director for Orbiter 104 *Atlantis* and Roberta Wyrick, USA Flow Manager for the vehicle and mission, who were exemplary in the manner in which they led and cared for their teams in preparing *Atlantis* for flight and recovering it after landing and getting it prepared for permanent display in the Kennedy Space Center Visitors' Center *Atlantis* Pavilion.] They nursed the team through while getting *Atlantis* ready to fly. We were sending people home at every step. Somebody finished their work on tile, and that was it; their job was done. We did not have one hiccup in terms of morale, safety, anything. That was because of the two of them. They were down in the chain of command. They were not center directors or program managers or any of that, but they just took it upon themselves to build this family if you will and said, "Hey, we got a job to do."

When *Atlantis* came back, I think everybody would tell you it was the cleanest vehicle we had ever seen over the whole 135 flights of the Space Shuttle Program. It was immaculate in terms of damage to the tile and stuff like that, because they had wanted to send it out and have it be the best flight in the history of the Space Shuttle Program, and they did. A lot of things happened for which we all should be very proud.

WRIGHT: I believe we have touched on a little bit every time that we've talked with you, but if you would, share with us your thoughts about the significance of the international community working with the Station and the impact it is having. For example, several months ago a leading television show on Sunday night, *Madam Secretary*, [Season 2, Episode 11, "Unity Node] included a scenario of an International Space Station crisis, where the crew worked together to save each other, and world leaders used the scenario as an example to how to work on Earth. I thought, wow, they're using NASA as an example for problem solving.

BOLDEN: I love it. I'm glad you watched that. I do not miss it. It's almost like the writers sit around and watch the events of the week and whenever they film it, go off and write the script, so that they can cover what just happened this past week.

WRIGHT: It was so nice to see NASA included in such a positive situation. It was a NASA catastrophe in a sense, but what was important was how it was handled, what happened, and how they did that. Could you talk—

BOLDEN: I could talk forever, but I won't.

WRIGHT: —about the significance of being able to have an international cohesive group and how you want to keep that Program going.

BOLDEN: One of my complaints since forever, but really I've said it verbally, vocally, publicly, a lot of times since becoming the NASA Administrator, is that what this nation needs is a public dialogue, a public discussion on human spaceflight. Is it valuable? Is it worth it?

When I was up here in 1992, '93 working for [former NASA Administrator Daniel S.] Dan Goldin, we held a series of six town hall meetings. We traveled around the country. Dan was a big visionary; I can't say much more about him but the fact that he was a visionary. One of my jobs was to put together these town hall meetings. We went to key places around the country to listen to the American public. We heard several things loud and clear. One was human spaceflight is absolutely incredible and absolutely essential. They talked about the science programs. People talked about aeronautics, but not a lot, because I don't think most people knew we were doing aeronautics, but it was a lesson in the value of human spaceflight to the American public.

We have not had that discussion since then. Productions such as *Madam Secretary*, *The Martian*, a lot of the space movies of late, even *Star Trek* and *Star Wars*, those things, they have caused people to start at least talking about—not in a formal manner but talking about space and space exploration. I get questions everywhere I go about *The Martian*. Is it real? I talk about going to our Web site and go to the little drop-down on the real Martians. I said, "It [the movie] is real, except for the dust storm, which couldn't have happened." You have to have a way to get into the story, but I said, "You can go to our Website, and you can see real live NASA employees who today are doing the same things that prepared [the movie character] Mark Watney to survive on Mars." I said, "It's not science fiction, it is real, and we're doing this."

I think we still need to have the public dialogue. I would love for one of these presidential debates to say, "Okay, we're not going to spend the whole time on space, but we are going to dedicate 15 minutes ~~to~~ of this two-hour debate, and we're going to talk about things that we never

talked about before, and one of them is going to be space and America's place in the world in terms of using space for science, technology, engineering, and is human spaceflight worth it." Let's see what the presidential candidates say and what kind of response that would get from the general public.

I just think we've been blessed. It has not been anything that we made happen, but we've been very fortunate that productions like *Madam Secretary* and *The Martian* and all that have come up, really call attention to what we are doing. And both these shows included working with China for a solution. We don't talk about it a lot publicly, because people just go apoplectic because we're under this congressional prohibition about bilateral activities with China in human spaceflight. I try to tell people every time I go out that I understand what the law is, and we comply with the law, but we still have China as a partner in a lot of our work that we do in science particularly. We're getting ready to do something in aeronautics next year, next summer. One of these days we'll get there in human spaceflight.

We keep the Congress in the loop and tell them what we're doing. They have softened their position significantly. I think China will be an important player. We'd love to see something along the lines of what we did with the Soviets in Apollo-Soyuz [Test Project, 1975]. Love to see us do some confidence-building flights if you will or activities with the Chinese Space Agency in terms of human spaceflight. I think that'll come.

You asked me earlier what was I most proud of? The fact that I didn't give up in terms of our relationship with China, because today if we're serious about going to Mars, the U.S. cannot do it by themselves. It is going to be an international effort. Just like on the Space Station, we may carry most of the load, because we always do, but other countries are going to contribute very

valuable things that we need. It may just be support from their populace that says, "Hey, this is really great."

People will get out and stand in front of windows of stores and watch the crew launch to Mars, just like they did during Apollo. No other nation in the world participated in Apollo, but everybody around the world thought that was their Program. When we landed on the Moon, we did it, but everybody else in the world said, "We did it," meaning all of us. I think human spaceflight and exploration is still doing the same thing.

WRIGHT: I'm going to hook back onto your comment about the presidential candidates, because the space industry coalition, 13 organizations, circulated a white paper recently, emphasizing the need for America to be a leader in space. What I found interesting was they included in the materials how this is a "$330 billion global industry that impacts national security, communication networks, and of course the understanding of our planet." One of those simple messages included was for the candidate to think nationally, not locally. Is there a way to convey that message to Congress that it's a national program and not just as a local jobs program?

BOLDEN: I tell my committees all the time, my congressional committees, that while it may seem strange, I actually enjoy going over [to Capitol Hill] for hearings. They do look at me strange. I said, "It's the only time that we come anywhere close to a national dialogue on space." My last three hearings, one with the Senate last week and then the two with the House this week, they got pretty broad coverage around the country, because I've heard from a lot of people. When you say, "What can we do? What can I do?" The NASA Administrator has got to be out looking for forums in which to present our story.

I don't know if you've ever heard Joe Madison [the "Black Eagle"]. [Joseph] Joe Madison is a black radio personality. He's infamous. He has one of the largest black audiences, probably one of the largest audiences in radio. He's on [XM] Sirius now. He has a national show that comes on in the morning. You'll see him on CNN, MSN, all those types of television networks. He was the head of the NAACP when he was 24 years old in Detroit and ran Detroit's NAACP for a long time.

When people start having questions about civil rights and race relations issues, generally Joe Madison is one of the people they call. This is the second time he's had me on the show [March 18, 2016]. We talk a little bit about space. We talk a lot about race and about diversity, but for that audience, it is an international audience, to be quite honest. We've got to do much more of that.

That's the job that I count on center directors and folk up here at Headquarters to do while the workforce really keeps their head down and keeps doing all the great stuff they do.

WRIGHT: Moving towards completing Agency goals and helping them to be successful is challenging enough on a daily basis. But sometimes you have conflicting and changing mandates, budgets, and directives from Congress and the White House, which can be an added component. There have been discussions to form an organization that would make NASA less political and supposedly help ensure stability across these presidential administrations and Congress. It's referred to as the Space Leadership Act. Now that you have spent time in this Office and you've also spent so many years in the Agency, do you feel you have pros and cons on how that would—

BOLDEN: I have a definite opinion, and it's all con. It has one purpose, and that's to get the President—and unfortunately, it's to get President Obama—out of the sphere of influence for the space program and to put all the power in Congress. John [A.] Culberson from Houston is the author, who is a good friend, by the way. He and I have had this discussion. He's not happy with my position because he would love to have the NASA Administrator say he thinks it's a good idea for the NASA Administrator to serve 10 years. I will have been here for a little bit more than seven years when I leave. That's a long time in this job.

I think you ought to stay, provided you're doing a service, and the President is happy with you, then you ought to stay as long as you can take it. But the one good thing I like is when people ask me about leaving, "Well, wouldn't you think about staying?" I said, "No way," because I am really enjoying myself.

You asked me earlier about things I want to accomplish. I recognize the fact that when I walk out the door, I won't see most of the things that we've actually worked on; they have not occurred yet. But I will be probably the happiest person in the world because I'll know that every single day I came to work was a really exciting day. I was looking forward to it. I never got to the point hopefully—there's still a lot of time left—but I hope I will never get to the point that I say, "Man, I'll be so glad when this is done." It was like that when I worked up here in '92, '93. My wife and my daughter literally had to put me on the airplane to come back up here the last time I left. It was a very unpleasant place to be. I didn't like what I was being asked to do. We were not oriented toward people. It was just miserable here. For my last few months up here all I could do was wait until my detail was done so I could get back to JSC. I don't think any NASA Administrator should be put in a position where they're having to go in and say, "Look, I can't make 10 years. I've had it, I'm done."

That's the first thing. The other thing is – a committee named by the Congress that makes a recommendation of three names to the President for the NASA Administrator. Congress influences the NASA Administrator selection right now. My name came up because [Florida] Senator [C. William] Bill Nelson. My name probably did not originate in the White House. I'm certain that Senator Bill Nelson said, "Okay, put this name on the list and think about it." Congress has that ability right now to go walk to the President and say, "We think you ought to consider this." That's hokey to think that you need a committee to recommend to the President.

The other thing is this idea that NASA can have a budget that doesn't go through OMB and doesn't go through all that process; it's just worked out with Congress so that we can be fully funded and everything else. I think that's absurd. We don't get everything we want out of Congress. A lot of things we do, as you mentioned, a lot of the initiatives that we have that cause a lot of heartache, are congressional mandates because a congressman knows of some company or somebody else in their district that wants to have something done.

To us it makes no sense. We generally argue against it for as long as we can. Then because they've got the checkbook, we finally just throw up our hands and say, "Hey, okay, peace, we're going to go do this. We'll find an efficient way to do it." I don't think that Act helps anything to be quite honest. It just takes all the power and puts it over there in the committees.

The other unfortunate thing is every chair is not as passionate about NASA and spaceflight as John Culberson and Barbara Mikulski. All of them are interested in helping their constituents. I think John Culberson and Barbara Mikulski have the national space program at the heart of what they were doing. They wanted to make sure their constituents were taken care of.

You may come across a time when all four of the committee chairs, they're there because it's a step in moving up in the Congress, and they really have no legitimate interest in promoting

anything in NASA. Then you go through a period of who knows how many years where the Agency just goes down, because there's no direction being set by anybody. Hopefully I wasn't too strong in my opinion there.

WRIGHT: No, I think we got that covered. Isn't it Congressman Culberson who wants you to pursue Europa?

BOLDEN: Yes. I was not sold on Europa. I have to admit as the Administrator I finally gave up. I finally said, "Okay, we're going to go do this," especially after Chairman Culberson became the Chairman of the Appropriations Committee. We just decided that okay, it's not worth it for us to be at odds with the Chairman of the Appropriations Committee. He is absolutely correct about one thing. This is in fact the second most important thing that the Planetary Science Decadal Survey, the experts in the world on planetary science who said: "Go to Mars and get a sample and bring it back, that's number one." They said, "But if you're not going to do that, then go to Europa and determine whether there's life there or not." We were going to do it sometime sooner or later. We just said, "Okay, if he's going to give us the money, let's go ahead and formulate the mission. Let's go do that. We think we can walk and chew gum. So, we can still go to Mars with humans and more robotic spacecraft and go to Europa."

What's happened is a lot of the technology that we use—like we've got the spacecraft called Juno that's going to go into orbit around Jupiter this coming July. In fact, it'll be Independence Day, July 4; that's the day it's supposed to go into orbit. Juno is very unique. It is the first spacecraft we've ever sent to the outer planets, way away from the Sun, using solar energy.

It's got giant solar cells, three of them, sticking out like a propeller on an airplane. We provide solar power to power all the instruments on Juno. That's never been done before.

Because we did that and it's been so successful, in order to hold the price of the Europa mission down, the team in their thinking about the design, they're actually looking at using solar power to power the instruments on the Europa mission, because Europa is a moon of Jupiter, and it's going to do the same thing that Juno is doing. It's going to orbit a Jovian planet. Now we have a different technology that we can use, so we don't have to use nuclear power the way that we historically have done to go to the outer planets.

That came about as the result of something else that really didn't have anything to do with the Europa mission itself. That points out the critical importance of continuing your efforts on technology development, because you never know what technology you're doing for something else will prove to be beneficial over here.

Sometimes we develop technologies and they prove fruitless, useless. What we thought we were going to use it for, either something else came up that was better or it just didn't work the way we wanted. It goes off, you transfer the technology into the private sector and they go do incredible things with it. That's one of NASA's jobs actually.

WRIGHT: It's nice when that plan came together instead of the other way around.

BOLDEN: Oh yes.

WRIGHT: I was thinking too you mentioned earlier about the Earth Science and how important it was. There's always some pushback about that, a question if that's NASA's job. If you would,

I'd like for you to talk about that, as well as your thoughts on the opportunity that you've had recently to work closely with your former fellow crew member and colleague [Katherine D.] Kathy Sullivan who's now the Administrator of NOAA [National Oceanic and Atmospheric Administration]. A chance for you guys to work together again.

BOLDEN: It's been great. Earth Science has always been in the heart of NASA's mission. When the Space Act of 1958 established NASA, one of the primary things we were supposed to do, in addition to explore space, was to take care of the planet. That is Earth Science. We've done that incredibly well. We are among the leading stewards of the planet. We work cooperatively with agencies like NOAA; you know NOAA has all the weather guys; they do weather – we don't. We provide satellites and data that allows them to do the weather.

Historically NOAA has come to us and said, "Hey, would you plan and build these satellites for us? Just do the program management to get the satellite on orbit. Check it out. If it's working well, we'll take it." That's the way we do weather satellites.

We do the same thing with the Department of the Interior, the U.S. Geological Survey [USGS] when it comes to Landsat, which is the most successful land imaging program in the nation, in the world probably. But Landsat has been around for 43 years, and we have built every successful Landsat satellite for USGS. That's one of the things that the Congress beats us up on all the time. Particularly the House [of Representatives]. "Why do you all build satellites for USGS? Why don't they build their own?"

There are a couple of reasons. President Obama back in 2014 in his budget, he put all the responsibility for Landsat into the Department of Interior's budget. The Congress said no way.

Said, "Department of Interior can't do it, so we want NASA to." The answer to the Congress's question is the President tried and you all rejected it.

The other reason is the Department of Interior doesn't have the people that we do that have the expertise in managing satellite design and manufacturing. They've got really sharp people who know how to get the information out to the general public the way that they do, but not the kind of people that we have who design sensors and all that kind of stuff. Like I told my [Congressional] committee yesterday, as the NASA Administrator I'd be glad to transfer all of it over to USGS or transfer weather satellite building over to NOAA, but they're going to have to take the people who have the expertise.

If you talk about aeronautics, there's this area of aeronautics called hypersonics. That's really fast. That's like space-fast or missile-fast. We are the repository for fundamental hypersonics knowledge and performance of fundamental hypersonics research. That's what keeps us ahead of the Chinese, the Russians, everybody. If NASA doesn't do it, somebody's got to pick it up or the nation will fall behind. We've gone through a long multiyear battle with OMB and others about who should really pay for the facilities, for the wind tunnels, for facilities like that. Langley, Glenn, and Ames [Research Centers] are our primary centers for hypersonics research. They have the wind tunnels that the nation—in fact nations of the world—use. We have the brainpower. We have people who know more about hypersonics than anywhere else.

As we mentioned to the Congress, we can in fact, let DoD handle hypersonics and do all the tunnels and stuff. But we've got to transfer those facilities and our people in order for them to be able to do that, because these other agencies don't have the people in their workforce. It's a good balance for federal agencies, where you get certain capabilities out of one but it's usable

across the whole federal entity. That's the way it is in aeronautics; that's the way it is in science. We're the only people (in the U.S. government) that do human spaceflight.

WRIGHT: I believe that is a message that does not make it to the taxpayer of how well their taxes are shared. Those shared resources.

BOLDEN: Exactly.

WRIGHT: That NASA does so well. I'm going to stick with Kathy [Sullivan] for a few minutes, because I have forgotten to ask you during the other times that we've visited with you, but when you first became part of the space agency you came from the military and joined with a class of astronauts that also included females.

BOLDEN: I was right behind Kathy's class.

WRIGHT: Through the years, of course, working with women as colleagues has become a normal occurrence for you, but looking back, would you share with us some of the adjustments you made, or explain how you had to do to adapt as a pilot to working not only with non-pilots [mission specialists] on a crew, but crews with females.

BOLDEN: Interestingly, first time I worked with Kathy was my first coed crew – the Hubble deploy mission, STS-31.

WRIGHT: I was going to ask you if she'd forgiven you, because I remember you told us that story.

BOLDEN: No, she still hasn't forgiven me, she blames me for leaving her in the airlock. But interestingly, I think it was a tribute to Kathy.

I flew twice with Kathy on back-to-back missions, STS-31 and then 45. Kathy was so at ease among men, and Jan Davis [STS-60] was so at ease among men when we flew together, it made it really easy on the rest of us.

You didn't have to worry about the stuff people always think about—Shuttle is a big place actually—but there are some pieces of working together you definitely want to consider as separate, like going to the bathroom, which was designed as a little place that's publicly accessible to everybody but with a privacy curtain and everything else. It took no time at all for the crew to just get used to being around each other and having people do normal human functions. It was never a question at all.

On three of my four flights, we always gave the airlock to the woman on board as that's their private dressing facility, so they didn't have to worry about trying to find a place to dress and undress. But that was something that the crew generally talked about right up front and settled on. Because guys can dress anywhere, we generally said, "Okay, let's be respectful. So, we should also decide okay, I'm dressing or I'm undressing or whatever it is, and go somewhere where the woman on the crew doesn't have to see your naked body." But because the women made it comfortable, it was almost as if I didn't have a woman aboard, wasn't like we had a different crew member.

Equally qualified, equally strong physically, emotionally, and equal every other way. In fact, after Hubble my next flight, because it was a Spacelab mission and I was not a scientist, I

actually decided—Mike Coats and I made the same decision; Mike was the first one—we actually took a mission specialist and designated the mission specialist as a payload commander. That meant that when you had a question about the science or the payload, you went to the payload commander, not the crew (mission) commander. Everybody knew that. We made that very clear.

Kathy loved the title of being commander because Kathy is like that. But for me it was a blessing because I didn't have to worry about trying to keep up with all the science stuff that I really didn't know. We talked about it all the time in flight, before flight, after flight, during the debriefs. It made it really easy for me.

WRIGHT: Speaking of crews, I heard you might have had some type of a reunion in Costa Rica not too long ago.

BOLDEN: We did. That was our very first flight crew. That was the STS-61C crew that flew then Congressman Bill Nelson. We returned almost two weeks ago. It was a reunion 30 years in the making. We've had intermediate reunions here in DC but Franklin [Chang Diaz] being from Costa Rica had promised President [Luis Alberto] Monge who was the president of Costa Rica at the time that we flew—we had talked to him from on orbit—Franklin and [Commander Robert L.] "Hoot" Gibson had promised the president that when we got back we would visit Costa Rica.

As you know, 10 days after we landed, we lost *Challenger*. Our postflight activities pretty much went away. We didn't do any visits to other countries or do anything. Franklin kept saying, "Okay, for our thirtieth." I think at first he said, "For the twenty-fifth anniversary I want to invite everybody to Costa Rica." That came and went. Then he said two years ago, "Okay, this is it. For our thirtieth we're going to go to Costa Rica. I'm going to work with the government, and

we're going to invite the crew, and we'll make sure you have a good time." They did, they rolled out the red carpet. It was an absolutely incredible four, almost five, days in Costa Rica.

President Monge is up in age now and not in great health, but we went to his house and took a photo montage that we would have taken to him 30 years ago and sat down and had dinner with him. He is sharp, he told us a lot of stuff we didn't know about Franklin. Costa Rica is such a tiny nation—and Franklin is a national hero; he could be president. Franklin's mother was with us, she and President Monge are very good friends. It was a really special time for the crew to be there.

WRIGHT: He [Chang Diaz] could be president but he's busy trying to get you to Mars, isn't he?

BOLDEN: He's busy trying to get us to Mars much quicker. We visited his laboratory down in Costa Rica outside of San Jose. I had been in his facility in Houston a couple times before. It's a great story.

WRIGHT: It's great fun to see that you all are still—

BOLDEN: Yes. Three of us took our daughters—my daughter Kelly, Senator Nelson's daughter Nan Ellen, and Hoot Gibson's daughter Julie—because we all have multiple kids, but the three girls are all close in age—like Kelly's fortieth birthday was yesterday, Saint Patrick's Day. Nan Ellen's is coming up next year, and Julie's was like a few months ago or something like that. They had not seen each other or been with each other for 30 years. When they last saw each other, they were like eight or something like that.

For parents, it was such a great thing to see. It was like they had been together for a long time. They took two days when we went to visit Franklin's facility and said, "We appreciate being invited, but we've got stuff we're going to do." They went on a cruise. They went scuba diving and snorkeling. They visited the rainforest. They went zip-lining. They had a ball together for two days. All three of them now are in DC. We were with Kelly last night for her birthday and I asked her, "Have you all talked to each other?" She said, "Oh yes, and we're getting together." It renewed a 30-year-old friendship. That was the other thing that was really great about it.

WRIGHT: Since you're talking about personal stuff, one thing that we have never asked about, because it is personal, is your wife. You thank so many people, but you and Jackie have been together a long time.

BOLDEN: Forty-eight years this coming June.

WRIGHT: She's been part of your career and—

BOLDEN: She is my life, yes.

WRIGHT: What a journey that you've brought her on, all this time. I'm sure she's looking forward to spending some time with you on your next adventure.

BOLDEN: She is one who will be glad. I mean glad when this term is over. She was reluctant when I got the call that said, "Hey, can you come to Washington and talk to the President?" It

wasn't about being the NASA Administrator. I was told, "The President just wants to talk to you about NASA and space and pick your brain."

Jackie said, "I don't think you should go."

I said, "What do you mean?"

She said, "They're going to ask you to do something and I don't want to go to DC. I don't want you going to DC. I just don't want to do that."

I said, "Look, I just want to meet the President." I said, "I promise you I am not going to commit to anything; I can do that."

She said, "Right!" She said, "Okay, well, go ahead and go."

I came up and had just an incredible 20 minutes or so with the President. He did not ask anything. He did most of the talking and talked about his dreams and his vision and how he had been inspired by the Apollo astronauts when he was growing up in Hawaii with his grandmother and grandfather. I went back home and I said, "Boy, that was awesome."

She said, "Okay, what did you commit to?"

I said, "Nothing." I said, "It's done, I had my meeting. He picked my brain. Let's just go back to doing what we were doing."

A couple months passed before another call came saying, "Hey, can you come back to DC?"

I said, "For what?"

They said, "Well, we can't tell you."

I said, "I can't come."

This was the White House Presidential Personnel Office. They said, "Well, the President has decided he wants to nominate you to be the NASA Administrator."

I said, "Hey, I can't answer that question. I need to talk to my wife." I talked to her. We called the kids. Reluctantly Jackie said, "Okay, we'll try it." I came back and went through all the prep and the confirmation hearing. We brought everybody back here for the hearing.

I come from a big family. We had family members from Florida, New York; it was like a family reunion. Everybody was here crowding in the Capitol Building. Then we had a party afterwards. Everybody was here for my swearing-in the next day.

It was almost instantaneous. It was nothing like today. My hearing was the morning of the 17th [July 2009]. Lori [Garver, Deputy Administrator] and I were voted out of committee that afternoon, voice vote on the floor of the Senate that night. We came over here [NASA Headquarters] and we were sworn in the next day and I was sitting at the desk. That doesn't happen anymore.

My family got an opportunity to participate in it. Jackie went back to Houston because we thought that I'd be able to go back and forth, I'd be a geographic bachelor. I'd work here and we'd still live back there. That worked not at all. Zero. It wasn't even close. After my first six months when I came home at Christmas she said, "You need help. I'm going back." She came back with me.

The house sat empty for several months, and then Diana [Norman], Diana King now, agreed that she would housesit for us, and they moved in, and they lived there for three years about, and so we didn't worry about the house until she fell in love with her (now) husband who lived in Huntsville [Alabama]. The timing was perfect because we decided we were going to sell the house; the kids had finally talked us into that. We were going to buy up here. She moved to Huntsville, we sold the house, and we bought a house up here about a year later.

But Jackie has been absolutely incredible, to be quite honest. I have tested her through the Marine Corps and through NASA. She'll be really happy when we're done with it. She'll probably miss it as much as I will, but she's ready.

WRIGHT: She's shared you for a long time.

BOLDEN: A long time. Yes.

WRIGHT: During your tenure there have been a number of decisions that were made for long-lasting benefits. I'm just picking a few such as the extension of the life of the International Space Station; sending an American astronaut on a really long duration, almost a year in space; selecting companies to not only build but design the space vehicles that are going to deliver crews to orbit. What type of impact or legacy do you hope that each of these are going to have in those future years? If you would, talk about some of the concerns that you had when you had to make those decisions to allow these to happen.

BOLDEN: Best one to tell you. I didn't have any question about retiring Shuttle. I was convinced a long time ago that that should happen. In fact, even when I was in the Astronaut Office. Had nothing to do with safety because Shuttle was a safe vehicle in relative terms.

Going to space is dangerous. You are never going to have a completely safe spacecraft. We throw around that "this" is going to be safer than any other vehicle ever known. I'm very uncomfortable when we compare SLS and Orion to Shuttle that "this" is going to be safer than

Shuttle ever was, or commercial is going to be safer than Shuttle. Not so. I don't think so. If we're as safe as Shuttle was, I'll be happy.

Phasing Shuttle out was not hard at all for me but having something to follow it up—I was worried. Because once we were told that okay, we're going to terminate Constellation, which meant at the time we're going to get rid of Orion, we're going to get rid of all the vehicles, I said, "Boy, that's pretty harsh dose. You're going to take us out of human spaceflight."

People were talking about how the civilian entrepreneurs in industry are going to do it [spaceflight]. I was not a believer. I was a very skeptical person. It actually caused me to be at odds with folks in the White House probably for my first two years, because there are certain people who wanted to paint me as an opponent of commercial spaceflight. I said, "Nothing is farther from the truth." In fact, I spent a lot of time with the Commercial Spaceflight Federation talking to industry about what we needed to do, but also saying, "You guys have got to step up to the plate. You can't keep talking big and doing nothing. If you say you can deliver, you've got to do that."

I spent a lot of time talking with the companies that won the first two [commercial] contracts, SpaceX and Orbital [Sciences Corporation]—very little time with Elon [Musk, SpaceX Founder] but a lot with Gwynne Shotwell [SpaceX President]. David Thompson [Orbital Sciences Corporation President] is a real close friend, plus [former Shuttle astronaut] Frank [L.] Culbertson was out there and they had others from the Astronaut Office. Then when Elon hired [Kenneth] Ken Bowersox, for a short period of time we had Ken at SpaceX that we could talk to.

We just kept harping on all of them, "Okay, you got what you asked for. You said you could do this, so now it's time to deliver." I cautioned them up front, "We are going to lose vehicles. You know that. When it happens, you can't chicken out, you can't decide then that you

can't afford this." I said, "That's crap. You have now convinced everybody that you're going to replace the Shuttle, and you got to do it. You're almost going to be like a government company because you can't back out just because finances are hard right now." I said, "You have an accident, we're going to stick with you, but you got to stick with us."

I slowly became what you might call a disciple, a true believer, but I don't think I became a really really true believer until we actually let the contracts for cargo and the companies started building. Then we saw that they could fly and do what they said they could do—not at all to the level that they promised, because what they promised was hard.

They may get there one of these days. It's like NASA promising that Shuttle was going to fly 50 flights a year. That was never going to happen. Whoever said it, I don't know, but they got us in all kinds of trouble. And the commercial guys had done similarly. Elon, for example, when you look at SpaceX, when you look at their manifest, there's no white space in it. That [white space] just means time between flights to catch a breath. They brag about the fact that they have this incredible backlog of flights. That's good if you have some miracle up your sleeve. So, they've still got a lot of growing to do, because they're not going to make the schedules that they put out for people. At some point in the company's lifetime, they're going to have to decide that they're either going to be completely honest and limit the amount of flights they commit to, or people are going to stop using them. They've already had some difficult times with some of their commercial customers.

With us, we need them as much as they need us. We can tolerate delays. We know about delays, but they didn't think they were going to have them. We said, "Welcome to the real world."

WRIGHT: It's rocket science, right? It's hard.

BOLDEN: It is. It really is rocket science. Yes.

WRIGHT: Talk about making the decision for [Astronaut] Scott Kelly to be there [at the ISS for almost a year]. You've spent many days in space, but that's a continual time.

BOLDEN: I never had a hard time with the one-year mission itself. I didn't make the decision on the crew member, but I always get an opportunity to veto it, because Ellen [Ochoa, JSC Director] and the crew office send them up there. I just wanted to make sure that Scott was going to be able to do what we expected of him, because Scott and Mark [Kelly], they'd had their ups and downs in the Astronaut Office. They're different. Then when your twin brother who's going to be back here is married to a congresswoman and you're starting to get more and more access to the White House, that in itself sometimes could be problematic. We had to make sure that we'd be able to communicate with Scott and he with us and we'd be able to control him for one thing. It worked out great.

The length of the mission I didn't have any problem with. The Russians had already flown, boy, much longer than that. They flew 488 days or something. We knew what kind of problems they had, but Station up until Scott launched had given us an opportunity to refine the exercise equipment. The medical doctors had finally determined that okay, we can control a lot of issues with the astronaut's diet. They always knew that, but some of the common things like bone loss and muscle mass loss, we knew that we couldn't solve the whole problem but if you get the right diet then you can solve a lot of that. Then there's always supplemental medication. Women do it

when they get osteoporosis; they take calcium supplements. That's what we're talking about for bone loss.

The docs had a plan for getting Scott through. As far as I know, he's had some muscular issues. He said, "Boy, I don't remember from my other long duration mission being as sore as I am up here." But other than that, he was like an animal. When he got back to Houston, I just went, "Holy geez, this guy couldn't have just spent a whole year in space."

WRIGHT: It's amazing. Of course, the Station itself is amazing. You wanted to make sure that it got extended to get the full usage of it.

BOLDEN: Exactly. A couple reasons for that. The primary reason actually was to enable, to allow the commercial companies any chance at all to survive. They were being delayed in flying. The first extension the President did was to 2020. But as you started looking at the dates, commercial crew wasn't going to fly until 2015, and you can see where we are now. Now 2017, 2018.

If Station had ended with schedule-end in 2020, the companies had told us they were not sure they wanted to invest in that short a period of time, because they wanted to get a return on their investment. They were going to put a lot of money into building these vehicles, and they needed some reasonable amount of time.

We wanted to go to 2028. The President said, "In principle I agree with you, but I don't want to go that far." Why he made that decision I don't know. Could be that he did not want to go farther than another Democratic two-term administration, so that takes you to 2024, or it could be some other reason. But after I thought about it, I said, "I can live with that because it does give them the extra time. But also, it doesn't give them forever." It puts pressure on the companies to

deliver. If they can't demonstrate in almost 10 years that commercial space is viable and profitable, we shouldn't be doing this, so it's all a hoax.

So, 2024 was fine, after we thought about it that way. We're about to get the Europeans to agree and then we'll be home free. They won't do it until December, but for now we're okay.

WRIGHT: That's good. You've pretty much been adamant about continuing to have two commercial providers.

BOLDEN: Oh, have to. As we have told everybody, for a couple reasons. One is as shown when we had the accidents, of course nobody expected that you would have three accidents where all three of your primary providers would be down for a period of time. The good thing was then we had the Europeans and we had the Japanese [partners to provide supplies with their vehicles]. But that was one thing. You wanted to have some redundancy.

The most important thing is you want to be able to keep the cost down, so you needed competition. As long as you have two [suppliers] who don't know what the other one is doing when they bid, they'll trim some of the stuff that they probably wouldn't have before if they were a monopoly. It's worked out so far again. Like I say, history will tell, time will tell.

WRIGHT: Yes, it will. I have a couple other questions before we close. It really gets down to your final thoughts about being in such a unique class of individuals. There are not very many people who have served in the position of NASA Administrator. Share with us your thoughts about having that opportunity, and also if there were some things that you had hoped to get done that you didn't get a chance to get done.

BOLDEN: Oh yes, there were a lot of things I wished I had gotten done, and just time will run out. The biggest probably is I would have loved to have had three years ago the support that we have for aeronautics now, so that I could have seen us begin to actually fly a demonstrator (for a quiet supersonic aircraft). I would have loved to have had Congressional support on the President's request for commercial crew so that even if we didn't fly in 2015, we'd be flying by now.

Delayed a year, we'd have been flying by now. That's just very unfortunate for the nation that we didn't do that. We've exposed ourselves to this risk with the Russians for two extra years that we really didn't have to do.

I think again going back to the international question, one of the things that I've enjoyed the most and I feel the most proud of is being allowed to take my experience from the Marine Corps and my firm belief in the critical importance of engagement, reaching out to people, even bad people, and trying to help them understand what it is you want to do and why you want to do it, and letting them see the way that we live here in the United States, and want to be a part of what we do. That's been a very very very very rewarding part of the job.

We now have very active partnerships on the African continent. We didn't do that before. Other than science we didn't. There are now 5 space agencies that are recognized as space agencies of the 50 some odd African countries. That's a big deal. We now have partners in the Middle East, all the way from Israel, across the Middle East to whatever the gulf is over there. The rest of my tenure here, a lot of it is going to be spent on the road doing international travel, just one, to thank the partners, but also try to encourage those that are slow coming along.

I have loved a lot of the work that we're doing in Earth Science. I think I mentioned Earth Science, but the work that we do internationally in Earth Science. We have a collaboration with

the U.S. Agency for International Development in a program called SERVIR. We have one SERVIR site in Nairobi, Kenya, and I had the privilege of opening the one in Kathmandu, Nepal, which services the Himalayan region countries. What it does is it provides archived Earth Science data plus real-time Earth Science data for decision makers, for farmers. We send scientists over to help them with crop development, crop planning, water resources management, disaster planning, and disaster relief, drought planning, flood planning, all kinds of stuff.

We've been told by no less than the U.S. Pacific Command that using our data and the imagery that we get for the SERVIR Program for example, they were able to work with the people in Bangladesh last year, and they think thousands of lives were saved when they had a big annual flood period come up. But because of the imagery and the data that we were able to provide to them, they knew where, they could project where the massive flooding was going to be and go in and actually convince the local governments to evacuate people. Send them somewhere temporarily because we're going to go through this flood season, and if we don't move them out, people are going to die. That's really nice to have somebody say that.

Or when you talk about Station, the ultrasound device that they use for the crew. I don't know if you've ever seen it. It's about the size of that water bottle. It's not a big machine like we all have seen at the hospital to get ultrasound. Not quite like MRI, but ultrasound used to be really big thing. Crews onboard now use the handheld ultrasound, and they can scan themselves. The data goes down to the flight surgeon, and when we look at even things like the increased intraocular pressure that's causing degradation in vision, we're using ultrasound to help figure out some of that. That technology has been passed into the private sector. There are midwives in African villages and South American countries who now have been trained how to use a portable ultrasound. There's no doctor within 200 miles. They can take an expectant mother and do a

periodic ultrasound, and the doctor looks at it real-time, and says, "She's okay," or "I see some complications, get her into a cart or car or something, and get her into a hospital," which may be 200 or 300 miles away. Those kinds of things are really rewarding, seeing how again we're making things better for people here on Earth just by the stuff that we do.

It's serendipitous in many cases, but it's happening. Makes you feel good when you go home.

WRIGHT: Yes, sounds like you're going to be busy for a few more months.

BOLDEN: I am going to be very busy for a few more months. In fact, next week we'll spend four days total getting to and then being in Russia with Scott, and meeting with my counterpart over there, and then we'll come back for about a week, and then we'll be off to India for about a week. Then we'll come back, and then over the summer we'll go to West Africa. We'll go to England for the Farnborough Airshow, and then from there down to Israel, and from Israel to Jordan and Jordan to UAE and then back home.

Then we've got a trip to Japan and then China. It'll be my last trip as the NASA Administrator to all these places. But if everything goes well, we'll sign an agreement with China on air traffic management, which is not airplanes, but it's just the tools that allow air traffic controllers to move traffic smoother. But if we're able to sign that with them, it'll be the first time we've signed an agreement with China in 20-some-odd years. That'll be awesome.

WRIGHT: That's a great way to end.

BOLDEN: Great way to go out, yes.

WRIGHT: I think so too. I'm glad we got on your schedule early this year. I don't think you would have had time for us.

BOLDEN: We'd have made time. We would have found time because this is really important.

WRIGHT: It's worked out well. Is there anything else you'd like to add?

BOLDEN: No, just thank everybody for everything they've done. It is an incredible family, and it's just like I said fun to come to work, watch people do what they do. That's about it.

WRIGHT: Thank you, sir.

BOLDEN: Thank you all for doing this and especially for working with Bob [Thompson]. I think that is incredibly important and I think will be invaluable when you're done.

[End of interview]