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INTERVIEWED BY SANDRA JOHNSON
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JOHNSON: Today is July 26, 2018. This oral history interview with Robert Lightfoot is being conducted by phone in Huntsville, Alabama and Houston, Texas for the NASA Headquarters Oral History Project. Interviewer is Sandra Johnson. I want to thank you again for joining me today to continue this oral history.

The last time we talked, we were around the 2005 time period. You had been at [NASA] Headquarters [Washington, DC] for a period of time working with the [Space] Shuttle Program and you were getting ready to return to [NASA] Marshall [Space Flight Center, Huntsville, Alabama]. You returned in 2005 as the manager of the Shuttle Propulsion Office. How did that opportunity come about, and why did you go back?

LIGHTFOOT: I pretty much committed to stay in DC through Return to Flight [post-Space Shuttle *Columbia* STS-107 accident]. So once STS-114 occurred, I was interested in getting back to the field centers and out of the DC environment. My kids were at an age where it made more sense, and it could be a little bit better from a family standpoint.

At the time, Dave [David A.] King, who was the Center Director of Marshall, approached me. If you remember STS-114, we had the PAL [Protuberance Air Load] ramp come off. There needed to be a pretty big effort to get to the next flight, because we didn't expect that to occur. We basically had a big foam loss that did not hit the orbiter, thank god.

We were going to have to do some work to get going on that. He asked me if I'd come back to run Shuttle Propulsion Office because he was moving Mike [Michael U.] Rudolphi, who had the job before me. He asked him to go run all of Marshall engineering. It was a good opportunity for me and my family to get back to Huntsville, so I went back and became Shuttle Propulsion Manager.

You're responsible for the [solid rocket] boosters, the solid rocket motors, the external tank, and the main engine. You're also part of the Mission Management Team. I think [N.] Wayne Hale [Jr.] was the program manager at the time, if I remember correctly. Wayne treated me almost as a pseudo-deputy in that role, along with John [P.] Shannon and Lucy [V.] Kranz.

JOHNSON: Talk about that mission a little bit. As you mentioned, there was a problem with 114. In fact, Wayne Hale said in some of the things he's written since then that we nearly lost [Space Shuttle] *Discovery* on that flight. It was, again, almost an accident. Not quite, but it was a stressful time, trying to get to the next flight after that.

LIGHTFOOT: When I walked into the office, as you might imagine the same external tank team that had gone through all the recovery from *Columbia,* worked through all the foam stuff—in the middle of all that had been Katrina, the hurricane that basically devastated the same area where those people lived. You get back to flight, and your first flight we lost that big piece of PAL ramp, after we thought we had these problems behind us.

You almost were in a very similar return-to-flight mode, if that makes sense, because we knew we couldn't fly again until we fixed that issue. You're taking a team—honestly, the

external tank team that was already pretty spent from what they'd been through emotionally, technically. It was tough, it was a tough time.

So when I got there, that team was pretty—I don't know what the right word is, but morale was not good obviously. And for the right reasons, by the way. Good lord, we'd been a contributor to losing a crew, and then a contributor to a big piece of foam coming off and could have been another accident that happened. Part of my time was spent really trying to help build the team up, and almost reempower them.

One of the things that I noticed was that, in my opinion, the team was very reactive, for lack of a better word. Instead of taking ownership, they were just exhausted. It was a case of "Just tell me what you want to do and we'll go do it." As opposed to saying, "Hey, this is what I want to go do. Are you guys okay with it?" There was a lot of consternation, as you might imagine, around that going forward. So that was what I walked into.

We got through it, and fortunately we got [STS-]121 out. When it happened, it was all kind of a blur from that standpoint, but it took us a while to get to that flight. I think I was in the job for 115 and 11[6], if I remember correctly. I can't remember the exact dates and which ones, because my next job was the Deputy Center Director, so I was still covering the launches from there too. They run together in my memory, which ones I was in.

JOHNSON: Going back, you mentioned that the teams were exhausted, and with good reason at that point. You said you walked into that, and part of it was trying to turn that feeling around that they had. If you want to talk for a minute—in the lessons learned from both those accidents, from *Columbia* and then [STS-]51L [*Challenger* accident] there were a lot of reports that came out afterwards. Of course the CAIB [*Columbia* Accident Investigation Board], part of it talks

about the culture and the attitudes. How did you work with those teams to help ensure that the lessons learned from those accidents were applied to the engineering culture at NASA?

LIGHTFOOT: We spent a lot of time working on decision making. Not tools, but really how to help make sure we're making decisions where we have everyone's input. Almost a forceful way of doing that. Wayne Hale set the bit pretty hard for the program manager. "Hey, these are the kind of things that aren't acceptable. We got to make sure we don't have groupthink, we got to make sure all voices are being heard."

A couple things we did along the way—I can remember specifically a particular issue with the main engines that a particular engineer had a real concern about. Even though the main engine program accepted the risk, I accepted the risk as the propulsion manager, and the program accepted the risk at Wayne's level, we still had him come to the flight readiness review so Bill [William H.] Gerstenmaier could hear it. Bill Gerstenmaier and Bryan [D.] O'Connor at the time, they chaired the flight readiness review.

We had him come provide his dissenting opinion, and ended up rewarding the gentleman for bringing it forward. That was some of the ways we tried to make sure people knew that we valued their voices and their opinions. Whether we took action on it or not, at least we flew eyes wide open, if that makes sense. We would have the discussion, and that's one example I remember very specifically that the guy came.

That's hard, that's tough. That can be a very intimidating environment. You can imagine, you walk in and you're telling 200 or 300 people that you don't agree with the fact that we're ready to fly when everybody else does. That's an intimidating environment. We wanted

to reward that, and I remember doing that specifically. There were a lot of things we did like that.

They actually put all of us, as Mission Management Team, through training on decision support. Making sure you're not decision bias, have unconscious bias to things that you don't even know that influence the way you make decisions. That was a result of the CAIB Report, and things that we said we'd do in the Return to Flight Implementation Plan. As you know, that was one of my jobs at Headquarters was to get that out, even before 114.

JOHNSON: As you mentioned, *Discovery* did fly again, and it was July 4, 2006, which was a good day for that. But you were still in that first position as the Manager of the Shuttle Propulsion Office. At that time it had already been announced—we talked about it a little bit before—that Shuttle was going to close out.

You had mentioned that 2010 seemed a long way off. But as you were at Marshall it was approaching quickly at that point, as you moved through those different positions. Talk about that. You were following other flights and working with other flights, but as each one progressed to be the last, talk about those positions and how you worked through that time at Marshall.

LIGHTFOOT: It really started from my time in DC. As soon as President [George W.] Bush announced we were going to retire the Shuttle—that was '04, right?

JOHNSON: Yes.

LIGHTFOOT: Because of the job I had in DC as the AAA [Assistant Associate Administrator] for Shuttle, I was asked to start putting together a transition and retirement plan, even in 2004. I had a team that helped me really start putting the framework around how we would execute an actual transition. After 30 years of flying, how in the world are you going to transition and retire all this stuff?

We started in '04. Really just the framework, not necessarily doing anything yet. But you began to lay out a schedule. At the time it was 2010. If my last flight is in 2010, hardware has got to be at the [NASA] Cape [Canaveral, Florida] by 2009, 2008, depending on what hardware it is. We had many, many discussions about "If there is no follow-on—"

At the time they had announced Constellation [Program], so we knew we had something, but what goes with Constellation and what doesn't? I'll give you an example of what we thought about. Let's say I need 10 of a certain item to get through the end of flight, and I may have been getting those 10 at the same cadence as the flight rate.

What if I went and just told the vendor, "I want you to go and deliver me all 10, and then I'm going to shut you down"? I can get a pretty good price on the 10 because I'm buying them all at once. But then I take a risk that that vendor—if I have a problem with those in the '09, '10 timeframe—they might not be there to answer questions. There was a balance to think about how we do all that.

At the time, at Marshall, most of the propulsion elements were going to transition over to Constellation. So I would say it was a fairly easy transition just from a planning perspective, but Constellation had a different flight rate, they had a different plan. You had different contracts, even though they might have been with the same companies.

While I was in the propulsion manager job, we really were just laying out "Hey, when's the last time we need this vendor, and can Constellation pick up that infrastructure?" One of the things that was fascinating was as we were going through that process—we began to realize just how much the Shuttle Program was paying for, as far as the institutional capabilities at a lot of the Centers.

There were a lot of interesting discussions because Constellation was going to be cheaper, so they didn't want to pay for all that. Somebody had to pay for it. The Shuttle Program paid for a lot of it and Constellation wanted to buy it by the yard, if that makes sense. It was an interesting time to do that.

The bigger challenge was when we actually got to the end of Shuttle and Constellation got canceled. A lot of that planning all of a sudden—and I wasn't in the propulsion job at the time, I was actually Center-level at the time. That was a very difficult time, very difficult. I like to talk about monkey bars. To move from one monkey bar to the other, you've got to have another monkey bar to go to. We had convinced everybody on the team, "Hey, hang in there with Shuttle to the end. There's going to be a job for you afterwards, you can work in Constellation." Then poof, it went away, and that was hard.

That was one of the hardest—from my perspective, from a just pure leadership standpoint, I probably learned more and I'm probably most proud of that time. I was the Center Director at Marshall then. Trying to manage Marshall through that transition of Shuttle retiring, about the same time we got told we were going to cancel Constellation. All the layoffs. How we went through that—it was a tough, but also the most rewarding time in terms of how we treated people.

JOHNSON: Talk about that for a minute, because the Shuttle was closing down. The last flight was 2011. They had already announced that Constellation was going to end. In 2010 they announced it, but then the funding was still there. We still had to work on Constellation even though we knew it was going to end. I can imagine it was a very frustrating time, an uncertain time. It was here [at Johnson Space Center], and I know it was at other Centers.

Talk about how you helped get people through that. If there were any programs that were started to help people transition through the end. How did you keep people focused through the next program, and then the Ares [launch vehicle] development, and whatever would come from that?

LIGHTFOOT: The best way for me to explain it—I took the approach that I was going to talk to the team more than we've ever talked to the team before. When I say the team, the entire Center. I had more all-hands [meetings] during that time period than I think I had combined my whole time as Center Director, about a nine-month period there.

I told my team we were going to talk to them and "you know what, if I don't know I'm going to tell them I don't know." Because if I don't say anything we will be in a mode where people think we're up to something. "Oh, they must be doing something up there on the ninth floor [executive offices]."

I walked in front of them many times, and I reminded them exactly what you just said. "Look, we're working this. I'm trying to figure out how we're going to wade through this. But in the meantime, we have got to fly the Shuttle safely. We've got to make our milestones on Constellation, because Congress could turn that decision around." We didn't need to give any excuses for them to turn that decision around.

That said, we still lost some momentum obviously. But I was most proud of the fact that we flew that Shuttle out safely, and I truly believe that last flight—and not just at Marshall, but this was affecting all the Centers. It was affecting [NASA] Kennedy [Space Center, Florida], it was affecting Johnson, it was affecting Marshall, [NASA] Stennis [Space Center, Mississippi].

I don't remember the exact dates, but it was like the Thursday [July 21, 2011] when we landed [Space Shuttle] *Atlantis* for [STS-]135. There were probably, I don't know, 1,500, 2,000 people there when it landed. Most of those got a pink slip [termination notice] the next day. And they knew they were getting a pink slip the next day, but they were there. They helped bring that bird home.

To me it's still one of the most emotional parts of this, just the pure teamwork and dedication to the mission that you just can't believe. It's funny because even today I see a lot of people that I know got laid off, but they're back. Heck, they may be working at SpaceX [Space Exploration Technologies Corp.], they may be working at Blue Origin [LLC], they may be working at NASA.

But what we do is in their blood, and you saw it. You saw it. We talk about that all the time, "It's in your DNA." People love these missions, they're all great. We talk about that a lot, and it's true. But boy, when you get to see it in action it just pounds it home.

That was part of it. The key was you just remind them, "Hey, we still got a job to do, so keep your head down coloring. I promise you I'm trying to figure out what to do, and working with the folks in the Agency. I will let you know, I'll keep you updated." Honestly, I received several notes from people. Even people that got laid off said, "Thank you so much for the way you communicated during that time. It helped us to stay focused on what we were doing, knowing that these things were still going to occur."

JOHNSON: I think communication, especially during a stressful time like that, is probably one of the most important things you can do.

LIGHTFOOT: I will tell you that I learned in that time period—I'm a student of leadership at some level, how you lead people. I had remembered a statement somebody made a long time ago that "It's easy to lead when things are good, but real leadership is when things are hard." That all sounds good, that's a nice statement. And I'm sure it's true. At the time I thought it was true.

I can tell you I exercised every leadership muscle I've ever had, some I didn't even know I had, during that time. That's why I said from a leadership perspective it was very rewarding. From an overall perspective it was very hard.

JOHNSON: I know [NASA Administrator] Charlie [Charles F.] Bolden [Jr.] made a statement in 2010 that to the people working on these programs, this was like a death in the family, it was one more knockdown. Did you worry about losing that engineering expertise after both cancellations? You mentioned that a lot of people were coming back and some of them in the commercial programs, but at the time was that a real concern? Especially for Marshall. You are an engineering center.

LIGHTFOOT: We were worried about it. I think by the time everything shook out though, people knew Space Launch System [launch vehicle] was going to be there. That's something that Congress and the White House had worked out. So we didn't have that huge gap, if that makes

sense. By the time Shuttle retired, they had already worked out that we were going to do Space Launch System. I think it gave some hope. We still lost a lot of people, but it gave some hope.

I think the bigger thing that I saw honestly was a lot of—I don't even know what the right word is - Survivor guilt, where the people that didn't get laid off—you're in a bullpen with 10 people. On Monday you come in and there's only two of you. Why did you survive? I saw that to be one of the hardest things that we dealt with.

I spent a lot of time with my Employee Assistance Program folks [EAP]. We really pushed the workforce to use the EAP as much as possible, so what I had asked them to do was bucket concerns they were hearing. I didn't want to know who. I wanted to know how many people were coming, but I wanted to understand the concerns as well, so that I could change my communication strategy to maybe address some of the concerns that people were having.

Was it purely financial? Was it struggle at home? Was it stress in the workplace? They have a set of categories, and they were just amazing. What they did to help me to understand how to talk to my workforce, and actually help my workforce through this as we were doing it.

JOHNSON: Around that time, the National Institute for Rocket Propulsion Systems was formed in May 2011. I think Charlie signed a letter of intent around that time because there was a concern about this erosion of rocket propulsion capabilities, and they housed it at Marshall. Can you talk about that for a few minutes?

LIGHTFOOT: That's actually kind of funny—there's an irony associated with that that I'll get to.

One of the things that I got worried about with the cancellation of Constellation and the Shuttle Program—while SLS [Space Launch System] had come in, it certainly showed a risk I

think to Marshall, and actually to the nation around that capability. If we're at the whim of a programmatic change, and all of a sudden a pure national capability of all that expertise doesn't have anything to do, how are we going to handle that? I personally thought it was a national risk.

I decided to ask for some help around forming some strategies around that. At the time, one of the support contracts at Marshall had a small company that was helping with strategic communications. I found out that they did more than that, and so I pulled on them to come in and help me. This is 2010 and '11. It was about a six-month effort we went through where my team worked with them, I worked with them, and we came up with some strategies. By the way—just to tell you what's interesting about it—that small company is where I am today, LSINC [Corp.]. They've morphed since then, but the irony associated with that I obviously find odd.

They helped me through that, and one of the things that our team came up with, with them—it wasn't their idea, but they helped us figure out this thing. From a national perspective, [NASA] Ames [Research Center, Moffett Field, California] has a lot of institutes, "I wonder if that model would work for rocket propulsion systems." Most of the institutes are usually built around science fields, not necessarily engineering fields. So that's what we did. We went up and said, "I think rocket propulsion systems would be something that Marshall could be responsible for. We'll get industry involved, we'll get academia involved. It's a way to collect the total skillset this nation has in one place." That was a strategy that came out of that discussion.

That was all about we need to have some—I would just call it basis or foundation of what we do and what we provide. Not just NASA but the nation, and not be at the whim of a programmatic decision, that that expertise stays in place. That was our strategy going in.

JOHNSON: Do you feel like that's what it's accomplishing, or that's working?

LIGHTFOOT: That's a great question. My goal at the time was to have it in place by 2016. They took on some actions, and it's morphed over time. Some of it yes, but probably not complete. They actually got some of the stuff done long before 2016. It probably hasn't taken off the way I expected, but that's probably because of funding, because you're also having to fund those people. That's the other piece.

But it's done a lot of things. It's done a couple studies for the Department of Defense. It actually took over some of the propulsion conferences that used to be run by other groups. I would say it's been medium successful, how about that?

JOHNSON: Let's talk about the COTS [Commercial Orbital Transportation Services] Program and the commercial development. Was there testing happening out at Marshall during that time, once COTS was started around 2005?

LIGHTFOOT: Not really. I don't think we were that engaged in that because it was commercial. We did some help, more on the engineering side. But for the most part it was being run out of Johnson, with some help from Kennedy. On the [Commercial] Crew Program, I think after I left

there's been a lot more involvement. Mainly around the propulsion systems, using the expertise there to help with making sure that the two providers of the propulsion systems are working fine.

JOHNSON: You've been at more than one Center—you were at Stennis and you were at Marshall, which were somewhat similar because of the testing—and then you've been at Headquarters a couple of times. Traditionally there was always some competition, I guess is a nice way of putting it, between Johnson and Marshall. Do you want to talk about some of those relationships between Marshall and some of the other Centers and how that worked, what those relationships were like?

LIGHTFOOT: I saw it probably as much as anybody in the Shuttle Program because I spent a lot of time at Johnson and Kennedy, too. Then at Headquarters, once I became the Associate Administrator and the Acting Administrator, I spent a lot of time trying to get us to act as NASA, not as 10 separate entities that just happen to be at NASA. Most of that that I did when I got up to Headquarters was because I'd seen what I consider—I mean there's a lot of strength in having that diverse background, but there's also a lot of challenges that come with that. The competition—I'm just going to say it—you need a respectful environment. What's interesting is what I saw was the cultures of the Centers were pretty much based on probably their strongest leader over time, whoever that had been.

Marshall—I used to joke about the fact that we'd go to Program Requirements [Control] Board (PRCB) for Shuttle, and the Marshall teams always wanted to be matched up before we walked into the big room with everybody. They didn't want Marshall Engineering to not have

the same opinion as the Marshall Program. I'm like, "Why?" At JSC, JSC Engineering and Orbiter would argue in the PRCB all the time, worked out fine.

There was just a difference in cultures in terms of "Hey, we want to make sure we seem unified." I'll never forget the one time I disagreed with my Marshall engineering team doing Shuttle propulsion and said that I was good to go fly, and they weren't. Wow, that was an interesting day inside the culture of Marshall.

But yet it began to change the dynamic. My whole goal that I can remember from my career is bridge-building. When I moved to Stennis it was about bridge-building, when I started working with the guys at Johnson for Return to Flight it was about bridge-building. I saw just tremendous—sometimes it was animosity, and sometimes it was just lack of understanding of what each group was trying to do.

I think when you get to the situation where you find a respectful place for everybody to know "We all have the same mission and we're trying to achieve that mission"—that was my goal all along. When I got to Headquarters I had very little patience with the competition piece between Centers, because there's plenty of work to go around. That's why I started some of the stuff I did when I was up there. What I did was try to get the Centers to identify what is their identity, what do they think the Administrator is going to call them about at any given time. "Nobody else, they're going to call you. What is that?" It was interesting to get that feedback, and it was interesting to see how certain stuff had morphed over time.

I believe at the end of the Shuttle Program, one of the things that Wayne Hale and John Shannon did that I was most impressed with was they refused to let the Center boundaries get in the way. They made sure we, as a team, were a team. That was critically important. We talk about the technical success of the last part of the Shuttle, but when we have an accident we talk

about the cultural piece. It always comes up. *Challenger*, *Columbia*—always talked about the culture. Never really talked about the cultural success of the last few Shuttle missions.

I believe frankly that there was a cultural success, that there was more of an intercenter team than intercenter competition. That's why I brought that to Headquarters, because it felt like it took Wayne and John's leadership to make sure that occurred. Does that help?

JOHNSON: Yes, it does. That's interesting, the cultural success. It is something that we don't hear a lot about. Like you mentioned, how hard everybody was working at the end of Shuttle, just as hard as they were at the beginning, to make sure that those were successful flights. I think that's a good point to raise.

LIGHTFOOT: This is such a small example, but I think it's a microcosm of what I'm talking about. I was told before I got there—and I wasn't intimately involved in the Shuttle Program before, so this may not be true. I'm just going on urban legend. When you're at the Cape for FRR [Flight Readiness Review] and flights, the JSC guys went to dinner together, the Marshall guys went to dinner together.

There were probably three or four of us in the program that would not let that happen after *Columbia*. It wasn't so much about the CAIB Report. It was about "We've got to be a team. We've got to be able to call each other when we're not doing the right things." It's different when it's "those Marshall guys" or "those JSC guys." Different when you say, "Hey, that's Steve. That's Lucy, that's Jerry." Totally different when you're in that mode. That's what I think we really tried to build.

I'm not saying it wasn't there before, but there was a conscious effort to do that. If we had had a failure, god forbid if we'd had a failure in that last one, I think most of us wanted to make sure it wasn't because of that. We wanted to not hear that story again. It would have come out that, I'm sure. I'm convinced that you'll always find cultural challenges. But we worked really hard to try to make sure we had a team. The team couldn't just be the Marshall team and the JSC team and leave each other alone. It had to be us together.

JOHNSON: It's an accomplishment to get that to actually happen. Let's talk about your move to Headquarters. You moved in 2012 after Charlie Bolden had been there a couple years, as the Associate Administrator. Talk about that position, and that time helping to guide the Agency after the cancellation of Constellation, the beginning of SLS.

That first time when you went in 2003 up to Headquarters, it was a little bit different. You mentioned that you'd never been to Headquarters before. I saw an interview with Charlie Bolden a few days ago, I guess it was Monday. He made the statement that the first two years as Administrator he was a lousy Administrator, because he didn't understand the DC world and how you had to work through that. You talked about that a little bit the last time.

Talk about that transition. Going from a Center Director to going back to Headquarters, but as Associate Administrator.

LIGHTFOOT: Yes, I often wonder about that decision. Charlie asked me a couple times to come up. Just to give you the dominoes, Rob [Robert D.] Strain, who's now the president of Ball Aerospace [& Technologies Corporation], was the Center Director at [NASA] Goddard [Space Flight Center, Greenbelt, Maryland]. He was retiring and Chris [Christopher J.] Scolese, who

was the Associate Administrator at the time, grew up at Goddard. He had never been a Center Director, and this was a great opportunity for him to go be a Center Director. As the Center Director of Marshall, Chris was my boss, because the Associate Administrator, all the Center Directors work for them.

Let me step back just a minute and share something else that I did when I was the Center Director. We didn't talk about much when I was the Center Director. One of the things that I created and started as the Center Director was what I called the Center Director Forum. What we did is we, as Center Directors, went around. I would bring a group of Center Directors to every Center. The whole goal in that was to show that the Center Directors are united. There were a lot of challenge between the Centers and Headquarters at the time. So we would bring human spaceflight Center Directors to Goddard, and vice-versa, and do all-hands. I started that. I usually had five or six Center Directors at every Center, not everybody could go to everything.

I can remember specifically—and I promise I'll tell you why this links to why when I came up to DC it made a difference. When I got to doing those things—I remember I was at Ames. Ames always felt like because it's on the west coast, [it was] left out. I had an employee come up to me and said, "I'm so glad you did this. It's fascinating to hear the Center Director at Marshall and the Center Director at Johnson and the Center Director at Glenn all have the same problems we're having here. Not just us."

I had told the Center Directors at the time—there was not a real forum for the Center Directors to meet together. What would happen is we'd all walk into Headquarters meetings, and it was almost like Headquarters and each Center Director was an individual instead of—I used to say, "Hey, as Center Directors, we're a pretty strong voting bloc. We'll have some time

together." What I tried to do was get us as Center Directors to be more of a team. Again, bridge-building kind of stuff going on.

Fast-forward to when I move up to DC. Now here are all my peers, I'm now their boss. Think about it. Trust me, I was not anybody's boss. On paper maybe. But these are people I respect tremendously and I've worked with for the last two or three years as a Center Director myself. Now I'm supposed to be leading them, and oh, by the way, my boss Chris Scolese is now working for me. From a personal perspective, it was an interesting time from that standpoint. Just how you make that swap. I think it went fine, I think. You can probably ask them. They'll probably talk about it if you ask them, if you interview them.

But the bigger challenge for me when I got up there was Headquarters was kind of disconnected in some places. Chris had been at it for a while. It's a hard job, Associate Administrator is a hard job. You're the pinch point between the career folks and the political folks. Because of all the changes and because of all the push, it was really hard on that person, because that person is getting pretty much pounded by the Center Directors, "What are y'all doing?" And at the same time getting direction from a political perspective, "Hey, we need to change this, you got to go do this differently, we're going to cancel Constellation."

Trying to actually explain why some of those decisions might not have been such a good decision, they don't want to hear it, and I understand. They've got four years or eight years, depending [on reelection]. They need to make their decisions and move on. I understood both sides of that in terms of what they're doing. My job, once I got there, was to try to recreate communication. Communication had pretty much stalled out.

That's what I did. I walked into that environment, and I actually tried to create things that the Center Directors—the Center Directors and the mission directors all officially worked

for me, so I created a couple of forums. I created something called the NBA, which was Nonbudget Action is what I called it. It was just a place for technical authorities, Center Directors, and the mission directors. We could all have a meeting and nobody else was in there. By calling it nonbudget action, NBA, we could have conversations that didn't get—I'm just going to say politicized. We could have the real conversations we needed to have, because we were the career team. We were the folks that were going to be there after an administration change. We needed to make sure that the core values of the Agency were at least being kept. We can change missions all day long, but the Agency has a set of values.

That was what I was trying to do when I moved up there. I felt I was pretty successful, honestly, in running that. I felt like I really contributed from an Agency perspective. But frankly it was because the team around me, the Center Directors and the mission directors—we'd spent all that time when I was the Center Director honestly just becoming friends. Some cases—friend doesn't mean you're like best buddies, it just means you had a respectful relationship with a peer, and that allowed us to have some really hard conversations. You don't want to have a hard conversation with somebody the first time you talk to them. You want to make sure you've built that relationship and you understand how they are. That's what I felt like I tried to do. I tried to change some things about the way we performed as an Agency.

My job in that role was the day-to-day performance of the Agency. Did we do great? We did okay. We did good in some areas, and some areas—the ones you see in the news—we didn't do so well from performance around cost and schedule. But it was an interesting time. When I look back on that particular part of it, it was not—I'm going to say the word fun. It was not fun. But it was very rewarding because I had such a great set of Center Directors and

mission directors. By the way, some of them came and went. I had great chief engineer, great safety, great health and medical folks. They helped me so much.

Over the course of time I began to expand that NBA and I included the chief financial officer, CIO [chief information officer]. I brought in different people to be part of that discussion. Tried not to be completely inclusive, because then you're talking about the Administrator meeting, but have a real understanding of what my role is. But it was not easy. I don't want to be horribly blunt, but there were a few disconnects up there that were just hard to work through.

JOHNSON: Disconnects at Headquarters?

LIGHTFOOT: Yes. There was a few disconnects between the political and the career. The political direction—frankly, the political direction of the White House and the political direction of Congress were oftentimes different. We're an executive branch agency, and we supported the budget that the President proposed. It's our job. If you don't want to do it, put your badge on the table and walk out the door.

But that was really hard sometimes when you knew Congress was not going to allow certain things to happen. It almost in some ways felt like you were in a do-loop [repeated blocks of software code]. You knew "Okay, we're going to propose that, Congress isn't going to accept it. We're going to be right back where we are, but we're going to do a lot of work in the middle of all this. And it's really wasted work." At this point I would call that whining on my part.

JOHNSON: You did come in there in an interesting time too, because once Constellation was canceled there was that whole period of disappointment, and it wasn't just at NASA. Like you mentioned it was Congress, it was former astronauts that were very vocal about some of their opinions about going back to the Moon and things that we should be doing. There was a lot of testimony before Congress that dealt with all that.

I know when we talked to Mr. Bolden he tried to convince people. Some people saw him one way and other people saw him another way. I know part of what you were doing was trying to, as you mentioned, keep the Center Directors all talking. I can imagine that that time period before there was a true direction—even though you knew SLS was coming, and you knew that the [Orion] Multi-Purpose Crew Vehicle was possibly going to come out of it.

It seems like it would have been a difficult time to keep everyone focused on what to do, and explain it to the public and to Congress and everyone else that was concerned.

LIGHTFOOT: First of all, I had a blast working with Charlie. As far as empowering and supporting employees, he was probably the best I've ever had from that perspective. He would listen to the people that really knew, and then he would try to support us as best he could. When I say really knew, I mean the details. As you know, sometimes the technical details get lost in the political arena. It was really quite an honor to work for him and watch how he tried to navigate that.

But it was hard, and he took a lot of personal grief. If you haven't been in it, I don't think you really understand how much of it is theater, in some ways. I have two things that I stuck with the whole time, that ran through my head all the time. The first was you have to have the courage to accept unjust criticism. I watched Charlie, and he was just amazing at that. He got

criticized a lot. Sometimes, probably he'll tell you, "Yes, I didn't do that right." He'll tell you that. He accepted all that. I would say the Marine in him always did the right thing. But the unjust criticism was the part that was hard, that was the hardest part.

But for me there was another quote that was actually inside the folder of my retirement party because people knew I talked about it all the time. It's the [President] Teddy [Theodore] Roosevelt [Jr.] "man in the arena" quote. For me that was Washington, DC. If you've never heard the quote—I haven't unpacked my boxes here in my new office, because we're moving. I usually have it on my wall right by my door. It's a long quote, and it basically says "It's not the critic that counts, it's the man in the arena whose face is marred with dust, sweat, blood, tears, who fights the good fight and sometimes may not win, but at least knows the joys of victory and the spoils of defeat, unlike those cold timid souls that just sit in the stands and watch, or criticize." I messed that up. It's a long quote.

> *[It is not the critic who counts; not the man who points out how the strong man stumbles, or where the doer of deeds could have done them better. The credit belongs to the man who is actually in the arena, whose face is marred by dust and sweat and blood; who strives valiantly; who errs, who comes short again and again, because there is no effort without error and shortcoming; but who does actually strive to do the deeds; who knows great enthusiasms, the great devotions; who spends himself in a worthy cause; who at the best knows in the end the triumph of high achievement, and who at the worst, if he fails, at least fails while daring greatly, so that his place shall never be with those cold and timid souls who neither know victory nor defeat.]*

But that's how it felt. People throw rocks all the time. Sometimes, by the way, we deserved them. Oh my god, did we deserve them. But other times you just have to let it roll off your back; that was the only thing we could do.

Sometimes I just got really legalistic with it with the team. I'd say, "We have an appropriations bill. That is the law of the land. Congress put it in there, the President signed it. That's what we're supposed to be doing. I don't care what anybody else tells you. It's the law, do it." Kind of a legalistic view, but it was also true, so that was how we managed to do that.

JOHNSON: I think part of the criticism is a lot of people felt—and I'm talking the public and Congress. It was the dependence on the Russians to get us to ISS [International Space Station]. It was a difficult time for people to accept that, I think at that point.

LIGHTFOOT: Yes, but—I have to be nice, I'll get myself in trouble. Some of that was actually inflicted for a lot of reasons. Blame it on anybody you want, but I could give you probably 10 different stories and pieces of all of them are correct. The way I looked at it is you can talk about it all you want, but that's what we have.

As long as that's what you got, then I kind of recommend that we as a team—the team that I was dealing with—deal with what we got. What can we control? Today we can control getting our own capabilities ready as fast as we can, based on the budgets we got, and in the meantime trust our partners in Russia because we need them. There's really no sense debating how we got there, why we got there, whose fault it was. A lot of times when those kind of issues popped up, that's the position I took.

There's a scene in *Apollo 13*, the movie. I have no idea if it actually happened on-orbit, but there's a scene in *Apollo 13* where Fred [W.] Haise [Jr.] and [John L. "Jack"] Swigert [Jr.] start yelling at each other. Tom Hanks [playing James A. Lovell Jr.] looks at them and goes, "Guys, you may as well stop because you're going to get done yelling after 15 minutes, and we're going to be right where we are. Nothing's changed."

That was the approach I took. We can debate why we're here, what happened all we want, but we are where we are and we need to deal with the conditions we've been given. Let's make sure we're successful, because at the end of the day the mission was what needed to be successful. Getting crews to and from the Station safely is our job, let's make sure we're doing that right. That's the approach I took. And what's funny is NASA is always famous for dealing pretty well with the cards we're given.

JOHNSON: Right. And accomplishing quite a lot in a short period of time.

LIGHTFOOT: I think that's the innovation. When I look at it I think that's what NASA is most innovative with, honestly. We are pretty amazing when it comes to that. Or can be.

JOHNSON: As you said, with NASA, sometimes you're told this is what you're directed to do, you have to go do it. And then things come along and get canceled, like Constellation. One of them was the Asteroid Redirect Mission.

Talk about that, about that plan and maybe dealing with those kinds of things at Headquarters. When you're directed to do one thing, everybody gets up and running on it, and then the next presidential administration comes in and decides "No, that's not what I want to do

anymore"? And doing this over and over it seems like. As you said, NASA, one of its strengths is being able to change directions. But it's back to that motivation. How do you keep people motivated?

LIGHTFOOT: I think the one thing within NASA is you've got to look at the whole portfolio. That's how you keep people motivated. There'll be changes in pieces of the portfolio, but we're talking a lot about human spaceflight here. Look at what we're doing in science, look at what we're doing in technology, look at what we're doing in aeronautics. It was a way to say, "Look, there's more to this." Did I grow up in human spaceflight? Absolutely. My blood is human spaceflight, there's no doubt about it. But the things we do in science are amazing, and we're still doing them. I kept telling them, "We're still flying on the International Space Station."

The most incredible lab [laboratory] ever built, period. There's nothing like it. I may be wrong, but I think history will show that it was at least equal to putting humans on the Moon, at some point. It wasn't a small step and a giant leap that had such a dramatic effect, but the fact that that thing is flying, and flying as long as it has, is just an engineering marvel. It was expensive, sure. But anything hard like that is going to be. Because of that, it's been the thing that's allowed us to have these commercial programs come along. That's their destination. If we didn't have that destination, where would they be? That's what started all that.

I think at the end of the day most NASA folks are used to programs and projects coming and going. But what I tried to do—this was my goal, especially when the administration changed in '16. All of us, I think, in the Agency went through—I don't want to say the word we got "paralyzed" when the [President Barack] Obama administration change occurred. I don't care if you agree or disagree with the change in policy that they did. It doesn't matter to me, I

don't really care. You were told what to go do, and we got paralyzed because we were like, "Oh wow, Congress doesn't like it. Are we really going to do it, or do we just lock up?"

What we tried to do, and what I really pushed the team to do—again, it's one of those things that I'm pretty proud of in terms of what we accomplished. Whether it was [Donald J.] Trump or [Hillary D. R.] Clinton [2016 presidential candidates], we went in and talked about "What does NASA do that they care about?"

When you do that kind of assessment, if you're really honest with yourself, an administration or Congress—except for individuals. There's some individuals that are like this, and I'll talk about some in particular. But they really are more interested in "What can you do for me from a domestic policy perspective? What can you do from a foreign policy perspective, what can you do about the economic security of this country? What can you do about the nation's industrial base, and oh by the way, what else do you bring to the table?"

That's when I went and said, "Okay, from a domestic policy, we provide jobs, create jobs." Whether it's the commercial program or the government-tax programs. From an international perspective, look, we're in countries all over this world. NASA is a respected entity, and that's what we can help you do. From an industrial base, we share a lot of the common industrial base with the Department of Defense. We're part of your national security, both economically and just from an industrial base standpoint. Then what do we bring to the table that not many bring to the table? We bring inspiration and American leadership.

Let me tell you. I didn't say anything in there about sensors, telescopes, humans on Station, humans on Mars. And that story resonated big-time. Big-time. We were lucky, we had Vice President [Michael R. "Mike"] Pence who truly was interested. He's truly interested in what we're doing.

That's how you have to talk, that's how to work through this. Are there going to be puts and takes around all that programmatically? Absolutely. But as long as NASA is doing what I just described at that level, NASA will always be relevant. We stop doing those things, we won't be relevant anymore. I think that's the way I looked at it, and the way I tried to address it.

JOHNSON: Going back to communication, as you mentioned, there's a lot of things NASA does. There's a lot now about Mars, I think just this week more information about water on Mars. The general public will hear those announcements every once in a while, but in between, the robotic missions are just doing incredible amazing things, and we don't necessarily hear about it as much.

When it was announced that Shuttle was going to close and then Constellation, just in our area we would have people ask us, "Well, we heard JSC closed." People think that if we're not flying humans on a NASA-built machine then NASA is not doing anything. Talk about that communication. What part does Headquarters play in educating the public, and how important is that for NASA's goals? I know you have to educate congresspeople, but is educating the public also important?

LIGHTFOOT: Yes. That's a hard thing to do, because the public is a pretty amorphous entity. There's a lot of the public that follows NASA very closely, and then there's a lot of the public that doesn't. I will tell you that for the most part our own, I'll say, unscientific discussions with the public was "NASA is a source of leadership and inspiration for our nation."

What does NASA do? We're not really sure, but the trademark of NASA is pretty deep and pretty far-reaching. If you look at the data and the facts, during Charlie's time we were the

number one. All the media, anything you can do publicly, we were the number one in federal government. Social media, hits on websites, all that stuff—we're number one in federal government. Yet people still don't really know sometimes what we're doing. It was always a challenge, it's always a challenge to communicate what we're doing. It's always a challenge to talk about the level of detail of some of what we're doing so that the public—that word carefully again—understands what we're doing. It's just hard.

What I saw mostly is the inspirational value. Think about the [solar] eclipse in August [2017]. I think the data was 25 percent of the people in the United States did something to see the eclipse. That's an enormous number. NASA didn't cause the eclipse, it happened naturally. But we were on the front of the train of trying to educate the public about the situation and what you do, what you're not going to do, all those different things that come with it.

To me that was the piece that was probably most important —I think it's just a hard thing to do. I think our public affairs folks do just an amazing job. They just do an amazing job, but they're pretty limited. It's not like a New York City marketing firm that comes out. Yet they still do just an incredible job, what they do.

I think public capture of what we do is always a challenge, but I also think that bringing in SpaceX, bringing in Blue Origin and Virgin [Galactic], all these guys that are coming in—I think that's exciting too. I think that excites the public, and that's not bad. That's where I used to get frustrated. It's not an "or," it's an "and." We all help each other with what we're trying to do in this whole exploration journey.

JOHNSON: I know it was important to Charlie Bolden, the "inspire" part of it. I know that was always very important. He took every opportunity he could to talk to children and schoolkids to

try to inspire that next generation, especially with the STEM [science, technology, engineering, and mathematics] education.

LIGHTFOOT: Absolutely.

JOHNSON: Before you stepped in after Charlie left, during that time are there some other things that you worked on as Associate Administrator? I know there's lots of stuff, and we could talk for the next three days probably about everything that you did during that time, but is there anything that stands out in your mind that you want to talk about or mention? Or you feel like there's any accomplishments?

Maybe even going back to Marshall. Do you feel like you accomplished everything as a Center Director that you wanted to at Marshall before you went to Headquarters? Then once you were in that Associate Administrator position, do you feel like you accomplished what you had set out to do, or had time to do it before things changed again?

LIGHTFOOT: I'm going to answer the Marshall piece real quick. I'm sure I didn't accomplish everything I wanted to accomplish, because I got pulled out before I was done. But I put some things in motion, then you let the person behind you pick those up. They can either do them or not, it's not mine anymore. That was something I learned pretty early in my career. When you move to a new job, you have a new job. You don't get to do your old job anymore. There was somebody there before you, there'll be somebody there after you. Let them do their job. That was really important for me.

I think probably since my days when I first moved to Stennis—that was when I first realized that I was a new guy at Stennis, even though I knew the subject really well, and they let me run it. I didn't have a whole lot of people telling me, or the previous person telling me, "Oh no, you got to do it this way." They let me do it. I think that was a lesson I took.

When I moved to Headquarters, I had a few goals. If I had one goal—I wanted to put a capability leadership model in place. We did that. We can debate whether it's successful, but this was a way to have the Centers understand what all the capabilities are across the Agency. Quit duplicating and start sharing, not only in the technical arena, but in the business services as well. That's a pretty big change. And it was a lot of work, a lot of effort associated with that, while you're still trying to do all the missions we were trying to do too. But my goal was to try to get the Agency more efficient, while staying effective in our ability to do stuff. It's not that we weren't efficient, it's not that we weren't effective. But we have lots of places we could go to be better.

As NASA's budget went up, the budget for running the place actually stayed flat or went down. So my goal was to always try to do that better. You guys know that in your [History] Office down there, because I think you were a victim of some of that at one point.

JOHNSON: Yes, we were.

LIGHTFOOT: Yes. I felt like there were plenty of places where we could get more efficient. I'll use you guys as an example. Why couldn't you do history for the whole Agency? Why do I have three or four people at every Center doing history? My guess is we could probably get away having a NASA history office. I'm not trying to say it was good or bad, I'm just saying

that was my thinking. The thing that really struck me—one Center in particular was having trouble hiring as fast as they needed to hire, and two Centers in the Agency were under freezes, couldn't hire. That Center didn't even think to look for help in hiring from those two Centers that were frozen, and yet what are all those people doing while they're frozen?

That's when it hit me that "My god, we have got to talk across the Centers." That's hard though. There's all sorts of reasons why you can't do it. Some will tell you that; everybody shared them with me, trust me. That was a really hard process to go through. It's still going, they're still working on it. I think frankly the results remain to be seen. I think we found some efficiencies. I don't know if we found enough efficiencies to justify all the work I put everybody through, but I do think it was the right direction to go.

If I had something that was left undone when I left the Agency—and I said it in my last speech that I gave at the Space Symposium in Colorado near the end of April [2017], right before I retired. I think the Agency needs to come to grips with the risk discussion. We have to talk about risk. My honest fear, and I'm on the record as saying this, is would we send Neil [A. Armstrong] to the Moon today knowing what we knew then? Would we have launched Crip [Robert L. Crippen] and John [W.] Young on the first Shuttle with the knowledge they had when we did that? Would we actually do that today? Our risk appetite is something that really needs to be discussed. I tried, but I ran out of time on that one.

Where I went, honestly, in my speech at Colorado was we have to become risk leaders. I'll probably write a book on this one day, we'll see if I do it. We have to become risk leaders, not risk managers. What I mean by that is if you look at a definition of leadership and a definition of management—managers do things right, leaders do the right things. If you put the word "risk" in front of that—risk managers do things right, risk leaders do the right things. And

that is hard. We have become risk managers and not risk leaders. Sometimes, as a leader, you have to accept the risk and move on. What we do will never be risk-free. It's hard, that's hard. You never know.

I was talking about a decision I made for a vehicle that was probably not going to take that risk and got brought up to my level, and I accepted the risk. This was in 2016. That vehicle is probably not going to fly till 2020, with crew on it I mean. That could end up being a stupid decision. But at some point you take the data you've got, and somebody has to make that decision. So I did. I made a decision and we moved on.

Now I'm not talking about just me, I'm talking about everybody. It's not about me. I remember in my speech I closed it with this. I said, "The least risky thing for us to do is not fly. If you don't want to take any risk, don't fly. But as a country, as a nation, that's the most risky thing for us to do." Finding that balance between those is something—I just didn't get there.

I have a couple white papers I've written, and just trying to work through with Ralph [R.] Roe [Jr.] in my Chief Engineer's office. Really good stuff, but I ran out of time. That's the one thing that I wish I had—it's not a regret, I think it's more I just ran out of time. It was the next thing on my list to attack.

JOHNSON: I read that speech, and I thought it was interesting because I did pull some of those quotes. In this risk-averse culture we're in now, I agree, it gets to the point where you just don't fly. That's the only way of actually avoiding risk. But one of these statements was "Risk is simply a discussion between likelihood and consequence." It becomes more about the process than the product.

LIGHTFOOT: I think that's what I mean by risk management. I had somebody tell me once—this is kind of interesting. I said, "Hey, what are we doing about this risk?"

They said, "Oh we put it in the risk system, so it's taken care of."

I went, "No, it's not, no." Just because you entered it into a system it is taken care of? Oh my god, no. But that's the management part. "I got risk, I got to put it in the system. It's now in the system so I'm done, let's move on." No. That's what I meant by "the process becomes the product."

But here's the other point. Those risks, they also have to be accepted by our stakeholders. Or understood. Not accepted, understood by our stakeholders. Because sometimes they can be the ones that drive us to be risk-averse more than anybody. Congress, the White House. Think about it. If we have a failure, I'm really not allowed to even work the failure. I've got to go respond to a million questions.

It's hard to say, but you've got to be willing to accept that you may have another tragedy. If you're not willing to accept that, then we just don't need to fly. Since this is a history thing, the last thing I want anybody to think is that I think we're going to have—I don't want anybody to think that I'm accepting another tragedy. I just know the reality of where we are.

Because hey, I can get in my car this afternoon and I can have a wreck going home. But that doesn't stop me from getting in my car. Somewhere in there I'm doing some kind of risks process. We all do it, internally. It's that risk-reward thing. By the way, there has to be a reward. We send soldiers into battle for hopefully a reward that someone's thought about, or benefit that someone's thought about.

If I send crews back to the Moon, or even further to Mars, we need to make sure that the public, our stakeholders, and everybody understands the benefit. I think I said in that speech,

that often we talk about the benefit of something when we sell the project, but by the time we get ready to fly, all we're talking about is the risk. You forget about it. The risk-benefit discussion, which is similar to likelihood and consequence, is a whole other piece that we have to work on. But I digress now. We're not talking history, we're talking philosophy.

JOHNSON: That's okay. If it was something you were trying to implement, that is history, so that's good. I'm glad you mentioned that.

Let's quickly talk about when Charlie stepped down with the new President [Trump], and you became the Acting Administrator. You ended up being the longest-serving person in that position. Talk about that very recent time period, and how you approached that as an Acting Administrator as opposed to a named Administrator. How that affected the day-to-day work coming out of the Administrator's office, or if it did at all as far as what NASA was doing.

Again, changing directions once we knew what the new President wanted to do, and also about the National Space Council. You mentioned Mike Pence earlier. I know we only have 10 minutes left, but maybe we can talk for a few minutes and then we can schedule another time to finish out the discussion.

LIGHTFOOT: I think for me it was pretty simple. I talked about being paralyzed when the previous administration changed. What I didn't want our team to do was be paralyzed. I pretty much stood in front of everybody and probably about as cavalierly as you can I said, "We're going to run till apprehended. We have an appropriations bill. We have missions we need to get done. I have crews on orbit, I got crews coming home, I got crews going up. What in that

makes you think we can stop and wait for somebody to tell us what to do? I've got a bill, so let's go."

Now I did that knowing that the typical Acting Administrator is only four to six months. It's real easy to be bold and obnoxious like that when that's the case. I will tell you that near the end there I'm looking over my shoulder, "Is somebody going to stop me, somebody going to apprehend me?" But the point was I just didn't feel any reason for us—there was nothing that said "Stop doing anything."

I told you what we did with the new administration, in terms of the goals of NASA, were goals where NASA can be part of your team. I didn't feel like I was at any disadvantage personally because I was the Acting Administrator as far as the White House goes. What I did feel like was we needed an Administrator, because it's always better to have the president's selection leading the Agency. It's always going to be better.

Did I have access to the folks in the White House? Of course I did. I talked to Vice President Pence several times. Just genuine interest, he was so excited about running the National Space Council, visibly excited when he talked to all of us on the Space Council. I still had a seat at the table as if I was the Administrator. They never treated me any differently, which I greatly appreciated. Congress worked with me as much as they could, until I think they got pretty frustrated near the end. I think for me it was actually a pretty exciting time. I didn't think about the fact that I was Acting too terribly often. Occasionally things would happen. There would be Center Directors that would leave and people would go, "Well, you really can't appoint the next Center Director."

I said, "I've got to have a Center Director, sorry." You had to do things, there were a lot of times where that came into play. I would call it more bureaucratic stuff of whether the Acting

Administrator can do it or not. But the other part that was cool was my team stepped up, and they were so awesome. The Center Directors that were there, the mission directors that were there. All my team around me. I just got to tell you, Lesa [B.] Roe was a godsend during that time. She was just phenomenal. I don't know if I could have done it without her help. She was unbelievable. Then, when she retired, Krista [C.] Paquin stepped in and same thing. These were two people—you need a sounding board when you're in those positions, and they were both very good sounding boards for me. Just to keep the sanity.

I had great support from Ellen Ochoa, Todd May, [Robert D. "Bob"] Cabana. These are people that were just—Janet [L.] Kavandi, David [D.] McBride, Dave [David E.] Bowles, Chris Scolese. Scolese had been through this—he lived it during the other change—so he was a really big adviser for me and helper for me. Rick [Richard J.] Gilbrech is an old friend of mine from years ago when I was at Stennis, we were at Stennis together. Even Mike [Michael M.] Watkins out at [NASA] JPL [Jet Propulsion Laboratory, Pasadena, California] was a big help. Eugene [L.] Tu who ran Ames. These folks, they helped me tremendously from the Centers.

Then I had Gerst, Bill Gerstenmaier, who just—I think a hundred years from now, whatever encyclopedias look like, if they say "human spaceflight" there's going to be a picture of Bill Gerstenmaier. He is the man. I had a good friend, Thomas [H.] Zurbuchen, he came. I didn't even know him, and we talked him into coming to run Science [Mission Directorate], and he just became a tremendous friend and asset to me. Steve [Stephen G.] Jurczyk, who replaced me as the AA. Jaiwon Shin—these are people that I couldn't have done it. Andrew [J.] Hunter will go down in history to me during that transition as probably—people will wonder "Andrew who?" He was the acting CFO [chief financial officer] for a year and a half. So he had an Acting job just as long as me, and he stepped up too for a role.

There were so many people that did that, that helped me run the Agency. The nice thing was I knew them already, I had such a great trust in them. I will say that the one thing that was probably most—I don't know if interesting is the right word. But one of my newer challenges that worked out pretty well I think—well, I shouldn't speak for myself like that—was the international engagement. Charlie had really owned the international engagement. Having meetings with my counterparts throughout the world was a tremendous experience. Al [Albert] Condes and his team at Headquarters—you talk about unsung heroes in the Agency and how they run the international program, it's just phenomenal. I was fortunate enough to go to Russia, Japan, Australia during this, Germany, France—I got to meet with so many world leaders in space. That was just unbelievable, unbelievable. Those guys did a great job setting all that up.

What was interesting to me—I'd heard it from Charlie, and I've seen it through these experiences—they want us to lead. Our partners want us to lead. If we lead, they'll come with us. We've just got to lead. If there was a new piece that came to me as part of the Acting time, that was the bigger part of the new piece. Everything else I had been through, because Charlie had pretty much let me participate.

You see how good this team is—or that team, I can't say "this" anymore. You see how good that team is and how dedicated they are to the mission. Those are the leaders that helped me, but their teams stepped up below them. When I asked them to take on extra duties, they had people take on extra duties at their Centers too. It was an incredibly rewarding time. When it was time to go, I was ready, but it was an incredibly rewarding time.

JOHNSON: Well, I don't want to keep you any longer than we have to, and I think that's probably a good place to stop. I have some more questions, so hopefully we can talk again soon.

LIGHTFOOT: Absolutely. Thank you very much, hang in there.

JOHNSON: All right, I will. Thank you.

[End of interview]