

**NASA SCIENCE MISSION DIRECTORATE
ORAL HISTORY PROJECT
EDITED ORAL HISTORY TRANSCRIPT**

EDWARD J. WEILER
INTERVIEWED BY SANDRA JOHNSON
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JOHNSON: Today is April 4, 2017. This interview is being conducted with Dr. Ed Weiler in Vero Beach, Florida for the NASA Science Mission Directorate Oral History Project. The interviewer is Sandra Johnson, assisted by Jennifer Ross-Nazzal. Thank you again for agreeing to talk to us and taking time out of your day.

In the *NASA at 50 [Interviews with NASA Senior Leadership]* interview, we covered some of your history up until 10 years ago. In 1996, you became Director of the Astronomical Search for Origins Program and I wanted to talk about that. You mentioned in that interview that there were four questions: How did the universe begin? How did we get here? Where are we going? And, are we alone? Why those four questions, and what was the purpose behind the whole program?

WEILER: Actually, I developed those when I was made Director of the Origins program by Wes [Wesley T.] Huntress [Jr.], who was the AA [Associate Administrator for Space Science]. Little did I know that I'd have his job within two years because he retired. I was trying to think "How do I explain this program to the average person on the street?"

I've always been a scientist who didn't like the way other scientists tried to explain science. I'd see my colleagues get up in front of a public group and talk to them like they were scientists. Not talk at their level, and not be very communicative. Instead of just having the

usual 50 viewgraphs—in those days there were still viewgraphs, now [Microsoft] PowerPoint charts—I wanted to explain all these complex things we did in space science, specifically the Origins Program. I tried to come up with basic questions which were human questions, not just science questions.

One day, commuting back to Annapolis [Maryland] in my car, I was thinking about this. I was stuck in bumper-to-bumper traffic, as usual, jotting down some thoughts. And it came to me, these four questions, which are basic human questions: How did it all begin? How did we get here? Where are we going? And to me the most serious question a human can ask: Are we alone in this universe? They explained everything we were doing in some way, from Hubble [Space Telescope] to Mars programs to planetary programs.

That became the cornerstone of the Origins Program, and then eventually all of space science. When I became the Associate Administrator in 1998, Earth science wasn't part of it, it was just space science. Those four questions have been long-lasting. I think they're still the core issues for SMD [Science Mission Directorate] at NASA Headquarters [Washington, DC].

JOHNSON: Along with that, there were a lot of missions that were planned. I read that you used those questions and used that interest that people have to find funding for that program.

WEILER: Yes, because in those days we were trying to sell the SIRTf, the Space Infrared Telescope Facility. And then beyond that, the Next Generation Space Telescope. And beyond that, interferometers that were going to look for planets, and even bigger interferometers, way out in the future, that would look for Earth-like planets and look for the signs of life, like carbon dioxide, oxygen, methane, and water vapor in these planets' atmospheres.

We got a lot of interest in these missions, even though we didn't get all the funding. We got some of the funding because of what we were saying. We were attacking these questions: How did we get here? Where are we going? And, are we alone? Especially the part of "Are we alone?" You've got to remember, it wasn't that long ago when we could talk about life in the universe and somebody could say, "What proof do you have?"

We'd say, "We can't even prove there are other planets." That was within our lifetimes, there were no planets except the ones in our solar system.

People would ask me at public lectures, "How do you know there are planets out there?"

I said, "There have to be."

"How do you know?"

I said, "How could we be one star in a universe that has one-followed-by-23-zeros stars?" Write down the number one, followed by 23 zeros. That's how many suns there are. Why are we so special that we're the only one that has planets? And take that even further, has life? Come on, you'd have to be extremely arrogant.

In fact, I started giving a speech—I've given it about 10 times now—called "The Search for Life." I talk about the cosmic decentralization of humankind. It's basically how humans have always tried to put themselves at the center of things. We would never do that, right? Wait a minute, weren't we the center of the universe for a while? As science went on, "Well, the Earth is not at the center. Maybe the Sun is at the center." No, that didn't work out. Then 1900 came, "Well, maybe we're in the biggest galaxy." No, that didn't work out. "Maybe we're in the center of the galaxy." That didn't work out.

Here we are, we kept getting further and further and further out. Now there's hundreds of billions of galaxies. We have no special place in our galaxy, we're out in the suburbs. What do

we have left? Ah, “We’re the only planets.” No, not true anymore. So what’s the last thing we have? The last crumb on the plate of human arrogance, “Obviously, this whole universe is for us. We’re the only life in the universe.” Come on.

I’ve given that speech so many times. I even used it sometimes when I testified to Congress. The search for life, the search for planets, was a good selling point. I mean, since Fred Flintstone [cartoon character] looked up in the sky, people were wondering “Are we alone?” It’s a basic human question, and it still is.

Now we know there are planets all over the place. The last thing we really have got to check off in this quest, and probably the most important discovery humans will ever make in the history of humankind—and it’s only made once—is to prove we’re not the only life in the universe. That’s probably going to happen maybe not in our lifetimes, but in our kids’ lifetimes. That will happen, I’m convinced of it.

JOHNSON: Did NASA have a relationship with SETI [Search for Extraterrestrial Intelligence] at that point?

WEILER: No, never. I worked for NASA for 33 years and I think SETI was shut out of NASA before I even got there. SETI is not a good way to search for life. Again, the universe is 13 billion years old. We’ve had radio communications for 100 years. That’s 10^2 versus 10^9 . If this were the length of time that the universe had been around, the time that we’ve had radio is like a micron in that timeline. What are the odds that we’re going to be pointing at the right star at the right time? Is it worth trying? Of course. Is it worth spending billions of dollars? No.

JOHNSON: You mentioned the Next Generation Telescope. That's the one that became the James Webb [Space Telescope].

WEILER: Yes, Sean O'Keefe named it that.

JOHNSON: Its beginnings were during that time you were at Headquarters?

WEILER: Yes, that's the time I called John [C.] Mather, the [JWST] project scientist who tells a story of the day he was in his office and he got a phone call from yours truly saying, "Hey, I've got a couple hundred thousand dollars leftover end-of-the-year money. Could you start a study at [NASA] Goddard [Space Flight Center, Greenbelt, Maryland], and get some outside scientists together and look at the possibilities of a Next Generation Space Telescope?"

He said, "Yes, I got nothing better to do," and the rest is history. He tells that story so well.

JOHNSON: Yes, he actually told it to us in an interview.

WEILER: It's true, I'm glad I confirmed it.

JOHNSON: Are there other missions during that two-year period when you were there?

WEILER: We got the Far Ultraviolet Spectroscopic Explorer [FUSE]. That was just an explorer, but we got that started. We got the Space Interferometry Mission [SIM] going, but it eventually

just cost too much money and didn't compete well. SIRTf [Space Infrared Telescope Facility, now Spitzer Space Telescope] got going very well, it got a lot of technology done.

Trying to think of any other missions. NGST [Next Generation Space Telescope] was really the big one. SIRTf was, of course, much closer to launch, but getting it sold to Congress was important, and we did a lot of that groundwork then. Those were the three missions I remember specifically.

You can tell somebody's been around a long time because they still call Spitzer "SIRTf," or Hubble "Space Telescope." Or Chandra [X-ray Observatory] I guess it is, it's AXAF [Advanced X-ray Astrophysics Facility] to me. GRO [Gamma Ray Observatory] is the Compton [Gamma Ray Observatory].

JOHNSON: You'll have to forgive me if I call them the wrong things.

WEILER: That's all right, it took me a long time to call it Hubble. It was always Space Telescope when I was growing up.

JOHNSON: In 1998 you became the Associate Administrator.

WEILER: Yes. Wes Huntress came to me, in August I believe it was, and asked me. He had talked to [NASA Administrator] Dan [Daniel S.] Goldin, and Dan said he would accept me as AA. I said, "Thank you very much, not in a million years." Then they started doing searches. I saw the kind of people they were talking to, and I asked myself, "Do I really want—?"

Wes said, “We’ll expect you to work with them and train them, because you’re the most senior.” It got to me.

About September, Labor Day or so, I called up Dan Goldin. He was on the NASA jet going somewhere. I said, “Hey Dan, I’ll do it, I’ll take the job.”

JOHNSON: What made you change your mind?

WEILER: I didn’t want to have to train somebody else to do a job I was probably better capable of doing.

JOHNSON: In the last interview, you mentioned that one of the first things you did after becoming Associate Administrator was going to [NASA] KSC [Kennedy Space Center, Florida] for the launches of the Mars Climate Orbiter [launched December 1998] and the Mars Polar Lander [launched January 1999].

WEILER: Yes. Little did I know the quote, unquote “gifts” that were left to me sitting on the launchpad. Two time bombs ticking, literally. Climate Orbiter was launched first, got there [to Mars] first. Of course, there was a serious error in basically human operations and the way humans deal with each other. The navigators were ignored because they saw this tendency and trend in a position that should have been taken seriously, and it wasn’t taken seriously. We didn’t go into orbit, we came in too low and burned up in the atmosphere.

Then of course the Polar Lander had a myriad of problems. After the fact, they discovered all kinds of problems that would have never allowed a safe landing. I think what

everybody learned, including Dan Goldin in those days, was that you can't have three things. "Faster, better, cheaper" is a great idea, but you can only have two of them. You can have faster and better, but not cheaper. You can have faster and cheaper, but not better. You can't have all three. That was proven in spades.

Dan, to his credit—I may have told you this then—I remember I was at my son's basketball practice. It was a cold night, and I was out in the parking lot with the cell phone. Dan had called me up after the second failure and said, "Okay Ed, you've got 24 hours to fix the Mars program." That's Dan. By the way I'm a Dan Goldin lover, just for the record, I think he was the greatest Administrator we ever had. He was great for science, absolutely great for science. The science program just took off under Dan. Anyway, he said, "You got 24 hours to fix the Mars program."

I said, "Okay, I'll get back to you tomorrow." I thought about it overnight and I called him up the next day. I said, "Fine, I got a solution."

He said, "What is it?"

I said, "I'm going to cancel the whole program, start from scratch."

He said, "Great, do it."

That's when we hired [G.] Scott Hubbard and got the community involved, and basically laid out over the next six months an architecture for a new Mars Program. It wasn't cheaper, but it was faster and better. Slightly more expensive.

The proof of the pudding is we proposed seven or eight missions. It's now the end of that line, and absolutely every one was successful. Every single one was successful. Next to Hubble, probably the most successful program ever in NASA's history. Starting with Mars Odyssey and Mars Reconnaissance Orbiter, the two Mars [Exploration] Rovers [Opportunity and Spirit].

Curiosity [Mars Science Laboratory], the Phoenix lander, MAVEN [Mars Atmospheric and Volatile Evolution)—they were all part of that original plan. Every single one went off successfully.

JOHNSON: What do you think made them successful, as compared to the two that had failed?

WEILER: The right amount of money. When engineers make bad decisions for cost you're doomed to failure. Engineers have to make the right decisions regardless of cost. That's the difference.

JOHNSON: Under Dan Goldin's leadership, the funding was more available? You said he was really good for science.

WEILER: First of all, let's put it in perspective. Under Dan Goldin—and this is over the course of four, five, or six years, starting in 1998—we doubled the space science budget. We went from \$2 billion when I took over to \$4 billion by the time I left in 2004. That's what the difference was. We got an adequate budget. People knew they had an adequate budget, and they made the right decisions. They didn't make bad decisions for cost. They made the right decisions even if they cost more.

JOHNSON: What did it take to get that budget doubled?

WEILER: Oh, a lot of lobbying with OMB [Office of Management and Budget]. And a guy named Steve [Steven J.] Isakowitz at OMB, who's the absolute opposite of the kind of people that are at OMB now. Steve was an MIT [Massachusetts Institute of Technology, Cambridge] graduate, an engineer. He was qualified to be looking over NASA. The people they have now are not, and the people who they had in 2007, '08, '09 were not. Without mentioning specific names, but they know who they are, like the person who canceled the current Mars Program. We had seven successes in a row, and we now worked with ESA [European Space Agency]. This was in 2010 and '11. Jumping forward here. But that was the end of the seven or eight successful missions.

So for the first time we got ESA to agree not just to work on one project with us, but to develop the follow-on program for Mars, the sample return missions, and beyond that, and be part of every single mission, and be half partner. They would fund half, we would fund half. They would lead half of the missions, we would lead half.

This was a major breakthrough. It took them a lot of work to do it, and took us a lot of work working with them. OMB, in their wise incredibly smart realm, decided to cancel the whole Mars Program. That was our reward for having one of the most successful science programs in history. They canceled the whole program and told ESA to go to hell basically. That's your OMB.

When I give my talks here in Vero Beach, I like to talk about what I call the "stealth agency." What do I mean about the stealth agency? They're not the CIA [Central Intelligence Agency], they're not the FBI [Federal Bureau of Investigation], they're not the NSA [National Security Agency]—they're the OMB. They have no oversight, they don't answer to the press. They don't even come to testify to Congress when they're asked. It's incredible, they've got this

incredible amount of power. GS [General Service pay scale]-15s and 14s making hundreds of millions of dollars of decisions, and they're not even qualified to do it. They don't have the technical smarts to do it. To me it's disgusting as an American taxpayer.

JOHNSON: By canceling those programs with international partners—we interviewed Lynn [F. H.] Cline and Michael [F.] O'Brien, different people that worked with the international affairs. I know it's happened before, it happened in the '80s. Because of the budget, these programs would get canceled.

WEILER: This had nothing to do with the budget, this was just they didn't like the Mars Program.

JOHNSON: But it does have an effect on our international partners, because it puts a burden on them. ESA partnered with Russia, and they moved on with that.

WEILER: That's right, ESA goes to Russia, yes. The reason it was done—I'll be brutally honest—was our Deputy Administrator who was connected to the commercial world, Lori [M.] Garver. Oh, she was the biggest disaster in NASA history for science. She had an inside track to OMB. They would go around [NASA Administrator] Charlie [Charles F.] Bolden [Jr.] routinely and undercut him. He was trying to get a letter agreeing with ESA to work together, and they got it cut. They got that letter stopped. A lousy letter, they got it stopped. Lori Garver was one of the main reasons I left. I couldn't deal with that person.

JOHNSON: I know over time it would make the international partners, I would assume, less likely to want to work together if they can't trust that we would be there later.

WEILER: Oh, absolutely. And when budgets get tight, what's one way to solve a tight budget? It's to find partners who are capable of being good partners, and ESA has been an excellent partner. ESA is part of Hubble Space Telescope, they're part of James Webb Space Telescope. They've been an excellent partner. For us to shoot them in the face—after all the hard work they did to get their member nations to agree to do something they'd never done before, to commit to a series of missions—to have this arbitrary and capricious decision made not to go forward with the Mars Program, I was just totally embarrassed. I couldn't take it anymore. It's one of the main reasons I left NASA. I couldn't take it. I was only 62, but I could not deal with incompetence. I can deal with people who are technically qualified to make technical decisions, but not people like Lori Garver and the people at OMB to make those kind of decisions.

JOHNSON: It is an interesting situation when a science area is determined strictly on another things.

WEILER: Yes. I'd understand if we'd had a bunch of failures or we weren't doing well, but seven or eight successes in a row—I mean, give me a break. That ain't bad. Especially when you're doing things that have never been done before. If you've built seven Toyotas [cars] in a row, so what?

JOHNSON: Science missions in general, they're complex. That's putting it lightly. James Webb began as Next Generation, and moved through the processes of funding and getting it built and partnerships. Do you want to talk for a few minutes about that process with some of these planetary exploration programs? Maybe there is no typical life cycle of any of these missions—some of them are short term, some of them are more long term—but generally talk about some of the perils you encounter. Maybe some of the successes versus the ones that weren't so successful, what some of those differences would have been.

WEILER: A lot of people wonder how do we choose the missions we get. Contrary to what people think, it's not dumb bureaucrat civil servants that choose the missions, especially the big missions. The big missions are chosen by the most respected scientific body on Earth, and that's the National Academy of Sciences.

About 20 or 30 years ago, yours truly and a few others convinced the whole community to copy what the astronomers do. Let's get the National Academy, once every 10 years, to look at all of our missions. Bring together 200, 300 scientists from your specific field—whether it's astronomy or planetary or Earth science or heliophysics—get them together, and make the tough decisions. Show Congress that you're capable of making the tough decisions and prioritizing.

What we saw in astronomy was Congress was very impressed with the astronomers back in the '80s and '90s. They saw astronomers as making the tough decisions and telling Congress what were the highest priorities. What was AXAF highest priority, what was Spitzer, Chandra, whatever you want—astronomers did that. That finally became the way business was done at NASA around 1995, 2000, for all. By the way, Lori Garver didn't like that process. She thought

that people like her should be making those decisions. Just a sidebar, and that's a direct quote of hers in front of other people, so I have proof.

The scientists and the Academy would come up with these so-called decadal reports. People in my position, Associate Administrator, would take these as the Bible, that those would be the missions that we would go to Congress to sell, and we would put our budgets behind those priorities. The scientists and the Academy always tended to be overoptimistic about budgets. They underbid JWST. They underbid a lot of things, not just JWST. Earth science especially, I think. All those budgets were 50 percent more than the National Academy said, but we still used the priorities.

NASA has been pretty successful getting those priorities started, and a lot of the missions we've flown over the last 10, 15, 20 years have come right out of the decadal. The decadal also prioritize something like a Discovery Program, that's not specific missions. The Discovery Program is very high priority in the decadal for planetary. What NASA does is issue an announcement of opportunity and ask the science community, "Okay, tell us what you think are great missions, propose them at the \$500 million or \$600 million level." Then NASA runs a full-up, competitive peer review of those missions.

In a sense, they're like decadal missions too because they're a full community review, and they're picked through peer review. A lot of our most interesting missions lately have been Discovery missions, New Frontiers missions. The Pluto mission [New Horizons] was a New Frontiers mission and Juno [mission to Jupiter] was a New Frontiers mission.

For very big missions, they're identified in the decadal. For moderate to slightly more than moderate missions, they're done by announcement of opportunities. Even small Explorer missions are done through announcements of opportunity. The bottom line is everything above a

few million dollars is full-up open competition and peer review. Not some bureaucrat at Headquarters who's a political appointee, say in the Deputy Administrator's job, saying what missions I like.

I always found when I went to Congress—and again, this is logic. If Senator Joe Schmo from Alabama says, “Dr. Weiler, why did you pick that mission?” there are two answers you can give: “Senator Schmo, because I thought it was a good mission” or “Senator Schmo, because we did the great American competition thing and let the community pick it.” Which one do you think Senator Schmo would consider more appropriate?

So I never had to defend a decision of mine because my decisions were always made the good old American way, through competition. I didn't say who the [National Football League] Super Bowl winner would be, I let the teams compete for six months, the American way. It's actually a good analogy.

JOHNSON: That is a good analogy. It's something that makes sense, because they're going to get what they need out of the science so that they can go on with their studies.

WEILER: Yes. I can't see a bad thing about competition. People have tried to stop it, but hell, it's worked for America.

JOHNSON: You started out working in the astronomy area. In all the different things that you've done, the evolution of technology has made a big impact. They used to do more ground-based studies and now everything's moved to space. If you don't mind, take a few minutes and talk about some of your thoughts on technology and how it's helped exploration.

WEILER: Just one little piece of technology, the CCD (charge-coupled device), it's a classic story. When I was doing my PhD thesis back in the mid '70s, to not get too technical, we didn't have really fancy detectors. We had one-channel detectors. If you wanted to look at a whole spectrum, light spread out, you had to have a movable grating which would go clunk-clunk-clunk-clunk-clunk and then take a reading every angstrom or every micron or whatever. It would take you hours to get one spectrum with a spectrum scanner. Jump forward 20 years and CCDs, which are array detectors, can do all that in seconds.

Why is that relevant? Hubble was the first real space astronomical device to use charge-coupled devices. It was launched just late enough to take advantage of the first Texas Instruments [Inc.] CCDs, which were declassified from Big Bird [KH-9 Hexagon] satellites, which now everybody knows about because of Tom [Thomas L.] Clancy books. I'm not relaying any secrets; read Tom Clancy. These CCDs were used by the DoD [Department of Defense] and Texas Instruments CCDs were made available for Hubble. They were in the Wide Field/Planetary Camera 1, and they were 800x800 [pixel] devices.

Jump forward to today's CCDs that are 4,000x4,000, 10,000x10,000. CCDs are in every single iPhone [smartphone], every single video camera on Earth. That's why film isn't used anymore. And that's just in our lifetime. We've gone from taking pictures with a Nikon [Corporation] camera, EM [35mm film, single lens reflex] like I had, to everybody has an iPhone. The technology was used in space long before it was in iPhones or cameras. It just revolutionized astronomy, absolutely revolutionized astronomy. And that's just one technology.

Computers are another, obviously. Hubble's first computer back in 1990 was probably a millionth of the power of your iPhone computer. It's just incredible how computers have gone

and changed the way we do data analysis. Back when I was doing my PhD thesis, I had to spend six months in the stacks doing library research. With the internet now, I could do that in a couple days. Science is very different. Today's kids are spoiled. They don't know what real science is, real work.

JOHNSON: Hours of research, right?

WEILER: In the library. "What's a library? What's a book? Paper? You mean you had books made out of paper?"

JOHNSON: You mentioned the technology transfer and the different things that NASA has done for the world. A lot of times people don't even realize that that technology is thanks to NASA.

WEILER: Hubble—I hope somebody told you about stereotactic breast biopsy.

JOHNSON: Go ahead and talk about that.

WEILER: People at Goddard could tell you about it, this was back in the mid '90s. These CCDs for Hubble were found by some doctors to be sensitive to soft X-rays. Before they came out, if you had a tumor or something they had to use an X-ray, which was dangerous of course. Then to do the biopsy they'd have to be very invasive with a scalpel, and you're in the hospital overnight. I'm talking about 20 years ago.

But then the stereotactic system came out. In real time, instead of using X-ray film they could use one of these live X-ray detectors. They could guide in a tiny little needle into the tumor and do the biopsy almost noninvasively. The woman comes in, walks out the same day. It's just made a huge difference.

[Memorial] Sloan Kettering [Cancer Center] was the one that pioneered this up in New York [City, New York]. There are people at Goddard and the Hubble project that are probably still around who could tell you about it, but there's a bunch of stuff written on it. If you Google Sloan Kettering, CCDs, and stereotactic breast biopsy you could probably find out.

Almost nobody knows about that. That came right out of the Hubble CCD program. In fact, it was CCDs made for STIS, the Space Telescope Imaging Spectrograph. The specific CCDs for that instrument—the company that made the CCDs is in California. It spun off into the stereotactic system.

JOHNSON: Like you said, there's a lot of things like that. It's interesting when you think about all the advances. Why don't people know these things?

WEILER: There's a whole generation of kids who don't believe we walked on the Moon. You tell them [Project] Echo satellite, "What the hell was that?" It was the first communication satellite. It was only a balloon that they bounced the signal off of, but it proved the concept.

JOHNSON: It's usually when something big happens that people pay attention, like when the Spitzer found the TRAPPIST-1 [dwarf star] with its seven earthlike planets. People tend to pay more attention when things like that happen.

WEILER: Then it goes right by them, day after that. They call it the news cycle.

JOHNSON: Let's talk about what you feel is the relevance of the Science Mission Directorate. It's important that NASA continues work in this direction, but why do you feel it's important? I know it sounds like a simplistic question.

WEILER: It's not. It's especially relevant today because I read a lot of—excuse the expression—crap out in the media about, “Well, we don't really need the government supporting science because commercial companies, private donors, they love science. They'll do it if the government doesn't do it.” What universe do you live in? Last time I checked, people are out for the bloody dollar. They want to make a profit.

Hubble is a classic example. Anybody, whether they make \$100 million a year or 10 cents a year, can get on the internet and download any picture of the universe ever taken by Hubble for free. Tell me what commercial company is going to invest \$10 billion launching a Hubble and then charge nothing for the data. What universe do you live in? That's not the Donald [J.] Trump America I know.

Let me put it this way. If NASA doesn't do it, nobody's going to do it. Just not going to happen. That's not what capitalism is all about. I'm not a communist, capitalism is good for some things. But when it comes to science and art and things that don't make money, you better have government do it. Just the way I feel.

JOHNSON: Part of having the government do it is of course it takes funding. You spent some of your time testifying before Congress members and talking to congressional staffers. You had relationships with some of them, like Barbara [A.] Mikulski [senator from Maryland].

WEILER: Senator Babs, my favorite senator of all time.

JOHNSON: Talk about that aspect of your job, about having to prepare to do that, and some of those relationships. Maybe what you could tell someone that had to do that now, especially in the current atmosphere in DC.

WEILER: I actually tell that story in the public lectures I give here, because they ask me “Why did I leave NASA?” I say one of the many reasons was the fact that by 2011 I had finally given up on Congress’s ability to work together. Professionally, I had grown up in Washington from the late ’70s on. In the late ’70s there were Republicans, there were Democrats. They fought all the time, but they were a different breed of public servants. There were the young Mikulskis, the young Senator [Robert J.] Doles.

They were opposite ends of the spectrum, but they found a way to work together and do things for the good of the country. Find a way to fund the Hubble Space Telescope, find a way to do science that’s going to excite our kids and to get more engineers and scientists coming out of our grad [graduate] schools. They cared about that kind of thing. They didn’t vote on every bill based on whether you were for abortion or not for abortion, ridiculous issues that don’t mean anything in science. They’re a dying breed. Now Senator Dole has left the Senate, Senator Mikulski is gone.

I got to know Senator Mikulski very, very well because she was my Maryland senator. I lived in Maryland, plus Hubble. I coined the expression of calling her the “godmother of Hubble” on camera one day, and it stuck. But she was the godmother of Hubble. She stuck with us. She really loved science, she cared about kids. She cared about exciting kids to major in science, especially young girls. She was very concerned about the future of this country.

I gave a commencement speech at University of Maryland [College Park] one particular year. It was for physics. Not picking on Maryland, but telling the truth, it'd be hard to find too many new PhDs that had American passports at that commencement. That was a sad statement. Our universities are still putting out lots of PhDs in physics and engineering, but not many of them have American passports anymore. That should scare the hell out of Americans, it should really scare the hell out of Americans.

MBAs [Masters of Business Administration] are important, lawyers are important, but they're not going to be the ones that develop the next CCD or stereotactic. They're not going to do the technology. This country has become great because it leads the world in technology and science, and I see that really, really falling away. I see a Congress that doesn't give a damn anymore. They care more about whether you're for abortion or against it, you're for this Supreme Court justice or against him. They only know how to fight and preach their gospel. Where are the Mikulskis and Doles? That's one of the reasons I left, I just couldn't deal with it anymore.

JOHNSON: Would you have any tips for anyone in science now that had to go speak before Congress? Anything that would be practical, even with the environment today, on how to promote science?

WEILER: I still think promoting science based on—even more so than in the past—the economic return. These people do understand the almighty dollar, and the almighty dollar is not going to come to the U.S. if the only country on Earth that's producing engineers and scientists is China. I'm not picking on China, but maybe I am. They are a real threat to this country technologically. They come to our schools, they get their PhDs at our schools. They go back and then they beat the hell out of us in the market. That should scare people.

How do you get kids to be interested in science? By inspiring them. How do you inspire kids? By doing things that are inspiring, by landing on Mars. You've got to do things, and then convince kids that doing it is more important than virtual reality crap on your little iPod or whatever. That's a bigger problem. How do you get kids away from the darn iPods, and whatever they use these days, and the virtual reality garbage and get back into reality?

That's why I thought *The Martian*, the movie, was one of the best movies I've ever seen. It was real, it was real. It really told the story of how dangerous it is and how much of a problem exploration is. You would hope that kids would be inspired by that. But most of the people I saw were people of our generation. Maybe we were the Greatest Generation after all, the baby boomers.

JOHNSON: I read the book, too. I thought it was so well done because it kept you interested, it was humorous, and it was exciting.

WEILER: It was excellent. Whether you're a botanist, an astronomer, a physicist, or an engineer—the thought of how do you grow organic stuff in inorganic soil.

JOHNSON: The country is pushing, and NASA also, STEM [Science, Technology, Engineering, and Math] education. Do you feel like that's helping trying to keep kids interested?

WEILER: It does a little good. One of the things I'm proud of is that I was the first AA who forced all of his projects to set aside 1 percent to 3 percent of their budget for STEM, for education. That's survived to this day, even despite the recent Trump cuts. Trump eliminated all education at NASA, except I guess his people didn't find all the little pieces we had. Don't tell anybody. But Hubble has got its own, and Spitzer has got its own.

Thank God we divide and conquer, or hide it. I've always felt that way. I remember one day I met this person from the blind association [National Federation of the Blind]. They had an idea of taking Hubble images and putting them into braille, and asked if I could help out. So I found \$50,000 in reserve out of our \$4 billion. To make a long story short, the association of sight-impaired people produced this braille book of Hubble pictures. The way they sense the colors is with the different height of dots.

I don't understand braille myself, but the kids could actually feel what Jupiter looks like, what Saturn looks like, what a galaxy looks like. They invited me to this release of the book, and there were about 20 sight-impaired students. They all had the books out, talking to their teachers. I went around, and the kids were just incredibly—it really warmed your heart. This was for \$50,000.

JOHNSON: Did you have a chance when you were AA to talk to groups of kids?

WEILER: Oh, I used to all the time. I went around the country. Mostly Maryland, but also the country, to various high schools and kid groups giving a talk after we fixed Hubble [in 1993]. The theme of the talk was “You see, adults can really screw up, but what’s important is we kept trying and trying and trying till we got it right. Riding your bike is really hard, but it’s worth to keep trying.” That was the whole theme; even adults screw up. It was the story of the redemption of the Hubble Space Telescope. We really screwed up, but we really fixed it. There were some good parts of the job back in the ’90s before it really went down the toilet in 2010, ’11. I enjoyed that a lot, I enjoyed that talk.

In fact, I even remember the last slide in my presentation, which showed that the Hubble really was fixed, and America really felt it was fixed. During the bad days of 1990, 1991, there were all kinds of cartoons and jokes in the newspaper about Hubble. One of the classics was a picture of Mr. Magoo [near-sighted cartoon character] with his thick glasses, and the caption was “The true inventor of the Hubble Space Telescope.”

But after we fixed it and all the pictures started coming out—from the Wide Field/Planetary Camera, not the COSTAR [Corrective Optics Space Telescope Axial Replacement] I might add—I remember this one picture. It was about the time Comet Hale-Bopp was showing up [1997]. It was a picture of a dad and his little boy. Could have been a mom and a little girl, but this one was a dad and his little boy, maybe eight years old. They’re in a telescope store, and the dad was pointing to this little refractor, very nice telescope on a tripod. The little boy had a tear in his eye and looked at his dad and said, “But Dad, can’t we get a Hubble?” That was redemption.

Senator Mikulski—I’ll never forget, because I briefed her in the green room [waiting area] before she went on TV at the big press conference advertising that it was fixed. I gave her

the pictures and showed them to her. She looked at them, before and after, and she goes, “My God, it’s like putting my glasses on.” Then, the picture I gave her she held up at the press conference and said, “The trouble with Hubble is over.” Direct quote. I’ve even got a picture of that somewhere in the house, picture of M101 [Messier 101] the [pinwheel] galaxy, with the quote from Senator Mikulski.

JOHNSON: You mentioned that relationship and the difference between what’s happening now, and the fact that you doubled that budget.

WEILER: Over five years. I didn’t personally double it, I worked with OMB and Steve Isakowitz.

JOHNSON: Right. It was an unprecedented level of funding that got added. You got this consistent support from the [presidential] administration and Congress. I know we talked about the changes in Congress, but did you learn any lessons during that time on things you should or shouldn’t do that you applied during those five years?

WEILER: The importance of OMB. That’s what I kept telling my scientist colleagues. I said, “You can lobby Congress all you want,” but the bottom line is Congress budgets year by year. They can do their earmarks and they can move things around a little bit, but they don’t change things that much from the president’s budget. The real power is the OMB, because they lay out a budget for five years. Once that budget gets out there, the Congress has to take action to change

it every single year. It's hard to get Congress to do anything ever, but to get them to do something every single year?

What I learned is the relationship with OMB, and dealing with OMB, is far, far more important than Congress. Congress is important, but the OMB is again that stealth agency, the three-letter agency. Not CIA, NSA, or FBI. OMB, that's where the power of the budget is. This guy, Steve Isakowitz who was our savior, who helped us double the budget, put the Mars Program in. His legacy, even though he left two, three years after I became AA—that five-year budget kept getting moved forward. His legacy followed him.

The OMB is incredibly important, incredibly important. If you've got some bad people in there, bad people in the sense of not technically smart, not really educated for the job they're doing, it can be very, very bad for you. There's not a lot you can do.

JOHNSON: Is there was anything that you could do to work around that?

WEILER: You can get Congress to earmark every single year. That's what JPL did, they lobbied their congressman. The congressman from Texas for some reason who likes Europa missions, [John A. Culberson]—they lobbied him, and he'd throw in \$100 million. OMB would zero it out the next year. He'd throw in \$100 million, OMB would zero it out. They did that for three years, but it took a lot of work.

Yes, you can use Congress, but OMB can make it really difficult for you. If they don't want to do something—every time there's a new president, of course things change. For instance, the OMB last year was very pro-Earth science. Now, the current OMB is very anti-Earth science, even though it's exactly the same people. Isn't that amazing? They do what

they're told, let's put it that way. Some of us, when faced with that thing of doing what you're told, retire. Hint, hint.

JOHNSON: How much of your time as AA was spent working on things like trying to find the budget?

WEILER: Too much. Budget and defending programs and fighting for programs was probably at least 50 percent of the job. Maybe 25 percent was working on programs that had problems, and trying to fix them with the right [NASA] Center Director or the right project manager. Maybe about 2 percent or 3 percent was the fun part of looking at what science is coming in, deciding what press conferences to do, doing press conferences, giving public lectures. But as you move up the chain that gets less and less and less of a percentage.

I started out as a GS-13. I really started at the bottom, as a staff astronomer. I think I held every job you can hold as a scientist at NASA Headquarters. Except Administrator, but that's okay, that's a political appointee job.

JOHNSON: You had the fun jobs.

WEILER: Some of them were fun.

JOHNSON: Some of them more fun than others.

WEILER: The two Mars crashes weren't fun, but the seven-in-a-row successes were fun.

JOHNSON: You spent a lot of your time explaining when bad things happened.

WEILER: Oh yes, it's amazing how your bosses disappear during spherical aberration, yes. I was only 35, 40 years old. In 1990 on the day for the [Hubble] spherical aberration press conference, I was given the honor of telling the American people why we wouldn't be delivering the science. One of my bosses was in Japan, I don't know where the other one was. Yes, I'll never forget that day because it's like explaining to the press when you stop beating your wife.

JOHNSON: Talk about that day for just a minute.

WEILER: June 27, 1990, the day that shall live in infamy. I still have a videotape of that press conference—I look so young. But that was an interesting day, speaking of the Wide Field/Planetary clone. I was preparing for that press conference, and I had talked to all the chief scientists of the five instruments. I had asked them a very simple question that day, because they were having a meeting at Goddard and the press conference was at 1:00 pm. I worked with them in the morning. I said, “I want to know what you can do that you proposed, and what you won't be able to do that you proposed.”

The two spectrograph people told me, “Maybe about 50 percent we'll still be able to do.” The Wide Field/Planetary Camera 1—Jim [James A.] Westphal was a very negative person. He said, “I can't do anything.” The Faint Object Camera from Europe said, “With image processing we may be able to do a little.” They were a little more optimistic. The High Speed Photometer

said they could probably do most of what they were planning, but regretfully that was not one of the more interesting instruments for the public.

I was looking at telling the press that we were really screwed. But on the way out of the room, John [T.] Trauger—who you’ve got to interview by the way—the principal investigator, lead scientist on the Wide Field/Planetary Camera 2, the clone—which was about half built at the time—said, “Come over.”

I said, “What do you want?”

He said, “I think we have a way to fix the problem.”

I said, “Come on.”

He said, “There are four little mirrors.” All cameras have bunches of lenses and mirrors in them, they’re not just a lens and a piece of film. They have a bunch of relay mirrors, four little mirrors that are concave. “We know what the wrong curve is on the main mirror” [of Hubble]. It’s like knowing what the wrong curve is on your eye. He said, “We could change the curve on our little mirrors that reflect that light and do this.” Correct it with the opposite prescription.

I said, “Are you sure?”

He said, “Yes, we’re sure we can do it. We can fix the camera totally, fix the images totally.” Imaging is what Hubble is all about, let’s face it.

I said, “Okay, can you get it ready?”

“Yes,” he said, “we can do this by 1993 for launch because they’re just four little mirrors. We haven’t built up the camera yet, it’s just a matter of changing out the mirrors.”

I went to the press conference, basically told them that we’re not going to be able to get any pictures. “The world is over,” the press said. But at the end I said, “But we are convinced

that by the time we launch the repair mission we will have a fix”—the COSTAR didn’t even exist at this time—“we will have a fix for the imaging and the pictures from Hubble.”

I explained this concept. Almost none of them bought it. “You guys are just full of crap. You’ve never done anything right on Hubble, you’re all a bunch of Flub-A-Dubs.” Except for Kathy Sawyer from the *Washington Post* [newspaper], one of the greatest news writers ever. A really sound old-fashioned journalist, before the days of bloggers, I might add, when real journalism was done, honest journalism, truth.

She took me seriously and she included in her story in the *Washington Post* that NASA believes it can fix this problem. Of course the end of the story is we did, and John was right. A couple months after we launched that [repair] mission, the American public saw that the Hubble was fixed.

JOHNSON: The first pictures that were coming down when everything was clear must have been a pretty important day, too.

WEILER: It was December 18, 1993 at the [Space Telescope Science] Institute [STScI] in Baltimore [Maryland], just after midnight. We got this on film, too. NASA has it in the official archive. For some reason—I’ll take credit or discredit—I told the PAO [Public Affairs Office] people, “Make sure you get a cameraman up there. I want this filmed. Whether it’s good or bad we have to have this on film, because it’s a historic moment. It’s the first picture coming down from the new camera. It either works and we’ve solved the problem that we’ve all been dying for, or we’re screwed and we’re all going to die.” So they filmed it.

The look on people's faces as this picture came up—this was an old [cathode ray] tube-type TV. It took a while for it to build up, but it got clearer and clearer and clearer. Everybody starts shouting. I remember my reaction was, on camera, "Holy shit." That made all the news shows that night. Literally, that was my honest reaction. I thought the Administrator was going to fire me for it, but he congratulated me to show that scientists can be real humans. Then the champagne corks started.

It was redemption. We had gone through three years of hell, absolute hell. Neighbors coming up to you saying, "Oh, I'm so sorry for you having to work on that national disgrace." This was for three solid years. Nobody believed we'd fix it, nobody except us. It was redemption. That's as close as you can ever get to the term; I really understand what the word redemption means at a human level.

JOHNSON: One of the things I read about Hubble was that early on, before Hubble was launched, you talked about repairing satellites instead of bringing them to Earth and how hard it would be to do that. If the Hubble had to be repaired at some point it would never have been relaunched.

WEILER: Never.

JOHNSON: So that was the beginning of repairing any of the satellites.

WEILER: Beginning and the end. Hubble. A lot of people at NASA had this idea, "Oh, now that we've done it for Hubble, we can do it for all these other satellites. Let's spend billions of dollars on satellite repair." People have to remember that Hubble was designed from day one to

be worked on by astronauts on the Space Shuttle. There are two problems with going off to do it on other things now. One, there's no Shuttle, and two, they weren't built to be repaired in space. Other than that, have a great day. But there are people out there that talk about it all the time. "Oh yes, satellite repair." Right, okay, good luck with that.

JOHNSON: It was tough getting that last repair done too, as far as getting that approved.

WEILER: Yes. Oh God, yes. Sean O'Keefe—I won't talk about that. Talk about foot in mouth disease. "I'm the Administrator, I'm going to cancel the last servicing mission." Yes, good luck with that, Sean. We were very proud to support him on that because we all knew how far that would get. It's like going up to a panda bear at the Washington Zoo [National Zoological Park, Washington, DC] and punching him in the nose. How's the public going to take that?

JOHNSON: That's a good analogy.

WEILER: No offense to the human spaceflight program, but there are two things at NASA that if you're sitting next to somebody on an airplane, people will recognize what you're talking about and say, "Hey, that's great stuff." One, Hubble Space Telescope, and two, Spirit and Opportunity, the Mars rovers. Everybody knows about those. They may not know who the astronauts are on the [International] Space Station—they may not even know there's a Space Station—but they know about Hubble and they know about the Mars rovers. Screwing with Hubble is like punching a panda bear in the nose.

JOHNSON: You talked about sharing scientific discoveries, and the fact that commercial enterprises may not be as open to doing that. You believed in this robust interaction and partnership with academic communities, with informal education for kids and museums and planetariums. Talk for a minute about why you think it's important to share these scientific discoveries in these type of communities, especially maybe the average person on the street. Why is it important for NASA to remain a leader in doing that and sharing that information?

WEILER: I don't think I'm unique as a person. I don't think that I was picked by somebody, a higher power, and said, "You're going to be the Hubble Chief Scientist someday." I was born to a very poor family. Blue-collar father—steelworker and then a meat cutter—in inner-city Chicago, very poor neighborhood. I went to a Catholic parochial grade school [St. Rose of Lima] with nuns, the [Religious] Sisters of Mercy. Of course, back in those days they knew how to teach, they got kids' attention. You got a good education from those sisters. If you didn't do what you were told, you got a ruler on your wrist or worse.

Then, my parents worked extra hours to send me to the best Catholic Jesuit prep [Preparatory] school in Chicago, Saint Ignatius [College Prep]. So I got a very good high school education. I got a full scholarship to go to Northwestern University [Evanston, Illinois] because my parents couldn't afford it.

Even during that process, I was inspired. I was inspired by the early astronauts, John [H.] Glenn [Jr.], Alan [B.] Shepard [Jr.]. I used to get up for grade school at 6:00 in the morning to watch the [Project] Mercury [first U.S. human spaceflight] capsules go up. I used to watch the early Pioneer [program] satellites that went by Mars and Venus. That stuff inspired me. I wanted to become an astronomer.

By age 13 I had decided I wanted to be an astronomer, I wanted to work for NASA, and I wanted to go to Northwestern University. That was because of what NASA was doing. Age 13. How many kids today know what the hell they want to do when they're 21? I was inspired to do this kind of stuff.

By the way, I did all of it. I went to Northwestern, I became an astronomer, and I worked for NASA. I was inspired to become what I did by outside influences. What inspiration do our kids have today? How do we inspire more kids to become not necessarily astronomers, but physicists, engineers, technologists? We need doctors and lawyers too, but that's not a problem. We've got plenty of lawyers, plenty of MBAs.

What we don't have anymore in this country is plenty of physicists, engineers, and hard scientists. If you don't believe me, go look at what's coming out of our grad schools. Our grad schools are putting out exactly the same number of PhDs in physics, engineering, but they're not carrying American passports anymore, and that should scare people. That should really scare people, and it doesn't.

In terms of recommendations to other people at NASA who are lobbying Congress or talking to Congress, you've got to hammer this home. Sooner or later, you've got to find the right argument that's going to get them to realize it really is the almighty dollar we're talking about here. It really is. This country needs to be competitive. If it's not competitive, in 2050 it's going to die, whether we like it or not. Our grandchildren are going to be cleaning toilets for Chinese tourists at all our hotels.

You want to be blunt, let's be blunt. Those are the kind jobs we'll have left, service positions. We're tending toward that now. Go look at the number of people in the service industry today in this country versus 20 years ago, 40 years ago. Is that the future we want for

our grandchildren? I don't think so. We want to be competitive. To be competitive we've got to be good technologists, we've got to be good physicists, we've got to be good engineers, we've got to be good architects. All that stuff that kids don't like to study anymore in school. Because it's hard, because it's hard.

Who said, "We do these things because they are hard, not because they're easy"? That rings a bell. [Referring to President John F. Kennedy speech: "We choose to go to the Moon in this decade and do the other things, not because they are easy, but because they are hard."]

JOHNSON: It does.

We've talked about some of the people you've worked with at NASA, a couple of the Administrators. You've also encountered other agency administrators or leaders. Let's talk about some of the leaders with science backgrounds or those in engineering, and their management styles, or some of the encounters you had with them. You mentioned even in OMB, because Steve Isakowitz had graduated from MIT, he understood. Did you find that throughout all of your dealings in this AA position, that it was easier to talk to someone that maybe had a science background or had an understanding?

WEILER: Oh yes. When you're talking technical matters, like why you have a problem on a mission or why things are going well on a mission, somebody who's got a physics or engineering or astronomy background, clearly you're speaking the same language. The real tough things were when you're dealing with somebody, trying to deal with them on a technical level, who's got a law background or an international affairs background. It's not that they're less smart, just that's not their background. They don't even have a lot of math to deal with.

Dan Goldin is a classic example. He was an engineer in his real life till he became a manager. You could talk to Dan about problems you were having and he'd understand it. He'd understand what a gyro [gyroscope] is or what a reaction wheel is and why it's difficult. Whereas somebody like Sean O'Keefe, who had a business background, it was a very different story. I had a great range of Administrators. I had guys that were technically smart, like Dan Goldin. Another very technically smart guy was Mike [Michael D.] Griffin.

Then I had Administrators who were smart in their own fields, but not necessarily in NASA-related fields. Which ones did I like to work with? Clearly the ones that were technically oriented or scientifically oriented. It just makes life easier. Not that it's impossible, but you can do things in half the time.

JOHNSON: Talk about some of the Administrators you worked with. You started out in your career—

WEILER: I came to NASA in '78.

JOHNSON: So [Robert A.] Frosch was the Administrator.

WEILER: Yes, it was Frosch. I was only a GS-13 at the time. From '78 to '80 I was a lowly GS-13, and I worked my way up to SES [Senior Executive Service] by 1981. By the way, I was the youngest SES ever at NASA. I hold that record, senior executive at age 31. I didn't really have a position at the Division Director level that would get to see the administrator very often until Dick [Richard H.] Truly.

Dick Truly was the first Administrator I actually dealt with personally. He was an astronaut. I liked Dick, he was an honest guy. I was Chief Scientist on Hubble in 1990 before it was launched, and I remember going up to brief him on some of the things that we expected Hubble to do—before the spherical aberration, of course. I remember specifically carrying up the viewgraphs, because in those days you used viewgraphs, not PowerPoint.

There were three viewgraph machines. You had to have a little agenda for each viewgraph machine, so you filled out this NASA form that had machine one, machine two, machine three, blank blank, viewgraph two, viewgraph—it was like a real production. The poor slob had to do all these viewgraphs in the back room, because it was rear projection. Must have been like a one-armed paper hanger trying to get these viewgraphs.

I gave the presentation to Dick. He was very nice, very appreciative, asked some good questions. I had a good impression of him. Later in life, just three years ago, I was on the Director of JPL's [Charles Elachi's] Advisory Council. Dick was a member with me, so we got to reminisce the “good old days,” so to speak. He was the first Administrator I really got to know.

I guess James [M.] Beggs was before him.

JOHNSON: Yes, he was '81 to '85.

WEILER: I never dealt with Jim, but I remember him beating up on all the people that worked way above my level trying to explain the overruns on HST [Hubble Space Telescope]. If you ask people today—this is an interesting test on a plane, “How much do you think Hubble overran?” People say, “Oh, it was probably on budget, it's a great success.” People are shocked

when they find out that it overran just about as much as James Webb Space Telescope, 400 percent. Four hundred percent. It was proposed at \$400 million, \$500 million and wound up being \$1.6 billion. Four times more. It was supposed to be launched in 1983, and it was launched in 1990, seven years late.

JOHNSON: Part of that was because of [STS 51-L Space Shuttle] *Challenger* [disaster], right?

WEILER: Just two years, just two years. The Hubble people like to blame *Challenger*, but let me tell you—and I predict this for James Webb. If James Webb is launched, is a total success, and blows people's minds for five or six years, nobody's going to remember that it overran 400 percent. Just like they don't remember Hubble overran 400 percent.

Beggs used to beat up all the time on poor Noel [W.] Hinnners and the Marshall [Space Flight] Center [Huntsville, Alabama] Director [William R. Lucas] for the overruns on Hubble. That's what I remember about Jim. He was a tough Administrator, that's what I remember about him. Thank God I never had to deal with him, because it was way above my pay grade.

After Truly—I guess Goldin replaced him. Goldin came in around the [Hubble] servicing mission.

JOHNSON: '92, yes.

WEILER: Yes, he was the one there when we serviced Hubble. I started dealing with him more and more. He really liked the Astronomical Search for Origins Program, so I got to deal with him on that. He was really into astrobiology. In fact, you're looking at the guy he asked to go

set up the [NASA] Astrobiology Institute from scratch, which was my job. I got to do that. That was a labor of love, because I do have an abiding interest in the search for life.

I got to know Dan Goldin very, very well. I understood why people didn't like him and feared him, because he was really tough. He was tough on people. But we always got along, we always got along. The week he was leaving, I finally got enough nerve to go up to him—it was about 2001 or so. He was there for 9/11 [terrorist attacks of September 11, 2001], I remember that, so this was after 9/11. I said, “Dan, you've had a lot of trouble with a lot of people. They say you're tough on them. Why is it you think we got along so well and I never had problems with you?”

He said, “Oh, that's easy.”

I said, “What do you mean? Because I don't understand it.”

He said, “It's because you told me ‘no’ once.”

I said, “What do you mean?”

He said, “Remember early in your AA-ship when these guys from Langley [Research Center, Hampton, Virginia] came in with this idea of a Mars airplane? Sending an airplane to Mars, and then flying it around and doing science for \$50 million? And I really loved it?” He did, Dan Goldin loved it. He said, “You dumped all over it. You told me that was ridiculous, it would never cost that; it would cost 10 times more than that. I beat up on you, and you wouldn't relent. You just said, ‘No, Dan, it doesn't make any sense.’” Finally it was canceled.

He said, “I never forgot that. You had the guts to stand up to me. Too many people here at NASA think that the way to get my support is telling me yes. You said no.” He said, “You've got to tell your boss what he needs to know, not what you think he wants to know.”

When I teach leadership classes, I tell that exact story. Tell your boss what he or she needs to know, not what you think they want to know. There's a difference. Most people want to tell their boss good things, not bad things. If you haven't noticed, I've always been kind of a blunt person. I call a spade a spade, or a club a club, or whatever.

I'll never forget that. I really, really, really think highly of Dan. He was retired for many years, living in Santa Barbara [California] out there on the beach. He's got a big ranch. To his credit, on his own money he flew to Washington to speak at my retirement party. That just touched me, what a guy.

JOHNSON: Telling your boss what they need to know, not what they want to know—of course you have to have the boss that accepts that truth.

WEILER: Right. That's why I think Dan Goldin was a lot better Administrator than people give him credit for, because that's the kind of guy he was. He didn't want his rear end kissed. I won't mention some of the Administrators I worked for who did, but there were a few. They tended not to be the engineers or managers—but you can figure out. Dan was a good Administrator. I can't speak for the human spaceflight side, but under his realm we went from \$2.0 billion to \$4.0 billion in budget authority. That's unprecedented.

During his realm—most of it I was AA—we started building and launched many of the things that are still operating today. Curiosity, Hubble, Chandra, Spitzer. The Pluto mission was started, Cassini [mission to Saturn], all the Mars missions, Spirit and Opportunity. I can go on and on and on.

JOHNSON: Of course, like you mentioned, the Mars missions and the [Opportunity] rover is still up there, still working past the time that anyone thought that it would.

WEILER: Opportunity is still working. It's like a panda, don't hit it in the nose.

JOHNSON: Of course Sean O'Keefe came in as Administrator, and then Mike Griffin.

WEILER: Yes, Sean O'Keefe. My reward for landing on Mars twice was to be sent to Goddard as Center Director. Which, by the way, worked out great. I loved my experiences at Goddard. I'd have been happy to retire at Goddard.

When I got to Goddard I was told by the scientists, "Al Diaz doesn't think we're good enough to compete with JPL on planetary missions."

I said, "Why?"

They said, "That's what he said."

I said, "Forget it. Go out and compete. I believe in great American competitions." They had never competed for a planetary mission, JPL got them all. After I got there, they got Lunar Reconnaissance Orbiter, they got OSIRIS-Rex [Origins, Spectral Interpretation, Resource Identification, Security, Regolith Explorer (asteroid sample return mission)], they got MAVEN, and they just got another Discovery mission [Lucy mission to Jupiter's Trojan asteroids].

So they can compete against JPL. Not only can they compete, they can win. I was very proud of that. We brought planetary science to Goddard. That was probably my most proud moment at Goddard, bringing planetary science there. And helping them with Earth science, they had a growing Earth science program. I enjoyed my days at Goddard.

While I was at Goddard, Mike Griffin became Administrator [in April 2005]. One of the first things he did was fire Al Diaz and bring in another AA, Mary [L.] Cleave. She lasted about a year. The end of the story that I call the “musical chair” AA timeframe—they had three AAs in three years. My first stint was six years in a row, until I was moved to Goddard. I’m a little sensitive about this, yes.

Then he brings in [S.] Alan Stern, which was a real winner. Alan has a certain personality. Alan was convinced that Charles Elachi, the Center Director of JPL, and Ed Weiler, the Center Director of Goddard, were out to get him. Everything that was wrong with NASA science was those two Center Directors. He had Mike Griffin convinced of this, so Mike wanted me to retire or quit. Finally, Chris [Christopher J.] Scolese, who was his Chief of Staff, said, “Mike, maybe there’s another side to the story. Why don’t you bring in Charlie [Charles J.] Pellerin and do a little independent study of these three people and see what’s going on?”

Charlie Pellerin did a little digging around, a little investigative reporting, and basically went to Mike and said, “Mike, your problem isn’t Weiler or Elachi. Your problem is Alan Stern. Go talk to the people who work for him if you don’t believe it.” They all were on pins and needles. To make a long story short, about March of that year, Alan, who had kind of an ego, decided he would shut off Spirit or Opportunity, both of them I guess, because he wanted to save some money to go fund something else. This is the classic punch-the-panda-in-the-nose scenario.

Mike Griffin, being a smart guy, knew that you don’t mess with Spirit and Opportunity. Especially back then when they were both working. He basically called Alan on the carpet and Alan said, “I should have the right to do this, and if you’re not going to give me that right, here’s my badge.”

Mike said, "Thank you very much," and took his badge. That's what really happened.

Let's put it this way. I won't say when I was called that day, but by the end of that day I was told I was coming back to be acting AA to replace Alan Stern. Two months later, I was told I was going to be staying at Headquarters and not going back to Goddard. Not necessarily things I wanted to do, but things I was told to do. Mike and I became good friends after that till the day he left. Alan Stern, that's another story.

JOHNSON: Of course, after that was Charlie Bolden.

WEILER: Charlie Bolden. Charlie and I got along quite well, despite his deputy always trying to undercut me in front of Charlie. Charlie was the pilot of my Hubble [launch] mission [STS-31], so we knew each other from back in 1990. We're good old buddies, Hubble guys. Hubble guys stick together. Thank God he was a Hubble guy, considering what that woman tried to do to me.

We got along quite well. We worked very well on the Mars Program, working with ESA. He loved the idea of getting half our missions paid for by the Europeans. That gave him a lot to brag about to Congress. What he didn't know was that a certain woman was undercutting us to a certain guy at OMB, to the point where it all fell apart.

Charlie and I still reminisce about those days when I see him at Mars launches. I went up to the MAVEN launch about two years ago and Charlie and I were reminiscing about it then. He was at OSIRIS too, I ran into him at the OSIRIS launch. I still go up to Kennedy occasionally for launches, or just watch them go up here. KSC is due north of here, so we can watch. I'll be watching TV at night and saying, "Barbara [spouse], let's go outside, there's a launch," because there's a big flame out the window here going up into the sky.

JOHNSON: Wow. That's a nice view.

WEILER: Yes, it's only 60 miles as the crow flies. It's 100 miles as the car drives, but it's 60 miles direct line of sight.

JOHNSON: Nice way to retire and still see what's happening.

WEILER: Yes, about every two weeks we see a launch. They're especially good at night because they really light up the north sky.

JOHNSON: Charlie of course, like you, believes in involving the public and talking with kids.

WEILER: Oh, he loved kids. Charlie would cry at the drop of a hat. To me that's good, I don't care about the male crap. He was just an honest guy. The way he was treated by his deputy incensed so many of us. The other AAs, we all said, "We can't wait till she leaves because we'll have a big party for her the day after she leaves." Which I believe they did. She was not liked. She was not liked in that organization, because everybody loved Charlie. Everybody loved Charlie, because he was just a human nice guy. Just a really nice guy.

JOHNSON: You mentioned that Astrobiology Institute that Dan Goldin asked you to start. Do you want to talk about that?

WEILER: That was his creation. He doesn't get credit for it. Oh, another thing. Dan Goldin— set the record straight, historical document. Do you know why there were two rovers, not one? Why Spirit and Opportunity, not just Spirit? Only three people on Earth know why. There are only three people who can tell you the story.

Dan Goldin and Scott Hubbard can verify that what I'm telling you is the truth. This was back when Scott was my director for the Mars Program, and we were working on laying out the program. We all agree we're going to launch Mars Odyssey, the 2001 orbiter. That had to go because we knew how to fix it. It would be ready to go, we'd spend the money to get it right.

Now we're talking about the landers. Scott and I agreed, "We've got to go back to the old technology that works." Forget this faster, better, cheaper stuff. We know airbags work, they worked for the Mars Pathfinder. Let's go back. Let's forget the Mars Polar Lander, landing struts and propulsion. Let's use the airbags, we know they work. Why did we test them out, why did we develop the technology if we're never going to use it? Let's use it.

JPL came up with the idea of Spirit, which was going to be a Mars rover surrounded by airbags. Go to Mars and land that way, 2003. Scott and I went up to Dan's office to lay out the program. I'll never forget this day, because Scott and I just about fell over. Dan says, "Yes, that looks like a good program, but I'm concerned about something."

We said, "What do you mean?"

He said, "We tried to land on Mars with Polar Lander and we failed. Now we're going to use this airbag technology that's only used once. We can't afford any more failures. The public, the Congress just can't accept any more landing failures. Even if Odyssey works, that's not going to redeem us. We have these failures, we've got to succeed. We've got to have a success."

“Dan, we can’t guarantee this. This is one rover.”

He said, “Let’s double our chances.”

I said, “What do you mean?”

“What if we have two rovers?”

Scott and I looked at each other. “Dan, we don’t have enough money or enough time.” This is like 36 months to launch, this is unheard of. JPL was proposing to do something they had never done before, 36 months to launch. “Dan, we’re not even sure we can do one.”

He said, “Do me a favor. Call up Elachi and spend 24 hours. Come back and tell me if you can do two. I like our chances better if we have two, because if one fails we can still have a success.”

Elachi just about had a baby on the phone. He said, “What are you talking about? You out of your mind? We can’t do two.”

I said, “Do you think there’s even a chance you could try?”

To make a long story short, we went up and said, “Dan, we can’t guarantee it but we’re willing to try it.”

He said, “Do it.” That’s how Spirit and Opportunity were born. Dan Goldin was the reason we have two rovers on Mars, not one. That’s the kind of thinking—he said, “I want to double my chances for success. We can’t have another failure.” True story. Very, very, very few people know. He’s vilified by scientists, engineers, people all over, but that’s the kind of guy he was. He’s inspirational. True story. Now where were we?

JOHNSON: Astrobiology Institute.

WEILER: Astrobiology—Dan saw things before other people saw them. The old way of doing this was to build a big building someplace, fill it with astrobiologists, and have an Astrobiology Institute. The future is the internet, the future is video conferencing. I became AA in 1998, so this was 1999, '98 timeframe. He said, “I want a virtual institute. I don’t want a building, I don’t want brick and mortar. I want three or four people at Ames [Research Center, Moffett Field, California] being the leader. I want to get groups tied in at major universities. Set up institutes at major universities—five, six, seven, eight people—and interconnect them by internet and video conferencing.”

That’s what he asked us to do, and basically we did it. It took a long time, but we did it. It’s been very successful, and it’s been done through competition. All the members have been chosen through competition and peer review. It’s another example of Dan being ahead of his time, thinking about the way the world is really going to be in 5, 10 years, and he was right.

JOHNSON: Speaking of thinking the way the world was going to be, you gave us that paper that you wrote. You gave me a description off the tape, but if you want to talk about that and tell us what this is. [Space Telescope Scientific Instruments Maintenance and Refurbishment, December 18, 1983]

WEILER: I was extremely young. In 1983, I was 34 years old. Here I am, I’m just a youngster. I’m program scientist for Hubble, which was effectively Chief Scientist for Hubble at Headquarters at NASA. We’re in the middle of all kinds of budget problems. Back in 1979 when they started it, it was going to be launched in 1983 for \$420 million. I even remember the number to three significant digits.

Of course here it was 1983, and they hadn't begun cutting metal. They had finished the mirror. We were told it was the best mirror ever made, let the record show, "Absolutely." I actually joined Hubble after the mirror was finished, so I literally can say I had nothing to do with the mirror—other than I remember certain scientists who were in charge of looking over the mirror getting up and saying, "We've got the best mirror ever built by humans." And they were right. It was the smoothest, most pristine mirror. It just had the wrong frigging prescription. The glasses were perfect, they were absolutely shiny and smooth, but it had the wrong prescription. Oh, geez.

Budgets were going up, the budgets in the bank were not enough. There were problems, people were talking about taking things off the spacecraft. We had these things called ORUs, orbital replacement units. Those were items that were designed to be easily screwed in and screwed out. For instance, a gyro could be taken out of the telescope by loosening four bolts, pulling it out, putting a new one in, tightening four bolts with a quick-disconnect connector. That was an ORU. A non-ORU would be something that's bolted in with screws and plates and would take days to get out. Not good for astronauts.

ORUs were very expensive, and Marshall started taking things off the list that would be ORUs. That was one way to save money. Another way to save money was not budget for new science instruments. We're going to use the same science instruments, 1980s technology, into the future? This was supposed to be a 15-year mission with refurbishment every two and a half years. Of course we have to have science instruments. What are we launching this for, a billboard in space? Or are we going to do science with it?

You need new instruments. That's the whole theory, the whole *raison d'être* of Hubble was to do new science, take advantage of new technology. Looking back, thank God, because

CCDs went from 800x800 to 4,000x4,000 that are up there now. But Marshall was never known for supporting science back in those days.

Here I am out of Headquarters, and I'm a lowly scientist at Headquarters. But I'm also responsible, on paper, for the scientific integrity of the program. That's the job description of the program chief scientist. "Responsible for the overall scientific integrity of the program" to the AA. On that level, he reports or she reports directly to the associate administrator. I said, "Hell, I'm going to take this seriously, because this is getting ridiculous."

I sat down at my DEC PC-350. It was December 18 [1983], which meant half the people were using use-or-lose leave [vacation time] and Headquarters was empty. I had a lot of time on my hands without being bothered by other people, so I just sat down. It still amazes my wife the way I write. I don't come up with outlines or think about it, I just sit down and start typing *a cappella*. I typed that whole thing in one afternoon.

While I was typing it, I came up with the idea of not just justifying why we needed new instruments, but saying, "Hubble is going to do a lot of great science." I remember my thinking process. "But the kind of science that's really going to make it interesting to the public"—which by the way will make it interesting to Congress, which by the way will produce money to pay for the continued operations of it. Duh, duh, and double duh—"are the pictures." Pictures are not just scientifically important, they're something that people can relate to.

Somebody once said, "A picture is worth ten thousand words." I'd say worth ten thousand votes in Congress. It's the pictures that are going to really knock the socks off of people. Suddenly, people looking at the universe are going to be putting their glasses on. For the first time, we're going to have pictures that don't take a leap of 50 percent, or a leap of a factor of 2 or a factor of 4. We're going to increase the quality of our pictures by a factor of 10,

which in 2 dimensions is a factor of 100. That's like being almost totally blind to being able to see 20/20.

I said, "The Wide Field Camera, the American camera—I love all my five instruments, but that Wide Field Camera, that's the teacher's pet. That's the camera that's going to sell Hubble ultimately, not just to scientists but to the public." It is so important. Again, I didn't know about the spherical aberration—"What if we launch Hubble, and because we're using these new technology CCDs the camera fails like a week or a month or two months after launch? How embarrassed are we going to be? It's going to be a national disgrace." Sound familiar? This is the kind of thinking that made me propose in that white paper, "We ought to immediately start building a backup camera that would be ready shortly after launch in case the unheard of happens."

That's what I put in there. I finished the white paper. The Science Working Group, which was the formal body of science advice to NASA, was led by the project scientist, who was Bob [C. Robert] O'Dell at the time. I was an ex-officio member as the program scientist. It was meeting January or February, right after I wrote this paper. I took this and presented it to get their endorsement. They resoundingly endorsed it.

The program manager, the moneyman—below the AA, but above me—basically said, "I don't have any money for this, forget it." Somehow, people in Congress learned about this. I had no idea. Although, John [N.] Bahcall was a member of the Science Working Group, and John Bahcall had a lot of friends in Congress. Apparently, John Bahcall did some work. Lyman [S.] Spitzer [Jr., astronomer] wasn't the only one who had a lot of connections on the [Capitol] Hill.

John did some work, and I forget whether it was May or June. Sam [Samuel W.] Keller, who was the program manager's boss, the deputy AA [for the Office of Space Science and Applications], went to testify. One of the congressmen or congresswomen said, "Mr. Keller, we've heard about this WF/PC clone idea. We think it's a really good idea, and something you ought to have. You are going to fund that, Mr. Keller?"

He said, "Oh, of course we are, we agree." True story.

That's how it got into the budget and started. John Bahcall deserves all the credit for setting up Sam Keller. True story, absolutely honest truth. I had nothing to do with the lobbying of Congress because I'm a civil servant. But John Bahcall was a Princeton University [Princeton, New Jersey] professor. True stories. "There are many stories in the *Naked City*" [television series]. Boy, that really dates me. That was from the '50s, I think.

JOHNSON: Moving around through your career, you mentioned John Mather earlier.

WEILER: John Mather, yes. Little did I know he was going to be a Nobel Prize laureate.

JOHNSON: Exactly. That's what I wanted to ask you about, the Nobel Prize that he won in that program. I believe that's when you were at Goddard, because it was 2006.

WEILER: I was the Center Director, Mary Cleave was the AA. He was my scientist. Not only was it the first Nobel Prize for Goddard, it was the first Nobel Prize at NASA. I remember that call. Early morning, I was at my home in Annapolis. It was John saying, "Ed, I think there's something you should know."

I said, "What do you mean?"

He said, "I just got a call from Sweden."

I said, "What?"

He said, "I just won the Nobel Prize in physics."

The rest is history. By that afternoon, Headquarters had set up a press conference. John and I went down to be on the press conference with Mary Cleave, who had absolutely nothing to do with the Nobel Prize, of course. COBE [Cosmic Background Explorer] was one of my missions when I was Astronomy branch chief [Ultraviolet/Visible and Gravitational Astrophysics Division]. When I was a lowly branch chief, COBE was one of our infrared missions. John is just a sweet guy, he deserved that so much. He was the perfect project scientist for JWST. Even-tempered, nice guy.

JOHNSON: Did you have any idea? Or was that just a complete surprise to everyone?

WEILER: We all expected someday he was going to get something for COBE, but you never know. We used to hear rumors that the Nobel people would never give a prize to an astronomer. Apparently, back in the eons of history, some astronomer had had an affair with one of the Nobel Committee's wives or something. It's a story, maybe it was urban legend, but it was all over the place. We astronomers figured we'd never get a Nobel Prize because one of our past grandfathers had an affair. But, as it turns out, they considered John a physicist, so that's how they got around it. Also true story. I can't give you a source, but that's the history. There's this rumor among astronomers we'll never get a Nobel Prize because of an affair.

JOHNSON: When you were AA—both times, because you went back, as you mentioned—were there any missions, or any projects or programs or anything that you want to talk about that we haven't talked about?

WEILER: Let's hold that question. We talked about the human factor above, but we haven't talked much about the human factor below. This is something I'm quite proud of. To jump to the end of the story, one of my people told me they were approached by another person at NASA saying, "Hey, do you have any jobs available in SMD?" OSS [Office of Space Science] it was in those days.

The person said, "I don't know, why?"

He said, "I hear you're like a UN [United Nations] up there, and I really want to work for an organization like that."

What they were talking about is that by the time I left, the minority of my senior people were white males. I had female division directors, I had Hispanic division directors, I had African American deputy division directors. I had a few white males. I did this all not because of the legalistic "You have to take a woman" or "You have to take a Latino." I did it by taking the best people, and by going out and asking the best people to apply, which is the key. You can wind up saying you got the best people and not do anything. Or you can go out and get the best people that's a balanced group, if I'm making sense.

For the Astrophysics [Astronomy and Physics] Division Director, I went out and sought after Anne [L.] Kinney to apply for the job. I sought out Orlando Figueroa to apply for the job. Then other people applied, but they turned out to be the best people, because I started out by

going after the best people. I was quite proud of that. I had a really diverse group, before diversity was really talked about a lot. This was 1999, 2000, 2001.

We called it the “dream team.” By the time I left, it was the dream team. I had some of the best people in NASA working for me. Orlando Figueroa, who’s now sought after as a consultant by everybody out there in the aerospace community, was my Mars director. Chris Scolese was my Deputy Director, was Chief Engineer of NASA, Acting Administrator, now Goddard Center Director. Those are the kind of people that we had.

We had a lot of fun. During my staff meetings, people would wonder what was going on outside—the lower-level staff—because they heard a lot of laughter. I always told my people my management style is “I don’t want people to get ulcers.” They don’t get ulcers by laughing. I was quite proud of the staff we had built there.

JOHNSON: When you were going out there finding those best people, did you ever have trouble convincing them that NASA would be the place to spend their career?

WEILER: Actually not. Maybe I’m very persuasive, but come to think of it, the people I really really wanted to come and apply usually came and applied. But remember the environment. This wasn’t the environment today where everybody’s worried about their job and losing their retirement and having their salary cut. Get RIFed [reduction in force], get told they can’t do the science because it’s not politically correct.

We were working in an environment where we were launching things. We were having seven or eight launches a year, we had doubled our budget. I remember one year we had to launch eight or nine missions in one year, almost every month. Go look at the launch rate now

for SMD. It ain't anywhere near eight or nine a year. I'm not even sure it's two or three anymore. I'm not talking little microsats [satellites] or whatever, I'm talking real missions. It wasn't hard to find people to work there.

At Goddard I hired a lot of people, too. I brought Laurie Leshin in from Arizona State [University, Tempe] to become head of Science [Director of Science and Exploration]. She eventually went up to be a deputy AA [Exploration Systems Mission Directorate] at Headquarters. The record of diversity was kept.

In fact, I brought an African American guy, Marcus [A.] Watkins. He was in Europe as the NASA ESA liaison. It was a plum position, you live in Paris. I said, "Come on, Marcus, we all know you're not doing anything over there, get your ass back here to Goddard. I've got a real job for you as Director of code 300 [Safety and Mission Assurance]." Took me about three months, but I finally got his butt back to do a real job. To this day, he still blames me for taking him out of that sweet plum. Not that they don't do real work at the ESA liaison office in Paris.

JOHNSON: In the *NASA at 50* interview you talked a little bit about asking people, "Do you want to be the person that did the fifth upgrade on an iPhone or do you want to launch?"

WEILER: Oh yes, that's a good story. The genesis of that was actually after the two failures at Mars. After the first failure, I was doing a press conference in Washington. The press was being their usual pissy self and they said, "How many people have you fired at JPL for screwing this up so bad?" In my usual way, I just blurted out, "Come on. If I fire these engineers, they're the best in the world. Who am I going to go out to get, better engineers? Go to Walmart? Come

on.” Apparently that had a real effect at JPL, that somebody was actually defending them. They were just being crapped on by everybody.

After the second failure event, they started losing people to Silicon Valley [California] because Silicon Valley can offer big bucks. Charles Elachi would say, “How can I compete? They double the salary and they offer a Mercedes as a signing bonus.” Which was almost true, in a lot of cases, to the best people. He said, “Could you come out here? We’re going to have a day of reflection and a little pep talk by myself and some of my people. We want you to say a few words, because people really respected what you did for them at the press conference.”

I went up there. I never prepare speeches, I just go *a cappella*. I was talking to them, and just literally it came to me. A moment of inspiration. I said, “Look at the things you guys and gals are doing here. You’re working on Mars programs, you’re doing missions that you can tell your kids about, and your kids can tell your grandkids about. You’re doing missions that someday may lead to the most important human discovery in history, that’s made only once in human history. The discovery of life on Mars or the discovery of life on Titan [largest moon of Saturn], the discovery of life around another planet, around another star. Those are the kinds of things you do. Something that your kids, your grandkids, your great-grandkids will remember and be proud of their grandparent. Or you can go to Silicon Valley and invent the fourth upgrade of an iPhone. How much respect is that going to get you?” Literally, that’s the way I did it. Got a lot of applause.

When I think about it, it’s not that I always say smart things, because I also have a lot of examples of other things. But some of my best lines, so to speak, that have inspired people or people appreciated came to me in real time, literally as I’m saying it. Actually, my best one-

liners are that way too. People have told me I'd be a great stand-up comedian. I don't know if that's true or not. *Seinfeld* [TV sitcom] was my inspiration, I quote *Seinfeld* all the time.

JOHNSON: It's like everything we learned we learned from *Seinfeld*.

WEILER: That's what I told my daughter and my son. I said, "Guys, let me tell you this. This is sage advice. There is nothing that can happen to you in human day-by-day that hasn't been covered by *Seinfeld*. Nothing." Soup Nazis, being gay, being not gay—"not that there's anything wrong with that."

JOHNSON: You did mention OMB, but there are other institutions and partnerships that NASA works with, DoD and NOAA [National Oceanic and Atmospheric Administration]. Talk about the relationship that NASA has with these other agencies.

WEILER: At Goddard I had a lot of interaction with NOAA. The best kept secret in the American public is that NOAA officially runs the weather satellite program, but Goddard has basically designed and managed the building of every NOAA weather satellite ever built, including the ones that are going up now. There's been a symbiotic relationship between NOAA and NASA over the years. NOAA gets the money, gives it to NASA. NASA builds the satellites, launches them, then NOAA operates them and does a great job predicting hurricanes and that kind of stuff. It's a good relationship.

I got to work very closely with Greg [Gregory W.] Withee who was the AA of NESDIS [National Environmental Satellite Data and Information Service] at NOAA, which is their

satellite weather division. His deputy was Colleen [N.] Hartman, who used to be part of the dream team at Headquarters. She was my Director of Planetary [Missions] who then went over to NOAA then came back to Headquarters. Now she's at Goddard as chief scientist [Director of the Sciences and Exploration Directorate and Acting Center Director for Science]. In fact I'm going to work with her Monday next week. I've known her for 35 years, boy, that's scary. Good old Colleen.

A lot of good relationships there—tough at first. I remember when I first came to Goddard, NOAA had decided they don't need Goddard anymore. They're smart enough to go build their own weather satellites, so "leave us alone." We worked through that, and the end of the story is they decided that wasn't a good idea because there's a certain level of infrastructure and historical knowledge of how to build space missions at Goddard that they don't have at NOAA. That worked out okay.

DoD. Most of the things I had personal dealings with DoD on were classified stuff that I can't talk about even to this day, so let's not even go there. We did share ideas on technologies that were available or not available. There is a lot of symbiotic stuff there, too. For instance, a lot of the infrared detectors that are flying on Spitzer—the original detectors that flew on Hubble came from DoD programs. That was not by chance. They were declassified just in time.

Congress obviously is a branch of government that we work with a lot, especially at Headquarters. At NASA Centers you're not supposed to work directly with Congress, but all the Centers do that. Headquarters doesn't like it, but when Senator Mikulski called me up as Center Director at Goddard and said, "I want to come to see you," I don't tell the senator no, or that I've got to have a Headquarters person in the room. If you know Senator Mikulski, you didn't tell her

that. She used to come over every couple months or so and sit on my sofa, and we'd just chat for an hour. That was great.

But most of the visits to Congress were us going to Congress. A lot more often visiting the staff or the chairperson's staff, and sometimes directly with the senator or the congressman. I remember Senator [Albert A.] Gore [Jr.], when he was a senator, just creaming us over Hubble's spherical aberration, as if we were personally responsible for it. That wasn't a good hearing.

A lot of hearings—hearings are really more for show. I'm not telling any things out of school here, but they're theater. At Headquarters there's a term, they call it a "kabuki dance," these hearings. Very little of substance ever happens at a hearing, at least the hearings that I've been involved in. They're a means to get things on the record, which is sometimes important. Some hearings are more important than others. Anything Senator Mikulski did of course was always useful and valuable. And that's for the record.

OMB—mixed. Again, the relationships were good when we had quality people at OMB with technical smarts. They weren't so good when we had politicians working political agendas, which has been the last many years at OMB, which is really a sad statement. The days of Steve Isakowitz are long gone. He was truly a great guy for science. What else is there besides that? OMB, Congress, DoD, NOAA. I can't think of any other agencies we work with.

Foreign governments—ESA. Spent a lot of time working foreign relations, working out problems on missions. Working out deals—who's going to do what, provide what. Not just with ESA, which is many, many, many European member states. We also had bilateral missions with the Germans [German Aerospace Center]. Germany was one of our best partners. Canadians [Canadian Space Agency], Italians [Italian Space Agency], French [National Centre

for Space Studies], all of them very good partners. Japanese [Japan Aerospace Exploration Agency], especially in X-ray astronomy.

I have all these neighbors now who just think it's the cat's meow to be retired and "Let's go to Europe," "Let's go to Japan," and they notice Barbara and I never travel. We never go anywhere, for a lot of reasons. One, we're already in paradise. These people who go on these Caribbean cruises, "I can't play tennis next week because I'm going on a cruise to Jamaica." I said, "Let's see, you're leaving here to go to a place that has palm trees, the ocean, beaches, swimming pools, and tennis. Hmm. The ocean, swimming pools, tennis, palm trees [gesturing outside]. And how much are you paying for this? Are you out of your mind? Oh, and by the way a terrorist might blow up your boat in the meantime, or you might get killed in Jamaica or whatever. Have a good day."

Barbara and I have both traveled—me for my business, and she was a professional biologist. We've both been to Australia and New Zealand three or four times. We've been to Europe 10, 15, 20 times. It was fun traveling. Of course in those days you parked your car close to the airport and you walked in the gate half an hour before the flight. You walked to the flight, you got on, you left. Now let's see how travel is today.

JOHNSON: Not quite that easy.

WEILER: No. I'm not really retired, I consult. I've worked for [The] Boeing [Company], I've worked for Lockheed [Martin]. I've worked for Goddard, Johns Hopkins University [Baltimore, Maryland], JPL, and a few others. I go up to Washington [DC] on average once every six or

seven weeks. I'm going twice in the next three weeks. That's a pain in the rear, even though it's a nonstop [flight] from Orlando [Florida]. It's still a pain in the rear, so we don't travel.

JOHNSON: Let's talk about your retirement.

WEILER: Don't fear it, it's great. Just do it. One of my neighbors is still working at age 66, in Arkansas, and his wife is living here. I said, "Are you out of your mind?"

He said, "I'm so afraid of retirement."

I said, "I was too." But let me tell you, I was married to this thing called a BlackBerry [smartphone] on my belt. On September 30, 2011 I had to take that thing off and leave it at NASA. Remember, I was the kind of guy who'd do email at 2:00 in the morning if I felt it vibrate, or 3:00 in the morning. It was never very far away. I'd answer emails any time of the day or night. I was really, really, really afraid of what it was going to be like, what kind of withdrawal I was going to go through.

I got up the next morning, and I kept reaching but there was nothing there. Then I walked into this room. In my Annapolis house I had a room like I have over there [gestures]. This room is called a den, it has this big screen. It's got this keyboard and some kind of a computer, I guess. What I discovered the next day was I can browse the internet, I can do email and use my big fat fingers on this big keyboard, type 100 words a minute from the comfort of my own chair. Who knew? Instead of using an iPhone and doing this [demonstrates]. True story. I never looked back. I started playing tennis and I never missed it.

Of course, I may have a special circumstance. I was at NASA during the golden age. I hate to say this now, but I think NASA is entering a decline. I don't think it's entering a decline,

it's in decline. Look at the Earth science program. Look at the budget, it's in decline. We have no human space program anymore that's well-defined with a well-defined goal. The science program is not launching as many missions.

I think I'd have been dead if I'd stayed at NASA. I was stressed out. I always had normal blood pressure, but when I left it was prehypertension and I was 30 pounds overweight. I was stressed out. I came here for the first six months and honest to God every day I walked six miles on the beach. I'd play tennis and I'd go to the gym, work out. In six months I'd lost 30 pounds, my blood pressure was back to high school levels. I felt better than I felt in 30 years. Best thing I ever did.

Do I miss NASA? Yes and no. I miss the excitement of landing on Mars, I miss the excitement of seeing Hubble's first pictures after it was fixed. I miss the human interactions with people within my group. What I don't miss is the interactions with the idiots in Congress, the idiots at OMB that only worry about politics and self-aggrandizement and not what's good for this country. I don't miss that at all.

JOHNSON: The year you decided to retire some people have called the "year of space science" because it was a good year for NASA.

WEILER: Eight launches.

JOHNSON: Yes. When you did decide to retire, it came as a surprise to a lot of people.

WEILER: That was a story in itself.

JOHNSON: If you could talk about that decision that year.

WEILER: December of 2010—God’s honest truth, because I don’t care, I’m not a civil servant anymore. I can tell the truth, the full truth. I had my usual Christmas telecon [telephone conference] with the idiots at OMB. In this case, I think they had a couple GS-13s dealing with an associate administrator. They were telling me why they were not going to fund the Mars Program.

In fact, my wife remembers this because I really was screaming after the telecon. December telecon with the OMB, a couple young GS-13s who aren’t qualified to be in the jobs they’re in basically telling me they’re not going to back off on the cuts to the Mars Program. I argued with the future of this country, and “How are we going to inspire our kids?” This was so beyond their [Nintendo] Game Boy [video game console]-mentality heads.

I just was so frustrated. I got off the phone and said, “Barbara, I cannot take it anymore. I’m getting the hell out of here. I’m going to retire at the end of the fiscal year because I’m convinced the Congress will do something to screw up our federal retirement or do something bad. I just want to get out while the getting’s good, by September 30, 2011. Will you be willing to retire, too?” That’s another story.

I made the decision to quit in December. We had already decided over the course of many months that when we retired there were three places we would consider: New Zealand; southern California, San Diego because she grew up in southern California; or Florida near Cape Canaveral, because I was at Cape Canaveral 100 times in my career. And we had already come down here once, for the first time in my life on a vacation, after I married Barbara. Barbara and I

have only been married 10 years. I said, "Let's go to Cape Canaveral, I've never been there on vacation. It's really nice down there, nice beach, east coast of Florida." We did.

While we were there, we drove down [Florida State Road] A1A, which I had never done on business. This was in 2010, I think. Noticed two things. One, every house was for sale it seemed. This is during the depression. Two, we stopped at a real estate agent just to get a book on house values. "They must be missing a digit." How could you buy a house like this for the price of the smaller home we had up in Annapolis? A wooden-frame colonial, and this is made out of cinder block, steel I-beams that would stand an A[atom]-bomb, literally. We saw the value right away. We had two different houses in Annapolis before we got married, so we had cash to get something like this.

We drove down and we got to Vero Beach. We stopped in downtown Vero Beach, all the little shops there and the parks, and we said, "This is it. This is one of the three places we want to retire." Subsequently we went to San Diego, found out about the 10 percent income tax, 10 percent sales tax. No water, dirty air. San Diego is now crowded like LA [Los Angeles, California], unlike when I was there 20 years ago. Of course in New Zealand you have to pay a million dollars to get in, so forget it. We decided to come here.

We had to sell my house, had to sell her house. We sold her house first, in March. By the way, I didn't tell anybody. If we had kept the H[hydrogen]-bomb secret from Russia as well as I kept my retirement secret, the Russians still would not have nuclear weapons. Nobody knew. We sold her house, and she moved into Annapolis. Then we put my house on the market, sold it in May, and moved into a rental house in June in Annapolis. Still nobody knew what was going on. I hadn't told anybody, didn't tell my staff even.

On September 1 we bought this house. So we were locked in, we now had a house to go to. On Labor Day, I go up to see Charlie Bolden and Chris Scolese, the Chief of Staff. This is now 25 days, more than the two weeks' notice I'm required. I went to see Charlie and Chris, and I told them basically, "I've made a decision, I'm retiring September 30."

"Why are you doing that?"

Among several reasons I said, "And by the way, one of the major reasons, Charlie, is that person who's your deputy. I cannot deal with her anymore." They kept it secret. We got to the week of my retirement, Monday—I'm leaving on Friday, the 30th—Monday, September 26.

By the way, the reason I had kept it secret was because I had all these launches, six or seven or eight launches up until September. Journalism isn't what it used to be, bloggers run the world. I didn't want a certain blogger to start saying, "Oh, why are they retiring? Who's going to replace him?" All this crap basically making me a lame duck, when I had launches to get off the ground and I had staff to keep thinking that we're moving forward.

I kept it totally secret from even the bloggers until Monday when I announced it to my whole staff. Then word got out and I was out the door four days later. Two months later I was in this house, moved in December 1. Not one person figured it out. To me it's amazing. To this day, we can't figure out how we got away with it. But there was a reason.

She kept it secret from the University of Maryland, too. Retirement, as I said, is not something to be feared. I think if Barbara and I had nothing to do—she works for the state of Florida and does some other consulting, and I work for all these places. Maybe 5 percent, 10 percent of the time, that's all you need.

JOHNSON: Something to keep busy.

WEILER: Plus, one thing we discovered—and you’re probably like this in Texas. Things here grow. You see those two palm trees there [pointing]? We planted those. They were Charlie Brown [short] palm trees, three feet tall. I planted them four years ago. Look, that’s four years.

JOHNSON: We have that issue, too. We always say if we left for five years everything would just take over, vines covering everything

WEILER: We’ve got a mango tree that was like a stick, and it’s now 15 feet tall. That keeps you busy.

JOHNSON: Going back, in your 2007 *NASA at 50* interview—I’m just going to read a little bit about what you said to get your feelings on this now.

WEILER: God, that was 10 years ago.

JOHNSON: Yes, it was 10 years ago. You said, “The country is on the verge of a reawakening in the importance of Earth science. People are waking up to the fact that the Earth is changing. Our job is to collect the data and give it to the decision makers.” That’s how you described what NASA’s job was, and that “NASA’s prime role in our society is not to allow what happened to the Romans to happen to America. Instead of looking outward they started looking inward. If America loses its frontiers, we won’t be speaking English.”

WEILER: My God, this is prophetic, this is scary. I actually said that?

JOHNSON: You did. I was reading it, and I thought that's pretty interesting that you mentioned that during this interview. Given the atmosphere we're in now and the feeling of the current presidential administration on science—you mentioned they've cut education, in their proposed budget, they're cutting a lot out in NASA and science. People are saying they can't use the term "climate change" anymore. How do you feel we're going to continue to attract those people to work for NASA, these scientists, these people that can make a difference? Or do we wait four years and hope that it goes away? How do you keep people around for the next four years? You mentioned they were leaving for Silicon Valley.

WEILER: There's several answers to that. One, if I'm an optimist I'll say people in Congress, regardless of their party, will wake up and smell the roses and they will fight back. All it takes is three lousy senators in the Senate to stop anything that guy wants to do. Three. That's all it takes, because there are 48 Democrats. You've got two ladies who have already taken him on [Senators Lisa A. Murkowski and Susan M. Collins]. That leaves you one, and I think [Senator] John [S.] McCain is capable of being that one. If this country has got any future at all, I've got to think that those three senators are going to show some moxie and shut down some of these stupid things like cutting to shreds Earth science.

You can argue all day long whether it's humans or not [that cause climate change]. But God, don't stop taking the data. How stupid is that? I don't care if you're a Republican or Democrat, can't we agree that we should take the data? Or just cover our eyes and say, "Oh, we

don't have to worry. Don't worry, be happy." I think we tried that with the drug war. Don't worry, be happy. Somebody said that.

JOHNSON: "Just say no."

WEILER: These thoughts come back to me randomly. I've got to believe that, because if that doesn't happen, then the answer to your question is really not something you're going to want to hear. That's what happened to the Romans. It's not a perfect analogy, but the Romans started looking inward at the end of their empire instead of exploring. Of course their version of exploring was conquering, but that's exploring, that's expanding frontiers. At least when they were doing that they were vibrant. Kind of cruel, but they were a vibrant culture.

When they came back to Rome and started living off the riches of the world and enjoying their orgies and their hot tubs and their vino [wine] and their parties, in the meantime not having a care in the world, they became isolationist. Does that ring a bell? While they were isolating themselves and enjoying the fruits of the land, these guys called the Barbarians up in Germany and France were massing their armies, and what happened? Duh. You can't be an isolationist in a world like this. You can't close your eyes to the rest of the world.

It's what I said. This country—again, if you ignore history you're damned to repeat it. If you ignore history you can get in really big trouble. If you ask "Why is this country so wealthy today, what made us wealthy in the last 30 years?" it's the technological revolution. This country developed the CCD. It developed the communication satellite. It wasn't Al Gore, it was this country that gave us the internet. We developed all the technology that we see in our rooms.

But there's a warning sign. We developed the inventions, but who makes it? Who makes that? Not us.

That's the scary thing. We're probably not going to get that back too easily, but we're still making money on the inventions. We probably can't get the manufacturing back because our wages are way too high, but what happens when we lose the ability to do the inventions and make the technology? Who does that kind of stuff? Scientists and engineers. What are we graduating less of each year? Scientists and engineers. I don't have a lot of hope for the world if we cut back on Earth science, if we cut the science budgets. It's hard enough to get kids excited these days with their Game Boys and all this crap. But if we take away exploration and frontiers, what's going to excite our kids to do anything?

I don't know the answer. We're best off when we look at our own experiences. What inspired me to become a scientist? I'm not a Nobel Prize laureate. I'm not a John Mather, I'm not a [Jonas E.] Salk. But I've had some successes, I've been a leader. I was inspired by looking at frontiers, looking at what's over that mountaintop, what's over that next star, what's beyond that next star, is there life beyond us? That's what inspired me. I've got to believe it's capable of inspiring other people.

Look at the success of *Star Trek*, *Star Wars*, *The Martian*. It's not just us baby boomers, there are a few kids that go see them. There still are kids out there that can be excited, and damn it, we better excite them. Not with building a better business and making a billion dollars like Donald Trump. We do these things because they're hard, not because they're easy.

JOHNSON: Did you have anything, Jennifer, that you wanted to ask?

ROSS-NAZZAL: I have a couple things that I was curious about.

WEILER: I've got plenty of time, so don't worry about time.

ROSS-NAZZAL: One thing that I was thinking about. We often associate the Augustine Committee [2009 Review of United States Human Space Flight Plans Committee chaired by Norman R. Augustine] with human spaceflight, but I wondered what impact that report had on your field.

WEILER: Remind me what it said. There've been so many reports.

ROSS-NAZZAL: That was the report that basically said if we're going to go to Mars we can't continue on the path that we've been taking. Norm Augustine and his panel of Sally [K.] Ride and some other folks said we've got four choices, but we can't continue the path that President [George W.] Bush had laid out, his Vision for Space Exploration. I was curious if that had any impact on your programs or exploration.

WEILER: Not really, other than launch vehicles. First of all, I agree that we don't have a clear path now. I happen to think—personal vision, but I'm very slanted in this because I'm a scientist—the Moon, been there, done that. Not a lot of science to do on the Moon. No offense. You're not going to find life on the Moon. We know a lot about the Moon, we've walked around on the Moon. We've driven cars on the Moon, dune buggies.

The one thing that's going to be the biggest discovery in human history is going to be the discovery of life. I am almost certain that if we dig down deep enough into the ice, just two feet below the ground on Mars, we're going to find ancient bacterial life, fossils. We're going to be able to prove that life evolved independently on Mars. I'm convinced of that.

If you can show that the very first place you look in the universe other than Earth had life, what does that say about the possibilities in a universe with 1 followed by 23 zeros? The immensity of that discovery to biology, to humans, is beyond anything humans have discovered before. We can go to Mars if we concentrate on Mars and stop screwing around, "Are we going to go to an asteroid? Are we going to go to the Moon?"

How did Kennedy get us to the Moon? He said, "We're going to the Moon, and we're going to make it a national priority." That's my Augustine Report. We're not going to get to Mars or the Moon the way we're doing it now, because we don't know what the hell we're doing. We've got to set a target. If you want it to be the Moon, fine. Is that going to inspire kids? Hey, kids already don't believe we went there the first time, so maybe that's the answer by itself. Maybe we should go to Mars if for no other reason.

JOHNSON: Just to prove it.

WEILER: Just to prove it. In terms of the value to me of a human space program, we've talked a lot about Hubble. One thing I'll say unequivocally in any form—the whole Hubble story we've been talking about, Hubble would have been a piece of floating trash if it weren't for the human spaceflight program and the astronauts that went up there and saved it five separate times. Astronomers owe their careers, literally thousands of careers have been made by that telescope

and its data. Young PhDs, old PhDs, tenure decisions, full professor decisions have been made because of people publishing data from Hubble.

That's all enabled by the human spaceflight program and astronauts. The connection of astronomy as a science to human spaceflight is unequivocal. There's not much for planetary or heliospheric, but no astronomer should ever say that the human spaceflight program was a waste of money. They'd be hypocritical at the highest level. Not that that would stop them. I don't know if that answers your question at all about the Augustine Commission.

ROSS-NAZZAL: I was curious about that. The other thing—Sandra had asked you about working with some other agencies. One that came to mind was the Department of Energy.

WEILER: Oh yes, I'm sorry. Thank you, yes. God, speaking of planetary, I spent a lot of time working with the DOE on issues of RTGs, radioisotope [thermoelectric generators]. Basically chunks of plutonium that give off heat which we convert into electricity with a converter. They're very simple, no moving parts. They're what's still powering Voyager [unmanned space probes] 40 years later, powering Curiosity. In fact, I call Curiosity our "nuclear rover." I always call it our nuclear rover.

Getting plutonium—we're running out of plutonium, because this country stopped making plutonium. We had to have plutonium for Mars Curiosity and some of our planetary deep space missions. DOE and we worked really close together, and did the unthinkable. We worked with the Russians. The way I helped sell this to Congress was "Hey, what a thought, taking plutonium away from Russia and using it here in America."

We didn't take it, we bought it. The Russians were willing to sell us RTG-grade plutonium, and we cut a deal to buy the plutonium from Russia. We got quite a few kilograms, I forget how many, of plutonium, which is flying on American spacecraft now. In the meantime, we're now, I think, starting up our plutonium manufacturing again, DOE is with some NASA money help. So there's a symbiotic relationship between DOE and NASA, specifically on RTGs and nuclear power generators.

ROSS-NAZZAL: Did you ever do any work with the State Department given the fact you were working with ESA, other international space agencies?

WEILER: Not directly. They would approve formal MOUs, memoranda of understanding. When we have a formal program, like on Hubble, that requires State Department approval because that's a major country-to-country commitment. JWST was major because we spent billions on JWST, Europe spent about \$500 million. It was a lot of money for them. That required MOUs and MOUs require State Department sign-offs.

There's some interaction, but that's primarily done by our international affairs office [Office of International and Interagency Relations]. There was talk by some outsiders—of course never civil servants—of going to the State Department and getting some help from them to clobber the OMB for killing off the ESA Mars program. But I don't think that ever got any fruit, it happened too fast for it to have. State Department moves very slow, despite what you see on *Madam Secretary* [TV series]. The State Department takes a lot of time to do anything, it ain't like that. Although it's a fun show.

ROSS-NAZZAL: Oh, it's a great show.

WEILER: Yes. Now they're throwing in the Trump connections, how you deal with a crazy leader in Latin America. That last episode was so obvious what they were talking about.

ROSS-NAZZAL: The last question I had was just about you being a program scientist. How did that benefit you, being an AA, in terms of overseeing all these projects?

WEILER: That's a good question. Again, you look at the theory, what's written in NASA regs [regulations]. The program scientist, their sole job is responsible for—and these are exact words—“scientific integrity of a mission”. The scientific integrity of a mission. That responsibility is to the AA. In that sense, the AA is delegating his or her responsibility for the scientific integrity of missions to the program scientists. And in that sense, the AA is really a program scientist for all of the missions in SMD. That's why being a program scientist made it a little easier to understand the role. In fact, that may explain a lot why it was easier. If you come in from outside, never being a program scientist, you don't understand the fine intricacies.

NASA works on a checks and balances system just like our government does, or should. That is, the scientists have a chain of command and the engineers have a chain of command, and they're separate. I was a program scientist and then there was a program manager on Hubble who was an engineer who had the purse strings. He or she reported directly to the AA. I also reported directly to the AA independently. So I didn't have budget authority, but I had yelling rights. On the clone, the WF/PC2, I couldn't say, “Yes, we're going to fund it,” but we had other ways of making that happen, as they found out.

Then, when you're the AA everybody's reporting to you. You've got to sit back and remember, as the AA, the reason you're the AA of SMD is science. The reason you're doing missions is not to claim victory over the Russians or Republicanism or Democratism or whatever. The reason you're doing these missions is for advancing science for this country. You've got to keep that in mind.

As a program scientist, that's what your job is for only one mission, if I'm making any sense. So the program scientist is actually a very good job for an AA. If you look at the AAs that I would call successful, like Wes Huntress was a program scientist. He was a successful AA. I think I was fairly successful. Then you look at the AAs who weren't so successful—Al Diaz, Alan Stern—they weren't program scientists. Maybe there's something to what you're saying.

JOHNSON: Is there anything else that you want to add that maybe we haven't talked about?

WEILER: We talked about kids and that stuff. That's always important. We talked about staff, which we very seldom talk about. I get a lot of questions about people above me, but I get very few questions about the staff. I'm really proud of that dream team. I really miss not only the landings on Mars and watching Hubble fixed, but daily interactions at staff meetings, and laughing with that team.

Going water-skiing. I was the guy with the boat, not just because I was the boss, but I was the guy with the boat who lived in Annapolis. So I had half of my staff water-skiing on any given time. Different people would come out. Orlando would water-ski with me, Anne Kinney

came out. Colleen Hartman—I taught her how to water-ski, even slalom. We had a lot of fun, both inside work and outside work. It was one of those rare symbiotic things. I really miss that.

Didn't talk a lot about Goddard, but that was only three years of my career.

JOHNSON: We kind of talked about that in your last interview.

WEILER: Goddard—in some ways I wish I had never gone back to Headquarters, because three years is about the time it takes you to really get yourself going as a Center Director. Just as I was really feeling comfortable in the job, knew where my parking place was, knew where the men's room was, Griffin says, "Get your ass down to Headquarters, you're coming back."

You often wonder about the path not taken, whether I would have retired when I did. I'm not sure I would have, because at Goddard I was pretty well-insulated from certain people at Headquarters, certain OMBs. And I was much closer to people like Mikulski, which was a good thing. I'm not sure if I would have retired if I were at Goddard. I think we're covered, good.

JOHNSON: All right, I appreciate you taking the time today.

WEILER: No problem.

[End of interview]