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NASA Headquarters Oral History Project: Edited Oral History Transcript

Excerpts picked by Jim Hansen

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Noel W. Hinners
Interviewed by Rebecca Wright, Littleton, Colorado – 19 August 2010

Wright: You were moved to be the [NASA] Associate Deputy Administrator to focus on institutional management matters.

Hinners: Well, it was a dual function. Jim Fletcher asked me to come down and help with the institutional management. **Part of the Challenger report [Rogers Commission Report] noted the insularity of the Centers and the close management connections between Headquarters and the Centers that from one perspective it's too cozy.** His thought was, "Let's take a look at the management structure. Are there things, looking at the Challenger report, that we should do to change our management approach to try to avoid the kinds of things that led to the Challenger accident?" I did spend some time talking with Centers, the Headquarters AAs to think about that, and concluded yes, probably time to make a management change. Take away from the AAs their Center management responsibility, and bring that together under a Center management system that built in **some separation between managing the Centers and managing the programs** that Centers do.

To me that responded to what he had asked for and the Challenger report. That didn't go very far. The manned spaceflight mafia, starting with the Deputy, Dale [D.] Myers, and Dick [Richard H.] Truly, who was heading up manned spaceflight, wanted no part of that. That was tearing their empire asunder. In that battle I did not win. Fletcher, I suspect that he must have felt he could not take on his Deputy and the AA for Manned Space Flight. That really started me thinking, "Well, this is a losing job." I didn't particularly relish the job to start with, but, "I came down here to help, I'll try to do what I can."

Also had a role, more on paper than anything else, as Chief Scientist. It was a dual role. In that role just provided the day-to-day input to Jim Fletcher and Dale Myers on the science part of the program. I was not trying to do the science job. Len [Lennard A.] Fisk was heading up space science, perfectly capable, and doing a super job of running the Science Directorate.

Headquarters two-year period—after it became evident I wasn't going to impact the management structure—and further, I was rather bored in the job. I was used to heading organizations and leading things. That was a staff job in effect, a number three. Being number two anyplace is a tough nut, but being number three is a loser, don't ever do it. I made my mind up, enough government.

I had several friends who went out to industry. One in particular, Tom [A. Thomas] Young, whom I replaced at Goddard, was at Martin Marietta [Corporation]. I talked to Tom a little bit, said I'd like to at least look into the possibility. I talked with Norm [Norman R.] Augustine, who was president and CEO [Chief Executive Officer] of Lockheed Martin—Martin Marietta then. I'd always had tremendous regard for Norm. He had just a style and a way of interacting, working with people, and a brilliance that are close to

unmatched. My knowledge of Tom and having gotten to know Martin a bit through the Viking [Mars] program, decided yes, that's it. That's the place to go. That's when I did decide to go with them and went out to spend two years out in Bethesda [Maryland] at their corporate headquarters learning the ifs, ands or buts of corporate life before they shipped me out to Denver [Colorado], which was neat. Good move in hindsight.

He said, "I don't want people who tried to make this happen blamed for it. I pushed too hard to make this 'faster, better, cheaper' approach work." I was dumbfounded. I had totally expected Dan to chew my butt out, blame me in large part for the failures. Didn't happen. That changed my view of Dan. I had thought of him as just being a pompous curmudgeon all the time demanding more and more of people, not worrying about whether you can really do it or not. So I developed a new perspective on at least one part of Dan Goldin, and used that internally.

I did two things, working out with the folks at LASP. I started to become an adviser to a student group working on designing a space experiment to fly on what's now called the New Horizons mission, which is on its way to Pluto. [S.] Alan Stern at Southwest Research Institute [San Antonio, Texas] had initiated a student project. Alan believed that the usual NASA outreach stuff is a crock. "Let's do something real, have some students involved in building something that flies," which he arranged to do with LASP. The students, with the help of the professional staff there at LASP, were building a dust detector experiment. I provided the day-to-day senior adviser [role] to them—working directly with the students, understanding their issues and problems, and helping them over some of the hurdles, how you build real hardware. Fantastic opportunity working with 12, 13 top-notch students, helping them understand how NASA does business, what you have to do qualify experiments to fly in space.

Wright: What a great resource for those students, because you could answer questions that other people could not.

Hinners: Well, one of them came up to me and said, "Could you give us an evening lecture?" It was right after the [Space Shuttle] Columbia [STS-107] accident. He said, "It looks to us as if some awfully stupid things were done. We don't understand it." So they got their AIAA [American Institute of Aeronautics and Astronautics] group together, had an evening lecture on what led up to and contributed to the Columbia accident, how things happen. The students said, "We don't get that in the normal courses. All our faculty are career researchers. They've never been out in the real world." They just loved it to have me available as somebody who'd been out there. I talked to them about career choices. A lot of them did want to work with NASA. A fair number said, "No, I don't want to work in a big bureaucracy, I want to go to some little company where I can really do things myself and contribute." It was an education for me.

Wright: What a great resource.

Hinners: Fabulous. I'd like to have kept it up, but that drive up to Boulder in the winter, when my eyesight went bad on me, I unfortunately had to give that up. But it was fantastic.

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Wright: Today is August 19, 2010. This interview is being conducted with Dr. Noel Hinners in Littleton, Colorado for the NASA Headquarters History Office Oral History Project. Interviewer is Rebecca Wright. The interview begins today by Mr. Hinners discussing the Large Space Telescope project.

Wright: I'll let you talk about the Hubble [Space Telescope], and you can give us your history of it.

Hinners: There were two, I think, significant items in there as far as I was involved in decisions. One is the decision to delay starting the Hubble in the [1977] budget process. It was clear that year that we weren't going to be able to get a full-up start. There was some opposition on [Capitol] Hill to getting a new start on it. It was driven, in large part as I recall, by the budget situation. [NASA Administrator] Jim [James C.] Fletcher proposed that we put in $5 million as a placeholder. I didn't like that idea. It was, in today's vernacular, a "sop" to the astronomy community. "There's something in there, so all is well."

I figured in my own little head that to get that community energized we'd be better off zeroing it out. Then they would say, "Whoa, we're in deep trouble," and it would marshal the troops. So I advocated that we not put anything in. I don't remember any of the detailed discussions or whether there were any, but Jim went along with that so we zeroed it out. It had, from my perspective, the desired impact of stimulating the astronomy community to renew their efforts on the lobbying front. While I like to think in hindsight it was a brilliant political move, I'm not sure I thought it through all that well. It was something that was spur of the moment.

Wright: That's my question for you, what you based that feeling on. Was there a certain series of events that had caused you to say, "Just stop and let's do this?"

Hinners: No, it was just $5 million would let them think that all is well anyway, but it's not. So let's give them a message. My own thinking, get them stimulated to get into action. Zeroing it out would certainly give that message. I think it was as simple as that. Didn't talk to anybody else about doing it first, just, "Let's go do that." Voila, it worked. Don't know whether I'd do that again.

Wright: Your decision has been referred to as the "Black Art" decision. Do you know why it's called that?

Hinners: I don't know who put that moniker on it, but that's, I think, a valid descriptor in the sense that none of these things have recipes for them. You have to assess the political environment, budgetary environment. Say, "Okay, let's give this a try," assessing the environment you're in at the time and that luckily worked. It wasn't obvious it would work, but it did. Whether that would work in a repeat situation, who knows? Sometimes you get lulled into thinking, "Well, it worked once, let's try it again," and the second time it doesn't work. Black Art is not a bad way to put it. You can't say this, this, this and this all led to it; it's just internally integrate everything and give it a whirl.

Wright: Share with me the results of your decision, and how it did inspire or motivate this community to rally around moving this telescope forward?

Hinners: I think in that case I'd say simply the results speak for themselves. The community did indeed get very active politically. The book [The Universe in a Mirror: The Saga of the Hubble Space Telescope and the Visionaries Who Built It by Robert Zimmerman] was right on. That really describes what was happening in the political process, right on through the final approval. You're never sure what's going to trigger what in that environment in Washington—it may not be unique to Washington—but try something. If it works, fabulous; if it doesn't, try something else.

Another thing was the telescope institute. The Space Telescope Science Institute now firmly embedded up there at [John] Hopkins [University, Baltimore, Maryland] was a concept that came out of the science community. They had fought and lobbied for an independent institute to operate and conduct the science on the telescope. [NASA] Goddard [Space Flight Center, Greenbelt, Maryland] was vehemently against it. That was, in their minds, taking away their birthright. "All those functions of the institute, the science operation of the telescope, should be at Goddard. We don't need an institute, don't want one, bad idea." Normal Center reaction.

I took a different view on that. I really believed that a program that was going to go on for decades could well use an external advocacy, and the concept of the institute struck me as a good vehicle to keep that. Certainly the science community had demonstrated through other science organization activities that they were fully capable of managing, operating a science facility of that nature. DOE [Department of Energy] had many examples in the nuclear business of institute-type things, and so had astronomy.

That's a little bit what the basis of my thinking was. An external advocacy lets scientists do what they can do well, and get on with life. Goddard finally accepted that. Not sure I gave them a lot of choice, but it has developed as far as I know into a very good working relationship, and became totally accepted, and now it's just part of the scheme of things. The institute continues to do well, and they are now going to be the location for the science operations for the James Webb Space Telescope. So it's embedded now, it's part of the game.

Some interesting discussion of a director for the telescope institute. Riccardo Giacconi became the first director. Riccardo is a very vigorous and sometimes controversial character. The group AURA, Association of Universities for Research in Astronomy, is operating it. They did ask my opinion about candidates for the directorship. I was a strong advocate for Riccardo, even though I'd had my own problems working with him. He was like so many of these really good scientists. They're a pain in the butt to deal with at times, but they get things done, they're good, they're smart. I was delighted when Riccardo became the director, over the fears of some. I think in hindsight it turned out to work very well.

Wright: This was a time when there was a great competition to host that institute, and attached with those were the opportunities for a scientist to be named as the coordinator [with Goddard]. One of them of course being Dr. [Lyman S.] Spitzer [Jr.], who had spent years—

Hinners: At Princeton [University, New Jersey]. I was not involved in the details of that site selection. Science politics is fascinating.

Wright: It's very intricate for such a small community, isn't it?

Hinners: Yes. Astronomers were the first ones to start off with these decadal studies with the [National Academies] Space Science Board, now Space Studies Board. One I think that George [B.] Field led, they were concerned that with the Hubble coming on there might not be enough astronomers to deal with all the new data. It got a lot of discussion. The conclusion was that no, we should not artificially stimulate careers in astronomy. Let the opportunity present itself, and then let students make their decisions.

I think that was clearly the absolutely right decision. Trying to artificially groom a community can be dangerous. If things don't work out, if say the Hubble never came into existence for whatever reason, "Well, you told us there were going to be all these great careers here, they're not." So let nature take its course. There's always a time lag, worked out just fine. The community has grown in response to all the opportunities, the data, the excitement of what's happening in astronomy and astrophysics.

Wright: Of course the career of Hubble grew a lot longer than it had originally, especially with all of its issues that it had.

Hinners: We initially had talked about a 15-year lifetime for Hubble, with two major servicing missions: five-year, and at ten years in. Very little thought had been given to the details of what that entails. Figuring that there'd be new instruments available in five years, seemed like a reasonable cycle to have two upgrade missions. We didn't call them repair missions because at the time we weren't thinking about what might go wrong. So conceptually that was built in from the start. It's turned out to be just an absolute delight and exceeding the expectations of both the quality and quantity of the upgrades and the ability to fix things. Particularly right from the beginning when it turned out we had the flawed mirror. That was pretty painful.

It's now headed into—it's about 20 years now, and it's got a prospect of another three, five years. Who knows after that? The thinking for a long time had been to try to keep Hubble going until its replacement is up there, now called the JWST [James Webb Space Telescope]. And that still looks like a reasonable transition time. You might say, "Well, scientists will get out there and lobby to keep both of them." I think budgetarily the ongoing operating cost, the fact that you've got the institute that's going to transition over—it was built in that the birth of JW[ST] on orbit will be the burial for Hubble.

Wright: Your employment opportunities changed during the life of Hubble. Have you been involved in its career as you have changed different areas?

Hinners: Not directly, no. Pretty much after I left the AA [Associate Administrator for Space Science, NASA Headquarters, Washington, DC] position it was up to others to carry that on. I did not have a lot of direct involvement. Before I went over to the [Smithsonian National Air and Space] Museum [Washington, DC] I was coming up on the five-year point, and had this mentality that five years is a good time. It was triggered by other things though as well. You get a bit worn out trying to figure out new ways to testify to Congress, say the same thing over but in a different way. "This is getting old, time to do something else," so I think everything just came together.

One of the people who had worked with me at Bellcomm [Inc.], Farouk El-Baz, had gone to the Smithsonian Air and Space Museum, their research arm there. Farouk called me up and said, "Mike [Michael] Collins is leaving as head of the museum, going down to the Castle," [Smithsonian Institution building] where [S. Dillon] Ripley and the management were located. He said, "Why don't you apply for the job?" Initially I said, "No, not interested, I don't know anything about museums." But that thought stuck with me.

About a month later [I] called Farouk back up, said, "Yeah, let me look into it." That started a series of interviews with David Challinor, who was head of this group of science museums—[National Museum of] Natural History, [Dibner Library of the] History of [Science and] Technology, [National] Air and Space [Museum], the National Zoo [Smithsonian National Zoological Park]. I interviewed with David, and it obviously went well for whatever reasons. I think part of it was they realized that having somebody with a NASA background and knowledge was probably a plus, in terms of the museum and its interaction with the outside world and internally thinking about exhibit structure.

Then next interview was with Dillon Ripley who was the head of the Smithsonian. Interesting name, they call it Secretary of the Smithsonian. That was a fascinating interview. We talked as much about the Zoo as we did about the Air and Space Museum. He found out I had a bachelor's degree in agriculture, so we talked about camels and elephants and the kind of surfaces they liked to be on in a zoo environment.

Wright: All those years at NASA paid off?

Hinners: Well, it even did in NASA on occasion, the ag [agriculture] background. We had a session—I think it was with Jim Fletcher—and we had somebody from the outside world come in to talk about some of the life sciences. This fellow was starting to talk about embryology and potential things that one might see in watching an embryo develop in zero gravity. He was talking about using chicken embryos, and I'd had a course in embryology so we got into a very detailed back-and-forth technical discussion on embryology. And I could see people looking at me wondering, "How the hell does he know anything about

embryology?" So that ag background has come in handy many times. Rather unusual in the NASA environment.

Wright: Just never know.

Hinners: I got us off track here, but in a sense these anecdotes are what make life. The technical stuff is chug-a-chug-a-chug-a-chug-a, calculate this, do that. It's all these interactions you have with everybody around you that make it interesting, fun.

Wright: So they offered you the position [at the museum] and you took it.

Hinners: Yes, not having any real foggy notion of what the job entailed. I got over there, and I settled in. I had a deputy who'd been there quite a while; there was a good staff there. The place had obviously been up and running, and drawing record crowds. Close to 10 million people a year were going in. So [I was] just getting the lay of the land, trying to figure out what needed change, if anything, what seemed to be working, leave it alone [if] it's going well. I found that the large challenge was more attitude in the sense that the crew there was still coming off the high of putting up this brand-new very large and popular museum, and hadn't yet really settled down into what do we do for the next 100 years in terms of exhibit renovations, changeovers. Getting the mentality in place of, "Let's figure out a scheme for approaching the steady state kind of operation." It wasn't all that hard. The people there are very adaptable. They're innovative and amenable to saying, "Yeah, sounds like a reasonable idea, let's take that path."

You had three main groups to work with, of in a sense entirely different backgrounds and functions. There's the whole restoration and exhibits crew, these are the people who would restore the artifacts, acquire artifacts, and then get them ready for the exhibit structures. Very talented bunch of people. Then there were the researchers and the departments of the curators. These are the history experts in the field either through experience, some through education. Interesting approach of many of the curators—they want in one sense to tell the public everything. Not realizing that the public doesn't care about everything, and even if you tried to tell them they wouldn't understand, because you don't speak in [colloquial] English. Getting those curators and exhibits people working together to come up with exhibit labels and descriptions that resonate with the public is an art form. Something I'd never thought about.

We had what's called an education department. Their function was to both look at the educational content of the exhibits and also to interact with the school systems. We had a lot of school visits to the museum. Putting together programs and hosting school groups was a major activity of the museum. So you had these three different groups of people—I forgot the security people and the building maintenance. I always said they were the most important people. Keep that place clean so every morning when it would open up again it had a fresh look to it. And security to keep an eye on things but not be obtrusive. Those people were fantastic. They really knew how to deal with, greet, and make the public feel at home in the museum.

Getting those pieces all melded together was not all that hard. The folks there are all professionals, easy to get along with. The daily challenges, as challenges, were almost nonexistent. We had the ability to do things both from government funding, and also there's private-side funding in the Smithsonian which you could use in order to do a lot of discretionary things that you might not be able to do under government funding. The Imax Theater was a big source of income. So when I needed more money I said, "Well, let's see, we're charging 50 cents a ticket, let's charge $1 a ticket." It's still a bargain, and another $1 million to play with here. Don't want to carry that too far.

All in all it was just a very satisfying and new kind of experience. Doing things that I had no idea of how to approach, but it was easy to learn. A lot of help from the staff there. I call it my three-year sabbatical. During that time I didn't really think about having that as a forever career. It did not have the environment I'd been in, those day-to-day challenges and adrenaline-boosting things that really really get you going. So when I got a call from Jim [James M.] Beggs asking me if I'd like to consider being Goddard Center Director, it didn't take too long to come up with the right answer.

Hans [Mark], very very interesting person. He had been Secretary of the Air Force, just a very sharp and perceptive person. He was Deputy Administrator to Jim Beggs. When I was at the museum I wrote an article about solar system exploration, how decisions were made, some of the politics involved in getting planetary missions approved. Hans read that, and he called me up and said, "Come on over, and let's talk about it." He clearly had some points he disagreed with, probably never would have asked me to come over if he didn't.

So I went over to visit with Hans, and we sat down and started talking. He had some disagreements with my interpretation of how things happen. It wasn't on facts, it was more on interpretation and belief in the political process. I didn't change my mind, and Hans didn't change his. It got—I wouldn't call it testy, but vigorous. Hans is like that, I came to find out. He really on purpose will push and poke trying to stimulate you and be sure that he's getting you to say what you really think and believe, or alternatively maybe you'll cave in. I held my ground, he held his. Interesting, but didn't think anything much more about it.

Then a few weeks later I got a call from Jim Beggs to offer me the Goddard Center Director job. Told me that Hans Mark was promoting me as a good person for it. Here I'd just come a few weeks before from meeting with Hans where we had at it, and turns out that's what Hans likes. People who stand up for what they believe in and defend it, take him on. It gave me an incredible insight into Hans I would never have had otherwise in terms of how he operates.

Wright: That I'm sure helped you when you had to have future discussions with him.

Hinners: Absolutely. I was at Goddard, and it was nothing new [that] NASA was under budgetary attack. Hans came out to Goddard for reviews, general conversations, tour around the Center. His advice at the time was to "facilitize" the Center. He had come from [NASA] Ames [Research Center, Moffett Field, California], was Director out there. Big wind tunnels are an important national asset, so can't close Ames down because you've got these required facilities. His advice was get yourself a facility to deal with the [Space] Shuttle payloads, the Hubble, and make that part of your base operation. It makes it that much harder for somebody to close you down someday. We did go ahead and worked on getting a major facility for Shuttle payloads out there at Goddard that were large enough to handle the Hubble when it came along. Interesting advice from Hans. He's still active down at the University of Texas [Austin, Texas].

Wright: What did you feel were going to be some of the major challenges that you were going to take on as a Center Director, especially at Goddard?

Hinners: I had no foggy notion when I started, just like all the other jobs I've had. But one right away I got hit with was dealing with the contract on the Tracking and Data Relay Satellite System [TDRSS]. It was just in the final stages of resolution of a major contract issue. We're talking about a $1 billion contract there at the end. So working through that and understanding the world of contracts, which I didn't get an awful lot of exposure to at Headquarters.

Most of the big contracting was done out in the field Centers. That was a novel experience to get involved in the contract end of the business and understand the perspective the contractor brings to it and the Center view and negotiations back and forth, back and forth. Where does it make sense to give, where do you hold strong—the art of negotiation, which was totally new to me. With a lot of good help from the staff, [we] worked our way through that. I was glad we didn't have any more of those for a while. They're not particularly fun. It's not doing real stuff, but part of the business.

At Goddard there was a question of, "Where do we go with the Shuttle activity?" We started a strategic planning [initiative] at Goddard. That was the first NASA foray into strategic planning. Took close to half a year setting up groups to just reassess everything we were doing and say, "Does this make sense? Are we doing it the right way? Should we take on new activities?" Infamous clean sheet of paper, recognize and buttress the strengths of the Center, try to understand what our weaknesses might be. Really tried to take a very basic look.

That involved also the Wallops Flight Facility [Wallops, Virginia]. Wallops was an adjunct of Goddard. [They] did the sounding rocket, balloon work down there. Folks down there at Wallops are just very down-to-earth, know what they're doing. Leave them alone, they get the job done. I found interestingly they thought this whole strategic planning, involving everybody in it, was a crock. One of them put it to me in very succinct terms. "If you don't know what we're supposed to be doing, just tell us what you want us to do, we'll go do it. We don't need a big study, we don't need to all be involved in it." So I got a totally new appreciation for the folks at Wallops. From their perspective, yes, makes sense. We did get some involvement with them, but it opened my eyes to the different mentality of the folks down there on the eastern shore versus the city folk at Goddard.

Wright: Did you devise the methods for the planning?

Hinners: Yes. We actually published a Goddard strategic plan. It did help us, based on all the discussions and activity. The plan itself was interesting, but all the discussion that goes into it, formulation of ideas and how you implement something is the real output. It did lead us to get into the Shuttle payloads and the Space Station activity. Somebody else can judge whether that was good or bad.

Wright: There were long-lasting impacts from that study.

Hinners: Yes, still involved in it. Of course the Space Station underwent such evolution that what we were thinking of at the time, Goddard's involvement, changed drastically. Some of the other Centers, mainly [NASA] Marshall [Space Flight Center, Huntsville, Alabama], saw us as encroaching on their turf in terms of outfitting a lab [laboratory]. One of the jobs we were going to take on was a lab module activity, interesting back-and-forth on that.

That was the major change in direction. The other was largely a reaffirmation of the value of having a high quality science component along with the engineering, that those two working together was what really made the Center strong. Were we just an engineering Center, you'd lose that hard connection and understanding of what the science is all about and therefore not implement it as well as you could and should. You see that to this day when you work with particularly [NASA] Johnson [Space Center, (JSC), Houston, Texas]. They still do not totally understand the scientist mentality and culture. I did note earlier that when JSC did put in a Science Directorate that aided incredibly facilitating the science back and forth within the Center and acceptance of the scientific methodology.

One of the things we did at Goddard was to take better advantage of what the Center did in terms of letting the public know what we were all about. The public affairs activity there was clearly not, in my view, up to snuff. So [I] brought a lady out who'd been at the Air and Space Museum to head up the public affairs. She did wonders, started to work with the scientists and the engineers to get them to understand the role of public affairs. She really worked that to the point where folks got to enjoy telling about what they were doing. Just a change in leadership and attitude did wonders. You'd just find that permeates everything. When there's an issue and people aren't cooperating and doing what you think, nine times out of ten, it's a leadership issue, not a technical or financial problem. People, people, people.

Wright: While you're thinking in that mode, share with me what you consider to be your management style.

Hinners: I like to sum it up as I did in an article in ASK Magazine a year or so ago, "Management by Wandering Around" [Issue 35, Summer 2009]. I found out so much by just going into people's workplaces. The standard way of management is you call people to your office. For a lot of things that's a good way, it works, but I found that when you go to their work environment, whether it's on the lab floor or in an office, it's a totally different environment and interaction you set up. People are very open, tell you what their problems are, what their perceptions—you just learn so much. I tried to, once a week, pick a building at random and an office at random and just wander in. Word soon got around.

First the division directors were very suspicious of this. Am I spying on them? They soon found out that I was relatively harmless and that no evil was coming out of this and that I was really understanding how they got their jobs done. It turned out to be a very profitable way of understanding how the Center really operated at what I call the working level, people who got the work done. I just enjoyed interacting with folks.

Wright: I think I read where you even got snowed in one night, out with the snow movers.

Hinners: Yes. The snow was bad, the [Capital] Beltway [Interstate 495] was totally clogged. "I'm not going home, just going to stay here tonight." So not knowing quite what one does all night at Goddard, I went outside. Guys were out there plowing. It was a big snow. So I got in with the head of the service area there and went around with him as he plowed. There's a real art to plowing snow. You can't just go in and start shoving snow around. You'll soon block the roads and your way out. It was just a fun evening, getting to know Tony, and how you coordinate cleaning the roads and the parking lots so that the next day people can get in and everything looks—cleaned it out, that's what you're supposed to do. It's an art form. That's how you really find out how a place operates. If you don't get down there and work directly with them, you think you know, but you don't.

Wright: A couple of other events that happened while you were there is of course Goddard turned 25. That was a big celebration, talking about all the great things it's done. And you had a presidential visit. President [Ronald W.] Reagan came after the Solar Max [STS 41-C Solar Maximum satellite repair mission].

Hinners: There was a major problem with Solar Max that the fuses were undersized, so it was blowing fuses and in bad health. That became a target mission for the repair, the Solar Max repair mission to go up, capture the satellite, change out the electronics that needed to be upgraded, and put it back in operation. That was a spectacular success with awards and so on. Really the ability of astronauts to do that kind of repair mission—this is all pre-Hubble, but it was a prelude to things that could indeed be done. There were other interesting things done with the Shuttle in those days. The launch of commercial communications satellites from the Shuttle bay, retrieval of one of the COMSATs [communications satellites]. Shuttle in those days was doing everything, trying to make its way through life.

The Reagan visit was interesting to me, just to get a sense of his demeanor—he comes across in person just as he did in public television. Just an extremely personable, easy to talk with person. We did start to, when we were over in the Earth science area looking at some of the exhibits there, talk about the global warming. He was a nonbeliever in the possibility that human contribution of CO2 [carbon dioxide] to the atmosphere was a major contributor to global warming. He got to talking about how it's really pine trees that exude terpenes, organic molecule. I did not choose to argue with him. He's got his belief.

That's what sticks with me on that visit—just how personable. I think still of all the Presidents he must go down as the top on that. Goddard is in a good position. They're so close to Washington. To get a presidential visit out there is a lot easier than one of the other Centers where they have to make a special trip. It also had a good side effect. You have lots of things you'd like to get done: cleaning the Center up, getting the grass mowed where it hadn't been mowed for half a year, getting the street fixed up. When the President is coming, somehow all that stuff happens. So we need one of these every year or two to keep the Center in good shape.

Wright: I think you're right. Tell us about the impact that the [Space Shuttle] Challenger accident [STS 51-L] had on Goddard.

Hinners: The impact was maybe long in coming. Initially of course when it happened none of us understood what that might really be. The day of the Challenger accident was just like many of these other things. Like [President John F.] Kennedy's assassination, you remember where you were. We were watching the launch, my deputy John [J.] Quann [and myself]. We had a TDRSS satellite on it, a Goddard payload. So it's taking off and John said, "Let's go to lunch." This was after liftoff.

I said, “No, let’s watch it for a couple more minutes.” Then we just stared at that screen. Initially I thought, “Well, that’s a strange separation of the solid rockets.” It did not dawn on me that it was something catastrophic. It rapidly became evident, then very soon after the network folks replayed that scene. We were just in total shock. You don’t think of, “What do I do now,” you’re just trying to absorb it. It was not at all obvious what the impact would be. That only unfolded with time.

It became evident that the decision to put everything on the Shuttle was a flawed decision. I noted yesterday that Pete [Edward C.] Aldridge [Jr., then Secretary of the Air Force] had already started the Titan IV [rocket] program to take that possibility into account [for the military]. That became a very smart decision, both in foresight and hindsight. It also started the thinking at NASA we too should not be totally dependent on the Shuttle as the only launch system. By that time the expendable launch vehicles were being phased down, so there was a scarcity of launch vehicles to handle all the payloads that now couldn’t go on Shuttle. That did lead to quite a backlog of payloads that were about ready to go and had no way to get to space. The overall impact of that was just a major change, a sea state change, in the view of how you need to deal with launch vehicles.

You might say, “Why today do we have a flawed policy on launch vehicles?” I do not have a good answer to that question. For whatever reasons, we have as a nation not dealt with the launch vehicle. I shouldn’t say as a nation, because the DoD [Department of Defense] made their determination that they were going to keep two competitive launch vehicles going, the Atlas and the Delta. So today you can fly on either one. Payloads have to be designed to be accommodated on either launch vehicle, so if one line goes down, use the other.

NASA has not subscribed to that philosophy. Some of it is understandable in this sense, that there’s probably no practical way you can have alternative launch systems of the Saturn V class or Shuttle class. You can’t afford it. And the DoD is not interested, they don’t require that kind of capability. So you’re on your own. In that sense NASA has this ongoing dilemma of how to afford a very large launch system that has low utilization.

I brought that up with Doug [Douglas R.] Cooke [Associate Administrator for the Office of Exploration Systems Mission Directorate] a month ago at a meeting, and he admitted that it’s a problem. You can’t afford to fly it frequently enough to keep the cost down. They are looking at ways to reduce the whole ground crew that’s involved in keeping a launch system going. Good luck, it’s a tough charter. It does say we don’t do a particularly good job of learning the lessons from the lessons learned that we try to document. Circumstances change, but also the applicability of lessons learned. The circumstances changing—that worked in that situation, it’s not clear that’ll work in another. NASA and I think APPEL [Academy of Program/Project & Engineering Leadership] is trying to use the storytelling mode as you’ll see in ASK Magazine and in their Masters Forums, to not necessarily transmit a lesson per se—do it this or do it that way—but the thought process of trying to foresee things that can happen. How would you work your way out of them, and how do you elicit from the people around you the potential good solutions that you can evaluate? It’s more using lessons learned as a way to stimulate how you operate and manage in today’s environment.

Wright: Did you have to make a lot of changes in your strategy due to the postponement of return to flight [after Challenger]?

Hinners: The large part of the Center was of course involved in building robotic missions. So the impact on that was more where or what do you launch them on. It was clear the expendables were going to come back and provide those opportunities, and use the Shuttle only for those things such as where you knew you might want to repair a satellite—to get it into an orbit that could be reached by Shuttle and design it to be repairable.

In that sense Solar Max was not designed to be repaired, so the crew had to do a lot of things on there that weren’t easy, because it wasn’t designed to be easy. The whole philosophy of “design it to be

repairable," such as the Hubble was, became a different way of thinking in satellite design for those which would be put into an orbit that Shuttle could reach. I left Goddard in '87, so I really did not see myself the full impact of how the Center adjusted to and worked with the changes in the Shuttle system, Shuttle payloads.

Wright: You were moved to be the [NASA] Associate Deputy Administrator to focus on institutional management matters.

Hinners: Well, it was a dual function. Jim Fletcher asked me to come down and help with the institutional management. **Part of the Challenger report [Rogers Commission Report] noted the insularity of the Centers and the close management connections between Headquarters and the Centers that from one perspective it's too cozy.** His thought was, "Let's take a look at the management structure. Are there things, looking at the Challenger report, that we should do to change our management approach to try to avoid the kinds of things that led to the Challenger accident?" I did spend some time talking with Centers, the Headquarters AAs to think about that, and concluded yes, probably time to make a management change. Take away from the AAs their Center management responsibility, and bring that together under a Center management system that built in some separation between managing the Centers and managing the programs that Centers do.

To me that responded to what he had asked for and the Challenger report. That didn't go very far. The manned spaceflight mafia, starting with the Deputy, Dale [D.] Myers, and Dick [Richard H.] Truly, who was heading up manned spaceflight, wanted no part of that. That was tearing their empire asunder. In that battle I did not win. Fletcher, I suspect that he must have felt he could not take on his Deputy and the AA for Manned Space Flight. That really started me thinking, "Well, this is a losing job." I didn't particularly relish the job to start with, but, "I came down here to help, I'll try to do what I can."

Also had a role, more on paper than anything else, as Chief Scientist. It was a dual role. In that role just provided the day-to-day input to Jim Fletcher and Dale Myers on the science part of the program. I was not trying to do the science job. Len [Lennard A.] Fisk was heading up space science, perfectly capable, and doing a super job of running the Science Directorate.

There was a fun little sidelight to the job that gave me my comic relief. Interesting thing happened to me in that job. I had a White House fellow working for me as a staff assistant. It rapidly reinforced my belief in the good part of military training. I think I mentioned that yesterday, relative to Sam [Samuel C.] Phillips and Rocco [A.] Petrone, that their military training background provided them a management style that was no-nonsense, no bullshit. Just get the facts out. "Here are the decisions that have to be made, here are the considerations going to it," and make the decision.

Art [Arthur J.] Athens, out of the Marine Corps serving as the White House fellow, would say, "Okay, what meetings are coming up tomorrow?" You'd say, "This, this." He would go to the people I was going to meet with, set the agenda, course of action, and a tentative list of decisions that had to be made. Fantastic. Go in the meeting totally prepared. You didn't spend half the meeting trying to figure out why you were there. Click, click, click. Then he would follow up on the actions. The military does a fantastic job of training and preparing people for decision making. Their environment, you don't have all day to send back to committees to figure out where the enemy is. So that was a wonderful year having Art there.

The Osprey [V-22 aircraft] was just being proposed. That's a tiltrotor vehicle. Art's view was that thing is a disaster, it's not what the Marines need, want or should use. It's not fast enough to outpace the enemy fighters so you've got to escort it everyplace it goes because it's too slow, it'll only do a couple hundred miles an hour. It's complicated. Marines don't need complex aircraft. The aircraft lobby won out on that, and let's see, we had five Ospreys crash, lost about 13 lives in that.

Really relates to the whole decision process and the industry-government relationship where programs take on lives of their own and the basic requirements don't necessarily match, yet these programs keep going. You see that all the time. The influence of both government people who are not involved in the

actual implementation of the program and the industry. [Dwight D.] Eisenhower talked about the military-industrial complex. I've thought about that many times. It certainly in many instances rings true. These large government programs that you say, "How does that keep going?" Interesting watching this Osprey evolve and thinking back to what Art said about it back in 1988 or so. And 23 years later I think he was right.

Headquarters two-year period—after it became evident I wasn't going to impact the management structure—and further, I was rather bored in the job. I was used to heading organizations and leading things. That was a staff job in effect, a number three. Being number two anyplace is a tough nut, but being number three is a loser, don't ever do it. I made my mind up, enough government.

I had several friends who went out to industry. One in particular, Tom [A. Thomas] Young, whom I replaced at Goddard, was at Martin Marietta [Corporation]. I talked to Tom a little bit, said I'd like to at least look into the possibility. I talked with Norm [Norman R.] Augustine, who was president and CEO [Chief Executive Officer] of Lockheed Martin—Martin Marietta then. I'd always had tremendous regard for Norm. He had just a style and a way of interacting, working with people, and a brilliance that are close to unmatched. My knowledge of Tom and having gotten to know Martin a bit through the Viking [Mars] program, decided yes, that's it. That's the place to go. That's when I did decide to go with them and went out to spend two years out in Bethesda [Maryland] at their corporate headquarters learning the ifs, ands or buts of corporate life before they shipped me out to Denver [Colorado], which was neat. Good move in hindsight.

I lost a lot of immediate touch with NASA in those years then when I got out here. I came back in a different environment from the contractor perspective. That is something, in an ideal world, it would be good for a lot of people to have. When you're in government you believe you know what drives industry and how they respond and react, behave. When you're in industry you think the same thing about the government people. The reality is that neither of you know what you're talking about. Which reminds me of Jim Beggs one day, a meeting we had with AAs and Center Directors.

Burt [Burton I.] Edelson, AA, said something about industry. Jim Beggs looks at him and said, "Burt, you don't have the foggiest notion of what industry thinks." He was absolutely right. Until you've been there you don't know. And even when you've been there, you see it from a particular industry perspective or a particular government organization perspective. The learning process working with both communities—and we'd seen that during Apollo with the industry background of George [E.] Mueller. He brought that perspective to it as well as the understanding, knowing the military side, though he'd never been part of it.

That was a total mental change, which also had a downside. I did not totally appreciate what it really took at a detailed level to implement a mission in the industry environment. When we were from Martin competing for the Mars Surveyor program, we knew it was going to be a tough competition. But they all are. The ways we devised to lower cost turned out with the Mars '98 disasters to be flawed to say the least [launched 1998, lost 1999]. I didn't have enough experience on the industry side to foresee that—and maybe I wouldn't have anyhow—but I clearly didn't have the experience.

Working with the other people in Martin who did have the experience, we jointly brainwashed ourselves into believing we had a viable program proposal. Pain of hindsight, it was very evident we did not. Tough, tough lesson learned. I can just be thankful that we survived it, which was an odd fallout advantage of the fact that we were in a program. The Mars Surveyor program was designed to launch two spacecraft at every Mars opportunity, that's every two years, for five launch opportunities.

We had already started building the 2001 missions when the '98 failures occurred. Had that not been the case, my belief [is] that there's no way we would have survived to go on and recover, because that would have been the end of that program; you'd have to compete for a new one. Coming off two failures, competing, that's a no go. The blessing was it was part of an ongoing program which was already under contract—I recovered, went on to do things like the Mars Reconnaissance Orbiter, Stardust, Genesis, other missions. You can say sometimes things conspire in your favor.

Wright: Were you happier having your hands back on some projects?

Hinners: Oh yes. You say hands on, I never did anything myself. It was always—just again as at NASA—you have good people around you and let them do the job, enable them to do the job. Interesting aspect of that, Martin and then Lockheed Martin—the NASA work is a small part of their organization. They are dominated by their DoD work. The NASA part of the business is small relative to the DoD, the profit it brings in, yet it gets an awful lot of the publicity and view of the outside world. DoD is largely classified, so nobody knows for the most part outside of the DoD organizations.

Particularly when some of the older Viking folk left, the management was wondering, "Why are we in this business? When things go well, it's good publicity; when they go bad, it's real bad publicity. That's always been a bit of an internal struggle. I suspect that must be common to the Boeings [Boeing Company] and Northrop Grummans [Northrop Grumman Corporation], ancient TRWs [TRW, Inc.] of the world.

All this, again, is a view that there's no way I would have understood, appreciated from outside. Working with particularly JPL [Jet Propulsion Laboratory, Pasadena, California]—most of our work at Martin was with JPL, very little at that time with Goddard. The JPL view of life in their business world was squeeze the contractor on potential profit. From a government perspective, "Why should anybody make profit on what we do?" So the JPL business side was always pressuring us to cut down the potential—not the actual but the potential—award fees if you did the job well.

So I decided, "I've got to go out there and work with the JPL management to turn this around. It's impacting all of our negotiations." I started with the director, the deputy and on down. That one day really turned out to be extremely useful in the long run, because I got everybody in that JPL management team to understand the role of profit in the industry and what that means to being able to implement a mission the way that NASA would like us to do.

Going out, not knowing what the reception would be, but then coming back and saying they all listened and understood—it changed the environment. I was really struck by the openness of the JPL management to listen and to respond favorably in that situation. So lesson learned. If you've got a problem, go talk about it. You may be surprised at the outcome.

Wright: Do you feel that your years with NASA gave you an entrance with the management team there?

Hinners: Absolutely. I knew all the people personally, and we had a trust. It didn't mean we always gave in to one another when I was with NASA or otherwise, but we understood and knew what was driving it. It was always the great stuff we were doing. When I was at NASA and contractors would come in to talk with me, they were pleasant meetings. They'd make a point, I'd try to respond, but it didn't have that same feel to it, because I really did not appreciate and understand what they were telling me about their environment. I hadn't been there. Once you've been there, "Yes, I do understand now." It doesn't mean that everything industry tells you is something you ought to listen to or do, but at least see the perspective that they bring to it.

One of the side ventures I took was working with the Space Studies Board. They undertook a long study of the relationship of human exploration to robotic. I was on the board in the late '80s and the '90s. We all realized that there's a tension there between these two worlds that could use some thinking and study to see, "What can we do to better create an environment where these two worlds can cooperate?" They're both here, they're both going to be here, we're going to have to work with them, so is there a way to better work or manage that interface between the science world and the human spaceflight world? We did a—went close to five or six years in total—three-part detailed study of the relationship of the robotic science world to the human spaceflight world, and published that report. I, to this day, use that as a basis for talking with the NASA management about suggestions of ways to foster a better working relationship between these two worlds.

The tensions are still there. Nothing has changed in that regard. But I do think we have ways formulated

to better work the interfaces, how one community needs to understand the needs and desires of the other and come out with a more long-term productive relationship. In the last year I've gone in to Space Science and to the Exploration Office to talk about the results of that study and show them, "Here are some of the things you can do to foster a better working relationship." Must say to date it doesn't seem to have much traction. The dichotomy for whatever reason seems to be so ingrained that it's hard to develop a strong relationship. Each side is very wary of the other and their motives for wanting to do things. The motives are actually fairly clear, but appreciating those and working with them is a constant management challenge.

Wright: Would you share some of the results of that study, the benefits of the two working closer together?

Hinners: Nobody disagrees. Looking at this, you can understand to some degree why there's a reluctance. Periodically the organizations do try to come up with ways to foster a better relationship. Exploration today took one step, they put Laurie [A.] Leshin in as the deputy to Doug Cooke. Laurie comes out of the science world. I think that is the first time there's ever been a science person as the deputy in the Headquarters Human Space Flight Office.

Scientists know her, they can speak with her. So that's clearly, in my view, a step in the right direction. You'll never get over the fact that implementing science in conjunction with human spaceflight costs a lot more than if you do it robotically. That comes down then to a budget situation, who's going to pay for it. Mike [Michael D.] Griffin [former NASA Administrator] threw that into a bit of a turmoil a couple years back. He said if scientists want to do science on the Moon, they pay for it.

The science program is not going to come up with a couple billion dollars to implement a couple hundred million dollars' worth of science. No way are they going to do that. So if the exploration office doesn't pay for the science that they do in conjunction with their program, chances are very little is going to happen. Yet they don't have the budget to even handle their own human spaceflight needs, much less the science that they might do. So there's a major dilemma in NASA as to how to fund this human exploration program, including what you do on it.

Wright: NASA also funds non-NASA ventures in science. For instance, the ground-based observatories. How were you involved with that?

Hinners: That came up back in the '70s in some of the congressional interactions we had with the Appropriations subcommittee in the House [of Representatives]. Eddie [Edward P.] Boland, chair of the subcommittee, talked about the astronomy budgets and said, "Your budget in NASA in astronomy is as large as the NSF [National Science Foundation] budget in astronomy." In essence he was asking how do you reconcile who does what, and why. He also realized at the time we were funding ground-based astronomy out in Hawaii, the planetary astronomy. We needed to get ground-based information to use in designing the astronomy satellites.

So we actually at that time formed a joint NASA-NSF working group to be sure we mutually understood what the ground rules were for why you did something in astronomy on ground-based, and then research programs in NSF or why you did it in NASA. We needed to be sure that we were totally coordinated and had a uniform story to tell to the congressional committee as to who was doing what in ground-based astronomy and the total size of the astronomy programs. That, at least while I was there, worked quite well. I haven't really kept up with what's happened subsequently in the back-and-forth between NSF astronomy and NASA-funded astronomy.

That also does raise a much more pertinent issue that goes on to this day, and existed back then, which is on the environmental science and Earth remote sensing. There was a tradition early on that NASA would fund and implement the first of a new science look at Earth, a new instrument. And that when it had flown and we understood how to use the data from that sensor, then NOAA [National Oceanic and Atmospheric Administration] would take it over and fly that instrument on their operational satellites. So

early on there was a relatively clean division on transition from a science research program to an operational program.

That, with time, became muddied as to what constituted research and what constituted operations. Part of that is because the research never really stops. Even when you have an operational satellite, that instrument is providing data of use to the research community. But the operational community is not going to build an instrument maybe to the specs [specifications] the scientists would like. They don't need it for their use, so you ended up in a back-and-forth on setting requirements. Are they science requirements or are they operational requirements? If they're science, you pay for it. It has led to a very tangled relationship between NASA, NOAA—and on occasion the DoD uses a lot of weather satellites—on the science content of an operational satellite. Who pays for it, who manages it? That's going on to this day.

The next generation of NOAA satellites is in, right now as far as I can see, rather a mess. They finally I think sorted out the roles of who's responsible for building which ones for the science instruments. It's just one of those interesting quagmires you get into when you take a science kind of instrument measurement and put it in an operational environment.

Wright: You've got the National Science Foundation, you've got the National Academy, of course NASA has its own advisory committees—what do you feel are the benefit of listening to these groups? How well do they work together, as you mentioned, to work toward a common goal? Can you share some anecdotes of things that have worked out well?

Hinners: The original Space Studies Board—at that time it was called Space Science Board—decadal studies were just in astronomy. Those provided for the major missions a good blueprint. Here was an outside organization that could work with the science community, argue about priorities, vet different ideas. That created, in a sense, a nice situation for NASA. They could take that output, say, "Well here's what the community thinks are the priorities." Since we're here to serve that community, makes sense to us. So they could take those results and work towards implementing the missions that got the blessing from the National Academy.

Then when others saw the benefit of that, others at NASA and outside, that led to an expansion of these decadal studies to where now there's one in planetary astronomy, space physics, there's a separate solar—they proliferated. Now the AA for Space Science, Ed [Edward J.] Weiler, said, "We'll take our priorities from the decadal survey results." Now it's become just a totally enmeshed mechanism for every ten years surveying the field, saying how much progress did we make, here are the new opportunities in missions.

Those studies in fact are just finishing up now on the planetary science, are of course going to be out early next year. The astronomy one just came out a couple weeks ago. Now science is much more reliant and dedicated to following the pathways for major missions laid out in those decadal surveys. They're comfortable with it, it provides them some cover. If the community doesn't like it, say, "Well, you had your chance. The National Academy did these studies so we're taking that as our input." Takes the heat off NASA in large part from the outside world, people complaining they don't like this, they don't like that. I must confess it's a pretty good system. To gather lots of input—they spend two years on doing one of these decadal surveys, digesting it, arguing about it, establishing a set of priorities. I think it's an excellent system from my perspective.

Wright: Somewhat different from where you were having to decide what priorities were going to make it through that budget process when you were AA.

Hinners: Yes, just made our own decisions. We had input from the Space Studies Board. It wasn't a dictum. It was interesting advice and we listened to them, sometimes took it, sometimes didn't. For the most part we did, because the advice we were getting from our own committees was pretty much in concert with that.

It did expand also to the Earth sciences. Academy had a major study on the priorities in Earth science. Again, they're pretty well following the path laid out. It's taken a bit of a change recently in those studies. The Academy committees would try to use the prospective mission cost as one of the criteria for setting priorities. Their concern has always been, rightfully, that something may be neat, but if it costs so much it squeezes out a lot of other science, it may not be a good thing. The ability of them to have good cost estimates of prospective missions—many of which were conceptual, not hard design—turned out to be a problem, because the early estimates of mission cost are notoriously low. In part because you really don't know what you're going to do, and you also know that if it comes out with those estimates too high it'll kill it off before you even had a chance to pay for it.

There was a clear tendency for the estimated mission cost to come out very low relative to what they ended up being, and that has led to the congressional request for NASA to take a detailed look and have the Academy do a study on why their mission costs end up so far out of whack with what the early estimates were, and to do something about it. That is under way now, something I'm working with NASA on with Chris [Christopher J.] Scolese [NASA Associate Administrator] to try to deal with all the input now that's coming out of cost studies. And the Academy is doing their own independent cost studies to try to get a better grip on what some of these neat new science concepts might end up costing so they can weave that into their thinking on how to prioritize the science that can be done on the new space missions.

Interesting process there on costing missions. It raises a topic that has to be dealt with but is—tricky is the wrong word. Complex may be the wrong word too, I'm not sure I have the right term for it. NASA could easily design things that they knew with very high fidelity what it would cost. The chances of that resulting in forefront science are slim. If you know in that detail exactly what you do, you're probably not advancing the state of the art, or the state of the science. Reaching out into something you've never done before, and therefore not really understanding and knowing precisely what it's going to cost—maybe even roughly what it's going to cost—balancing that off against doing what you already know how to do and have done.

The NASA tendency is, "Hey we're doing forefront stuff, we got to keep reaching out." Almost at times you can get a feeling that it's "cost be damned." But in the environment we're working in today it can't be. You'll be pricing yourself out of business. So we're right in the midst of trying to get that balance between understanding and factoring in probable cost into the priority system and then implementing missions and having them finish within the envelope of cost that you had committed to. In this budget environment we're in, as you might guess, that's a pretty important topic.

Wright: Was this different from the environment that you inherited when you stepped into the AA position?

Hinners: We always did have to be concerned about cost. In our testimony on the Hill, I would get beaten up for cost overruns. If the missions were successful, a lot of those sins were forgiven. We'd go on and work the next one. It's a much tougher environment today. We could get away with a lot more then. It was just a simpler overall system, the interfaces and the insight. Now, the number of people who demand detailed reports from NASA on a monthly, sometimes a weekly basis, boggles the mind.

The bureaucracy in Washington is totally out of control. To feed that data dog, as my friend Charlie [Charles J.] Pellerin would call it, is taking an inordinate amount of time and effort. So part of our challenge now is to try to educate particularly the outside world, the OMB [Office of Management and Budget], the GAO [Government Accountability Office] and the congressional committees on the situation and what we're trying to do to better forecast and control the cost. Right in the middle of that. This time I'm seeing firsthand, getting reimmersed in the world of Washington politics.

Wright: Do you recall any project or specific mission that you had wanted to undertake for the science world while you were with NASA that just didn't get to launch, somehow it got canceled out? I know you

saved a few along the way, but I didn't know if there was something that you had hoped would have been able to make it.

Hinners: At that time in the '70s it was more elements of a mission or sequence that would have to be cut back or reconfigured to make it affordable, or just not doing something that sounded real neat. For example, in the '70s JPL proposed a set of really forefront missions using new technologies. One of those was solar sailing using a huge structure, a kilometer on a side, of very thin foil to provide propulsion from just the solar energy hitting it. Conceptually a pretty neat wonderful thing, and you could do all sorts of fun missions.

We looked at that at Headquarters and said, "Boy, the cost of this and the unknowns." A lot of the proposals that would come in, our decision not to do them was usually not necessarily cost-driven, but is the technology developed far enough so that you say, "Yes, I know enough that I can now do a mission using that technology". Very frequently it was the lack of readiness of technology to implement a mission that would be its downfall.

Another side, true to the whole cost consideration, came in the international world. If you couldn't afford within the budget envelope that you had to do a mission, if ESA [European Space Agency] is interested in the same kind of mission, let's join forces here. If neither of us can afford to do it alone maybe we can cobble up a joint mission that makes sense to do cooperatively and get better overall total benefit out of each of our budgets by doing a cooperative mission.

That concept has expanded over the years. If you look now at NASA missions, it's a rare space mission that doesn't have a foreign contribution. Or a foreign mission, an ESA mission, that doesn't have a US contribution. International cooperation has become close to a standard way of doing business. Almost these days don't think twice about it. It's just normal, accepted. There are some European proposals that won't cost us anything if we fly their experiment in terms of out-of-pocket cost, and vice versa.

That is taking on a new step with the future Mars program where the sample return mission was judged by NASA to be just too expensive for NASA to undertake on its own in the science budget. It recently became joint with the European Space Agency, so the future Mars program starting in 2016 is a joint program right from the start. Of course the [International] Space Station has well known international parts and pieces. We've really leapt into the future here, history in the making maybe.

Wright: Well, I think it's been like one nonstop trip as it all weaves itself together. As we're getting close to closing out for today, I wanted to ask you about what you believe to be some of the most significant contributions that you've made to the agency and/or the field of space science that you're proudest of.

Hinners: It goes back to the fact that I can't take credit for any real specific accomplishment. Other folks have done it. So what I have to believe is just that the management style I'm comfortable with and use, of creating the environment in which all these other great people can practice their trade and do their good things, is my major contribution. Enabling the others to do their jobs and get it done. I would say it's in the management approach rather than a specific hardware or software accomplishment. That's my comfort zone.

I hadn't thought much about it until just now. Taking that approach or behaving that way really makes it easy to have good people come out with their ideas and perform. I think I am not seen as a threat by anybody, and that creates an environment where people feel very open, communicate well, feel comfortable doing that. My take is you get so much more done that way than just chug-a-chug-a-chug-a-chug tell everybody what to do and how to do it. You get the best out of people. There's a lot of good stuff out there, so suck it up. It's there for the taking.

Wright: What are just some of your most favorite memories? You've been around so many great accomplishments, and part of them in your own way.

Hinners: This may sound odd at first, but recovering from failures and problems. My mentality is just such that, "Okay crap happened, let's get on with life, learn from it, carry on." When involved in mission failures, and not just the ones I've mentioned like the Mars or the Challenger, those who've put so much of their life into it can get very very down and depressed and wonder, "Why am I doing this?" So after each of these I spent a fair amount of time, concerted effort in working with the folks who were involved in those disasters, showing them that there was life after death. Because I believe that. "It happened, let's figure out why, what went wrong, get on, take the next step." Being able to provide to those people some hope that there is something else, this is not the end of the world—even though it may seem that way at the time.

With the Mars failures we had some very very serious people problems. There were people we were concerned about potential for suicide. Bringing in professional help from the company was a real plus. And just talking it out, not keeping it bottled in but getting it out, talking about it, facing the facts, and not sitting around describing the blame. Get out of the blame bit. After the failure, after the lander, probably a day or two later, I called Dan [Daniel S.] Goldin up, who was the NASA Administrator, and said, "I apologize for the screwup." Dan, in contrast to what I expected, and based on previous history of watching him—he reacted in a way I had totally not anticipated.

He said, "I don't want people who tried to make this happen blamed for it. I pushed too hard to make this 'faster, better, cheaper' approach work." I was dumbfounded. I had totally expected Dan to chew my butt out, blame me in large part for the failures. Didn't happen. That changed my view of Dan. I had thought of him as just being a pompous curmudgeon all the time demanding more and more of people, not worrying about whether you can really do it or not. So I developed a new perspective on at least one part of Dan Goldin, and used that internally.

There'd been other problems at the time. The Titan had a major failure, and everybody involved in the Titan program took a hit in terms of merit reviews, salaries, bonuses, the whole bit. The indication was they were going to do the same thing on people involved in the Mars programs, and I resisted that. I told our management, "The people who worked this program did what we asked them to do. This was a management disaster, not a technical disaster per se, and they shouldn't be punished for doing what we asked them to do." They bought off on that. I said, "Those of us in management should take the hit." Which we did. But the general folks there did not, and they shouldn't have. So I felt real good about it. But if Dan Goldin hadn't stood up and taken himself the responsibility, I couldn't have used that lever.

JPL took the same view. Larry [N.] Dumas, who was the deputy there, talked with me and he said, "No, we're not punishing people for the failure. Some of our best project managers come out of failures. They learn." That was a very interesting aspect of the whole Mars failure scenario. And those same folks, the bulk of them, went on to produce some fantastic good missions. The Odyssey, the Mars Reconnaissance Orbiter and a whole number of other missions. So there can be life after death.

Wright: You went on for a little while and taught at the University of Colorado at Boulder, so you experienced some days as a professor as well.

Hinners: Yes, that was a neat adventure. I had known the head of the Laboratory for Atmospheric and Space Physics [LASP] up there, Charlie [Charles A.] Barth, for times going way back into the '70s. When we moved out here Charlie invited me up to talk at the dedication of their new building there at LASP, renew acquaintances. Charlie was also going to retire soon, so I went on the search committee for a new director for LASP.

The search committee was fumbling around a bit. I said, "I've got the perfect candidate for you," Dan [Daniel N.] Baker. I had recruited Dan from Los Alamos [National Laboratory, New Mexico] to Goddard when I was Goddard. Dan came to Goddard and headed up space physics there, and turned out that going through the process Dan was selected to be the LASP director. When I retired, Dan said, "Hey, why don't you come up and spend some time here with students?" LASP hires a lot of students to work on projects in their space operations. It sounded like fun, I'd known the people in the aerospace department.

I did two things, working out with the folks at LASP. I started to become an adviser to a student group working on designing a space experiment to fly on what's now called the New Horizons mission, which is on its way to Pluto. [S.] Alan Stern at Southwest Research Institute [San Antonio, Texas] had initiated a student project. Alan believed that the usual NASA outreach stuff is a crock. "Let's do something real, have some students involved in building something that flies," which he arranged to do with LASP. The students, with the help of the professional staff there at LASP, were building a dust detector experiment. I provided the day-to-day senior adviser [role] to them—working directly with the students, understanding their issues and problems, and helping them over some of the hurdles, how you build real hardware. Fantastic opportunity working with 12, 13 top-notch students, helping them understand how NASA does business, what you have to do qualify experiments to fly in space.

The rest of the time, I started a lecture series in the aerospace department, a seminar series on NASA missions, how they get done, implemented, systems engineering. [I was] trying to give them a feel for what the infamous real world is all about and how things are done, and use that as an aid to them in implementing what are called senior projects. Colorado and a number of the other aero departments—[University of] Texas, MIT [Massachusetts Institute of Technology, Cambridge, Massachusetts]—senior students get involved in a yearlong project, taking it from establishing the objectives to building something that works, but they're for the most part totally ignorant on process.

You might say NASA may be overly driven by process, yet it's that process that helps you do things in an orderly good fashion and frequently saves your butt from doing something stupid. So my goal there was to show the students how the NASA way of doing business resulted in missions, what it takes to actually make these missions fly and succeed, and on occasion why they fail, and the things you need to be cautious about in implementing a mission that can lead to failure. Just try to give them a sense of the systems kind of thinking that goes into putting a mission together. I had a ball doing that.

It was a shocker also. You think giving nine or ten lectures over a period of nine, ten weeks should be a snap. I thought, "Yeah, I can put those together in an hour or two per lecture." Oh, what a shock. I ended up spending close to 20 hours to put a one-hour lecture together, combining graphics and talk. I had not ever understood what it takes to put together a decent course at a university. You think people just go in and talk. First you have to know what you're talking about. We tend to think we know something—until you have to tell somebody else about it, you find, "Oh, I really don't understand that in detail." I saw it at a high level. This is probably a result partly of my never having worked on the gory detail of things but always at a higher level. You think you know how things happen. In reality, it doesn't work that way.

I had to educate myself and sometimes reeducate on things I'd just totally forgotten in putting those lectures together. That was a great opportunity, but I saw what it really takes to put a good set of lectures together on any topic. It's work. The outside view that faculty just screw around having a good time and going to conferences, talking and giving a lecture now and then—a lot of hard work goes into being a good faculty member.

Wright: What a great resource for those students, because you could answer questions that other people could not.

Hinners: Well, one of them came up to me and said, "Could you give us an evening lecture?" It was right after the [Space Shuttle] Columbia [STS-107] accident. He said, "It looks to us as if some awfully stupid things were done. We don't understand it." So they got their AIAA [American Institute of Aeronautics and Astronautics] group together, had an evening lecture on what led up to and contributed to the Columbia accident, how things happen. The students said, "We don't get that in the normal courses. All our faculty are career researchers. They've never been out in the real world." They just loved it to have me available as somebody who'd been out there. I talked to them about career choices. A lot of them did want to work with NASA. A fair number said, "No, I don't want to work in a big bureaucracy, I want to go to some little company where I can really do things myself and contribute." It was an education for me.

Wright: What a great resource.

Hinners: Fabulous. I'd like to have kept it up, but that drive up to Boulder in the winter, when my eyesight went bad on me, I unfortunately had to give that up. But it was fantastic.

Wright: You mentioned earlier about the advocate for having a Mars sample return mission. Would you share why you feel so strongly about that?

Hinners: Goes back to Apollo. The bulk of what we really know about the Moon came from the analysis of the samples that were returned, and then using that knowledge and data in conjunction with the orbital remote sensing data to extend those results to the larger part of the Moon. It really proved to me that you really don't—and can't—understand these bodies until you've had the sample in the Earth labs and been able to do the detailed analysis that's possible here that is totally impractical by sending instruments there to the surface of the Moon or planets. You can never miniaturize and send enough of all the right equipment to do that same kind of job you can do so easily in the terrestrial laboratories once you get the sample back. Just that aspect alone, there's no way you're going to understand this planet until you get some sample.

Meteorite studies also have proven that out. We'd be almost in a blind if we didn't have those meteorites to analyze and understand what asteroids and comets are all about, to complement the remote sensing. Instrumentation indeed has gotten a lot better that you can send to these places. See what we send to Mars now, relative to what you could send two decades ago. It's phenomenal, yet it's still no match for what you can do back here, because the terrestrial labs and instrumentation—at the same time space instrumentation has expanded, so has it back here. Terrestrial instrumentation and laboratories are always at least a decade ahead of where you can be on anything you can fly in space. Once you get those samples back they're here to stay. We're learning things from the lunar samples 35, 40 years later that we couldn't conceive of when the Apollo samples came back. They have an infinite life. As new techniques are developed, let's go back in and look at them again. Learn new things.

The value of it is just so unquestioned in my mind. To understand Mars to the degree we want to both for science purposes and for eventual human exploration, get that sample back. It'll just open up a tremendous new bin of knowledge about Mars that there's no way we're going to get otherwise. That's the real driver. The return on the investment relative to what you can do robotically with remote analysis is just so high that the value is there. It's expensive, but the value is there. We have to figure out, "How can I make it affordable?" It's probably going to be another decade of plotting, scheming, conniving.

One of the things the Apollo program was so proud of was that the astronauts collected these samples and brought them back, and it wasn't done robotically. There's a belief that this is a great thing for astronauts to do. So [if] astronauts go to Mars, they can bring the sample back. I understand the genesis of that thinking. And though I've not heard anybody express it this way, I believe they have a fear that if we bring sample back robotically it might lead to some people saying, "Well, we've got the sample, why do you need to send people?" Because we can get sample back without people going. So I think there's that fear that bringing sample back could be a detractor for eventually sending humans to Mars. I never heard anybody actually say that, but I can hear the gears turning at times.

There are other parts of the human Mars advocates who also support bringing back sample robotically. They appreciate that there's potential content in those Mars materials that could be very hazardous. If we don't understand that and deal with it before we spend hundreds of billions of dollars to go, it would be totally foolish. One being the high oxidation state, stuff inherently chemically dangerous if you ever get it on you or in you. Two other things about the sample that are important to know when we get it back here and use it to enable the mission to succeed; mechanical properties, that type of thing. Right now I think in sum the human exploration community would support and does support the sample return.

Wright: I know you mentioned that you're working as a consultant helping Chris Scolese on a current project. Are you doing other work as well working on any other committees or consulting with other Centers?

Hinners: Yes, I work with some of the industry folks with Lockheed Martin, with the [John Hopkins University] Applied Physics Lab, occasionally with Goddard on their proposal activity. That comes and goes. Working with NASA's APPEL program, the Academy of Program/Project and Engineering Leadership—Ed [Edward J.] Hoffman runs that program, so I do work with them on putting on educational forums for the NASA folks. That's always a lot of fun. You get a lot of midcareer NASA people who are eager to learn lessons learned.

A lot of these forums are bringing the lessons learned and trying to get people to understand what those lessons are and where and how they can benefit from it and learn from it. That's a gratifying experience. Occasionally work with the Space Studies Board. I'm not doing anything with them right now. I think I'm coming off into a period of decreased activity here for a while, which may be good so maybe I can clean this office up. As Diana [my wife] would say, "When are you going to clean that up?"

Wright: I thought I'd ask a broad question here to close out. When I was doing some research before I came to see you, I found a statement you made that you believed while you were at Princeton you had received a very broad-based education, and that you prefer to see a broad spectrum of what's happening in science and not narrow yourself to a specific field. Do you believe, now looking back over your career, that this type of education and somewhat personal philosophy has helped you be the success that you've been able to be in the field that you are in?

Hinners: Yes, most definitely. I hesitate to try to extend that to a large number of people. I think it just happened to fit my personality. As so often happens when something fits you, you think this must be good for everybody. Without a whole lot of very detail-oriented people, in engineering and science in our case, these missions wouldn't happen. I could not possibly do what they do. If we didn't have people who could do what they do, there's no program. So I'm hesitant to extend that philosophy. I think it probably applies only to people with a similar penchant for liking to work with other people and manage things, see the big picture, try to make little pieces fit in with it, and have a lot of fun doing that.

How people find that as a career path is a good question. In fact I don't have a good answer other than people experimenting, trying different things. Those who have the inclination, they just head out and try different jobs to see where they find a fit. I'd hesitate to make a college curriculum out of management. In fact that touches on a sore point in some ways, the great topic of systems engineering. Now at NASA and many other places systems engineering has become a cult, in the sense that it is worshipped as the god of creation and implementation. I'm obviously taking a very exaggerated point of view here for a purpose.

Systems engineering, developed initially mainly by the DoD in the ICBM [Intercontinental ballistic missile] world—brought to NASA by the likes of George Mueller—is an extremely valuable activity, extremely. And it is the glue by which so many of the pieces are systematically brought together and integrated into a successful mission, so I don't in the least devalue the value of systems engineering. It's more how do you best inculcate the principles of systems engineering and to a degree culture it, cultivate it and teach it. The issue comes in that last part, teach it.

Several universities have started to teach systems engineering even in their undergraduate curriculums. CU [Colorado University] is doing it now in aerospace. MIT I think does it, the University of Texas at Austin is doing it. A good friend of mine from NASA who's on leave there is putting together their systems engineering course. You can read a superb book on systems engineering, and there are several of them. Indeed all the elements are there, except doing it. You can read all this stuff and think you're a systems engineer and you're not. I, and many others, believe that you can only become a good systems engineer by practicing the art, augmented by formal teaching. It's great that there are these resources around where people have written down the basics and the fundamentals so you can incorporate those in real-life experience implementing systems engineering as a practice.

I had an employee at Goddard, been there a year, came to see me. Had been working on a project and said, “I want to go and be a systems engineer and get a job as systems engineering on this project.” I looked at him and said, “There’s no way. If you want to be a systems engineer, you go back to doing the job you’re doing and learn how to make something out of wires and glue on the bench and work your way up.”

The best systems engineers I’ve come across are those who’ve worked their way from a very low level piece of hardware, software, taken the next step up, putting it into a subsystem, maybe then getting more responsibility, putting a system together, taking on increased responsibility for putting these pieces together, having done it and knowing what it takes to do that, and not just book knowledge of what systems engineering is. There is only a handful probably of real top-notch ace systems engineers. It takes a mentality and experience, understanding that very few people seem to be able to pull together the way these top ones have. There are a lot of systems engineering jobs also at a lower level of implementation that require those skills, but not the total savvy being needed for a systems engineer on a major mission.

JPL and Goddard are both making major strides on trying to integrate the hands-on experience with the academics of systems engineering and trying to assure that they’re educating the next generation of people in systems engineering. A lot of them do understand it. Orlando Figueroa at Goddard really really gets that message and has been trying to put programs together at Goddard to foster the education of systems engineers.

Unfortunately, [in] tight budget times, one of the first things that goes are that kind of program. The hardware and software and the rest of the bureaucracy always seems to squeeze out these educational opportunities that do cost. You’ve got to invest in them, but the payoff is there. It’s a constant fight to keep that kind of thing going. Working with the academic community on how they implement the coursework in systems engineering is something I’d like to spend more time on. I’m sure that people when they come out of those don’t believe they’re systems engineers but that they’ve got some fundamentals in it, but now they need to really get out in the infamous real world and start to make and build things.

Wright: Is there a title that you would consider, if you had to describe what you have now become? You started out as wanting to be a chicken farmer and have worked with selection of sites for the Moon and space telescopes. Now you’re talking systems engineering, you’ve helped projects that have gone to Mars. What do you consider yourself to be?

Hinners: I try to stay away from a “jack-of-all-trades.” In the meeting a couple weeks ago—this was on a proposal review activity—one of the scientists from JPL came into the room. The fellow who was chairing the meeting said, “Well, we’re a bunch of engineers. We need to understand the science.” I said, “No, I’m not an engineer.” But it’s interesting that when I’m with engineers they somehow by this time think maybe I’m an engineer. When I’m with scientists they think I’m a scientist.

Wright: We’ll have to come up with a term with the two and then slash on the management behind it. It’s been an interesting career.

Hinners: It’s been so much fun.

Wright: Is there anything else you’d like to add before we finish for today? Something maybe we haven’t talked about?

Hinners: It’s been fun. You’ve made me recollect some things I’d long forgotten.

Wright: I’m glad that we were able to capture them.

[End of interview]