NASA AT 50 ORAL HISTORY PROJECT
ORAL HISTORY TRANSCRIPT

DR. SCOTT J. HOROWITZ
INTERVIEWED BY REBECCA WRIGHT
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WRIGHT: Today is March 20th, 2007. We are at NASA Headquarters in Washington, D.C., to speak with Dr. Scott J. Horowitz, the Associate Administrator for the agency's Exploration Systems Mission Directorate, for the NASA at 50 Oral History Project. Interviewer is Rebecca Wright. In preparation for the space agency's fiftieth anniversary the NASA Headquarters History Office commissioned this oral history project to gather thoughts, experiences, and reflections from NASA's top managers. This information recorded today will be transcribed and placed in the history archives here at NASA Headquarters, where it can be accessed for future projects.

Are there any questions that I can answer before we begin?

HOROWITZ: No, I think you have most of the questions.

WRIGHT: Well, we shall begin. Thanks again for providing this time in your busy schedule. You are responsible for leading the agency in the development of the nation's new spacecraft that will return astronauts to the Moon, and travel to Mars and other destinations in the solar system. You began your career with NASA in 1992 as a pilot with the Astronaut Corps. Tell me how your career brought you to this current position.

HOROWITZ: Well, that's an interesting path. How did a wayward pilot find his way to the Headquarters building, which is something that a pilot never wants to do? Well, in '92 I joined NASA as one of the astronauts in the Class of '92. I was fortunate enough to get to fly on four different shuttle missions. I flew on [Space Shuttle] *Columbia STS-75.* I flew on [Space Shuttle] *Discovery STS-82* to the Hubble, and then flew twice to the station on *STS-101* on [Space Shuttle] *Atlantis,* and *STS-105* as the commander on [Space Shuttle] *Discovery*.

Between missions you work other items in the Astronaut Office, other duties as assigned, work a lot of technical issues. One of the things that I had worked on and off over all those years was as an interface between the Astronaut Office and the group at NASA Johnson Space Center [Houston, Texas] that was looking at advance programs going on to Mars. A lot of work was being done by a small group led by Doug [Douglas] Cooke, who is now the ESMD Deputy Associate Administrator.

So I got to know Doug Cooke and the group that were doing a lot of these trades, and had always been interested. My background is in aerospace engineering and design of rockets and aircraft, and I was providing a crew perspective in a lot of the design trades they were doing, to figure out how we were going to go to Mars someday.

I also ended up working in a new group in the Astronaut Office called the Advanced Programs Office. We started that up about the time we were working on the Orbital Space Plane, OSP. We had a few people from the Astronaut Office, and we were responsible for, again, working on the Astronaut Office, the operator's perspective, coming up with concept of operation and everything for OSP.

In that time also, near the end of OSP, NASA received the vision for space exploration. In 2004 that started, that was kicked off, and myself and a couple of other people were working

ideas on the concept of operations. Of course this was after the *Columbia* accident [STS-107], and we had a few ideas on how to make the next generation of spacecraft safer to do the mission we needed. The concept that we came up with was one that we called Safe, Simple, and Soon. In order to be safer you need a simpler vehicle, and the country probably needed it sooner than later.

That was a small group of people including John [M.] Grunsfeld of the Astronaut Office, Marsha [S.] Ivins and myself, and a lot of this was a lot of very deep soul searching after the *Columbia* accident as to how did we ended up where we are today. The real basic realization is we had built a very, very complex vehicle (the Space Shuttle) that no matter how hard we worked on it, chances of making it or not making it on a mission was on the order of about one in a hundred, and that was as good as it was going to get.

So when we were looking at Orbital Space Plane, which was being looked at about the time of the *Columbia* accident, in fact the requirements, high-level requirements for that came out within three weeks, actually, after the accident, we realized there was a need for somebody to pursue a safe, simple, sooner approach to getting people to and from low-Earth orbit.

I'd worked on that and then when the vision for space exploration, came out after that in 2004, started looking at this concept and actually came up with an idea for a vehicle that would meet the performance requirements of going to the Moon, which required more performance, because it's a healthier mission, and came up with a concept that utilized a solid-rocket booster 1st stage and an upper-stage-LOX-hydrogen engine, which was eventually to become the *Ares I* launch vehicle.

Couldn't sell that concept inside of NASA, in fact, even submitted information to the JSC Legal Office for a patent on that idea, and they saw no useful application for the idea, and I have

that letter today. Pretty much out of frustration I finally decided to leave NASA at the end of 2004 and go off and pursue other opportunities, and ended up through a whole series of events eventually working for ATK Thiokol in Utah. I really went there to go skiing, and they offered me a job, so I said okay.

My wife said I had to work, so I got a job, and they were interested in helping me develop the idea of the concept further, which I did. Eventually Mike [Michael D.] Griffin took over NASA. They ran the ESAS [Exploration Systems Architecture Study]. ESAS concluded that the right answer was a vehicle similar to the one I had sketched, with a heavy launch vehicle, which several of us had come to the same conclusion that you needed a heavy launch vehicle.

Then I was contacted if I'd be interested in applying for the job as ESMD Associate Administrator, so I applied for the job and was offered the job to come to Headquarters, and basically give up living in a ski resort making a lot of money and working real hours, to come to Washington, D.C., which is the sixty-four-square-mile logic-free zone, to deal with the abuse and work ridiculous hours at half the pay, but happy to do so, because it's in the pursuit of a worthy goal. So that's a long answer to a short question, how did I get here.

WRIGHT: We definitely like the long answers, and it was definitely an interesting journey. During that journey through your NASA career, how has NASA changed?

HOROWITZ: That's a great question. NASA, when I showed up at NASA in '92, there was very little change. It was pretty, what I called a fully matured bureaucracy. NASA had been around a long time—we're approaching fifty years—and we kind of got set in our ways, so a lot of processes and a lot of thinking process were kind of set in the way we did business, which is a

problem. When you're doing something new you don't know everything, and it's exciting and people are learning and developing, and the process is all changing.

The good thing for Shuttle is you had a nice steady process. You do this, you do this, you do this, and you fly a Shuttle. But what had happened during basically since [19]'81 when we first started flying the shuttle, designed it in the seventies, it's been almost thirty years since we developed a new launch vehicle, so we had gotten completely away from how to develop a human-rated spacecraft. Hadn't done it. In fact, it's been almost two generations of engineers, so if you go around NASA it's really tough to get people who think in the development mind frame.

The people we had developing Mercury, Gemini, and Apollo were developing all the X-planes that were the first ones to go supersonic and all of that kind of work, and there were dozens and dozens of projects they cut their teeth on. What's happened in the last couple of years since Mike Griffin has come onboard is to change the culture to start thinking like a group that's going to design a new spacecraft. So there's been a huge amount of change in just the last couple of years. We have an administrator who understands how a rocket works.

So where we are today is there's been a huge amount of change in the last couple of years. We have an administrator who is technically competent, and we have a vision, which is something NASA was lacking. One of the things I saw for a long time is NASA really was missing a high-level objective. The Shuttles are amazing vehicles, the [International] Space Station's an incredible project, we've done amazing things in space, but there was no high-level from-the-top goal for NASA to really sink its teeth into. It was more of, do this project, do that program, business as usual.

So with the advent of the vision for space exploration, and then with someone who understands the technical realities of what it takes to do a program, and understands the type of organization that it needs to carry out that kind of a vision, there's been a lot of change in the last couple of years. So I saw a long period of very little change, in fact more of digging in, same old same old, and then the couple of events in the last five years, the vision for space exploration and Mike Griffin coming onboard, changing the basic governance models of how we do business has really begun to turn the boat around, if you will, to get us vectored in the right direction to accomplish this.

That's not to say that it's all perfect. We still have a long way to go. But it's the most change I've seen at NASA in my career, just in the last couple of years.

WRIGHT: Well, you're mentioning the combination of a vision and leadership, and then earlier mentioned about your responsibilities. How do you take your scope of current responsibilities and move it into a strategic plan to fulfill that vision with your leadership?

HOROWITZ: Yes, the way I look at my job is it's kind of interesting being in this office at NASA Headquarters. I'm kind of a technical guy, too, just like my boss, love technical design, but also understand that there's a need to explain what we're doing to all of our stakeholders. One of the reasons we're sitting in an office in Washington, D.C. is that we have the Congress and the White House. We work for the White House, obviously, the administration, to help keep them all informed as to what it is we're doing, and why we're doing what we're doing, and to be working really hard to improve our credibility.

NASA has a problem with its credibility; it's very low. A lot of people go see a lot of programs and projects that we have started and not finished, a lot of budgets that have been overrun by huge margins, and a lot of it was due to people promising things that they couldn't deliver on.

So my job is to make sure we don't promise things we can't deliver on, and make sure I allow the people that work on doing the real work, my program and project managers, to provide what I call the top cover for them. So the way for a program, especially a program of this size and complexity to succeed is they need stable requirements, they need to make realistic assumptions on what technology they're going to have, and not base things on "unobtanium" as we like to call it, and they have to have a stable environment, which means a stable budget and other things that allow them to operate their programs in a manner that lets them produce the results that we want.

So really my leadership, if you will, is to help provide that environment, not allow high-level changes to the requirements, not allow them to base programs and projects on unobtanium technology, and to do everything I can to get them a stable budget environment, and if things change in that environment to make sure that the people that are paying the bills understand the consequences of changes to the budget, and not promise that I can deliver when those changes occur.

If you change the amount of money available to do something, you either have to change the content or the time. Something has to change. You can't keep promising, "Oh yeah, I'll take a 25 percent cut and we'll make it happen, thank you very much." That's not realistic. So part of my leadership is really just to provide a good environment for the people who do the real work to get the job done. That's kind of my job.

WRIGHT: Do you have some insight that you can share on how to provide understanding for those that right now you're developing something for the future out of nothing?

HOROWITZ: We've been to the Moon. We've been there. We have the technology to go to the Moon. Now, are we going to use the same exact bolts and nuts and screws and computers? No, we're not. We're going to take advantage of the existing technology where it makes sense. So one of the things trying to explain to people, for example, the design of this new launch vehicle. The first stage of it is the solid-rocket booster. We're going to add another segment to it, but it's basically the same technology. In fact, a larger version had been fired in 2003, so the changes to that are pretty minimal. So that's a good, cost-effective solution, because that's a very safe, reliable solution for the first stage.

We're bringing back the J-2 as the J-2X. That flew on Apollo. It will be a better engine. So one of the ways I explain things, it's like looking at airplanes. People say, "Well, we've been there, done that."

And I say, "Well, you've been there and you've done that with airplanes." If you go out to an airport and you fly a 737, which you probably flew on your trip up here, you probably flew a 737-800. Well, the very first 737 flew back in 1967. If the two airplanes were parked on the ramp, unless you're an aero [aerospace] engineer or an airplane buff, you probably couldn't tell the difference except one's got little funny things pointed up on the wingtips, and maybe you might notice that the engine looks bigger in diameter on the new one versus the old one. Other than that you wouldn't know the difference, but they are significantly different aircraft.

They're about the same shape, about the same size, they do the same thing, move people from Point A to Point B, but the new one does it much safer, much more fuel efficiently, and has much more technology embedded in the aircraft. That's kind of what we're going to be doing here, is the shape and the basic—the reason the rocket looks the way it does, which is a tall, skinny rocket with multiple stages and a capsule on the top is, that's what physics drives you to.

The physics hasn't changed, and barring any what people are always trying to bet on, this revolutionary technology, which again remember I said earlier that if you try to bet something on a revolutionary technology you will probably fail if you're not trying some kind of a technology that has a high level of maturity. So when I try to explain to people I try to relate it in terms that they can understand as to what we're doing.

So really, we're not doing anything Earth shattering. What we're doing is we're trying to do good engineering, good systems engineering, and so this is a big program. It's a big project, but we're not violating any of the laws of physics this time, and that's why we have a high potential of success.

WRIGHT: You've talked a lot about going back to the Moon, but your job encompasses past that as well. So share with me your vision of where we will be within the next fifty years, or where you would like to see us be within the next fifty years, [with you] being in such a position to shape that now.

HOROWITZ: Yes. When you look at the vision for space exploration it talks about Moon, Mars, and beyond. It's very clear about that. The Moon is not the goal. The Moon is a step along the way to further human exploration of the solar system, and eventually beyond. We can look how

much further beyond? Some people ask will we ever go to Mars? Absolutely we're going to go to Mars. It's not a matter of if, it's a matter of when.

If you look at our current budget and you look at what we've accomplished, there's no reason to suspect why in the next fifty years we wouldn't be at Mars. In fact, given current spending rates, if we do it right one could forecast that we might be at Mars in the 2030-35 timeframe, just looking at the kind of budget if NASA gets about the same money per year, if we don't go off on a weird track somewhere and try to do something strange.

What you'll see happen is in the next few years we'll develop the Ares I and the Orion spaceship. We'll start flying it to Space Station, and then we'll prepare to go on to the Moon. We'll build the Ares V, and the Ares V will really change the ability of the United States by allowing us to send a heavy-lift vehicle, which can put on the order of 260,000 pounds in low-Earth orbit. This is actually more than the Saturn V could do. We gave up a fundamental capability, the United States, when we stopped flying the Saturn V back in the seventies. We lost twenty years.

So barring making another mistake like that, we will have the basic capability required to go anywhere, because we'll be able to put up large objects required to go on to Mars and beyond, and beyond will depend on what technology we have to launch on this heavy-lift vehicle. You still have to do the first fifty miles. As was once told to me, the first fifty and the last fifty miles are the hardest.

So what I see happening is by 2020 you'll see us returning to the Moon, but we're not going to go back—it's not going to be just to get there and that's the goal. We will actually go back with a capability we're designing today that's much more capable than the Apollo folks enjoyed. We'll be able to send four astronauts down to the surface, and we'll have a vehicle that

can deliver large amounts of payload to the surface to be able to put some infrastructure in place. We won't just go to the equator. We'll probably start out at the poles, and we're going to build up an outpost.

We're also going to provide an opportunity for other countries to participate, that's part of the whole strategy, and the commercial world will hopefully be providing us low-Earth orbit capability, and then eventually the commercial world will find a reason to sell services to the Moon, so it will continue to follow as NASA explores. We will be hopefully opening the frontier for the commercial world to follow as they see markets and see fit, because if we can buy services from them more cost effectively, then we can concentrate on the next-harder thing.

After we spend some time in the outpost and learn all the lessons we need to go on to Mars, then we'll start seriously contemplating putting together a Mars mission. We have to solve some problems like, how do you deal with the long exposure of radiation to astronauts, because Mars missions are measured in many of months and a couple of years, versus just a couple of days or months on the Space Station.

So I fully expect that you'll see us starting to go to Mars, particularly in the 2030-ish, [20]35 timeframe, and by the fifties, fifty years from now you'll see an established Mars outpost and us going to other interesting places in the solar system.

WRIGHT: What do you believe is NASA's most important role for the nation with this vision, how will it impact society, and how will it impact the future generations knowing that NASA's sending this vision ahead?

HOROWITZ: Well, one of the most important things that I like to think about is we can look back in history and see what the Apollo program did, and one of the things—then people can try to put a dollar value on it, but I think it's fairly difficult—is how do you measure the value of the motivation of a generation?

One of the reasons that I'm sitting here today is I was motivated by watching NASA do great things. Everyone comes up with these, "Oh, we need a cute theme," or, "We need a cute poster," or, "We need some kind of a crazy saying to motivate people."

And my response is, "No. You just need to do great things. If you do great things, you will motivate people because they're excited." Putting an outpost on the Moon is exciting, and you don't have to become an astronaut. There are thousands of people that went into the math and sciences and engineering disciplines that really peaked around the Apollo program, and then at the end of that program we saw that drop off in this country.

So the United States is losing its technological edge, and, in fact, in some segments people would claim we've lost it, and so maybe one of the greatest things, greatest gifts that this nation can get out of its space program is the fact that we will inspire the next generation to do something that's even grander than what we're doing today or doing tomorrow or in the next few years.

In fact, one of my biggest fears growing up, especially through high school and stuff as I watched the end of the Apollo program and people were talking about what they were going to do next, is I truly believed that at the rate I watched NASA go, that by the time I was old enough to go to work for NASA that all the cool stuff would have been over, and we would have been on Mars and that would have been done.

Little would I have guessed, because if you had looked at the rate at where we were headed, there was nothing to say we shouldn't have been a big presence on the Moon and off to Mars with a Space Station flying and everything by the eighties. Those were the original projections and I believed it as a kid. But there were some changes in policy and major decisions made that changed that course of history. So I think by picking grand goals and doing exciting things, then we'll motivate the next generation. That may be the biggest benefit of doing something like this.

WRIGHT: Since you're helping to develop that foundation for the next fifty years, what is the importance of robotic spaceflight?

HOROWITZ: There's always been this big feud, if you will, between the robotics and the human spaceflight capacity, and I think that's just a silly feud to have. There are great things for robotic spacecraft to do, and there are great things for humans to do. For example, I could send a robot out today into a field to go look for fossils, and the chances of that robot finding a fossil are slim to none. It could spend days and days and days and days running around looking for fossils, and probably couldn't figure them out, where I could just take somebody who knows what to look for to find a fossil, either a trained geologist or just anybody who's trained in a little bit of basic geology, and they could go out and find a bunch of fossils in an area that had them.

There are tasks that require the human mind to make decisions. There are dangerous things you'd rather send a robot to do. There are places that we can't protect the crew that it's better to send a robot to. There are robots working with people, and so there's a whole field of study going on there. For example, you could be at your Moon base, so let's just fast forward ten

years. I fully expect on the Moon base that you're not going to jump in your suit and run outdoors every day to go do the million things that you want to do.

You may have some robots, and you may have a control panel there in your little lunar outpost, and you might send a robot off to go look at some prospective, interesting areas, and do some surveying and all that, and then you might get in your suit or a rover and go out to that area and do some detailed work with a robot helper. So I think you'll see the collaboration between humans and robots changing all the time, and people need to realize there's roles for both, but there are huge advantages to having a human in situ.

WRIGHT: Before NASA there was NACA [National Advisory Committee for Aeronautics] with the primary focus on aeronautics. What are your feelings as you look to the future, how NASA will be involved with that field as well?

HOROWITZ: That's interesting since I'm an aero engineer and a lover of airplanes. I have a lot of old NACA reports, and, of course, books on airfoil design and everything that we got from NACA. NASA has four major directorates. We have aeronautics and we have science, we have exploration and we have ops [operations]. I see NASA going forward with a balanced portfolio, and aeronautics has been kind of in the background for a few years and is starting to come around on its own again.

There's a lot of very important work that aeronautics needs to do to support both science and exploration. I'll give an example. When we come back from the Moon we'll be going really fast. When we hit the atmosphere we'll have to design the spacecraft to have a heat shield that'll be able to maneuver in the atmosphere and reenter, and that requires the knowledge of how a

vehicle reacts when it hits the atmosphere at a very high speed. It's an aero-thermodynamics problem.

Well, that expertise resides in aeronautics, so we need smart people in aeronautics to advance that state of the art in their ability to analyze that problem, that really haven't done so in a lot of years. So there's some basic aero work we need done now. We're going to send a Mars surface lab to Mars. Well, it also has an atmosphere.

Well, someday we're going to send people to Mars, and we're going to need a large vehicle with a fairly good size heat shield, and so actually today the Exploration Mission Directorate, the Aeronautics Research Directorate, and the Science Mission Directorate are working together to instrument the heat shield for the Mars surface lab, to get data for all three directorates, and the aero people will be using that data to update their models and prediction capabilities so we can use them for future vehicles that we design for Mars.

We're also looking in the field of hypersonics, which is a field that I've always been fairly interested in. I think it's a very exciting field, and not a lot of work has been done in that field. In my estimation we could do a lot more, and so we're seeing more work done in hypersonics.

I know that we're working in aeronautics to help the FAA [Federal Aviation Administration] by providing expertise in how to analyze systems that will affect the airplanes that fly in the future airspace. People are always going to want planes that are more efficient, that are quieter, that are safer, and that's going to require the experts that we used to think about in the old NACA, in the aeronautics. People forget that NASA is the National Aeronautics and Space Administration; the first A is for Aeronautics. So I think there's great things for aeronautics to do.

Of course now with Lisa [J.] Porter running aeronautics, I think that's great because I think she gets it. She's a smart lady and so I enjoy working with her on aeronautics. I'm a closet aero engineer, so I try to sneak to their seminars.

WRIGHT: She's probably glad you're on this end, too.

HOROWITZ: It's fun. It's good stuff.

WRIGHT: You've mentioned some aspects of it, but what are some of the lessons that you've learned being part of the NASA agency these years that you want to apply as you move through the next years?

HOROWITZ: Lessons from management or technical?

WRIGHT: Well, from your own experience either organizationally, technically, just ones that you feel are some basic lessons that you want to make sure you apply.

HOROWITZ: One of the basic lessons I've learned is especially in large organizations, communications is a problem. Most of the issues I deal with day to day can trace their roots to a breakdown in communications. It's the old, "What we have here is a basic failure to communicate," line. It's really tough in large organizations, and we've had the advent of Blackberrys and Internets and all that. I'm not sure that's helped. In fact, in some ways I think that has made it worse. People have gotten sloppy in their communications.

In fact, one of our project managers came up with a great suggestion at our last quarterly. You'll find yourself in one of these e-mail flails, I call them, where suddenly you have forty messages, and I'm not exaggerating, on a topic, and people are talking past each other and it's getting out of control, and he says at any point, he's instituted a rule that someone can throw the e-mail flag. Everyone has to stop sending notes and pick up the phone or call a meeting and talk face to face.

So what I've learned from being at different levels of the organization is that keeping people informed of what's going on is really important, and so I work hard, I'm not always very successful at it, but try to work hard at making sure information is going both ways, up and out to our stakeholders—they don't like to be surprised, I don't like to be surprised—and down and in to the people doing the work so they're not surprised.

In fact, what you usually find most people are upset about is they've been surprised, one way or another. Someone found out you were looking at something and they had no idea that you were concerned about this, so they're surprised. So communications is one big lesson.

One of the other lessons I've learned is that this agency needs people in leadership positions that have the technical background to understand what it is they're leading. I don't care what anybody says, you can't just go to some school and learn how to be a manager, and expect to be able to manage anything as complex as the space program. It just doesn't work. And while I have a lot of lessons to learn in management, at least I understand what it is we're trying to build. I don't know everything about what we're trying to build, but at least I know which end of the pointy rocket goes forward, and that F equals MA [Force equals Mass multiplied by Acceleration].

You need that. You really do, or you're not credible to your stakeholders, you're not credible to people you work for, and you can't decipher the reams of information that are being thrown at you, that most have a technical basis on which you're going to make a decision. So I think technical competence in leadership positions is what this agency, more than probably any other agency I know of, needs, because of our particular mission, which is, it is rocket science. It really is rocket science.

So those two things from management, the communications and technical competence in leadership is really important, so maybe those are a couple of the top items that I think about.

WRIGHT: A lot was said, especially after *Columbia*, about NASA's culture. What is your perception of NASA's culture, and where would you like for it to be?

HOROWITZ: Everybody talks about culture. What was missing in *Columbia*, I think when people are talking about culture was there wasn't a good flow of information from the right people to the people who had to make the decisions. So you can have people with good technical backgrounds in good decision-making roles, but if they aren't presented with the right information at the right time, they can't make the right decisions. So I've seen that a lot.

NASA's new governance model is actually very interesting. We have the programmatic chain of command, if you will, and we have the technical chain of command. It used to be mission directorates, which were then called codes, owned Centers. There were Centers that worked for Code M, and there were Centers that worked for Code S, and there were Centers that worked for pick your code. That's not the way NASA is organized anymore.

The new governance model is we have Mission Directorates, and the Mission Directorates have programs. So, Exploration, we are a Mission Directorate and we have programs like Constellation. I have a program manager, and that program manager's job is to execute the program, and we tell him budget and requirements and, "This is what we need you to go do." Now, they get technical help and technical expertise from the Centers, so the Center Directors own the bulk of the talent, if you will, to actually do the job. And so the Center Directors don't work for Mission Directorates anymore. In fact, they're on the same level in the agency, and so that's the board of directors, includes the people responsible for the programs and the people responsible for the technical work, which makes sense.

So I'll give you an example of a situation that might arise. The program gets told by the Mission Directorate, I say, "Program manager, I want to launch this rocket tomorrow."

And he goes, "Yes, sir, going to launch that rocket tomorrow."

Now one of his technical guys working for him goes, "Well, that's the dumbest thing I ever heard. We're not ready to launch that rocket for—," pick a technical reason. So he goes to the program manager and says, "You're full of baloney, don't want to launch this rocket tomorrow."

And he goes, "You don't understand. Senator fill-in-the-blank has told the ESMD [Exploration Systems Mission Directorate] guy, 'You're going to launch this rocket.' And he's told his program manager, me, to tell you to go launch this rocket."

He goes, "Well, I disagree, so I'm going to go tell my management."

So now in one or two phone calls the Center Director is calling me and saying, "That's a dumb technical solution."

And I say, "You don't understand the program pressure I'm under."

And he says, "You don't understand that's a bad technical solution." So within two or three phone calls, if you use a phone instead of a Blackberry, we are now meeting face to face to look at the programmatics versus the technical. If we can't resolve the problem it goes to the NASA Associate Administrator and the NASA Administrator. So in less than half a dozen levels of communication you've gone from almost any level in the organization to the top to resolve a serious issue. You always want to resolve the problems at the lowest level, but you need a way to elevate to upper management if required.

But if it cannot be resolved, people know there's a path all the way to the top, where the NASA Administrator can make the final call, and that is a huge, huge difference, and that is a huge benefit of the way we're organized now, which is completely different than the way the organization worked. Now, it doesn't work perfectly, and what we're trying to instill in people is that there is this chain of command. You are expected to be technically competent, you are expected to bring up issues, and so the challenge is teaching everybody their responsibility and how to use that responsibility correctly.

So that's the big challenge now that we've given them the framework. It's now getting everyone to learn how to use the framework. So the cultural issue now is training people how to work in this environment. We want them to be the experts in their field, and we want them to speak up when they need to speak up.

WRIGHT: As our time starts to move closer to the end, a couple of questions I wanted to ask before we close, and one of them is we've been talking about vision, we've been talking about the next fifty years. If someone asked you today, "Why would I want to have a career at NASA?" what would you tell them?

HOROWITZ: Well, anybody who's thinking of getting in this business, this is a good time to think about it. The next couple of years will be a little tough, because we're in this transition, but we're ready to open a whole new frontier. So I truly believe in a few years that you're going to see excitement like I was able to enjoy as a kid growing up in the Apollo program. It's going to only get more and more exciting as we start making progress towards the new vision.

The next few years will be the hardest. This will be a difficult time, because we're transitioning out of twenty-plus years of operating Space Shuttles into a new system. But once we get through that transition point, you know, it's like, watch our dust. It's going to be something, because we're going to be developing a little launch vehicle, the Ares I, we're going to be developing the Orion spaceship, and then we're going to be developing the Ares V Heavy Lift, and then we're going to be doing lunar landers, and then we're going to be doing outpost design, then we'll be doing missions to Mars, and the future is very bright, and we can do all that on the budgets that we have today.

WRIGHT: What do you find to be the most challenging aspect of these next years?

HOROWITZ: Living in D.C. [laughs]

WRIGHT: For the agency?

HOROWITZ: The biggest challenge for us is to make sure that we can prove that we have credibility with our stakeholders. We have to deliver. We have to say what we're going to do, and then we have to do what we say. If we do that, then I think the future will get a lot easier.

But again I come back to, NASA has a credibility problem. We haven't delivered a lot of programs on cost, on schedule, and we've promised a lot of things because we thought it was in our best interest to promise things that we could never deliver. We have to stop doing that, and so we have to be able to lay out a program like we have in the exploration program, that is achievable, doesn't require miracles, doesn't use hope as a management tool, and gets back to our basic tenets of technical credibility and excellence, and deliver on the vision for space exploration. That's our biggest challenge.

WRIGHT: Well, before we close is there anything you'd like to add, maybe a thought might have run through your head.

HOROWITZ: I think I espoused almost all the thoughts I have in my head, not that I have many, but that I truly, truly think the next fifty years will be real exciting. We just have to provide stability and execute on the programs that we have, and the best way to show the nay sayers that they're wrong is to prove it. So, getting launch vehicles on the pad, and getting new spacecraft flying, and executing the missions in a timely manner, and being honest.

I think that's something that's really been lacking is real technical credibility and program credibility, because NASA either hasn't been honest with itself or with all of its stakeholders. I think it'll take time, but as we move forward it can only get more exciting as we execute these things. It'll be tough. This is not easy stuff. It is rocket science, and technically

that may be the least of our challenges. Dealing with the politics and trying to keep everybody interested and excited about the future, that's probably our largest challenge.

WRIGHT: Well, I wish you the best of luck with all that you have to do.

HOROWITZ: Thanks. "Good luck with that," right? [laughs]

WRIGHT: Well, we'll be on your side, and thanks again for finding time today.

HOROWITZ: Thank you, glad I was able to do it.

[End of interview]