NASA HEADQUARTERS ORAL HISTORY PROJECT
EDITED ORAL HISTORY TRANSCRIPT

SEAN O'KEEFE
INTERVIEWED BY REBECCA WRIGHT
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WRIGHT: Today is September 23, 2014. This oral history interview is being conducted with Sean O'Keefe in Washington, DC, for the NASA Headquarters Oral History Project. Interviewer is Rebecca Wright, assisted by Sandra Johnson. Mr. O'Keefe served as the NASA Administrator from December 2001 to February 2005 and is currently with the Airbus Group, where, until recently, served as its chairman and CEO [Chief Executive Officer] of the North American division of EADS [European Aeronautic Defense and Space Company]. The interview is a continuation of an oral history held on March 21, 2013. We thank you for visiting with us again today.

When you started your tenure as NASA Administrator, you had a mission, and it had three components to it: to inspire the next generation of explorers, to explore the universe and search for life, and to understand and protect our home planet. If you would, tell us why you put that mission statement together and explain where you wanted to go with that.

O'KEEFE: I'm a firm believer that any plan, any budget, and any program that you're organizing and advancing for approval within the [Presidential] administration, to the Congress, to the American people, ought to have a framework for what the strategic objectives are. One of the first exercises that we conducted early in my tenure was to assemble all the Center Directors, the Associate Administrators, and the leaders of the Agency, and asked them each to define the Agency's mission objectives.

As you might imagine, the whiteboard was full of every idea that you could possibly imagine. There wasn't much white space left over, let's put it that way. A lot of really creative ideas, a lot of very driven, focused leadership went into the input that they provided. But it was a disconnected combination of goals, aspirations, programs, and ideas. There was no obvious answer to the questions—"What is the mission objective of this Agency? What is it all about? What are we really trying to accomplish?

NASA's purpose has changed over its 50-plus years to adapt to new technology, new developments, new world events. Any number of different factors over the decades of NASA's history drove different definitions of basic goals to explore or to seek an understanding of challenges and opportunities that were poorly understood prior to NASA's engagement. The entire NASA history is punctuated with developments, discoveries, and revelations about where we are in the greater continuum of the existence of the universe. What we've learned is how little we understand. It's always been a quest for that understanding. Everything that was on that whiteboard, fit within that parameter.

Then, we re-examined the reasons that NASA was first established. We talked about the 1950s' environment that brought about the need to pull together all the disparate pieces of excellence across the federal expanse, within the Army, within the civil aviation community, the very early Air Force capabilities, a range of scientific and technical capabilities that were embedded in various federal departments that were there for reasons that people couldn't remember anymore. Assembling all that capability under this remarkable new logo that became the NASA "meatball" that everybody knows the world over today, was an amazing event. There were world imperatives at the time that motivated the administration in the 1950s, and certainly in the early 1960s, to respond with a capability to advance exploration, discovery, aeronautics

capacity to achieve the next technological breakthrough, the next technical development. Had it not been for that vision and that discipline of the time, we would never have achieved the remarkable things that this Agency is known for: *explore the universe and search for life*.

When you trace the history, part of what was at the foundation of NASA was a very strong commitment to education. The proposition that the [President Dwight D.] Eisenhower administration advanced, and certainly the [President John F.] Kennedy administration advanced, was a catalyst for the purpose of developing technologies, searching for new technical breakthroughs in science, and what we now know to be STEM—science, technology, engineering, and math—that has completely altered the way that many university curricula were developed and contributed to a broader set of advancement objectives.

What I found fascinating was the historical research and looking at the record of how NASA was initially organized. It wasn't just assembling a lot of very smart people in a room and saying, "Give this your best shot now that you're all together in the same place." We've seen plenty of government reorganizations and continuing challenges to establish synergy over a lot of time. All these decades later, there are still defining cultural features about the Agency based on its "stove pipe" origins that existed well before the NASA "meatball" was ever introduced.

In the 1960s, the NASA initiative was fueled by a very concerted effort to ramp up the capacity to develop engineers, scientists, technologists, and those who would have the passion to want to press the envelope of what is in the realm of possible—to put a man on the Moon. That was the education hook. The universities that were originally aligned turned out multifold from there. There are still some legacy roots that are found in various universities that trace all the way back to those origins, and many others that grew up there after, simply because of the manner by which NASA took this on. It's a very unique way of alignment with cultures of innovations and

discovery that is characteristic of a very, very few number of agencies. NASA is certainly preeminent on that short list.

Reinvigorating, reestablishing education as a foundational piece of NASA's mission was what we set out to do. This was not to take over what the Department of Education does, or what state and local governments do to provide public education or any private institution. The objective in the 1960s was to provide a catalyst to motivate and inspire people to want to pursue technical fields, to be a part of something really exciting. That changed the dynamic and the focus of how we view education forevermore. It made a huge and powerful imprint on how we defined ourselves as a culture, to say nothing of the accelerated economic and technical development of that time.

[Norman R.] Norm Augustine and so many other very thoughtful folks, like [Robert M.] Bob Gates, were part of the National Academy of Sciences "Rising Above the Gathering Storm" research on the looming education challenges we're dealing with today, in terms of technology, engineering, science, and math—education as fundamental core disciplines where our nation is lagging. NASA is one of the agencies that really helps our society understand this imperative for national technical excellence.

Articulating education as a mission objective was a recommitment to the origins of what the Agency was all about. NASA's goal is to provide the opportunity, the motivation, the stimulus for people to want to pursue those kinds of opportunities: "Inspiring the next generation of explorers."

The motivation to be part of a place like NASA far transcends any of the scientific, engineering, technical disciplines. The quest for exploration and discovery applies to all the tenets of the disciplines. But historians, philosophers, psychologists, medical experts all derived an

understanding of new objectives from discoveries that have really changed the way we view so much of everything. No administration in 50 years has done much of a job helping the public understand all of NASA's contributions. Just the sheer number of developments that contribute to our everyday life that we just take for granted today that all stem from some discovery that NASA was responsible for, range everywhere from heart pumps and every other kind of med tech [medical technology]-related kind of breakthrough that was all derived from some engineering characteristic, that was learned by various medical technical and professionals who looked at how you can apply that for different purposes. The spin-offs have been enormous.

As a consequence, NASA's education mission focus is a means to provide some focus to articulate the value of technology development more dominantly throughout the society. It capitalizes on the fascination that every American has with exploration and the amazement of what some of these achievements have been over these 50 years. That's all good, but it's merely a stimulus. It doesn't produce another big breakthrough. We've got to have the technical disciplines to develop what may come from this inspiration. This is the thinking that went into the *inspire the next generation of explorers* feature of what came out of that mission statement.

The inspiration for the third objective—*to protect our home planet*—is understanding more how NASA can use the scientific information we have, the technical information we're able to gather, the basic capacity for observation of our own planet and the solar system that we live in. What is it that affects the way our planet reacts, behaves? What are the conditions that make that understandable? To the latest development just announced, I guess it was over the weekend or late last week, the observer [space probe] around Mars, the MAVEN [Mars Atmosphere and Volatile Evolution Mission], that is now in in orbit and transmitting data, is predominantly for the purpose of understanding why the nature of the Mars atmospheric condition changed so drastically

over some centuries. This is the closest neighbor we have. If you're from Houston [Texas], this is the equivalent of wanting to know what's going on in Clear Lake [suburb or Houston] or vice versa.

We're not anywhere near any ability to explore much beyond that. Here in Washington, DC, it's like throwing a rock across the Potomac River. Mars is just around the corner. That's the limit of how far we've been able to go so far. It behooves us to know more. If changes occur in the communities where we live, that suddenly gets our attention, and to be curious enough to want to find out why. In a larger sense, what's happened on Mars has the value and purpose of understanding and protecting our home planet.

That's a practical application of that statement, but it also included a wide range of other things: aeronautics capabilities for lowering emissions, improving fuel consumption standards, achieving any number of different objectives within the aerospace engineering kind of limitations of what currently exist for today's understanding of propulsion systems, and aerodynamics and the capacity to do things, transport and convey. As a result, that's part of the protection of the home planet as well. In a deeper sense, too, it also includes some important collaborations with other agencies of the federal government that have the capacity to utilize the ability that NASA can develop to inform other decisions on how the federal government can protect us. So, that's a piece of the protection mission that is quite exciting.

All that came out of an intense weekend retreat that was then refined, continually edited, reviewed, disseminated, discussed, and debated around the Agency that finally ended up being summarized as those three mission objectives.

All three have legacies that trace back to the origins, plenty of strategic objectives that captures what NASA's all about, and then in turn looks at the nature of some of the enduring

responsibilities the Agency has. Fairly straightforward. There are a lot of things NASA can contribute, but these three objectives became the criteria of how we evaluated the efficacy of why we were pursuing something. Just because it's interesting doesn't qualify as a reason to do so. It has to be a definition of what uniquely utilizes the characteristics of what NASA does.

One of the sidebar dimensions that is not included in that NASA strategic statement is a dedication to the view that the Agency should be about development of new technologies, new engineering solutions, new scientific breakthroughs, and then once achieved, move on to the next challenge. It is human habit that NASA has also manifested, where once we become pretty good at something or we think we are, then we like to repeat it as often as we can. That's not the purpose of the Agency.

Production focus and repeatability and all the other things that go into those management dynamics requires a different set of disciplines. It starts to drive basic equations on cost, efficiency, and all the other features that NASA was never built to achieve. Some of the challenges we've encountered over the course of the 50-plus years have occurred when we've wandered into the repetition cycle, or made that part of our mission approach. Not that it was the wrong thing to do—it just then ended up yielding an organizational focus that was less about exploring, educating, and protecting as our responsibility, and more into repeatable features of how do we take this capacity then to achieve some other incremental dimension. By definition, the focus became incremental.

That was worthy of the soul search, if you will, that went into these discussions, what we really ought to be about—move away from anything that's already been done, that anybody else could do, after we've shown them how it's achieved, turn that over to those who can then produce

it with regularity. Much like so many wonderful breakthroughs that have ever been achieved in modern history.

NASA is built around the proposition of, "We're looking for how to break down limitations that prevent us from doing the next thing, the next achievement, the next opportunity," or knowing what's on the other side of that mountain, or knowing what is affecting this solar system beyond just going from the equivalent of Houston to Clear Lake. That's all we're doing. That's as far as we're getting right now. Just in our own little bitty part of this universe, that's all we got. This is not even a trip from Houston to Dallas—it's just right around the corner kind of stuff. To do the things that are necessary to go further than that to achieve a deeper understanding of exploration beyond the scope of what we can do is going to require a tremendous focus on a technology breakthrough for in-space propulsion. That is the only means by which that's going to be accomplished.

Which is skipping ahead to your next question which you introduced, which is, what was one of the basic features of what I really wanted to try to accomplish and didn't get to or didn't get to see to fruition? That was the biggest—the ability to establish an in-space propulsion development focus. We got part of the way—we introduced a new program called Project Prometheus, that during my tenure was very active and it was developing with an objective of reaching several different mission stages to demonstrate capabilities to achieve in-space propulsion. But today, the reality remains that there is no means for in-space propulsion at all. We still rely on the basic laws of physics and orbital mechanics, the same way we have for 50 years. The only way that any spacecraft moves is by those laws of physics and very, very modest adjustments to the trajectory. That's it.

That means, definitionally, you wait for a very long time to achieve the space equivalent in this solar system of getting from Houston to Dallas. Forget about over the Rockies to the West Coast. It is a limitation that's been there for some time, and one that we just have never, ever cracked the code on how to achieve it. Yet, that was an effort to try to begin to tackle it, through Project Prometheus and a range of different engineering options that were examined, selected, and pursued and ultimately, died on the vine. We'll come back to it at some stage. It's still an enduring limitation, but the effort focused at that time was around just how do you conquer that limit, how do you get past that problem, to get us the ability to go anywhere and do anything beyond the scope of what we've done? Which is tremendous and it's impressive, but in its relative sense, it's not very far relative to where we live and the scope of what the universe looks like.

A second major thing that was a real limitation was the ability to send a human being to any of those places beyond the Moon. The answer is today, we cannot do it. Even if you developed an in-space propulsion capability to achieve that, the good news is you would get to any destination you could think of significantly faster than what you can do today. And speed will contribute to the opportunity to minimize the sheer volume of what you have to bring with you to sustain life. The reality is, we do not have the means to send anybody past the Moon today. Even with improved speed, there's no one who could survive it, given the radiation effects, the consequences of human degradation consequent to long duration spaceflights. All the biomedical and scientific consequences are impacts that we are still just scratching to understand.

We know a lot more today, as a result of the International Space Station [ISS] and the six-month deployments that have occurred there, and a few that went beyond that unintended, but by and large, our focus has been around a six-month deployment. We understand that a whole lot better and we understand how to condition human beings to survive that a whole lot more

effectively. But, we're talking conditions that are no more than 250 to 300 miles straight up from where we're sitting right now. That's it.

When you go any further than that, we don't have the means to accomplish it, unless we wanted to go back to the Moon and achieve that same goal and do that repetition again. If there were some purpose for that, that may develop, may become attractive, but at this stage in the game, in and of itself, we couldn't accomplish any of those missions for any duration of time to speak of, and surely couldn't go beyond that. Every other destination everybody talks about—and everybody's got their favorite—none of those places could any human being survive going to, based on what we know today, much less returning. It's almost a conscious condemnation to a one-way trip, which we're simply not going to sign up to.

Those are two big, major, major limitations that really prevent us from going beyond exploring and all the basic features of what the Agency's about. We've really made a very modest dent in those limitations. Again, I shouldn't belittle that because what we understand today about biophysics and everything else and the effect of long-duration spaceflight on astronauts has changed dramatically in the last dozen-plus years over the International Space Station. It is a major, major breakthrough. It was a near-certainty that in the earliest flights, most, not all, but most of the crew would come back in a significantly degraded physical condition. That's been minimized, now, on a routine basis, and the condition of most crews is substantially better than what the condition was in the early days, in the earlier decade. We have made strides. There have been incremental improvements. We've seen it, but again, that's still restricted to not more than low-Earth orbit. Everything beyond that, we don't have a clue on how to endure the experience.

WRIGHT: Part of what I've read, some of the threads that you put into your suggested proposals for moving forward, were driven by not necessarily destination, but you wanted things to be driven by science in more of a stepping stone approach to build from those. Is that where you were hoping to get, if you would have had the ability to keep moving forward?

O'KEEFE: Yes, very much. There was no question; the idea was to at least commit ourselves to the proposition that while it's exciting or interesting or intellectually stimulating to debate any of those destinations, the stark reality is none of them are possible. Let's all understand that upfront. If any of those destinations are of value, of interest, of curiosity, whatever, that would justify such missions, great. That would be a terrific objective to then agree to. But let's all agree that before you ever get started, we better develop the means to go to any of those places, to do any of those things, to do any of that exploration. That's part of the mission of what NASA does.

This is a quintessential, classic example of that limitation that is yet to be overcome. The Agency needs to dedicate itself not exclusively but dominantly towards achieving—developing the means to overcome these obstacles. When something gets too hard, human nature is to put off the tough problems to another time and instead look at how we refine what we're able to do today, just that much better and incrementally improve it. We're not there yet. I don't see as a significant commitment to refocusing objectives about what that mission statement, what that strategy implies. That's part of the challenge that NASA will always endure.

WRIGHT: When you came on to be the NASA Administrator, you came out of the Office of Management and Budget [OMB]. I'm not sure if being the NASA Administrator was on your list of things to accomplish, but when you walked in, you inherited almost 10 years of a faster, better,

cheaper philosophy, that had been put in place by the previous Administrator [Daniel S. Goldin]. Just, if you could, share with us, did that help what you wanted to accomplish or did it hurt? What was the definite impact of having that tenet over the Agency for so long?

O'KEEFE: I learned a long time ago that you cannot fully appreciate what any prior predecessor, any leader that you've inherited something from, you can't possibly understand the dimensions of the challenges they dealt with that brought them to that position. You can read about it, you can talk about it, and you can listen to people's opinions, but in the end, you really don't appreciate fully what were the factors that drove decision making at that time.

I think Dan Goldin's effort was partially in response to an overhang of public critique that NASA was too slow, too expensive, and really wasn't yielding a higher quality result. Every piece of evidence would suggest that his focus was around changing the cultural mindset to focus on deliverables and make things that will happen. He stressed that NASA needed to focus on what the cost of something is and press for the qualitative advantage of what would be yielded from what the Agency pursues. Very noble objective. I don't think it hurt a bit.

There were still vestiges that I found when I arrived at NASA that some program managers believed that a program "costs what it costs." I didn't think we were going to be able to really deal with that as an answer. If we don't have the level of definition necessary to define the outcome, to understand the objective of where we're going, and be able to quantify what we think it will take, in terms of resources, capabilities, assets, time, people, expertise to go achieve it, we need to go back to the drawing board until we can do that. Without saying that no one should ever use the terminology "It costs what it costs," again, I never uttered that as a directive, but certainly

conveyed that that would always be an unacceptable answer. It's not one that passes anybody's tolerance test. It speaks to a different cultural challenge that we really could ill-afford to sustain.

I can't speak to the current circumstances, but at the time that I was there, that message got pretty well conveyed. That was very consistent with the focus my predecessor was attempting to articulate. "Cheaper" was an objective that he argued. But the only way you know something is cheaper is to know what it costs right now. His "cheaper" credo at least motivated an awareness of what today's expense is.

WRIGHT: How were you approached to become the new Administrator?

O'KEEFE: I went through a year as deputy director at OMB and the number one program issue that dominated my time was the ISS cost overrun. Not by any means the exclusive issue, but it was the biggest. I spent a lot of time working on this issue with the analysts and the examiners at OMB, with Dan Goldin and his staff, working through the emerging challenges that all started to surface shortly right after inauguration day. It became a bit of an international cause célèbre on the agenda of the partner nations.

Fifteen nation states had a stake in this and were all being handed a bill of increasing cost and ill-defined deliverables. There were cost and schedule dimensions to this that really left our partners quite agitated. Partner state leaders began visiting with the Secretary of State, then Colin Powell, certain members of the White House staff, lots of members of Congress. Many foreign dignitaries put this on their agenda and several of the heads of state put it on their itinerary to speak to the President about, "When are we ever going to see this complete?"

It was certainly not the most significant source of tension during the course of the President's first year. But, it was a big enough one that prior to September 11th [2001, terrorist attacks on the World Trade Center, New York, and The Pentagon, Virginia], it showed up on the daily calendar more frequently than several folks would like. Given the fact that it fell into my portfolio as deputy director, overseeing that particular division, that branch of OMB that was responsible for helping to develop the President's budget therein, I ended up becoming more familiar with the details of the International Space Station in that role than I ever had imagined I would be. Having not known much about it prior to showing up in the job, I suddenly found myself working it more frequently than I ever thought I would.

Dan Goldin wanted to wind up his nine-plus year tenure, but waited for months for the administration to find a successor. When he submitted his resignation, the Agency had no successor named to relieve him. There was no deputy. [Daniel R.] Dan Mulville, God love him, was the career public service SES [Senior Executive Service] who'd been there for quite some time, and assumed the interim duty as Administrator. A remarkable guy, a really solid leader, loaded with integrity, and a terrific partner to work with, but he had no designs on assuming that capacity as an appointee. It finally came to the point in whatever vetting process the Office of Presidential Personnel went through, I found myself in the Oval Office after a meeting that was scheduled on other matters, in which the President said, "Stay behind, I want to talk to you about something." That's rarely good news when you hear that.

As everybody left the room and he instructed me to sit down, he said, "I need you to go over to NASA. It is all about the management challenges. I need you to focus on the Station problem, resolve it, and go work through that challenge. You are on your way to the National Aeronautics and Space Administration." To which the answer, of course, was, "Yes, sir, you bet."

When the President tells you that's where you're going, that's it. By December, I was confirmed to the job and on my way.

WRIGHT: Sounds like you had a head start.

O'KEEFE: Yes, a little bit. Enough that it was at least a familiarization with the leading problem that the Agency had. I cannot proclaim to have been steeped in NASA folklore, history or the great achievements. Certainly more than most people, most Americans, with any curiosity about those amazing achievements. Having spent time over my career with episodic exposure to NASA, I never dreamed or imagined that this was an Agency I would be privileged to lead. Were it not for the circumstances of the International Space Station, I never would have ended up there. I don't believe that the President would have even considered me.

It says a lot about President [George W.] Bush in that his decision on this matter occurred after 9/11. To those who assert that the administration was totally fixated on the events of 9/11 and nothing else could be on the agenda, here's an example of something that was certainly outside the scope of that event, but nonetheless, the President of the United States himself was focused on managing the challenges there.

For whatever set of reasons that may have been ill informed, he thought I fit that bill to lead the Agency. I still question exactly how he arrived at that decision, but it was certainly a tremendous honor to have this chance to lead. It was best characterized by a reaction my kids had that evening. I told them, "You're not going to believe this—the President of the United States wants me to run NASA." My middle child was about ten years old. He looked at me and said, "That's really fantastic, Dad, but I thought you had to be smart to be in that job."

WRIGHT: Got to love those kids.

O'KEEFE: Nothing like one of your kids to really put you right in your place. It's just how it works. He did point out a glaring deficiency in the President's logic. I had a hard time refuting it. Were it not for the continuing, enduring challenges with the International Space Station, I don't believe that would have occurred.

WRIGHT: You took the job and you walked in the door, but at what point did you start assessing what you needed to be successful in that job? As in, did you need staff members that you brought in or reorganization? Can you walk us through those first months, or at least when setting the direction for the Agency?

O'KEEFE: It's a basic leadership philosophy that served me pretty well in every job I've walked into, that you don't start with a preconception of exactly what the answers are. Take the time to learn that, learn everybody else's perspective, get a different view of where everybody's coming from. But have some guiding principles that will at least be introduced to give people, colleagues, a better understanding of exactly how the new direction will be taking shape.

The first part, I've already talked about—developing the strategic objectives. That served a couple of purposes. One was an institutional purpose—to define a very straightforward description of what we could all sign on to and say, "These are the strategic objectives of this Agency." We've talked about that. It also served a personal objective, which was to get an

interaction going, to hear what other colleagues thought was important rather than coming to some conclusion long before I knew anywhere near enough in order to make such decisions.

It was very informative to get not only an education about what colleagues thought was important, but also contextually, why they thought those selections were important. Then, it also served to familiarize them, each of them, with every other colleague's sense of what was important, which was a fascinating little development in and of itself. Listening to the conversations of people between and among themselves, "I didn't know that you thought that way," or, "Why didn't you ask me?" Any number of comparable responses. The dialogue was a discovery by each colleague of the views of other colleagues. It was also a useful venue for the senior leaders to tell me what they thought was important. It certainly served the purposes intended. It yielded the strategic product, it yielded the results that we were looking for, and was important to go through together.

Second principle was to think a little bit about what we've learned from past events and what would we do differently. A "lessons learned" exercise. Inside the first few hours of assuming the job, on the first day, I asked for a briefing on what is the standard policy and plan for how this Agency will act in the event of another catastrophe akin to [Space Shuttle] *Challenger* [STS-51L accident]. A lot was learned during that tragedy. Much has been written about it and that's a NASA history lesson all by itself with different perceptions and characterizations. The question I asked was, what do we do if that happens again? What is the plan, what's the reaction, who's responsible for what? How do we present ourselves to the public as responsible for the event and dedicated to working through those challenges to go find out what occurred and to be leaders in meeting that objective?

What I got back was not bad. As a matter of fact, I asked for the plan to be brought in, two hours later. Don't go away and write something up—I didn't want to give any time for something

to be embellished. It was simply, tell me what's on the shelf right now, in the event that were to happen on the next—God forbid—launch. What came in was pretty solid. It was an interesting framework that was drawn from many of the challenges, deficiencies, lessons from the tragedy of the *Challenger* disaster. And it demonstrated to me that NASA was a learning organization.

Rather than just leave it at that and say, "Okay, put it back on the shelf and we'll grab that the next time something happens," what I asked everybody to do was to benchmark this against organizations, companies, or agencies we think are admirable on safety objectives. We debated for half an hour or so all the different cases that were current at the time of exemplars who had responded effectively to challenges, as well as those who weren't really good at responding, so we had lots to choose from.

The Tylenol case was a good example of a company identifying a problem, taking responsibility, and going about the task of correcting it. Before it became a public crisis, the company was already well ahead of it. Similarly, companies like DuPont have a world-class reputation for safety. It's baked right into the fabric of the entire company. They respond to events and prevent events by a very rigid safety regime. Given the fact that NASA has historically been a very safety-conscious Agency, this became an opportunity to benchmark that safety objective against the exemplars. How do others embrace safely effectively, and does it inform some things we ought to be thinking about as well?

What we finally arrived at was the peerless record of the Naval Reactors community [Naval Nuclear Propulsion]. This was H. [Hyman] G. Rickover's original conception of building nuclear-powered vessels and focus intensely on a very rigid safety regimen to assure that there be no incidents. Each time there is anything that would suggest the potential or the beginnings of an

incident, there's a procedure to button down and understand the nature of the problem, go fix it, and return to operations.

It really made a powerful impression on our colleagues at NASA that the Naval Reactor community never had a catastrophic incident. They've had plenty of issues, close calls, challenges, shutting down reactors and many things, but it never got to the stage of a nuclear incident that went critical on board a nuclear-powered vessel. That's a tribute to the culture that the Naval Reactors community adopted. These are very rigid people that really play it by the book.

That's pretty severe, but let's figure out how they respond, what do they do, what is the procedure that they go through when a commander of a nuclear-powered vessel reports an incident. Whatever the incident, there's a procedure that every single one of the folks in that community know cold. They don't need to go look it up. They don't need to go refresh their memories. They're immediately mobilized to go deal with that problem.

We forged a pretty close partnership with the Naval Reactors community in the months that followed to pick things from their procedure that would fit compatibly into the way NASA does business. We compared our existing procedures against how they react and both communities learned something. The Naval Reactors community at that time was led by Admiral [Frank Lee] Skip Bowman, who had been a friend for some time. He became a great professional colleague during the course of all this, really informed a whole different way of looking at how we do things, but would be the first guy to say it was amazing how much his people learned from NASA as well. It worked both ways.

What came from that was an entirely different plan than the one that was on that shelf on the first day I walked in, that called for a very scripted set of procedures when incidents occur. Lots of debate went into how the spaceflight community put this together. Everybody had to get

together to input to that process to upgrade what we're doing. What they came back with was a really exemplary plan that applied to a number of scenarios that could have occurred, what the reaction needs to be, how you need to work through, how do you launch the investigation, who ought to be on it.

I never would have imagined that this new plan would be used, less than a year later. The reaction after [Space Shuttle] *Columbia* [STS-107] worked exactly the way it worked because of that study effort. I attribute that entirely to the discipline, the focus, the dedication of the entire spaceflight community in organizing that soul search of how we go about that process, in a way that turned out to be far more timely than we ever would have dreamed. It was really exemplary. I look back at how the process unfolded in the hours and short days that followed the *Columbia* disaster and wonder how the reaction would have been significantly altered had we not done the proper planning I described.

Just months before the accident happened, in November of '02, I was advised that there would be a test activation of the whole procedure, as an exercise, and a simulation. One of my roles was to call the members of the post-accident investigation team that were named in the plan. The initial members of the *Columbia* Accident Investigation Board were assembled straight off that sheet.

There were about three different additions to the panel to include the chairman himself. Admiral [Harold W.] Hal Gehman was selected based on his experience as the principal lead investigator with the *U.S.S. Cole* incident that had occurred a few years earlier in Yemen. Fresh from that experience and given that he was a four-star admiral just retired, I thought he was an ideal chairman. He was not a nuclear submariner himself, but he certainly knew that community, knew how to tap the capabilities that were there. We added a member to the Accident Investigation

board who was a representative from the Naval Reactors community. It was a very closely forged set of relationships.

There were two others that were ultimately selected, too. Sally [K.] Ride was brought back, given her experience on the *Challenger* board, and Roger [E.] Tetrault, who had run Babcock & Wilcox [Company] nuclear reactor production facilities, and ultimately ran the corporation that had the responsibility for that division as well. He came from a Navy background as well, but his business experience was a big plus. He had also served on the NASA Advisory Board at the time looking at how to achieve closer Shuttle and Station operations integration activities. He was well familiar with NASA and also brought that dimension of the safety ethic from the nuclear reactor community. Those are the only additions to the board otherwise identified as part of the development of this benchmarked safe plan.

Long answer to your question, but it is important. That study plan became part of the fabric of the Agency on day one of my tenure. I wish I could tell you I was smart enough to have put this together, because I thought we had problems coming. It was more motivated by the curiosity of how we would we react to another accident. Having just been in the White House during 9/11, I guess that was on my mind. I worked in that complex until December of that year, so I saw plenty of how do you react, how do you deal with this, and some of the challenges. It turned out to be a highly effective exercise.

Those were the two primary issues I focused on when I first arrived at NASA: focusing on the strategy and how people articulate what our mission is all about. Then, examining our safety ethic that had been baked into our Agency DNA, prove it to ourselves and firm up our response plan in the case of tragedies. Those were two pretty powerful messages.

That, combined with the cost and schedule issues on Space Station focused a lot of my time early on. We focused our management time on cost and schedule, redesign the station configuration to meet the objectives of the partners, and wrestling down the overrun that occurred to deliver an International Space Station, fully assembled, by some timeframe.

The question of when ISS would be completed did not have an answer when I first walked in the door. The prevailing mindset seemed to be: "It's finished when it's finished." Instead, we needed to define what ISS is going to look like, when we think it's feasible to deliver it, and what's it going to cost to get there. That was a fairly straightforward proposition. Meanwhile, the strategy and safety ethic objectives were really more about learning a little bit about the Agency, applying what I learned, but not instructing everybody. Rather, we reached consensus on those objectives.

Both were accomplished in the first few months. And I didn't need to say, "Here's the rules and here's how I'm going to act." Instead, it was more the goal of, "Let's go figure out how to do those tasks together." Job One clearly was how to wrestle to the ground the ISS problems that the President sent me there to address. That became instructive and set a priority early in the game.

WRIGHT: An easy directive, but not necessarily an easy journey. As part of the, as it was referred to the U.S. Core Complete, you decided to bring back the Educator in Space Program. I know you have already talked about your passion for education and the reasons why, but this was not only just starting an educator program; you wanted to also reincorporate Barbara [R.] Morgan into the whole philosophy of education. Give us your thoughts about bringing her in and having her be involved in this.

O'KEEFE: The "Educator Astronaut" initiative became a focal point for the education agenda. It was a strategy enunciated, in the spring of 2002 timeframe that I did at my old graduate alma mater, the Maxwell School [of Citizenship and Public Affairs] at Syracuse [University, New York], and they provided the venue for it. It also happened that the congressional district that Syracuse University resides in was represented by Congressman [James T.] Jim Walsh, the chair of the Appropriations subcommittee with NASA jurisdiction. The adjacent congressional district was represented by Congressman [Sherwood L.] Sherry Boehlert, the chairman of the House Science Committee. It was obviously a great venue to deliver the policy speech.

Both of them were there, so it was a terrific opportunity to discuss NASA's strategic objectives, what we're all about, and the education initiative was discussed in that speech. Education has been at the historic beginnings of NASA. Our goal was to make NASA more accessible to middle schools.

Most educators will attest to the fact that if you do not motivate children at the middle school ages to be interested in math and science, they will never be engineers or technical field folks later. There are plenty of examples of engineering students who decide this is too hard and become history majors in college. There are pitifully few in the reverse. On many occasions I made the statement that you never find someone who's a history major who decides, "I really want to be an engineer." I found one. I found one person who stood up in an audience, said, "I did!" So there is at least one out there but they are rare.

We focused on programs that were targeted dominantly towards middle schools to "inspire the next generation of explorers." Most of the interest on the part of the public, the press, and the congress was, "That's nice, that's interesting, but how is that different than what the Department of Education could do? What are you really trying to achieve?" What NASA does really excites

students, and most teachers will also attest to the fact that NASA brings to life the application of these basic math and science principles. To jump start this, we revived the Educator in Space Program.

That motivated lots of internal debate before that speech. We learned from the *Challenger* accident that the proposition of having crewmembers aboard who were not necessarily trained as astronauts posed an unconscionable risk. Christa McAuliffe's passing as a member of the crew of *Challenger* drove that emotional point home for all of us.

It also raised some real important questions that the spaceflight community wrestled with. To launch with a crew member unaware of the risk is a disservice to anyone else who would ever follow to fulfill the noble objective of being an educator, a teacher, who went to space and sought to share that experience with children. Totally unfair to do that to anyone unprepared.

Each succeeding astronaut class was selected to include candidates from the community of educators who seek to do this and trained to understand the risks. They are required to go through the Astronaut Candidate Program, like every candidate selected. Barbara Morgan is the first Educator Astronaut. One of the most heroic people I have ever met and she is positively one of the most inspiring people I've ever encountered.

She pursued this goal because it lit her imagination. Even after the *Challenger* tragedy, she resolved to follow Christa. Barbara went through the Astronaut Candidate Program, sat in a queue for years like they all have waiting for a flight, going through all the mission preparations for every and any contingency that could happen. When she flew her mission, she was a fully trained, qualified astronaut. We thought about whether it was reasonable to expect this from others—can you really get an educator who has been in the classroom for the last X years with the

objective of standard two or three years of training, perhaps one or two flights, then return to being an educator after this experience. That was part of the idea. It seemed like a long shot.

That then started planning the criteria of how we'd set it up and what we'd do, and it became a different program than the Teacher in Space program that was the basis upon which Christa McAuliffe was first selected, and Barbara Morgan was the backup. Barbara ultimately flew as the first educator astronaut, which is a different kind of concept, but one in which she was confident from the minute they lifted off to the point of her return that if any contingency emerged, she knew just as well as any other colleague on that flight how to respond to it. She'd been through the training and done it all. She is a remarkable person—again, one of the most extraordinary people, who was driven by a dream, an aspiration, and did it with just great skill. And she is an electrifying teacher.

I've been with her on a number of occasions where she would walk into a classroom and within minutes, take over the place. It was just phenomenal. That's not just because of wearing a blue astronaut uniform. She'd walk in just like any of us are dressed and within minutes, they're all eating out of her hand. It's a talent. It's an extraordinary gift, and she was able to take this experience over all those years, not just the one flight, over all those years she dedicated to being in the Astronaut Corps. She's now taken it back to the education community. She's at Boise State [University, Idaho], and she's just amazing. An astonishing person who set the gold standard for the Educator Astronaut Program. She became the very best ambassador for the program that we could ever, ever have imagined.

Within a year of starting the Educator Initiative, we had signed up 50 middle schools in the first initial run of the NASA Explorer Schools program. During the course of my time, by the time I left NASA, over 250 schools had been part of the program. It cost nearly nothing. It took the

existing information, data, things that we used every single day, and made them more accessible to middle school educators at NASA Explorer Schools, that they then applied for the use in math and science classes. It was already paid for. This was something that simply was an outreach to use what the taxpayer of the United States had already paid for to inspire the next generation.

Barbara was a major, major piece of making that happen. She became the principal spokesperson for it. It wasn't just middle schoolers that were electrified when she walked into a room—it was members of congress, it was the press. She's one of the most genuinely sincere people you ever want to meet.

WRIGHT: You served as Administrator for a little more than three years, but they were very full years of events and transformational changes. As our closing question, because our time is starting to go away, what do you believe to be the most significant contribution you were able to make during your tenure there?

O'KEEFE: I'll leave that to others to sort through and make decisions about. My opinion on that is of no particular value. I tried, in everything we did, to do the best I could at working through the challenges and conditions we were wrestling with at the time. I'd like to think that no decision was made on the basis of some impulsive view or some preconceived sense of what ought to be. Instead, it was informed by facts, objectives, a strategy, a purpose, and I did as well as I could to communicate that as often and as broadly as I knew how. What constitutes the achievement there, others will interpret that, and that's, quite honestly, for historians to decide.

WRIGHT: Of all the things you didn't get to do while you were there, is there something you wish that if you could go back and get something done?

O'KEEFE: You bet. I'd like to see Project Prometheus realize the objective of in-space propulsion. It was the most significant catalytic effort to really transform propulsion. It was the one major initiative that never got further than the development stage and the planning phase for how you'd design a series of missions that would demonstrate in-space propulsion. That, coupled with the real deep examination of how to develop capacity for humans to survive any of these experiences beyond low-Earth orbit, was another significant initiative that never really got the leap-ahead boost that it needed to take it to an entirely different level.

Great strides, wonderful achievements, what we've known and what we've learned from the Space Station has informed our understanding, but to go beyond the conventional wisdom of how to get anywhere sooner, faster, to make the speed of transit from here to wherever you go feasible for a human being to survive, so that your mission there, wherever "there" is, is as expansive as you can make it. Presently, our current means of travel requires a means to sustain life for extended periods of time, which means big, heavy spacecraft.

Ninety percent of what it takes to go anywhere, is getting off this planet. But with today's capacity, once you're in low-Earth orbit, you're waiting for the laws of physics to take over, and then you're corkscrewing your way off to wherever that will go. That's the only way to do it today, and that requires a finite weight, mass, density, etc., to achieve that. Those variables are un-adjustable. They are constants. By the conventional means of propulsion we have today, these are the limits. And the means of survival is limited. Until we conquer those limitations, our exploration goals are limited.

WRIGHT: Anything else that you'd like to talk about before we close? Any other subjects?

O'KEEFE: Just one, and a very summary point that bears some mention. I have been away from the Agency now almost a decade. I am still amazed at the number of people who are positively fascinated by what NASA does. Yes, there is a notion that space exploration has lost its buzz and it's no longer as exciting as it was during the '60s. The Apollo era, it's over, and so therefore, it's just drifted off and it's lost its attraction to the public. From what I can see—based on admittedly anecdotal evidence—I would say that is nonsense.

The excitement people have is still as vibrant as it ever was. Conversely, the excitement that we like to ascribe, what we believe existed in the 1960s during the Apollo era wasn't nearly as over the top as the folklore would suggest. This has come from lots of conversations with some really interesting people who lived during that time who say, it wasn't quite that. Yes, there were exciting features to their era; public interest rose and fell based on the events. The more it had been seen, the less it was interesting. We choose to forget all that.

We like to ascribe this Camelot era to that period of time—which was remarkable, there's no question, taking nothing away from the achievement. The Apollo era was phenomenal, but we ascribe more to public enthusiasm than what existed at the time. It was hard then and it's hard now.

However, NASA is a universally recognized symbol. It's something that is admired, revered, respected, and viewed as that's a group of people who do exciting things, and do things that really matter. That hasn't changed a bit. There's no amount of polling that says what I just said. Most of the polling people have lost interest in exploration. They wonder how much we're

spending on it and all that. Reality is, that is not the overwhelming, prevailing view of most people, and there is still human curiosity the world over.

WRIGHT: That's a great way to end. Thank you so much.

O'KEEFE: Thank you. I appreciate y'all spending the time.

[End of interview]