

**NASA JOHNSON SPACE CENTER SPACE SHUTTLE PROGRAM
TACIT KNOWLEDGE
ORAL HISTORY TRANSCRIPT**

STEPHEN S. OSWALD
INTERVIEWED BY REBECCA WRIGHT
HOUSTON, TEXAS – MAY 20, 2008

WRIGHT: The day is May 20, 2008. We are in Houston, Texas to speak with Stephen Oswald, who is currently Vice President and General Manager of Intelligence and Security Systems for Boeing. This interview is being conducted for the JSC Tacit Knowledge Capture Project for the Space Shuttle Program. The interviewer is Rebecca Wright assisted by Jennifer Ross-Nazzal. Thanks again for coming in and giving up part of your vacation time to talk with us. Tell us how you first came to work with the Space Shuttle Program. We know you joined as a NASA employee and then became an astronaut—so if you wanted to give us some background information, how that evolved into the duties that you're doing now.

OSWALD: I actually had no interest in the space program at all; I just wanted to fly airplanes. So I joined the Navy to do that, and I think my interest in—or lack of interest—in the space program started because I'm pretty big, about 6'1". In 1962 in Seattle, they had a World's Fair. Alan [B.] Shepard [Jr.] had flown in '61, so they had his capsule there. It's one of the couple early memories that are still around. We got in line with my dad to go look at the capsule, a big long line and stood through it, and got up there and looked inside. I was looking inside the capsule, which was really small, and I looked at my dad, who's also about 6'1", and I just wrote that off. It's not anything I was interested in.

It wasn't until '78, when I got to test pilot school, which was an entirely separate decision. It's just kind the next step in flying airplanes. In '78, they selected the first [Space] Shuttle group, and some of those guys were at Pax River [Patuxent Naval Air Systems Command, Patuxent River, Maryland]. Hoot [Robert L.] Gibson and a couple of the other guys, [Daniel C.] Brandenstein and [Frederick H. (Rick)] Hauck, had already left and gone back to the fleet. I knew some of those guys and had been drinking beer in the bar with them, and they were kind of like me. So it became something I was thinking about. They had the next interview opportunity in 1980, and a bunch of us applied and went down and had interviews.

I remember I went down there in an interview group that had Charlie [Charles F.] Bolden [Jr.] and Bonnie [J.] Dunbar and Franklin [R.] Chang—because at the time it was Chang, it wasn't Chang-Díaz yet—and Linda [M.] Godwin. I think out of that interview group of 20, eventually something like 15 got selected, just because some of us were a lot lighter than others. I didn't get selected. Ken [Kenneth D.] Cockrell was in that group. So we went back and flew airplanes a while longer.

I actually got out of the Navy in '82 or '83. When the next interview opportunity came along in '84—didn't get selected again, and that irritated me a bit. I was thinking that one was going to work out okay. Hoot called me after that interview—after I got a phone call saying I wasn't selected—he called the next day and offered me a job down as an instructor pilot. Initially, I turned him down. Because we had this house that we built—we'd been in it less than six months, as I remember. I had a pretty good job flying airplanes for a company that is now Northrop Grumman [Corporation] but then was Westinghouse, flying out of Baltimore doing test work, so it just didn't make any sense to do.

I was talking to a friend of mine. I was flying F-8s in the reserves out of Andrews [Andrews Air Force Base, Maryland], and I went down there for a drill weekend. We were talking, and I was telling him about the option of going down there, and he says, "Well, you know what you ought to think about? Five years from now, if they're launching Shuttles once a month, and you can watch all that happening and not regret that you didn't go down there, I guess then you might ought to stay here. Otherwise maybe you ought to go." So I went home and talked with Diane, and we sold the house and came down here in November of '84, and I got selected in spring of '85 and started in '85.

WRIGHT: Eventually you became part of the Astronaut Program and pilot, as well as commanded.

OSWALD: Yes. We started in August of '85 in the Astronaut Office, which is kind of a neat way to do it because everybody else came down and was trying to figure out how to become a civil servant, and I'd already done all that and checked out in the airplanes, so it was a pretty easy transition. Good group. Smallest astronaut class since the first two; we only had 13 folks. We had one of them get killed in an airplane crash, so we were down to 12. Steve [Stephen D.] Thorne was killed in a private airplane. He was out messing around with a boyfriend of another one of our classmates in a Pit Special, they got it into an inverted spin and it just went into somebody's backyard down here—bad deal.

We started in August, and then [Space Shuttle] *Challenger* [STS 51-L accident] happened that next January, and that slowed everything down. Rick [Richard J.] Hieb and I were down as Cape Crusaders [astronaut support personnel at Cape Canaveral, Florida]. Our first job

was down at the Cape. Now they've got a very structured, year-long astronaut candidate thing, and they've got a bunch of stuff that they go through. We were on a fast track; we were going to fly in two years and needed to hurry up. We had about five months of generic stuff, touring around and learning how to fly the T-38s, and then they put us in our jobs.

My first job was down at the Cape with Rick Hieb and Jay [Jerome] Apt and Carl [J.] Meade. Two pilots and three mission specialists. Three mission specialists, but Carl was an F-16 pilot, too. We were down there, Rick and I, and we'd been in the vehicle [*Challenger*] the night before the morning launch. We were down hanging around the families of the crew because we'd gotten to know them because their office was right next door to ours. They invited us up on the roof to watch the launch with them, which of course didn't go well. So we spent the day with the families and then flew back here.

Then, of course, started the post-*Challenger* recovery, which took about two and half years and put us, in terms of flying, back a bunch because the flight rate was slower. We finally started flying, as a class, about six years after we were selected. Eventually, I got mine in [January] '92. That was STS-42 on [Space Shuttle] *Discovery*, and then flew again 15 months later—caught up pretty quick—in the spring of '93. Then cycled back as a commander in '95, about two years later. Flew pretty quickly once we got going.

Then I was really tired of training. The training is structured such that it trains to the lowest common denominator, and it just takes forever. You're going through all the stuff again for those that haven't flown before. It got to be kind of a long, drawn out deal. It was a great flight, great crew; I had a great time. At the time, that third flight was the longest flight that we'd flown on Shuttle. But afterwards, I was just done. I was pretty frustrated with the system and didn't feel like I could make any—because they assign commanders about three years into the

planning cycle for the flight. About a year before you're going to go fly, maybe a year and a half, you get involved in it and it's all planned, and you really can't affect what's going to go on on the flight. Other than just kind of on the margin.

I wanted to try to get into a position where I could actually influence the process, so they assigned me to a job in D.C. [NASA Headquarters, Washington, D.C.] that was going to be working with the DoD [Department of Defense]. I'd been working space staff in the Department of Defense as a reservist for about five years before that, so I was pretty familiar with the Air Force and how they worked or didn't work. This job was as an Assistant Deputy Undersecretary of Defense for Space, which I learned in that job that you never accept any job with more than one modifier, like Assistant or Deputy. If you're going to be an Assistant Deputy Under, it's just really a bad deal. But that was actually a pretty good job, and I was only in it for about 30 days. Maybe not even that long.

At the time, George [W.S.] Abbey had convinced Mr. [Daniel S.] Goldin [NASA Administrator] to reorganize NASA such that the Center Directors—because before they had just been, and are today, station keepers. They keep the infrastructure going. But the programs are in a line reporting with the folks that are in Washington. So he put Center Directors, specifically him, in both the Shuttle and the [International Space] Station reporting chain, and took the folks out of the line process at Headquarters. So it went from the NASA Administrator to the Associate Administrator for Space Flight. It used to go through a guy named Bryan [D.] O'Connor—who was another astronaut—the Deputy Associate Administrator for Space Shuttle, down to the Shuttle Program Manager, who was Tommy [Thomas W.] Holloway at the time.

They cut Bryan out and replaced Bryan with George [Abbey], and Bryan wasn't very happy with that. Not because he was worried about anything for him; he was just thinking it was

the wrong thing to do to have the Center Directors involved. So he gave them notice that he was going to leave; thirty days. I got a phone call saying, "Hey, we've looked around. You're the only guy that can possibly take this job, and so we want you to come over and relieve Bryan." I said, "Well, Bryan left for a reason. Let me talk to Bryan."

So we talked. And they called a couple, three more times. The "they" were Mike [Michael] Mott and Wil [Wilbur C.] Trafton. I had known Trafton for 20 years at the time, and Mott for probably 10. I didn't want to disappoint them; I was just enjoying the job that I was in, and it didn't sound like a good deal jumping back into that with those guys—just because of the reason that Bryan was leaving and so forth. I kept telling them "no," and finally, the day before Bryan left, Trafton calls me and says, "You've got to come over here. We can't leave the job empty. We'll find somebody else in a couple of months, max, you'll be back over there in your job." That was two and a half years before I left Headquarters. I went in and never did get out of that job, and another friend of mine took the other job that I had wanted to go to. It turned out to be fine. It turned out that we developed a pretty good relationship with Tommy Holloway and George, and it worked okay. That was '95 and '96, and the first half of '97.

Then I came back to Houston. Talked Bill [William F.] Readdy into going up and taking my place, and he was there until just after [Space Shuttle] *Columbia* [STS-107 accident]. In the interim, of course, Mott and Trafton left, so I called them and I said, "Hey, this has changed. It's not too late." "Yeah, it is." He was up there in not nearly as good a position as I was in just because of the personalities involved. Anyway, came back down here. The intent was to fly another flight or two or three, so I was back in the Astronaut Office. I was probably the most senior guy ever to be in the Astronaut Office. They needed me in SES [Senior Executive Service], so I came back down. They left me as an SES, didn't take me back to the normal GS-

15 [General Schedule] that you are in the Astronaut Office. I was there for about a year and a half.

The deal was with George that when you went off on an assignment outside of the Office, that you'd spend at least a year in the penalty box, just doing jobs around the office and getting back into flying. It got to be about 15 months—which is more than a year, at least the way I did the math—so I was trying to figure out when I was going to get assigned. Then in December of 2000, they sent me a letter which said, "We think you're eligible for early retirement, and we've been offering early retirement for a couple years, but we're about to stop. We think you ought to check your options with the personnel guys and see what the benefits would be." So I did, and I got all the information before Christmas.

NASA had been downsizing, trying to get the number of civil servants down. Those never go well. They end up losing the folks that they'd like to keep, and the ones that they'd really just as soon have go somewhere else don't feel qualified to go anywhere else because they're not, so they don't. They end up losing a lot of talent. And that happens everywhere; it doesn't matter whether you're NASA or other places in the government or industry. Buyouts are just a bad deal for the organization because it dumbs down the team. They cull the herd, but it's the wrong folks leaving.

I looked at the numbers, and they were going to give me X amount of money starting February if I left in January. I was 48. The next opportunity to retire was 55, and I think there was a \$300 a month difference for waiting another eight years. The math was pretty easy, and I went home and talked about it with my wife, and she went, "So what's hard about this decision?" It was pretty clear to her what the right move was, but it took me another couple weeks to get there. I went and I talked to George, and he said, "We were planning on flying you a couple

more times. They'd be both [International Space] Station flights." We talked about the future after that, and there wasn't a whole lot of clarity. By then, I was kind of mentally down the road that we were going to go do that. So I retired, effective the end of January, from NASA. Which was the same month I got picked up for one star in the Navy Reserve, just coincidentally, and they offered me a job to start in April back on active duty. I did that for about 20 months, and then went to work for Boeing and did Shuttle stuff again for six years.

WRIGHT: You joined Boeing. Tell us about what you were doing there. I understand you were working, at some point, with the interface on the Shuttle Program.

OSWALD: Relationships are important. The same guy I was working with at Headquarters, Mike Mott, had left and gone to Boeing years before that, three years. He was running the Boeing human space flight stuff, so he had Station and Shuttle. He had been told that he needed to move what was being done in Southern California at Huntington Beach out of there to Houston and Florida, or they were going to re-compete the contract. Because they just weren't happy with the way that was working. "They" was USA [United Space Alliance] and NASA.

The guy who was running the Shuttle Program at the time had ten kids. He still works for Boeing—Stan Albrecht, great guy. Ten kids in the area, parents in the area, and it was pretty clear that he wasn't going anywhere out of Southern California, and he's still there. That opened up an opportunity for somebody else to take his place, and Mott asked me to interview for that. I had a really awful interview because it was just post 9/11 [September 11, 2001] and my head was other places. The good news is that I guess the other guy they interviewed had a worse interview than I did, so I kind of backed my way into that job.

For six years, we did basically three different things. First two years was transitioning people out of Southern California, and we moved about 700 jobs out of Huntington Beach to mostly Texas, but probably a couple hundred of them went to Florida. We only retained about 25 percent of the original people with those jobs, which it turns out is pretty normal. Somewhere between 20 percent and 30 percent are what you're going to get, and it doesn't matter whether you're going from California to Texas, or Texas to California, or Maine to Washington state, or the other way around. People tend to have reasons to stay, whether it's kids in high school, joint custody of kids in the area, ailing parents in the area, family ties. There were a few folks that just liked the beach and wanted to stay at the beach. There's a big herd of them that just don't like change. So they ended up, most of them, choosing not to go.

It is possible, though, to influence how many go through leadership. We had three different major program areas, if you will. We had Orbiter, and we had Integration, and we had Flight Software. Flight Software we didn't decide to move until a year later. But Orbiter and Integration we were moving immediately. Let's start with the Integration guys. Dick [Richard N.] Richards was leading the Integration bunch, and he didn't want to leave Southern California, his wife didn't want to leave Southern California. But he'd been in the Navy, and he was used to moving around, and he saw the handwriting on the wall, understood the reasons, and got his team fired up about leaving. So they had about 33 percent of the folks moved. Orbiter just refused to believe that they could do that work anywhere else: "They can't do it without us and if we resist this, they'll change their mind." We didn't. We only got about 20 percent of the Orbiter guys, and it was pretty ugly.

But the good news about the whole Space Shuttle team is that they're pretty loyal to the mission. They may not be very pleased with what's going on in their immediate leadership and

the decisions that get made. They do give ex-crew guys a lot of slack, and I noticed that I could get away with talking to those teams, and it was never personal with me. They were mad at some other people, but they were never mad at me, which was nice. But I was kind of the guy that was pulling the trigger on the thing. We came up with a pretty good transition plan and just basically had a really good leadership team with Dick and Bo [Bohdan] Bejmuk and some of the rest of the folks. We went back and we moved Flight Software later. That was actually kind of harder. Tony Fleckland [phonetic] did a nice job. Because we got almost nobody to move out of the Flight Software bunch. That was kind of an interesting study in human dynamics.

We ended up being successful in moving all of that work out here, and it said a lot about the loyalty of the folks involved to the program. Some of the jobs it only took a couple of weeks to get the new guy trained up. In others, it was eight or nine months of running two people in parallel and trying to teach the new guy the job while you're flying. The government did a good job of funding that. I think they funded it to the tune of about \$35 million, which was partly \ physically moving people, but mostly it was covering two paychecks in a single job for however long it took to do the transition. That was done almost seamlessly.

We were just finishing it up, and we were planning on going down to less than 100 people at Huntington Beach—we started with about 800 or 900. Then we lost *Columbia*, and we were down to about 250, 300 folks at Huntington Beach in the tail end of that transition. Then it became obvious that we needed some help in getting back flying again. We were very lucky with timing because there were some other big programs that were kicking off within Boeing in Southern California. The Ground-Based Missile Defense Program and the Future Combat System Program—there was a lot of work that was going on, so I don't think that we had to lay off more than about 35 folks out of about 600 that left the program. Again, a lot of that had to do

with luck. I think half the people that we laid off wanted to catch a lay off with their retirement and just left.

Then post-*Columbia*, we needed to do some more design work to make the boom and the brackets—to put the boom into the payload bay and work all of the static and dynamic loads numbers and so forth. So we ended up getting about 300 or 400 people came back. They had left and gone off to other programs where they had a secure job, and came back to the Shuttle Program to get us flying again even though they knew that they were going to end up needing to find another job within a year and a half or two years. Again, just a demonstration of loyalty to the program.

There was about a two-year recovery program that took us from 2002 to 2004, so '04 to '06 was kind of the recovery from *Columbia*. Then during the *Columbia* downtime, they had the Vision for Space Exploration, which was good, going back to the Moon and on to Mars. The bad news was it had Shuttle shutting down in 2010. So the last couple of years I was working Shuttle—and they're still going through it now—how do you keep folks motivated? I'm confident that's going to work out okay for the same reasons that we were able to transition the program and then recover from *Columbia*, just the loyalty that folks have got to the program.

But you can help that by giving folks a financial lifeboat, if you will. So we have some incentive programs. Even if folks end up being laid off out of this, I think the majority of the folks, at least the critical ones, will end up having a lifeline to the next job. Because you can end up getting yourself in a position where people don't have any choice. If they're coming to the end of their job and they're only going to get a month and a half of severance pay or whatever because they're a relatively new employee, if they got kids in school and so forth, they just need

to make sure they're taking care of their families. So we have, for most of those guys, incentive plans that would bridge them for as much as a year.

I think that at the end of the day, as they look back on the phasing out of the Shuttle Program, hopefully we'll have done better than we did in the Apollo to Shuttle Program, where they basically went cold iron for six or seven years in between and lost a huge chunk of the workforce. Because if you lay folks off, even for a few months, and they get in a new job, and they're pissed off about the way they were treated, they won't come back. On the other hand, if you treat them with dignity on the way out, you may get them back again a couple years later. But if you've got a multi-year gap, it's just really going to be hard.

WRIGHT: Did you do some interface work with USA between, with Boeing?

OSWALD: They were our customer the whole time. Still are. USA was formed back in '96—between Lockheed and Rockwell, and then Rockwell was acquired by Boeing—so it ended up being Lockheed and Boeing that were the parent companies of USA. The original plan with USA was to have them do all the ops [operations] work, including the propulsion stuff. But the first phase of the SFOC contract—SFOC, Space Flight Operations Contract—was mostly the Orbiter and Integration work, and all the ground processing work at the Cape, and the Flight Operations. Lockheed had the ground ops work in Florida, so there were 6,000 or 7,000 people there. Rockwell had the Mission Operations Contract, doing the flight planning and crew training and so forth. Then Boeing had the Orbiter work, Integration work, Flight Software work. When they put all that together it was, a billion, two, worth of work that was being done. But it didn't come out even for the two companies, and the two companies were going to share

the earnings 50/50. When they put that together, the Boeing work ended up being more than the Lockheed work, and so they took Orbiter, Integration, and Flight Software that we did—we were doing backup flight software—USA ended up eventually doing the primary work. But as they put that together, it made more sense to have us stay as a Boeing team working under a subcontract to USA. So when I joined them in 2002 essentially, we were working as a sub[contractor], and still are. So it was NASA, then USA, and we were working for USA, which worked okay. It was fine.

WRIGHT: What are some of the challenges that you encountered as you were going through some of the changes working with the Space Shuttle Program, especially after you were at Boeing? Some of the lessons learned during those challenges. You already mentioned one about loyalty; if you treat people with dignity, that they have a great loyalty to the program. Are there other ones that you learned during that time period?

OSWALD: A lot of folks are in this position, where they've seen it from both sides; they've been government management types, and then they've been on industry. I think that NASA generally does pretty well at the senior management level in terms of recognizing the contribution of the contractor workhorse. In most of the teams, it's relatively badge-less; it's not so much which badge you're wearing as what you know. Knowledge, expertise, technical skill, leadership skills are highly valued by most of the folks on both sides. You see some folks in government who look at the industry workforces as being hired help. Less so than in DoD, but it's still there. That ends up being bothersome. It bothered me when I was a government guy that some folks thought that way.

NASA is especially challenged now because of what we did to them in the 90s. There were decisions that were driven by [United States] Congress to outsource operations, which ended up in the formation of USA. A lot of the work that NASA used to do because a lot of folks were actually driven out of government, incentivized to leave government and go to work for contractors. That transfer of expertise to USA was one of the things that enabled them to be successful. But it also gutted NASA of any significant technical expertise. The guys that were working the big programs and had done the development work for a lot of that Shuttle stuff left, and the work that NASA was doing was the odds and ends, say over here at the JSC Engineering Directorate. They had a contractor that did an awful lot of work. The government guys did an awful lot of watching contractors do the technical work.

The challenge that Mike [Michael L. Coats, JSC Center Director] is left with is trying to figure out how does he get significant technical contribution out of a team that hasn't done it for a long time. The government hasn't really designed and built anything of significance for a long time. A generation. All these folks who are off trying to lead this really tremendously huge development program, Constellation, haven't done any of that. They're being asked to integrate that, and I don't know that that's going to work well. I don't work in it anymore, but I'm still emotionally wedded to it. It's puzzling to me why we would think they could be successful doing that. I think they're going to need a lot of help.

And Mike is in a box. When you're put in a situation where you can't close a Center because you've got to have ten healthy Centers because it's not politically acceptable to not have ten healthy Centers. You've got 16,000 employees and you can't riff any, so you've got those 16,000 paychecks that need to continue. You've got two and a half or three billion dollars or more tied up in the employees and the infrastructure, and you're budget's essentially fixed, and

you have an operation to run and, you've got to go develop stuff, and you can't spend any less money on earth science or space science—you can't get there from here.

He has an overly constrained problem, and there aren't very many places in government where they would do it this way. If you look at DoD, they BRAC [Base Realignment and Closure] bases. Shut them down. And over the long haul, you end up getting more efficient. They have enough money such that they are able to phase in new acquisitions. They don't end up having to shut down all of the F-18s in the Navy while they build F-35s to replace them over time. Don't have that luxury; there's a defense thing there. In NASA, this is discretionary spending—as is the DoD budget—but it's not as essential as national defense, so you can choose to play or not. The box that Mike has been put in is one where he is forced to shut down Shuttle and rely on foreign upmass and downmass and frees up that money to go off and develop the new stuff. It's a huge gamble. If somebody pulls the plug in the middle of that, you're just out of luck. It's not a very good situation.

WRIGHT: Knowing all that you've just said, if you were charged with training the new people coming into the Space Agency, what would you want to equip them with? What would be some of the lessons that you would like for them to know if they're going to work in the Space Agency? How do you best train that next generation of space leaders?

OSWALD: I think they need to be technically credible. If you're not, in an organization like NASA—and it doesn't have to be in any specific thing—but all of the successful leaders that I've ever seen within NASA have some significant technical background. Whether it's operations at the Cape, ground operations, whether they worked in mission operations, or they worked in

engineering, or they're a crew person. There are a few exceptions where there are folks that are more political in their experience base than others—and those folks, by the way, are incredibly valuable. The only way that you're going to be able to fly Shuttle longer, for instance, is to get an extra billion or two in the budget, which is a political nightmare. People in the field really don't understand the value that the Washington crowd bring. Without them, the budget would be a disaster.

Folks in Houston and folks in Florida [Kennedy Space Center, KSC] and folks in Alabama [Marshall Space Flight Center] disparage those folks that are in Washington, and they generally won't go there. If I had one change that I could make—and this has been tried before—I would not allow a GS-15 to be promoted to SES unless he had spent at least a year in Washington and at least three years at another Center. I would never allow anybody to get Center-centric. I'd drive it more toward the DoD model. You never see a guy in the military—Air Force, Navy, doesn't matter—that is more loyal to their base than they are to their service. At NASA you see that all the time, and it limits the future for the Agency. I would blast these guys out of their Centers. In fact, I wouldn't even let them make [GS-] 15 unless they'd done a tour at another Center. It would cost more in terms of travel cost, but you would begin, in a generation or so, to change the culture.

They're still fighting wars between Marshall Space Flight Center and JSC, and it's been three generations. They hate each other. They don't really hate each other personally, but it's all about work share and who's driving the bus, and it's not getting any better. The only reason KSC isn't as bad is they've always been the orphan stepchild of the two, and they've got geographic advantage. They launch from there. So they're pretty secure, but they're pissed off about getting table scraps from Alabama and Texas. They argue about which way the money's routed.

When SFOC came in, KSC was all upset because instead of getting their money directly from Washington, it went to Houston first and then came down. Same amount of money, nothing changed, but Texas was getting their hands on it first. I think the one thing that I would change would be the way that they raise their leaders. If you look across at the program managers today running Shuttle, Station, Constellation—all good guys. Not one of them has ever had a tour outside of the Johnson Space Center. I think that's borderline irresponsible.

WRIGHT: The experiences that you have, especially in the transition with Boeing, must have taken a lot of planning. What are some of the lessons or the suggestions that you would offer anyone trying to build good planning technique? Or maybe some of the ones that didn't work that you could share with us.

OSWALD: You need to hire the right folks. Sometimes you don't even know who the right folks are until you get into it. There are some people who understand where you're trying to go, and buy into it and will help you get there. There are others that just can't stand change. It helps to have a model. There are a lot of them out there. When we were moving from Southern California to Texas and Florida, we used a book by [John P.] Kotter called *Leading Change*. It was a big deal six or eight years ago. It is an eight-step process that starts with creating a sense of urgency, and ends with imbedding the change in the culture of the organization. The steps in between are create a vision, communicate the vision, get some early victories. It's a pretty structured process, and we used that in Shuttle and graded ourselves against steps one through eight as we went through it. We were pretty close to being through five, and we were getting

there. Then we lost *Columbia*, and then we got out of the transition mode and into the recovery mode.

Once you get everybody's head wrapped around the fact—that's pretty clear to maybe a few leaders—that if you don't change, it's going to get ugly. If you can get that core group of leaders, if you pick the right leaders and you really all believe in where you want to be and the best path to get there, then you can end up communicating that to the rest of the team and get folks on board as they see things moving in the right direction. But you have to make them believe that there's a light at the end of the tunnel—and it's a train. The sense of urgency with that transition was they were going to re-compete the contract. It's real. You will be out of a job. You have an opportunity to do the right thing for the program, do the right thing for the company, and do the right thing for yourselves. Or not. Your choice. That was the first three or four months that I was on board. It was that mantra over and over again.

You've got to pick the right team; you've got to pick the right vision. There are certain people that have planning skills that are really extraordinary. There are others that don't. They're executors. It's kind of like trappers and skimmers. You've heard about people that are BD [phonetic] guys—they're the trappers. Most of those guys can't execute. There's a whole other group of folks over here that are the skimmers. They can execute. There's some folks in between that are the folks that can plan, and they're not very interested in trapping, and they really don't like skinning, but they can see where you are and they can see where you want to go, and they can make the plan. Those guys are really valuable. So when you find them, it's a good idea to hang onto them. A senior leader's job is mostly personnel. If you can pick the right people to go off and do certain things for you, because you can recognize talent—that's one of George Abbey's greatest talents was to recognize talent and to go after it.

WRIGHT: Once you recognize that talent, how do you make sure that you have established a system that you can have good managers and good performance in that management? What are some lessons about management performance that you can share with us?

OSWALD: I don't think I've ever had to fire anybody. I might soon, but never had to do any yet. If you're really kind of straightforward with folks, and you have them understand what your expectations are in terms of performance, and set the bar, generally they'll step up. The ones that either can't or won't tend to recognize that after you've had a couple of conversations with them, and they generally find something else to go do. That makes life easier on everybody. If somebody is failing or not meeting your expectations, you really have to sit down and talk to them about it.

I think one of the biggest mistakes that some leaders make is they just don't do that hard thing of sitting down and having those discussions. They're not necessarily pleasant, but they can be the most valuable discussions for the other person in terms of critiquing his or her performance, and it can be the greatest favor you can do for them. But it's still hard, so folks tend to not do it. The government's the worst. Industry's bad. The bigger the industry organization, the more they're like the government because the bureaucracy is proportional to the size of the organization and the length of time that it's been around. Boeing's been around [about 90] years. So there's a lot of bureaucracy in Boeing. The same kinds of hiring things and firing things that the government has, we have in Boeing.

What people tend to do, because they like to have a lot of pleasant conversations when it comes to be performance evaluation time, is they don't sit down and grade people honestly.

They really do have 85 percent to 90 percent of their team is doing a good job. They have a few rock stars working for them. But they've got 10 percent or 15 percent of their organization that are just showing up. And generally, we don't take the time to have the tough conversations and document them, and if you haven't documented two or three years of substandard performance, you don't have any option. The best thing that's going to happen to you or the person that needs to leave your organization because they're not performing is they're going to go screw up somebody else's organization. You can't get them out of the government, you can't get them out of the big company. So they continue to hang around, and one of the key challenges for government organizations is to try to keep these guys engaged.

But when somebody decides they've been a GS-13 for eight years and they've figured out they're never going to be a GS-14, it's tough to motivate them. You're going to get 40 hours of showing up out of some of those folks, so trying to get them to be engaged and members of the team—and most folks are. They show up, they've got pride in their work. But there are some percentage—and it's more than 15 percent —of those people that have realized that they've maxed out, that are just kind of hanging on. The government needs to proactively manage those folks. You can lead people that will allow themselves to be led, and those that won't, you need to figure out how to manage through the process. That's hard, and it's unpleasant. And most people are nice people, and they don't like to do that.

I said you need to have a credible technical background in order to be successful in NASA. A thing we don't do within NASA in general—there's almost no financial background for any of these leaders. They're a flight director. So they come out of the flight director's job, and they might work in scheduling and ops and program management end of things. There's only two rules in the government in terms of money: don't overspend, but spend it all. I operated

like that for along time. I'd spend it all, obligate it all, because if you don't, they won't give you any back. That's just a really bad way to do business in any kind of business. But most government folks don't know any better. If we could get some of these leaders out and get them some financial acumen so that they understand how business guys think—it's entirely different in industry. It's a profit and loss thing, and there's margins, and there's margins that are considered acceptable.

They're getting better—but for a while, if you were making 7 percent or 8 percent margin, NASA was doing you a favor. When the industry looks at that and goes, "I've got these tremendously talented folks," and they are. There are some of the best in all of the industry that come down here and want to work for NASA. If you could take those same people and have them go work for a different customer and make 15 percent margin, why wouldn't you do that? For a long time, the guy who was the head of one of the big companies wanted to drop NASA like a hot rock, and he couldn't because the one guy that was senior to him was kind of a NASA kind of guy and wanted to support NASA. We've finally gotten to the point where there's opportunity through good performance to get margins that are up in 9% or 10% range, which is at the low end of DoD stuff and half of what commercial is. It's almost a labor of love for industry to come in and work for NASA because NASA still looks at it like, "8 percent of a lot is a lot." Well, that's true. But 16 percent of that same amount is twice as much. And you're having those people go off and work for other folks.

If we could get NASA folks out into Wharton School of Business, into Harvard Business School, out to Stanford [University], and sit in a classroom. Not for a week, for six months, with industry guys, doing a short course or something, I think that they would come back and be really enlightened about the ways of the world. We allow folks to live in this insular world like

we talked about: "Yup. I went to work, got out of college, and went to work at Huntsville, Alabama. I've been at the Marshall Space Flight Center ever since." It's a 20-year career unaffected by any look at the outside world. I think we need to get out more on the government side.

WRIGHT: When you started your time with NASA, you were in the Astronaut Corps, so you understood risk one way. Then, as you've been on the other side, on the contract side, you understand risk a whole lot more ways. Share with us about risk mitigation, risk assessment, risk management—lessons that are important to continue the program forward in a safe and secure way, but at the same time, moving it forward.

OSWALD: Everybody struggles with managing risk. I remember after *Challenger*, there were some people that came in and said that they could do a probabilistic risk assessment on the Shuttle, and it didn't work. They were doing it in nuclear power plants. The problem was we didn't have enough time on the Shuttle, enough operating experience, to really know what the reliability of the components were, so when we did that risk assessment, it came out to a number that nobody believed. We had one failure in 25 flights, but the numbers said we should have lost half the vehicles we ever launched. That wasn't, obviously, a good way to do that. So we kind of went back to the more or less gut feel.

As you design things and operate things, if you're paying attention and you're designing quality and reliability into whatever the system is, you'll generally minimize the amount of risk. What we didn't do in *Challenger* was listen to the hardware as it was telling us that it was being stressed. There were a few folks that knew that it was aggravated by low temperatures, but we

weren't listening. The hardware was talking to us, and we weren't listening. Same thing with *Columbia*. Nobody believed that the foam could really hurt the vehicle. It was all about turnaround time and dinging tiles, but nobody imagined that you could end up punching a hole in the leading edge with a big piece of foam. We failed to listen to the hardware.

Some folks within NASA and the industry will tell you that if the engineer and the quality guys are doing their jobs, then risk will take care of itself. I think you need to look at it differently, and there's multiple ways of looking at risk. There's the five by five cube, and it's red in the upper right and it's green in the lower left, and it's a matter of likelihood of the event and then consequence if it happens to you. You can do those trades for financial stuff, you can do it for schedule risk, and you can do it for technical risk. The problem is—if you look at what happens with any kind of a space launch system, generally the consequences are a five if it's an important component, so now all you're dealing with is likelihood. Trying to determine how many nines you need in terms of reliability is difficult when you have an awful lot of critical components, which kind of brings you right back around again to the design and understanding the behavior of the hardware as you first test it and qualify it and certify it.

You can have as many five by five matrices as you want. Some stuff, you can actually do probabilistic risk assessment. But at the end of the day, the way that you minimize risk in this business is by having the right people with the right skills in the critical jobs. And that's for ops folks, both ground ops and flight ops; it's certainly for the engineering technical design teams. You need to be willing to pay for those folks to hang in there after you're doing operations. In Shuttle, we did that pretty well. We had a sustaining engineering workforce that is just world class. They're really good at what they do, and it doesn't matter whether you're talking software

or hardware or thermal. Then keep a management team that is willing to listen and to ask the right questions.

Any time you're changing something, the risk goes up. Everybody ought to realize the change is important but carries its own risk, and that sometimes better is the worst enemy of good enough. We have really good engineers. I don't know very many engineers that have looked at something and couldn't figure out a better way to do it, and so they will constantly tinker. "A, you can't afford that, and B, it adds risk." Except for when it reduces risk. The technical leadership needs to understand the difference between the ones that are nice to do but unaffordable, and the ones that are needed to do regardless of how much it costs. Those are tough calls. I think risk is always going to be tough. The tools will continue to get better, but at the end of the day, it's all about the people that are using the tools. It's like golf. It's not the clubs, it's the operator. You can buy as many sets of clubs as you want, and if your golf swing sucks, you're going to be a bad golfer. It's not any different with the tools that these guys have got.

WRIGHT: Can you give us an example of a time that you've seen good risk management tools applied and actually maybe have turned around a decision that was going in a different direction? Or maybe just someone's sense of practicality, with their experience, has affected risk assessment or a risk management decision?

OSWALD: There was a process—and this is a different kind of risk than technical risk—during Space Station. There were two meetings that were cranked up in the management process that, I think, saved the Space Station. One of them was when George Abbey dragged in all of the

senior leadership—government and industry—on Saturday morning, every Saturday morning for two years. Maybe longer. That got folks' attention that the Station was at risk. That was during the time frame where the Station was kept alive by one vote in Congress. That reduced political risk and technical schedule risk through that leadership technique. Pretty onerous, but it worked.

The other one was with Jay [H.] Greene—had a much lower level, technical meeting on Space Station stuff. Jay is one of the best leaders, I think, that NASA's ever had, flight director. But Jay can be a little hard on some folks. It was not a pleasant meeting for some folks. I was the Astronaut Office rep [representative] to that meeting, and it would have been like '98. Jay made a real difference, and he ran that meeting for years and he made risk decisions. I remember one that we were worried about had to do with a hatch, and he just said, "I think you guys are making this up in the crew office. It doesn't make any sense to me." He just wrote that one off, wouldn't fix it. I remember getting a note from him a long time later when they launched that particular piece of station, the hatch worked okay. It said, "Hatch worked."

At management levels those kinds of calls are routine, whether it's at the Shuttle PRCB [Program Requirements Change Board] or whatever. You need to have somebody with enough technical background, enough knowledge of the team, so that he knows who to trust. Because nobody's going to be an expert in everything. You need to know who is the guy that you trust in entry thermo [thermodynamics] of the RCC [Reinforced Carbon-Carbon]. How about tiles? Who would you call to find out how much conservatism is in the thermal modeling such that you can make a decision to enter as is, or whether you've got to put somebody out there on the end of the arm and go fix something which has its own set of risks? You've got structures guys and you've got thermo guys, trying to understand the facts of the situation, and then they bring all

that stuff forward. But they just know about what they know. They know about structures, or they know about thermo.

They don't know how to integrate those, and so that's left to some manager that's going to make, based on his or her judgment and his or her knowledge of the people involved and how conservative each of them are. Because some people will come back and they'll give you a belts and suspenders answer every time. Other folks will tell you what they think the answer is, period. One belt. Unless you know the people, unless you know who to trust, your ability to manage risk is marginalized.

WRIGHT: Do you have any thoughts to share on how best to instill trust within a team?

OSWALD: Do what you say you're going to do. And over time, you'll get there. It's one of those things where it doesn't take very many times of not doing what you say you're going to do and you will have lost them. You need to be consistent. People respect folks that respect them and what they do. They can see through a phony a mile away. Some people are born leaders. Gross generalization—it is not very often that you see many folks that have really world-class technical capabilities and are great leaders. Sort of like having a Miss America who is also a top five player on the LPGA [Ladies Professional Golf Association] circuit. God doesn't hand out very many royal flushes. Occasionally you see some. I didn't know von Braun, but I heard that he was a real long ball hitter technically and a great leader. I can think of half a dozen that are around here right now that are that way.

But they're pretty rare, and I don't think that you can make somebody a good leader. I think you can make somebody who is a good leader better through some training. If people

generally don't like people, but they like sitting at a computer all day and writing code—you see an awful lot of folks that try to get out of there because their perception of their self-worth and their career path is along the management line or the leadership line, and they get out of technical stuff where they're really good, and they get over here and they just flail. They try to be something that they're not, and therefore they end up not being able to identify with folks and they don't do well as a leader.

Leadership and management is different, by the way, and everybody knows that. Basically, to me, you manage stuff. You manage money, you manage widgets, you manage schedules. To a certain extent you can manage skill sets, but that's different than people. You lead people, and leadership is about getting people to do things that they wouldn't ordinarily do for some greater cause. So in the Marine Corps it would be why would you run up the beach? They're shooting at you. That's an abnormal thing. People do that stuff, been doing that kind of stuff for years. Not based so much on the leader—the leader has to help. They do that because they're worried about not doing their job in front of their peers. You'll hear folks talk about being in battle, and they're not there for their country, they're there for the guy next to them in the trench. Which is why they followed Pickett up the hill at Gettysburg. It was dumb. Everybody was going to get killed, but they did it anyway.

This is different than that, but it's still really tough work, and it's long hours. You end up doing it for the mission, but leadership is important in trying to keep the team together. Again, that peer pressure thing: if you get little pockets of people heading in undesirable directions, a good leader can drag them back in and get them aligned. So I think it's critical. I think that on occasion we try to stuff a square peg in a round hole. NASA has a lot of really good technical folks, and good leaders are more rare than that. So NASA will try to take a guy who is

successful as a Flight Director or a crew guy and put him in a leadership position, and it's not a good match for their skills.

WRIGHT: Personally, what do you feel is the best, or maybe the hardest lesson that you've learned working in the Shuttle Program and with NASA and its activities?

OSWALD: I don't know that there's any one lesson. The hardest lesson—there's a cartoon. There's a tree in the middle of this painting, and there's a biplane that's stuck in the tree, and it says, "Aviation in itself is not inherently dangerous. But [to an even greater degree than the sea], it is terribly unforgiving of [any carelessness, incapacity, or] neglect." When you lose an airplane, you can track it back to something that somebody did that wasn't right. Usually not because they got up that morning and decided that they were going to kill somebody, but they just screwed something up. It could go back to the guy that designed the airplane, or it can be the guy that maintained the airplane. More often or not, it's the aviator that's driving the airplane. But something happened such that there's a bad day at the end of the time.

Human space flight is like flying airplanes on steroids. It's just really unforgiving of neglect. So when you have a bad day in the human space flight world, it's really ugly. Hardest lesson is how do you avoid doing all of the memorial services and stuff? Because as tragic as it is for the people that end up losing loved ones and friends, I think the folks that you lose would tell you that maybe the biggest tragedy is what it does programmatically. Because it shuts you down for two or three years, so you're in the recovery mode for a long time because you lost sight of something. Whether it's an O-ring in a solid or whether it's foam that we watched for years coming off. I sat in a bunch of those meetings, and I missed it. So did everybody else.

That's a tough one, and you can never get complacent because it's just pretty dangerous stuff. That's the hardest lesson. The best lesson is what great groups of people can do when they're motivated to do great stuff. Two sides of the coin.

WRIGHT: I'm going to ask for the last question. You've talked about your experiences and a little bit about the Vision for Space Exploration, but knowing what you know, what kind of advice would you give for someone who'd be interested in joining the programs that are associated with the space adventures at this point in time?

OSWALD: We talked about it a little bit, but I think this is really an interesting time. There's a lot of opportunity in building new stuff, really for the first time in several generations. Not without risk, and it's all kinds of risk: technical risk, and budget, and schedule. And international intrigue. What are the Russians going to do when you shut Shuttle down? I would bet that the cost of riding to orbit for the Russians is going to get a lot higher. But we'll see. They've been good partners here when we've been not flying before. I think there's going to be a whole lot less space flying going on for folks that are in the Astronaut Office. Flight rate's going to be tiny relative to what it was in Shuttle. You're flying six or seven folks a flight on Shuttle. They'll be flying—I don't know—three, four. When they're flying with the Russians, they'll be flying one or two with the Russian flying. That'll be twice a year for a while. So the numbers of people flying is going to be significantly reduced, but the missions are going to be different.

I actually liked Shuttle. I was almost of the Fred [Frederick D.] Gregory school of human space flight, which is it's all about entry and ascent. “This on orbit stuff is okay, but three days is enough.” I wasn't quite that bad, but at the end of the 17-day flight, I was ready to come home. I

don't think I'd have been very interested in four to six months to a year. The Mars thing is going to be two years plus. That's a long mission. I've been on cruises in the Navy and they were long, and they were only six months. But different folks like different kinds of things, so for folks that like being in orbit for six months and working as part of a Station Crew, there's going to be some opportunities to do that. There won't be quite as many folks flying. I think the carrot of being able to go back to the Moon and going onto Mars is really, really inspirational. It would be a very good thing for us to be in that. It's not a matter of whether or not somebody's going to go back to the Moon, or whether or not somebody's going to land on Mars, it's just a question of when and who.

I think we're kind of at a crossroads here. It's an election year; who knows what's going to be important to the next president? The only thing I know for sure is it's not going to be in the top ten things they're going to worry about. They're going to be worrying about lots of things having to do with healthcare and having to do with Iraq and Afghanistan. So sometime around May, after they take office in January, they'll get around to thinking about who the NASA Administrator is going to be. It will be very interesting to see where they go with Shuttle. Is there more money that you could put in there? I think it will be a more—from everything I read—a more Democratic Congress than we've got today.

The good news for human space flight is it's not a partisan issue. You end up having zealots on both sides of the aisle. It is sort of geographically oriented. If you're from Alabama or certain parts of Texas or Florida, you tend to be more spun up about space flight than you are if you come from Montana. I think that the next year is going to be really kind of pivotal in how this transition is conducted. Or if there's a transition. Because there is a possibility, I suppose, that somebody might decide that the Moon's going to be there in ten years or four years, and so

we'll put that off for a while. And you guys over at NASA, keep doing what you're doing. On the other hand, they can come in and say, "Full speed ahead. Shut Shuttle down in 2010." Or, like politicians tend to like to do, maybe they'll do something in the middle. Compromise. I have no idea how that's going to go. I hope we end up getting there eventually.

Shuttle is just a magnificent vehicle that was before its time. I think once we shut it down, we won't see anything like the Space Shuttle again for probably 100 years, if you look at the way programmatic cycles go. But eventually we'll get back to something with wings that's reusable. The current design really is more fragile than you'd like. And it's all about the wings. I don't think those of us that were flying it really thought about it because we were thinking about ascent. Entry was pretty benign because there wasn't a whole lot of chance of really loading up the vehicle. If you were going to do that, it was going to happen on ascent.

So when we lost *Columbia*, it shocked a lot of us, and it changed my view of Shuttle and its long-term viability. On the other hand, adding a few more flights, four or five, eight—the way we're operating it today, I think is an acceptable risk. If that's what the country decides to do in order to maximize the return on this \$100 billion Space Station investment that we've got, and to get us through the gap and not be dependent on somebody else. But that's going to require additional money at a time when deficits are up. The economy's not doing so well. So I don't know. We'll see.

WRIGHT: We'll have to see. Before we close, are there any other thoughts about sound processes, best practices—anything else that you want to add before we close out?

OSWALD: I think it's all about people, and as long as NASA keeps attracting—and they do attract some of the best and brightest. As I mentioned before, I think we could do a better job of training and preparing leaders for their positions 10 or 15 years down the pipe. Part of that's formal education. A lot of it is getting them out of their Center into another Center. Learning to appreciate the value of the folks in Washington by going there and being one of them. I said a year. I don't think you could learn what's going on in Washington in a year.

Because I was going to go to Washington and change the world, right? It took me a year and a half to understand the fundamental truth that the Founding Fathers put this whole thing together to resist change. If you want to amend the Constitution, it's two-thirds of the Senate ratified by three-quarters of the states. It's hard. So getting anything done there is hard for a reason. It can be really frustrating if you come from the colonies and you're used to just making decisions and away you go. So I think going there and spending a couple years is something that every senior manager ought to do.

They're doing better in terms of assignments of Center Directors. The guy who is in Alabama today [David A. King] grew up on the Cape. Bill [William W.] Parsons has worked everywhere. Mike [Michael L.] Coats was in the Navy. Arguably he's JSC, but he's been everywhere. So I think we're trying to do better at the senior leadership positions, but you still get very Center-centric once you go down one level from the Center Director. You're right back into, "Yup, grew up on the Cape, still at the Cape." I think if we could fix that one situation, and over a generation had people grow up from the time they were GS-11s realizing if they wanted to be in the leadership, they needed to get off the Johnson Space Center, they needed to go to Marshall, they needed to go to Washington; it's an expectation.

In the military you see that. You're just going to go from place to place, and it's expected. And you can make a decision along the way that that's not worth it to you, that your family situation is such that you're just going to max out at GS-15 or something. That's fine. But if you want to be a real decision maker in the Agency, that you would do these other things. I haven't seen them doing it yet, and until they do, I think they're going to continue to be Center-centric.

[End of interview]