

NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT

ORAL HISTORY TRANSCRIPT

MARK K. CRAIG
INTERVIEWED BY SANDRA JOHNSON
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The questions in this transcript were asked during an oral history session with Mark K. Craig. Mr. Craig has made minor modifications to several answers for clarification purposes. As a result, this transcript does not exactly match the audio recording.

JOHNSON: Today is May 2nd, 2006. This oral history session with Mark Craig is a continuation from his earlier sessions on March 24th and April 11th, and is being conducted for the Johnson Space Center Oral History Project in Houston, Texas. The interviewer is Sandra Johnson, assisted by Rebecca Wright.

I want to thank you for joining us again today for a third session. When we stopped our last session, you were beginning to discuss your move to [NASA] Stennis Space Center [Mississippi] in 1995 as Deputy Director under Roy [S.] Estess. So if you could, share with us some of the details of how that move came about and what made you decide to take that position.

CRAIG: Okay, I'd be happy to. I was still a JSC [Johnson Space Center, Houston, Texas] employee, but had been at [NASA] Headquarters [Washington, DC] for about, at that point, a year, year and a half, working for General [John R.] Dailey on the agency's Strategic Plan and Strategic Management System. We'd gotten the Strategic Plan approved and the Strategic Management System in place, so it was pretty clear what's next. My plan was to come back to JSC, although I'd been gone—between Moon-Mars and this strategic stuff for General Dailey—years. I was a little apprehensive, although I knew many people here, of how I would reindex back into JSC.

As that was all playing out in my mind, and I was having discussions with Carolyn [L.] Huntoon, at that time the Center Director, Dick [Richard J.] Wisniewski, who was the Deputy Associate Administrator of the Office of Space Flight, approached me and asked me if I would have any interest in going to Stennis and becoming Deputy Center Director. I certainly was not expecting that opportunity. Didn't know much about Stennis particularly, but knew Roy Estess very well, because he and I had worked on a number of the Red Team, Blue Team, pick-your-color teams under Dan [Daniel S.] Goldin, and really just thought the world of Roy. We'd developed a very nice friendship, which I valued very much.

So when Dick approached me about this—and Roy, on occasion, had approached me about coming to Stennis to be a Division Director or Directorate head there, and I was in the middle of strategic planning stuff for General Dailey, so I wasn't really particularly interested. The timing was right when Dick Wisniewski approached me about going to Stennis to be Deputy Center Director. Talked to Roy about that. He was very encouraged about it, and encouraging in doing it.

I think Roy liked the idea because Stennis' origins were at [NASA] Marshall [Space Flight Center, Huntsville, Alabama]. In fact, for a very long time it was part of Marshall, like [NASA] White Sands [Test Facility, Las Cruces, New Mexico] is a part of JSC. It very much had personnel and relationships with Marshall, but did not have a lot particularly with JSC. I think Roy liked that in my coming, and also liked the fact that I'd spent a lot of time at Headquarters, so I knew the larger NASA and how things worked, as well as all the JSC programs. I believe that's why Roy found it to be an idea he wanted to pursue.

I had visited Stennis once or twice when I was working on Agency strategy, because I would do road trips, trying to help the Centers understand what the strategy was and where we

were trying to go, and to get their input and their views. I'd been to Stennis once or twice on that; knew some of the people there. Gerald [W.] Smith, who was the Deputy Center Director who was leaving NASA, was a longtime friend of mine. He'd been at Marshall and was the Subsystem Manager on the booster separation motors, which was a part of my larger booster separation subsystem. I'd known Gerald for a long time, and he and I were very good friends. He was also very encouraging of my coming there to take his place.

Went to Stennis. Talked to Roy. Seemed like a no-brainer. Great people, great Center. Very different Center. Stennis with 300 civil servants is a lot different than JSC with 3,000, which I liked.

One of the real advantages—and this is one of the selling points Dick Wisniewski had made to me, and I think he was exactly right—when you're Deputy Director at Stennis, you see everything, and you can get a chance to learn everything, and you're involved in everything, whereas at a much larger Center, although you'll see a broad span of what's happening, you won't be nearly in a position to understand it to the level you will at a small Center.

That made sense, and indeed, I did find that to be the case. I learned more about how Centers work. I'd done technical stuff. I'd done program stuff. I'd done program management stuff. I'd done policy stuff. But I'd never done the real business of running an institution. I looked forward to learning that, and Dick said—and he was absolutely right—Stennis is a perfect place to do that, because you do see how everything works, and you have a chance to encounter all the same problems you have at a bigger Center, but you encounter all of them, not just some subset.

That was one very attractive thing about Stennis. The people was the first thing. Roy Estess and the people there were very attractive. The configuration of the Center and the chance

to learn some new things about—to learn things; I had never run a Center before. How that's done was very intriguing.

The other thing I found very intriguing—and it wasn't until I got there I really understood the power of this—Stennis is a very different Center, because it's a NASA Center, but most of the occupants within the gate of that Center work for other federal agencies and companies, the Navy being by far the largest resident of Stennis. Stennis has a very different business model. NASA made money, and far more than half the cost of running this Center was paid by other federal agencies. It was a whole different frame of mind that folks there had, which I really liked. I knew I liked going into it, and I really liked and learned a lot from it.

To me it's a model that has a lot of potential across the government, which still has not been figured out. We also had commercial entities on-site that helped pay for the cost of running the Center. Just having a culture that understands that, business systems in place to be able to deal with that, was a great learning opportunity. And I like to think I helped further that while I was there, because I just think it's so powerful. It's powerful for us in NASA. It's powerful for me as a taxpayer when we as a government find ways to do things like that.

That's a long story of how I got to Stennis and why I went. Once I got there—well, there's one other unique thing about Stennis. There are many unique things, but one that I will bring to your attention that I liked. With a small civil service staff—and especially a small Center that had a history of being part of a bigger Center and had a history, looking further back in time, of almost going out of existence a number of times—the workforce really understood that they have customers. And that if you serve those customers well, you'll probably do pretty well. If you don't, you won't, and in fact, you may go out of existence.

The concept of *customer* was not something that had to be explained to the workforce, or people bludgeoned into doing something for a customer. People got that, and I really liked that. This was a small workforce, very motivated; understood the vicissitudes of life; understood they were a small fish in a very big pond; really worked hard for their customers. I really liked that environment, because it allowed us as a team to figure out ways to—they had very good customer service, whether it was the resident agencies or entities that would come there to test rocket motors. It allowed us to think through how we take that up the next level, to really focus on our customer service.

As a result—not just as a result, but at the same time, several things happened. Dan Goldin was pressing to consolidate NASA capability. He concluded, correctly, that NASA had too many rocket test assets and the nation had too many rocket test assets. Stennis, having been built by Wernher von Braun, was his test place. That was the Marshall big rocket motor test place. That's where all the big Apollo engines were tested. That's where the whole first stage of Apollo was tested, huge. It had tremendous test stands and capability, which was fundamentally underutilized. It had been used to develop Shuttle, but wasn't doing much other than that.

We undertook an aggressive program, which actually had begun before I got there, to look for other test customers. As Dan Goldin wanted to consolidate testing, he instituted the concept of *Lead Center*, and we were named the Lead Center for rocket testing in NASA, which meant that we looked across all of NASA and worked hard to figure out where the best place to test was and then made test assignments. Sometimes it was at Stennis. Sometimes it was at Marshall. Sometimes it was at White Sands. But the team there really took that seriously and really stepped up to being the leader for NASA of rocket test.

We also began very aggressive campaigns to get commercial testing of rocket motors there, which became very successful. Rocketdyne [Propulsion & Power] was developing some engines for their various activities, and those engines, we sold Stennis as the place to test. In fact, we were so successful that Rocketdyne ended up putting a plant there to actually build the rocket engine on Stennis, so the RS-68 is built there today.

We encountered some resistance in that, as you can imagine, across NASA, because the fear was, well, if you're a Lead Center, you're going to make everything lead to you. We really worked hard for that not to be the case. We tried to be good stewards of NASA's test capability, and I think were. We did end up closing down some test facilities at [NASA] Glenn [Research Center at Lewis Field, Cleveland, Ohio] and at Marshall. We ended up moving some assets around the agency so we didn't buy new stuff. I'm very proud of the team and how that was handled.

We also, at that time, fresh from these successes in NASA, looked across the government and proposed to the Department of Defense [DoD] that we create the National Rocket Test alliance, where with the model that we'd used in NASA to try to be good stewards of rocket test assets, we would try to do the same thing for the government. That was something Roy Estess saw very clearly as a need. I then, as his Deputy at that point, that was one of my jobs, was to put this national alliance together, which we did.

I ended up being the founding Chairman of the Board of Directors. With the Army at Redstone Arsenal in Alabama, the Navy out of [Naval Air Weapons Station] China Lake [California], and the Air Force at several of its test sites, we created an alliance where we would meet twice a year, look at the capability across the whole government, and try to direct, as testing became needed by different programs, try to be the entity that would figure, "Well, that test is

best done here. Don't spend your money to develop a new facility over here. There's already one over here," independent of what agency it was in.

We began to have some success with that. Again, it's a good model for how the government ought to work. I'm very, very proud of the team's putting that together and being—you've got to be good with people to make things like that work, and be collegial, and really work to partner and to identify common needs. That was very successful, so I'm very proud of that. That's kind of the large picture of Stennis.

I really enjoyed working with the other agencies, especially the Navy. Developed a very close relationship with them, since they were the biggest customer. The Navy's Oceanographic Office is there. There are more oceanographers at the Stennis Space Center than anywhere else on Earth. The Navy has a huge facility there; has one of its supercomputer complexes—in fact, one of DoD's supercomputer complexes that does the processing of all this oceanographic data, and just hidden away here in southern Mississippi is this amazing oceanography capability. The National Data Buoy Center from NOAA [National Oceanic and Atmospheric Administration] is there. All the big oceangoing data buoys that this nation deploys all over the world are built and maintained at Stennis, and then towed out to the Sea of Japan or wherever. It's just an amazing place.

Toward the end of my time there one of our challenges was that the Navy had decided they wanted to put a SEAL [Sea, Air, and Land, special operations force] base on Stennis, so the SEALs' Riverine Warfare Training Center was built on the Stennis Space Center. Doing all the integration of that building, which our team was so good at, was another great achievement of Stennis during that time. It really is a federal city. I have so many friends from Houston that

would drive to Florida and see the Stennis sign pointing off I-10 [Interstate Highway 10]. “Oh, yeah, that’s where you are. We ought to come up and see you.”

I say, “You ought to come up and see me. You’ll be amazed at what you’d find there.”

It got to the point, one of the—I had met a co-op at the Cape [Canaveral, Florida] from JSC, and was telling her about Stennis, and she got so excited that she brought her whole co-op class over to Stennis, so we set that up as a regular deal, where the JSC co-op class would come over. We’d give them a tour; spend a day on the test stands; go up and touch a Space Shuttle Main Engine; see one fire. It’s a great place to really touch big stuff and see big stuff.

JOHNSON: During that time, the first time ever that guests witnessed the evening test firing of the Shuttle Main Engine in front of a public audience. I think you had 13,000 guests. How did that come about, and what was the reason behind that?

CRAIG: Well, that came about because I insisted on it, frankly. We had been firing big engines there since Apollo, but as engineers and as rocket scientists, we, when we’re ready, we fire the engine. Of course, it’s got to be safe, and it’s got to be tuned and everything else. The Public Affairs Office did have a visitor program to—eventually—let people in to see a firing, but, of course, if you never knew when it was, it was not particularly well attended.

For a long time I’ve been a very firm believer that one of the elements of the power of the space program is people experiencing it. Not reading a press release, not watching a video, but actually experiencing space exploration. That’s why our visitor programs at the Cape are so important, to see launches. Our visitor programs here—for years we wouldn’t let people in these

buildings. But now, it's been a while, but we have catwalks and things, where at least people can come in and experience what this is like, not just see a presentation on it. That's so important.

At Stennis we're sitting on this gold mine. We're firing these huge rocket motors, and we don't share it with people. After some negotiation with our technical team, we finally concluded that there are a couple of times a year we're going to set the time we fire the engine, and that means we build into it ahead of time time to deal with contingencies, time to deal with—and we're not going to fire it if it's not ready to fire, but that may mean it's ready to fire the day before, and we sit there for a day. Well, that's a hard sell to engineers, but I said, "That's what we're going to do, period." I sold that to Headquarters and got their—so they couldn't see it as a problem.

Then once we had the date and the time, the Public Affairs folks would really get the word out that this is what's going to happen. "Be here at this time." We weren't sure how many people we'd get. We thought maybe two, three thousand, the first time, but we hoped to grow it.

The other thing that made that just so obvious, we're right there on I-10, a major east-west corridor in the nation. We're right there, and we fire these giant things and don't invite people in to see it, when the country is driving by our front door every day. We thought, "Well, we've got to do this." We thought we'd have a couple of thousand, and thirteen thousand showed up. It was incredible.

Of course, the technical team was just amazed. They didn't think anybody would show up. After that first one was so successful, even they started to get excited. "Yeah, you know, this is the right thing to do. We ought to do this a couple of times a year, and we ought to really put out the word, in New Orleans [Louisiana] and Baton Rouge [Louisiana], in Jackson [Mississippi], in Florida. Hey, stop by and see it. You're going to see something amazing."

In talking to people that—it was an evening firing, which is very—when an SSME [Space Shuttle Main Engine] is fired, you can be close enough to be safe, but it is in a lot of ways like a launch. The acoustic waves make your clothes vibrate on your body. It's brighter than you can look at, louder than you can bear. You know you're at something happening. Often with these big firings, because the stand is deluged with water for cooling and to suppress acoustics, a giant cloud forms over the stand, and sometimes it comes over and rains then on the—well, that's just a whole other experience that is very memorable to people and really connects them emotionally with exploring space. This night firing, the giant plume comes out of the stand. There are all these weird lights that come out from the exhaust, the way the light filters through the cloud, the sound. It's just a really undescrivable experience.

Talking to people in the crowd, I talked to a couple from Vermont that were coming down I-10. We had put out word at the Mississippi Welcome Center there near the Center, and they actually decided to spend the night, so they were on their way somewhere and said, "You know, we came by during the middle of the day, and this sounded so different and so exciting, we thought we'd just spend the night and see it, and we're so glad we did." Everybody I talked to had stories like that. People that came down from Jackson or from towns in that area said, "You know, I've lived here my whole life. Heard them sometimes in the distance, but we're just thrilled to get a chance to actually come out and see one."

We really did tap into something with that. That may actually be my greatest accomplishment at Stennis. It's the one I'm certainly most proud of, probably. We need to look for things like that. The people of America pay for everything we do, but that's a crass reason to involve them in it. The real reason is it's what we're all about as Americans, and exploring space is what we're all about, and not some poster of exploring space, but actually experiencing

something, seeing something, feeling something. We miss a lot of opportunities to do that, and Stennis was the perfect place to make that happen, for a lot of reasons.

Thanks for bringing that up. [Laughter] I'm very proud of that accomplishment, and I think back on it with such great memories of how much the people enjoyed it and how much our own people enjoyed it. They couldn't believe that 13,000 people would show up to watch it. It validated our own team. "Gosh, this really is important. Gosh, people really do think this is cool."

JOHNSON: Are they still doing it even today?

CRAIG: I don't know. I think so. We don't fire as many SSMEs today, and although the commercial companies don't want people necessarily watching their firing, and they certainly don't want to delay it.

JOHNSON: You mentioned the number of agencies that were at Stennis, and then, of course, the commercial entities, and you said that those relationships worked very well. Were there ever any problems that you remember as far as sharing that testing facility, any issues? When you get that many agencies together, sometimes there's going to be issues on who thinks they're more important.

CRAIG: There had been issues in the past that I think Roy Estess had worked through when he was Deputy Director. He'd been Deputy there before Gerald Smith. The ones that he conveyed to me most often actually were around money. We had an accounting system to deal with how

much it cost to run the Center, and an accounting system at some level then to allocate that cost to the different agencies. But in previous times, as Roy related to me, and this sounds exactly the way it would have happened, NASA was so focused on its mission, it viewed these other agencies as a nuisance.

It didn't have the rigorous—and I'll say rigorous because you can never do it exactly right, but it didn't have a system of charging agencies their share of the operation of the base costs that was seen to be fair. A lot of the early struggles had been how do you set up a system that's transparent enough that people (a) believe they're being more or less charged for something and (b) that it's reasonable. That is, they're getting something back that's worth what they're being charged, and (c) that you're trying to do a good job of managing. You're not just going to let it escalate through the roof.

By the time I got there, that was pretty much all in place. We would meet with the heads of the other agencies several times a year. "Here are the charges for this coming year. Here's how we arrived at them. Here is how they have changed from last year, and here's why they changed." It was transparent. It was collegial. Did people like increases? No. But many of the years we actually decreased the amount of money that we charged the other agencies, because we'd found efficiencies to drive the cost down. Again, because it was in an environment that had customers, and the people on the Center understood, "If we don't do this right, we could be gone." There was a fundamental motivation to figure it out, which is very important.

Some of this goes back to the roots of Stennis, and boy, were there great stories about von Braun setting this place up. He was, of course, in Huntsville, Redstone Arsenal, as the Apollo Program was beginning. Knew he needed a place to test these really big rocket engines. He tested some of them in Huntsville, and they have big test stands there. But by the time you

put five of them together for a Saturn V first stage, you probably need to do it way out. So he was looking for a test area. Looked at several; picked this one.

This was an area on the coast of Mississippi, or just inland from the coast, right on the border with Louisiana, that had several towns on it, actually, that had been logging towns going back to the 1800s. It was concluded, because you needed—Stennis was about the size of [NASA] Kennedy Space Center [Florida], it's 150,000 acres—because you needed this big area, there really was not a place that you could find that didn't have some human habitation. When he selected this area, he went to Senator John [C.] Stennis, who was from Mississippi, a very senior senator, very powerful senator, and told the senator, "This is where I think it needs to be."

It meant actually moving towns. Not a house, not a trailer, but towns; several towns, actually. There are great stories of Senator Stennis coming to these towns, getting up in the back of a pickup, and telling the people, "For the good of America, for the good of your grandchildren, you need to move. Your whole town needs to move." And people stepped up to that—they gave up their land, and it became federal land—and moved to other places at great emotional and fiscal impact to themselves and their families, because they—people are very rooted to their land. They'd been there a long time and were very emotionally attached to it.

They moved. Stennis is built. All these giant engines are tested. Apollo Program, great. Then the Apollo Program ends, and the nation decides, well, that's the end of that. There was an effort, a very focused effort, at the end of the—we don't need Stennis anymore. We're just going to close it. Well, Senator Stennis, who was still a very senior senator, basically said, "The hell you say. Ten years ago we just told people this was the future of the country, and they left. Now we're just going to walk away from it? Think again."

Senator Stennis and others that were the fathers and mothers of this current Stennis Space Center said, “We’ve got to look for other federal capability we can move in here to really productively use this land, not just kind of turn it into a corn field or something.” A number of things were undertaken, and that’s how the Navy got there. That’s how NOAA got there, and some other agencies, and that was the beginning of Stennis. NASA was told, “You’re not leaving, period, and you’re in charge.” That was the beginning.

From that, people in that area know that “stuff” can happen. They came that close to going away, and it can happen again. Really it wasn’t until the Shuttle engines began testing there that things took somewhat of an upswing. Going out of existence was not just a concept to people. They felt it, that you really could. That always to me was the deep root in the history of this place that empowered the people and caused them to be a little more realistic about the vicissitudes of life. This was not an entitlement program. That’s what drove a lot of—I think it drove their outlook. It drove their customer focus. It drove their energy.

That also created a very interesting situation, in that we had a giant buffer zone around Stennis. It was not federal land, but as a part of this original setup there was this central federal land, and then there was this huge buffer zone around it, like a five-mile-radius circle, that was not federal land, but the federal government encumbered it. You could not build a habitable structure on that land. That was one of our principal battles at Stennis. There was always pressure to encroach in that buffer zone and build something. There’s a lot of growth along the Gulf Coast in tourism and other things, so there was always pressure to use that land for something.

Our attorneys were continually trying to—and that was part of our relationships with the larger community, was to tell people how precious this buffer zone is, because you couldn’t

reconstruct it. You couldn't do another Stennis today anywhere in the country to test these big rocket engines. The day the country loses that is the day we've lost the ability to test big rockets, so it's strategically extremely important.

But again, it has impacts on people's lives. How do you keep good relations with the community? How do you maintain the defense of the buffer zone and the land itself? And frankly, how do you make sure you're using the land so it's worth this pain to people? Not just "Well, it's federal, so get over it." It needs to be used effectively for the good of the country and the good of the community.

The day it's not is the day it ought to be shut down and given back to the people, because there are still plats in Stennis. Graveyards were actually moved. That's how much moving meant to these towns. But people, individual families, can tell you exactly where their house was, exactly where their grandfather's house was; tell you about the memory. "Here's where the street was. I remember sitting on my grandmother's porch." It's a very visceral, personal experience for a whole lot of people in that area. Stennis, more so than any other place I've ever been, is just viscerally tied into the community, which creates its own set of management challenges and responsibilities.

JOHNSON: You also represented NASA on the Executive Management Council for the Mississippi Space Commerce Initiative during that time. What did that entail?

CRAIG: Mississippi was trying to be aggressive in figuring out how to take advantage of the fact that the Stennis Space Center was there, not only NASA but the Navy and other things. Many of us believed, as I still believe, that commercial activity in space is inevitable. It's important, and

NASA needs to be part of helping make that happen, or at least make sure we're not in the way so it doesn't happen. The State of Mississippi was trying to figure out where this is going, how it could take advantage of not only its federal assets, but also its academic, the great universities that are in this state, how we could be married up in a way to anticipate this coming so it would have some advantages for the state.

Senator [C. Trent] Lott for much of that time was the Majority Leader in the Senate, a very powerful position. Senator [Thad] Cochran was the head of the Appropriations Committee. The two senators from Mississippi were very powerfully and strategically placed. It was in that environment, figuring out how we could make sure Mississippi took advantage of the evolving situation and its political leadership positions.

JOHNSON: Also during that time Stennis was designated the head Center for activities surrounding remote sensing. Do you have any memories of that?

CRAIG: Very vividly. We were Lead Center for rocket testing and for commercial remote sensing. NASA, in its history, has a very robust scientific remote sensing capability, mainly at [NASA] Goddard [Space Flight Center, Greenbelt, Maryland] and [NASA] JPL [Jet Propulsion Laboratory, Pasadena, California] for Earth.

Back to our previous discussion about space commerce, it was recognized that Earth observation would probably be—communication had been one of the early commercial activities of space, comsats [communication satellites] and all that stuff. It was recognized that most likely, and that was at that time a nascent commercial remote sensing, where you actually use space assets to look at the Earth and sell what you see. The French were getting into that with

Spot Image. There were very nascent U.S. companies starting to get into that, some of them related to big aerospace firms, some of them really not, just start-ups.

Dan Goldin was personally very interested in that, as we were at Stennis. We saw that as a real potential of the future. Again, not that NASA would do it, but we ought to try to enable it as best we could. We had been doing this work for some time. We had set up capabilities, laboratories where companies and universities could come and then work with us on our Earth-observing data to learn how to do it, to figure out where some business models, business opportunities were. Then we actually had a kind of an embryo bed there, where the companies could work, get a critical mass, figure out what their products and services were going to be, and then hopefully grow and leave.

We, the folks at Stennis, again with this common theme of customer and the bigger picture, were very good at encouraging commercial remote sensing, helping companies get started, build relationships, help them find people and capabilities and tools, help them develop tools. But the whole idea, not that they'd be ours, but that they'd be theirs, and they'd go out and grow a business, which I think is exactly the right model for the role of government. Never be confused about the fact that you're not going to do it yourself.

First order of business is do no harm. Make sure you're not going to screw somebody up in doing it. But second order of business is, now what within our mission can we do to help, which means listening. Oftentimes I'd had the experience where we would go in and tell companies—not we, Stennis, but we, larger NASA—would go in and tell companies how they ought to do it to have a good business. Well, we're about as clueless about that as we are about cheese on the Moon. It really does take the right worldview, the right framework and

motivations, to truly help commercial activities get started, and the folks at Stennis were just great at that.

They had been doing that for some time. We grew it. We started to marry with the Mississippi Space Commerce Initiative, because that looked like a great area to make Mississippi the area code you call to get data about the Earth, because there was us, NASA, trying to help these commercial entities. There were some huge customers for that data, like the Navy, there already, so start to try to marry that up. And we were very effective in that.

JOHNSON: In 2001 Roy Estess left to come here to be the Acting Director at JSC, and then you took his place as the Acting Director at Stennis. What were the differences as far as your duties during that time period?

CRAIG: I didn't have me working for me. [Laughter] I've been in that situation several times in my life, as have many others, where you're the acting something, and it sounds so obvious that it kind of sounds stupid, but it's not. Roy and I, I just love working for Roy Estess. He became a very close friend and a great mentor to me, so working with Roy as the management team at Stennis was (a) a great learning experience and (b) just a wonderful opportunity and an experience I will always value and treasure.

When Roy left, I had no concerns about running the Center, because Roy is such a—as a manager, he really involves his Deputy, and he made it clear, “You are me.” It wasn't “I'll do this, and you do that.” It's, “We're going to manage this Center together,” which I really appreciated. We just divvied everything up, going to launches, being on the management team for launches. He'd do one. I'd do one. He'd do one. I'd do one. Everything he did, I did, so it

was not “Gosh, here’s this whole new realm of activity and I’m clueless what to do.” I’d been doing it. I had no concerns about that.

It was just the fact there had been two people doing it, and now there was one. There was a great management team there, so I—and it worked out well, I think—also then started spreading what I had been doing as Deputy to other folks, both because I needed the help, and to give them a chance to see what this echelon of management did. I think it worked out, worked out very well. There was a lot happening at that time, with Mr. Goldin, and then Mr. [Sean] O’Keefe coming in, so there were some not normal activities and loads during that period, but I think we did okay.

JOHNSON: Well, in [19]’99 you had the honor of being the keynote speaker at the Third United Nations Conference on the [Exploration and] Peaceful Uses of Outer Space. Can you talk about that experience?

CRAIG: That really was an honor and an experience. I had, back in my working for General Dailey and working on the NASA Strategic Plan and setting up the Strategic Management System, and then doing that for the Human Exploration and Development of Space Strategic Enterprise, and even going back further, in my stint heading up the Space Exploration Initiative—had come to the conclusion that NASA human space flight has a tremendous responsibility and also a tremendous opportunity to provide more value to this nation.

Not just build spaceships and tell PAO [Public Affairs Office] to explain them to people, but actually understand the market in which we live—because we do live in a market; we compete for money and resources and ideas and people—to better understand the market in

which we live as NASA human space flight, and figure out ways to better connect with that market and better deliver value in that market. I came to conclude, and still very fervently believe, that support and resource come out of delivering value.

Until we realize that and really deliberately understand it and use the tools that exist in the larger world to do that, we're not going to be as responsible as we could be to the taxpayer, and we're certainly not going to get the resource and support we could get.

Having developed the framework to do that, both in the Human Exploration and Development of Space Enterprise and then NASA, there were people who, I think, appreciated what I had done and agreed with this point of view. I was not infrequently called to speak to different groups, unfortunately, usually outside of NASA. And this was one of those. I've also, through—I'm in the International Academy of Astronautics [IAA]. I've been elected to that some time ago, which is a player in the international arena of space activities. I have made a lot of friends and acquaintances in that larger international arena.

As this conference was put together, speakers and fora were being assembled to address space in the largest possible context, and it was through some people that I had known in IAA and at International Space University who knew of these views that I had and the thinking I'd done on that, and so invited me to speak on those ideas, which I was very honored to do and very pleased to do in a larger forum. I think we, the U.S. human space flight program, have that challenge; I think our international colleagues have the same challenge. Although, frankly, I think they've stepped up to it better than we have. But it's still a nice opportunity to share ideas.

This is an arena in which we do not—we don't even think about it much, much less share ideas, and I think we're the worse for that. I've always been open to opportunities to speak on this and have dialogue with people about this. It does make a difference over time, I think.

The younger generation today in human space flight in NASA, I think, understands this, not because of anything any of us have done. Their life path and career path have led them to this understanding. I'm very hopeful about the future, but where we are today is not where we should be, and we're suffering for that, I think, and we'll continue to suffer for that.

JOHNSON: In 2002 you returned to JSC. Was there any thought of staying at Stennis at that time?

CRAIG: I would have stayed at Stennis. When I went to Stennis, I was single. I, the first year I was there, married a woman that I had known here in Houston, and she was nice and gracious enough to move there with me, and enjoyed it, I think; in fact, I know enjoyed it quite a bit. We ended up having two children while we were there, Katie and Claire.

I lived initially in Slidell, Louisiana. Ended up moving to Picayune, Mississippi, a small town just north of the Center, right at the edge of the buffer zone, an old logging town. A quintessential American small-town experience, although it's now the outer suburb of New Orleans in some ways. It was the main street, the Baptist Church on one side of the street, the Catholic Church on the other side of the street, and the high school right next door.

We lived in a house built in the 1890s that was four blocks from that, on an acre of land with a stream in the back and hundred-year-old camellias, and two wonderful, quintessential southern women living across the street from us, who just adopted our family. I was traveling quite a bit at that time, because Roy was gone, and these two women, a woman in her eighties and her daughter in her sixties, who lived together, just adopted my wife and our little girls. They're now our grandparents. We have no choice about this.

I cannot describe what a wonderful experience we had in Picayune, Mississippi, the people, the place, the history, everything. I also had developed very good friends in New Orleans in a different social environment, people I'd met at a restaurant called Galatoire's, which is one of the old New Orleans restaurants.

I'm sorry to go so long into this, but it really gives you a window into our experience in that area. I was on the board of the Boy Scouts in the New Orleans area and would go in once a month for a board meeting. This restaurant had been one of my father's favorite restaurants when we lived in New Orleans as a kid. It's an old, hundred-year-old, restaurant. It's a restaurant where every family has their own waiter. You don't have a waiter based on anything but your family.

I just love this restaurant, and so after I'd go to the board meeting, I'd stop there for lunch on the way back out to the Center, and it was on Fridays. Well, I'd done that for several months, and I'd noticed this table of men, obviously having a very good time, and they just looked like very nice people. I hadn't really thought much about it.

After about four or five months of this, one of them came over to me and introduced himself and said, "Clearly there's something wrong with you."

I said, "I beg your pardon?"

"Well, here you are on Friday at Galatoire's, eating by yourself. What's the matter with you?" So he invited me to come over and join them, which I did. They've ended up becoming very good friends.

It turned out that the man who came over to introduce himself—this is just beyond belief to me—went to the same high school in West Texas I went to, Midland High School, and dated my high school sweetheart's aunt. Went to the University of Texas [Austin, Texas] and then

moved to New Orleans and was in the oil business; had been there forever. This group of men has been having lunch at Galatoire's every Friday since 1957. They're a fixture, I guess one could say. But they're just these wonderful people, the old New Orleanian, very—very New Orleanian; I'm going to leave it at that. They invited me into their circle, and they've become very good friends. I still go back over there often for that. That was the New Orleans experience, plus I'd been on a Mardi Gras crew and am on a Mardi Gras crew that I had joined when I was here in Houston before.

There were some deep and important connections to me to the New Orleans world. Very different than the Picayune world. We had those two worlds at least that were very, very special to our family, and will make our experience there something we will never forget, for a lot of reasons.

At any rate, back in 2002, Mr. O'Keefe came in. He had a model of management. He wanted Naval Flag Officers in senior management positions, and I was not a Naval Flag Officer. He said, "What else would you like to do?"

I said, "Well, at some point our plan as a family was to come back to Texas," because my wife is from Houston. We really wanted our daughters to be from Texas.

He said, "Well, go back to JSC."

I said, "Fine."

I had met General [Jefferson D. "Beak"] Howell [Jr.]. When Mr. O'Keefe first came in, we had several management retreats where the Center Directors would go off, so as General Howell was named here to replace Roy, Roy would bring him along to these retreats to introduce, "Here's NASA," because he, having come from the Marines, didn't know anything

about NASA particularly. I'd met Beak through those different meetings; knew him well. Talked to him, and he was excited for me to come back.

We talked about what the job would be here and put it at the Associate Director level to work. We ended up calling it Space Commerce and Development, because that really is an important dimension of the value space exploration has. I came back to work those things, again, in the vein of what I'd seen as deficiencies and where we had a lot of opportunities. I was excited (a) to get back to Texas and (b) to work for General Howell and (c) to work on space development and commerce. That's how all that happened.

JOHNSON: Shortly after you returned, the [Space Shuttle] *Columbia* [STS-107] accident happened. Would you like to share some of your memories of what you were doing at that time when you heard of the accident and right afterwards?

CRAIG: Well, my wife and I were packing the car to go back to New Orleans to see our "grandmothers" in Picayune. Her sister called her. I'd gone to the gas station to gas up, and her sister called her and said, "Have you heard about what's happening?" When I got home, she told me, and we turned on the TV. All that was available on the TV at that point was the image coming across the sky, so it was pretty clear what had happened by looking at the image. Didn't know what the ultimate source was, obviously, but what had happened and how catastrophic it was. Very difficult. Very difficult.

I came out to the Center. Since I wasn't really involved programmatically in anything, didn't have much specific to do around the accident. I was very concerned how we would communicate this, again, in the context of value. I don't mean this at all to sound morbid, but I

think loss of life under these circumstances, as we experienced also in [Space Shuttle] *Challenger* [STS 51-L accident] and Apollo [1, AS-204, fire], validates the importance of this business. This is really dangerous, but it's really important. It's so important that these individuals, these heroes, they knew it was dangerous, and they gave up their lives. They were willing to risk their lives to do this.

We should do everything we possibly can so that these don't happen, but it is why we do this. Again, back to value, it frustrates me. What we do ought to be as valuable as it can possibly be to the nation and to humankind. And that takes deliberate effort. Everything we don't do to understand our value to the nation and everything we don't do to deliver that value, in a way, almost demeans, to me, the sacrifice of these brave people that do this. It just makes me all the more frustrated, frankly, because it *is* that important. It could be truly more valuable. We're so fortunate that we have people that are willing to make those sacrifices and do these things, who are truly heroes.

JOHNSON: In January of 2004 the current President [George W.] Bush made his announcement of going to Moon and Mars, and right after that in March you made a presentation to the NASA Cost Analysis Symposium, "Creating Sustainability for the President's Vision for Space Exploration." Again, the theme is the value to the nation and how we need to let marketing lead that. Maybe you could explain some more of that and how you were talking about using "story" as a strategy.

CRAIG: Yes. Having gone through the first [President George H. W.] Bush experience of exploration and having lived through its failure, and having that been the beginning of these

ideas about what we really have to do to make this sustainable, as it came out again, I was asked, by people who were aware of the work I'd tried to do to figure this out, to talk to different groups.

The costing community is a community I'd worked with quite a bit back in the first Moon-Mars, because cost is pretty important. Some of the folks I knew in that community asked me to speak to them about what are your thoughts about—we all say “sustainable.” But—it's unfortunate—I haven't found much real thought about that other than just, “Yeah,” or, “It will,” or whatever. It takes deliberate action and effort. So I did talk about that.

[Rear] Admiral [Craig E.] Steidle, the first AA [Associate Administrator] for Exploration [Systems], put together an Exploration Conference [Space Exploration Conference], which is going to be more or less a yearly conference. I ended up writing a paper for that on sustainability, to try to lay out a framework for how this can be made sustainable. Again, this—although it includes robotic exploration, which I do believe is fundamentally sustainable, because science is adequate to get the level of funding you need—this really does address human exploration.

Frankly, in talking about these things, I am under no delusions that—these ideas could be wrong. I really think the more important thing is to try to get ideas out and get a larger community of people carefully thinking about these things, and actually then building them, whatever “them” ends up being, into how we do business, because until that happens, it isn't going to happen. As long as it's viewed as Public Affairs' job to just explain it better, it's a problem. As long as that's the case, NASA human space flight is not sustainable in my opinion.

One of the red flags I've found, and I know I talked about it to the cost guys, and I've, in most other talks I've made tried to say, “Let me give you some red flags. When you hear these

words in a conversation, your ears ought to perk up, and you ought to think about, ‘We’ve got a problem here.’”

One of those, to me, one of the most fundamental of those red flags, is outreach. We use, as a culture, and I invite you to listen for the context and the content of how we use the word *outreach*. We use it to describe anything in which we talk to somebody else. We don’t even particularly—and this is the danger of it—we don’t really do it in a way that we understand the outcome we want. We don’t do it in a way that we really shape what we do to produce an outcome.

We just say it, and it’s like a magical balm. “Well, we must be doing okay.” “Well, we must be connecting with America.” Or I’ve had people tell me, “Well, that’s how we deliver value.” No, that’s how we talk, and often, if you listen to us, we’re not even talking in a way that relates to the audience we’re talking to. We’re talking in a way *we* are comfortable with, and then when they look funny at us, we go, “Well, what’s the matter with you people?”

Outreach undermines many of the efforts we need to have to understand and deliver value, to me, because it’s a balm. If we’ve got somebody in charge of it, we must be doing okay. When you look at how we actually do it—and it’s so frustrating, because there are really smart, really hardworking people working in outreach in these areas, but they haven’t been given the context to do it in a way that it really delivers value. It’s just using people, using them up, to do things that at the end of the day aren’t as useful as they could be, and these are very motivated, smart, energetic people.

We ought to be using them—and that, to me, is the job of management, create the context so that the work that’s done gets you someplace. As management creates a context—or worse, doesn’t create a context, just cuts people loose to expend resource and energy and time and

passion—and then it doesn't get us anywhere, that's a problem. That, to me, is what outreach is the poster child for.

If you listen to every time you hear the word *outreach*, and see how it's done, and then think about it in a larger context of really understanding our value and really causing us to change what we do, that's another hallmark. If we say we're delivering value, then it has got to change what we do, not just how we talk. We can't build the Space Station and then make speeches and posters about how wonderful it is if we haven't done anything on Space Station to deliver value. It's a shame.

To that cost group and others, I've always tried to—"Here are my ideas on what the answers are. I'm under no delusion to think they're correct, but it is your responsibility, whoever you are in our culture, to help get this figured out and then cause us to do something. If this is a platform to help you do that, if what I say makes you mad and you go off and figure out what the right answer is, that is great. But figure out what it is in the real context of delivering value, not making speeches, not making us feel better, not isolating us from our customers, not making sure we don't even know who our customers are," which is often what we do.

JOHNSON: And as you mentioned in the presentation, its value as the nation perceives it, not the way NASA perceives it.

CRAIG: That's correct. If it's value that's going to cause us to be sustainable, it has to be value as our customers see it. People get that. If it's my sense of value, and I just tell you, "You have to have it," well, you're not going to be particularly compelled to do anything or interested in it.

But yet, in my view, that is often what we do. We understand what our value is, so just, “Here it is. Shut up.”

I have found over the years—and I used to wonder, “Why is this?” I don’t want to oversay this, but Public Affairs is often a not very liked organization, and I used to think, “Well, it’s just because the professionalism of our communication professionals is different than engineers. It takes a different part of the brain. It takes a different worldview, and engineers just aren’t comfortable with that.” And I do believe that’s true.

But at a deeper level, I’ve concluded for some time, it’s because it’s really—I’ve never heard anybody say this, but we act this way. The fact that we don’t have as much support as we need is Public Affairs’ fault. We’re the engineers and we build this stuff. If Public Affairs just explained it better, we’d have all the support we need. Again, it’s the fundamental notion, I don’t have to shape what I do to deliver value or even understand value. I just have to explain it better, because you’d get it. I get it. If Public Affairs told the story just right, if they used better words, if they had better pictures, people would get how wonderful this piece of hardware up there is, and we’d have all the support we need.

I do believe that’s how many people feel. That is not true. You actually have to shape what you do to deliver value, and Public Affairs and communication is certainly a part of that, but it’s step two, not step one.

Now, your question about “story.” I have—curiously, to me, looking back on my career, and seem to be known for this—have been involved in strategy for a long time, strategic plans for enterprises, the agency’s Strategic Plan. I just finished a strategic plan for the American Astronautical Society of which I am now President. Somehow I’m tagged with this, and that’s okay. I actually like strategy. There are many misconceptions about what strategy is.

I'm not sure where you get the quote, but it is very much how I view strategy. Strategy is a story. It's a story because it has to connect the dots. It can't just be dot one, dot two, dot three. Story is a way to connect dots. Story is a way to convey to other people a deeper meaning in something, rather than just listing the dots. So a good strategy is a good story, and if you can't articulate it as a story, it's not really a strategy, because story carries with it—you don't have to say everything. It triggers things in the mind that flesh out and make real in ways that you could never do with a bunch of dots or words.

Good strategy is ultimately a story, but it can't be a standalone story. It's got to be a story in a context. Organizations and people exist in an environment, and they're sustainable, and strategies will do well, if that story deals with the environment in a very effective way.

So it can't just be a story, it's got to be a story that works in a context. Very simply put. Strategy is not ultimately goals, objectives, visions; all the structural things that many—not just NASA, but many people leap to right away. That isn't it. At the end of the day, it's a story, and it's an intellectual story, but once you've done that and it works in the context, or you hope it does; you shape it to work in a context you've listened to. It's a context you have to listen to.

We talk about listening to the hardware all the time in the engineering world. "Well, the hardware is telling us something." Well, our environment is telling us something, too. Listening to the environment, carefully thinking about it, and doing research where one needs to, and then putting together a story in that context to do whatever you ultimately want to do. Thrive is ultimately what any organization wants to do. That's how strategy really works.

Once you have that, you can then articulate it to people, because it's a story. It's both the construct in which you put strategy together, and then once you have it, it's a way to get people

on board and hopefully excited about it, because it is a story. It's not a bunch of dots. It's not forty-eight spacecraft, it's a story.

That's what we've tried to put in NASA's strategy at different times, things like "Follow the Water" with Mars. That's not quite a full strategy, but it's close, and it's a story. It's one you can get, and it's one that can shape, better shape, all kinds of things that one does. That's a small example of what a real strategy is.

JOHNSON: Do you feel NASA is moving into that frame?

CRAIG: No. No, I don't, although I will say this, having lived through the first Moon-Mars, this Vision for Space Exploration is a much more robust strategic framework for NASA, and is one we have desperately needed. I think Mr. O'Keefe deserves all kind of credit after *Columbia* and, of course, the CAIB [*Columbia* Accident Investigation Board] itself, for seeing this, not just limiting themselves to *Columbia*, but looking in the context. The CAIB saw it. O'Keefe heard it, and he had the influence in the White House really to step up at the highest levels and say, "We need a strategy. Where are we going? What is this about?"

If we don't have that—again, back to our previous point about loss of life—we're not taking this as seriously as we need to to make it worth losing one's life. I think Mr. O'Keefe deserves all kinds of credit for that. He is right on the money with that, and the White House deserves credit for stepping up, because it is not politically the easiest thing to do, and it hasn't been and won't be. I think we have a tremendous framework in the Vision for Space Exploration, and shame on us if we're not using that for all of its potential.

I heard Dr. [John H.] Marburger [III], the President's Science Advisor, give a speech at our American Astronautical Society meeting several weeks ago, and he laid out the vision as a story. What it's really about, it is really bringing—and he said it in several different ways, and I won't say it as well as he did—but it's fundamentally about bringing the solar system into our activities here on Earth. That's what exploration is all about. Into our economic activities, into our philosophical—he was talking to a group of scientists. It's bringing the material trapped in orbit around the sun into our life here on Earth.

Well, that is exactly what it's all about, and that's a story. That's just not about building a CLV [Crew Launch Vehicle] and a CEV [Crew Exploration Vehicle]. That's a story that I think people would hear and go, "Oh, yeah." That's a story and a strategy that we ought to step up to. We haven't yet, and I hope we do, but that's a real strategy.

That's why I'm very encouraged about the Vision for Space Exploration. I really do think it is a robust strategic framework for NASA that we desperately need. I tend to be "the glass is half full" and kind of naïve, but I think it will survive change of administration. We may have to change the name; may have to paint it purple. But if we, NASA, if we, the U.S., are going to send astronauts into space, we have got to have something like this. I think it's just right on the money as to what it needs to be.

Now we, NASA, have got to step up and implement it in its fullest grandeur. Not on day one, but we need to have a strategy, or an approach to implementing the vision, which I haven't seen yet. We're concentrating on launch vehicles, on CEVs. We even have the order out of order. We're doing the transportation devices, and then we're going to figure out what we're going to do at the destination. The destination is the business end of what's going to make this vision sustainable.

I think strategically that's a mistake we, NASA, have made for a very long time. We concentrate on the transportation, fundamentally, and we have not put an equal or an appropriate balance, in my view, on the destination. The theory has been, and it's still, I think, prevalent. If you get the cost of the transportation down, if it costs nothing to get to orbit, everybody will go, and then you'll find all kinds of great stuff. Well, the trouble is, if there's nothing of value to do there, then no cost to get there is too much. The flip side is if there is something that's beyond value at the destination, the transportation cost is immaterial.

We don't know how that's going to sort itself out over time, but I think we have done strategically a horrible job, because we put all our eggs—for the most part; not quite true—but we put an excessive emphasis on the transportation and no, or very little, emphasis on the destination. It's a numerator and a denominator. It's two parts of the equation. By concentrating on one, we've robbed the richness of where this could go, and have not done all we could to support things that will find that balance, which gets into commercial space, but we just love rockets. I mean, we just love them. [Laughter] We absolutely love them. And I love rockets, too, but the trouble is if you don't think about the destination some, you're not going to have rockets. So that frustrates me.

Again, I think if we really concentrated on value, it would drive us to different places, and it would drive us to things we have not done. Therefore it would be hard, because there are certainly constituencies and stovepipes and all kinds of things around the way it's set up now. We have got to get past that. Again, if you're doing it around value, that's harder to argue against, real, listened-to, perceived value of the larger customer base, not, "Well, I think we need" something. You get the gist of my framework here. It has lots of manifestations.

JOHNSON: After that time period and you'd decided to retire from NASA in 2005, what led to your decision to do that at that time?

CRAIG: It actually was emotional, which I think is good. It wasn't a thought process so much. I had been, through a curious set of circumstances, asked to work on the NASA strategy. Mr. O'Keefe had set up an organization under Charles Elachi and Mary [E.] Kicza, Charles being the Director of JPL, and Mary at that time was like the number three person in NASA. Mr. O'Keefe wanted a strategic framework to lay out where we go and how we get there, and he asked Charles and Mary to set that up.

They began to collect around them some people to help do this, and I got a rather curious phone call one day from a longtime friend at JPL that said, "You know, this is happening. Shouldn't somebody from JSC be involved?"

I said, "Yeah."

"Well, would you come to this meeting?"

So I did, and it was a retreat. It was, again, a group of very hardworking, very dedicated people laying out something that, based on our history, to me didn't make sense, because we'd tried a lot of these things before, and some failed miserably, and some worked okay. But they had not really picked up on a framework within which strategy should be done, as Charles' and Mary's team. I went to the retreat. Shared my views of things, and they were readily accepted, and I was asked to be a part of this team to lay this thing out.

So, started down that path. This was now my second endeavor of agency-level strategy. In some ways it was overturning my previous strategy of, at that point, twelve years before, the Strategic Enterprises, which I still thought were a key strategic element around value. That was

okay. Strategy should always be adaptive. In fact, it's got to be adaptive, because it's about the environment, and the environment changes.

But it just—you know, I'd done everything I ever wanted to do in NASA. I walked on the launch pad. I've done the zero-G airplane. I've managed programs. I've been a Center Director. One NASA strategy I was very proud of, so now here's another one. It just kind of emotionally—I'm ready for something new. It's like *Groundhog Day* [1993, Columbia Pictures Corporation]. [Laughter] You're just trapped in this reality that's coming back and back and back. So I really did, just emotionally I got to the point, and talked with my wife and said, "I just need to learn some new things, do something different."

It was not a decision so much. It wasn't any kind of an intellectual thing. It was a feeling. It's just time. At that point I'd been here thirty-eight years, and I'm fifty-seven. I'm ready for something new.

I had worked, in the first Moon-Mars efforts, a lot with JPL when I was the Deputy Manager of the Mars Rover Sample Return Project. One of the people I had met in those endeavors was a guy named John [C.] Niehoff, who was an SAIC [Science Applications International Corporation] employee and probably one of the smartest people I have ever met. He can do interplanetary trajectories in his head, and I don't think I'm exaggerating. He can design lander spacecraft in his head. He's just a very smart engineer. He's also a wonderful gentleman; just one of the nicest people you would ever meet.

So John and I had kept up over the years, so I'd always thought a lot of SAIC from that. Also Neil [B.] Hutchinson, who I had worked for in Space Station 1 back in [19]'84, '85, '86, had left NASA when Station moved to Reston [Virginia] and had gone to work for Rockwell [International Corporation] and then various places, but he was at SAIC. Neil and I have always

been very close, and I really have always respected Neil. So when I decided it was time for something different, I was, “Well, how different do I want this to be?” So I thought, “Well, at least I’ll talk to SAIC and see if they have any interest in me.”

Turns out they did, so here I am. It wasn’t painful. It wasn’t agonizing. So many of my friends, I hear these stories, “You know, I’ve agonized over this. My wife, we agonized over this,” and I know it can, because it’s such a big change in your life, especially since my entire adult life had been spent with NASA, so, my identity is NASA. But it really wasn’t agonizing. It just felt right emotionally. That was a year ago, and I’m learning a lot, so it still feels right emotionally. I’m close enough that I still am hopefully contributing to—now as a contractor—this grand endeavor, and still here with all my friends and colleagues.

JOHNSON: And back in the area of safety, as you were.

CRAIG: We have other things, though. We do a lot of the really high end exploration architecture work, which was the other piece of SAIC that I’d seen. In fact, SAIC had worked for me in the first Moon-Mars, doing this high-end kind of exploration architecture. So those areas and areas where I have insights, I’m probably more valuable. The S&MA [Safety and Mission Assurance] stuff, technically, I’ve never really been involved in. I understand the larger context of programs and program management. That’s a big chunk of our work here, so I’m learning more about it, but it’s certainly not anything I contribute to very much yet.

JOHNSON: In the last interview you mentioned that you considered your recommendation to General Dailey of creating the Strategic Enterprises to be one of your proudest achievements.

Are there any other particular accomplishments in your career that you would consider significant?

CRAIG: Well, the public firing at Stennis, I'm really proud of that. Those are two specifics, and I guess there are some other activities. Being on the start-up team for Space Shuttle in [19]'69, Space Station in '83, Moon-Mars in '89. One person to be on the start-up for three big things in human space flight, I find curious. I'm proud of it, I guess, but that has nothing to do with me. It's just the course of one's life led one to these different experiences.

I'm proud of the SRB [solid rocket booster] separation system on the Shuttle that I led the development of. It's a very complicated system, very unusual. It's not a typical subsystem like the power or propulsion. And it involved working with Marshall very closely. So I'm proud of that.

I'm proud of our math model in propellant slosh we developed for an RTLS [return to launch site] abort, which has never occurred and [knocks on wood] pray to God never will. There's a tremendous tool that's completely unused, which I'm proud of that, too. [Laughs]

Laying out strategies for Moon and Mars, I did a lot of that work in the first Moon-Mars, and I'm proud of that.

I guess ultimately I'm probably most proud not of a specific event, but just of the wonderful friendships and relationships I have, have had and have, in this country, in other countries. To have that many good friends and colleagues who have taught me a lot, I'm very proud of that. What a great gift that is to me personally. This is a great community of people, space. It's pretty small. It's amazing. It's almost as small as Galatoire's. [Laughter] And almost as fun.

JOHNSON: What would you consider to be your biggest challenge over your career?

CRAIG: Change. Good question. You know, they were different. Being Subsystem Manager for the staging system, that was a huge challenge. You're just thrown into it, and you just do it. That was a huge challenge. Putting together the first Moon-Mars architectures and things, and then talking to the Vice President about them. Gee, that was a huge challenge. Developing NASA's strategy.

It's funny. They get less focused and probably less technical with time, or at least they have in my career, and the further away they get from the technical, in a way, the more challenging they are, because you're not necessarily working in a community of people that have done it. Not that any of us has ever done any of this before, but working on it, even on a separation system—technical problem; very complicated technical problem, a lot of different aspects to it, but a technical problem—in a community of people that if you're having a problem, you can sit down and, "I don't know what to do about this."

Then you get up into strategic stuff, or you get up into this überstrategic stuff of value and of real—there's not much of a community of people to talk to there. I've always found that discussion and diversity of views leads to a much more robust solution. When a community of people can talk through something, people that are different, I've always found one arrives at a better solution. Sometimes it's arduous and painful to get there, but it's a better solution. In the technical world, that was much easier to effect than in the more strategic world, although strategy has to come out of discussion.

One of the things, I guess, is a part of—because it's got to be implemented. It can't just be, "Here it is, buster. Go make it happen." There's buy-in. That was part of the thing with General Dailey, which he was insistent on and so right, was we were the facilitators to get a strategy. Now, one has to have one in mind to facilitate it, but it's that delicate balance between having enough there for people to begin to congregate around and then change, as opposed to, "Here it is. Shut up."

That's a very delicate balance, and it worked so well under General Dailey because he was so good at that kind of thing. But you've got to know what you're doing, both intellectually, to know what it is, and then from a relational standpoint, to make it happen. That was very much a part of that strategy was getting all the AAs and all the Center Directors to "Yeah, that's right," so that at the end of the day, it's their strategy, because it's got to be.

There is a community in that, but the community of figuring out how to do that and what the balance is between the intellectual content initially and where you end up, that's less of a community, I've found. Especially, again, this value dimension, there are just so few people in NASA to talk to about that. Turns out there are lots of people in other places, because that's how companies live or die, so they understand this. But in NASA it's been a struggle.

JOHNSON: Is there anything that we haven't talked about? In your other interviews that I've read and in this one, you mention a lot of things, a lot of people and how important those relationships are to you. If there are any people you haven't mentioned or anything you'd like to speak about.

CRAIG: I'm sure there are other people I haven't mentioned, and other things to speak about. I'm counting on—I thought your suggestion from several times ago to get all this in front of me and

then look at it, and I'll see things I've missed or connections I wasn't very good at making, and people. That's probably the best way. None leap out at me now.

JOHNSON: Okay. Then I guess we'll end for today, and I appreciate you doing this with us and contributing.

CRAIG: Oh, it's very important. I really appreciate y'all doing this.

JOHNSON: Okay. Thank you.

[End of interview]