NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT
EDITED ORAL HISTORY TRANSCRIPT

THOMAS V. SANZONE
INTERVIEWED BY REBECCA WRIGHT
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WRIGHT: Today is August 30, 2011. This oral history is being conducted with Tom Sanzone in Houston, Texas, for the Johnson Space Center [JSC] Oral History Project. Interviewer is Rebecca Wright, assisted by Sandra Johnson. This is a continuation of Mr. Sanzone's oral history from July 26 and August 23, 2011. He begins today's session by talking about his involvement with the JSC Exchange Council.

SANZONE: Initially Greg [W.] Hayes was the Director of Human Resources for JSC. He was looking for a contractor to serve on the Exchange Council. The Exchange Council was like the board of directors, if you will, for all the things that happened on site relative to the Gilruth Center, the athletic facilities, the cafeterias, the vending machines. The Exchange Council was very heavily civil servant. That's an understatement; they had one contractor on there. The guy who had been on there before me was really overcommitted with a bunch of other things and he had difficulty making all the meetings, so Greg was looking for some other contractor to participate. I had been involved some with the Clear Lake Area Economic Development Foundation. Jim Reinhartsen was running that organization at the time.

I think Greg went to Jim and Jim recommended me or gave him my name. Then Greg got in touch with me. Long story short, I ended up joining the Council. It was fascinating and it was enjoyable and it was very heavily staffed by the Center Director's direct reports. About half the members, I think, reported directly to the Center Director, so that ended up being good from

a number of aspects, not the least of which was I actually became personal friends with people that in my prior life or in my business life were just business people, they were NASA people, they held certain positions of stature. I got to know them on a whole different level. That actually enriched my career at JSC when I think back on it.

Relative to the Shuttle retirement, about a week ago I got an e-mail from Karen Schmalz who's the manager of Starport which was the name that's used for all those entities I mentioned earlier. There's still a legal Exchange Council, but everything is now called Starport. Karen sent me an e-mail, and she said they were looking for a number of people to participate in the Shuttle flag retirement ceremony on Saturday night at the JSC [Salute Our Space] Shuttle event [August 27, 2011]. Would I be interested? I needed to let her know right away. I said, "Yes, I'd be interested for sure."

We did a dry run a couple of days later [August 24, 2011]. I realized that there were actually six people on each team. There were five Shuttle flags. Karen had indicated that it was the sponsors of the event who were going to carry the flags, so that ended up being Boeing, United Space Alliance, Jacobs [Engineering Group], and Lockheed Martin for four of them. Then the fifth one was Starport, and it had six of the smaller companies that participated, including my former company, Hamilton Sundstrand, and SAIC [Science Applications International Corporation]. There was a rep from Wyle [Laboratories], JES [Tech], and I know I'm leaving one or two out. When we got to the dry run practice that we did over in the [JSC] Teague Auditorium, it was funny, because for the other companies, they were pretty clear on who was going to carry the flag. It was generally going to be their senior executive.

Brewster [H.] Shaw carried it for Boeing and Lon Miller carried it for Jacobs [Engineering Group]. Somebody said, "Well, who's going to carry the flag for this group?" So

Joyce Abbey, who I've worked with for years, was standing next to me up on the stage. She looked at me and she instantly said, "Forty-three years. You get to carry the flag." So I had the honor of actually carrying the flag. Initially the plan, I think, was to have six people actually carrying the open flag. Then they recognized that the flag was 14 feet wide and a comparable height, which would have meant that all you would see would be six pair of feet under this flag as it moved across the stage, so they made the decision that the flag would be folded.

The flags were actually heavy because they are so large, but it was really an honor. It all came together so quickly. I didn't really have that much time to think about it. They had a color guard. It was very formal. The *Columbia* flag was retired first. *Challenger* was second. That was the flag that I was carrying and Starport was representing.

We all waited at the bottom of the stairs of the stage, and then the color guard finally came off carrying all five flags. I don't know, it just really hit me, seeing them carrying those flags down, that that's the last time we'll ever see those flags. It was touching. It really was. I felt more honored after the fact, the more I thought about it. I thought, what an honor to carry that flag, particularly the *Challenger* flag. Anyway, it was a special event. It's funny, because I've been retired from full-time work for eight months or so, and I'm still reaping all these benefits from JSC. It's amazing.

WRIGHT: It's a good time to close out your career when the Shuttle is closing out its.

SANZONE: Yes it is. Brewster Shaw just retired last week. I don't know if you knew that.

WRIGHT: Oh, I didn't know that, no.

SANZONE: I had learned it from Joyce the day before. I think she put it on Facebook. I thought gee, people are aware of this and I just didn't know it. Well, I know quite a few folks who work at Boeing. One of them was telling me last night that they actually had an all hands meeting last Wednesday, and that's when Brewster announced that he was retiring and his last day was Friday.

I know his successor very well, and he's a fantastic guy. John Elbon. So John was part of the Columbia flag team where Brewster carried the flag. Afterwards I wanted to congratulate Brewster, and I told him, "I retired eight months ago and I think you're going to like it."

He had a smile on his face. Then he looked at John Elbon with a smile said, "Good luck." I really didn't know till last night that his last day was actually last Friday, so that was, I guess, his last official event.

It still amazes me, the people that I've gotten to meet over the years, and just be around. The quality of the people. I've got a good high school friend who's an intermediate school guidance counselor. She was always telling me and e-mailing me that I didn't live in the real world, working at NASA, and that I didn't appreciate where I was. Not that I didn't appreciate what I was doing or my job, but I just didn't have that understanding of the difference between the real world out there and the JSC world. She got me thinking about that more and more, and I think I did become a little bit more attuned to it, particularly when I'd be outside the JSC environment and see what the real world was like. We really are very spoiled. The people that we get to work with every single day—motivated and intelligent and friendly, and thousands of them, thousands and thousands of people. It's an amazing place to work, just an amazing place to work.

I'm recognizing it more since I left. When I was still working you have the daily grind that you have to deal with. It's really when you take a few steps back and you look at it from a little bit higher level. You just realize what an amazing place it is. The place is not the geography, it's the people.

WRIGHT: It's people. Let's talk a little bit about the other opportunities you had to meet other people. I know that you also worked for instance in community partnerships with BAHEP [Bay Area Houston Economic Partnership]. Talk about how the companies got to know each other, although they were competitors, but yet you had some missions that you all worked on together. Not missions as in space missions, but community missions.

SANZONE: My first venture outside of the internal work environment—I took over for my boss, Fred [Fredrick] Keune [Jr.] in 1986. There was a lot of turmoil around that time. We had just lost the Flight Equipment Processing Contract, and the Challenger accident had happened. NASA and we were in a lot of turmoil. Fred had been involved in some external relations type stuff, but it was one of those things that as deputy I was never involved with. I didn't really have an appreciation for what it was, how much time he spent doing it, and how important it was to do. It was probably several years before I really got involved initially. It was with the predecessor to BAHEP, same organization with a different name. It was called Clear Lake Area Economic Development Foundation [CLAEDF]. Later it got renamed to the Bay Area Houston Economic Partnership.

Hamilton Sundstrand was initially not a member of CLAEDF. I think one of the reasons was our company had quite a bit of business in Huntsville [Alabama]. I know there was some

concern by our executive management in Connecticut that we didn't want to be viewed as singling out Clear Lake [Texas] and possibly send a message that's where we want all the business to go. That's really what CLAEDF was about, it was an economic development foundation, and they were trying to develop business in Houston. There was reluctance on us joining while not being in a comparable group in Huntsville, Alabama, which I don't think existed at the time.

About the time I got involved, actually a little before the time I got involved, Space Station Freedom started to come under significant threat of cancellation. The one name that comes to mind is Representative [Timothy J.] Tim Roemer of Indiana. Each year he would propose a bill in the [U.S.] House [of Representatives] to cancel the Space Station. Each year it would be defeated but by a closer margin.

For the first time, and it was under the auspices of CLAEDF, a call was put out to many of the people who were members or companies who were members like [The] Boeing [Company] and McDonnell Douglas [Corporation] for example. CLAEDF also put a call out to nonmembers in the aerospace community and basically said, "We don't care if you're a member or not, please come join" what was called or later became called the Aerospace Advisory Committee. I don't even know if it was called that back then but that's what it's called today. We're going to work together to try to make sure we keep the Space Station program sold. It actually got a name called "Keep It Sold." That name stuck for a number of years.

Clearly the message was while we were all competitors with each other, or most of us were competitors with each other, partners on some things and competitors on others, Space Station was the big future program for NASA and JSC, and if it were to be canceled and fail, there would not be a single company that wouldn't be affected very significantly. We certainly

had the onus to work together to keep this thing sold. There was an incredibly minimal amount of company politics involved. When I think back, people really did all row in the same direction. I know Hamilton Sundstrand got really actively involved in New England. They put together a truck that they drove from state to state. They visited all the state capitals in New England. The side of the truck said "Keep It Sold" and had a big space suit photo. They handed out literature and tried to educate legislators and voters.

I guess the peak in stress that I can remember was a vote that was occurring in the House [June 1993]. We were actually in one of our Keep It Sold meetings at CLAEDF in the afternoon, and the vote for Space Station was going to be that afternoon or evening. I went home by myself and I turned on C-SPAN, and it was probably like 8:00 at night or something like that. I watched C-SPAN and this vote like it was a basketball game. They had the vote tally up on the screen, and the clock in the middle showing how much time was left. I actually have a VCR tape of this. I have never watched it, but I actually taped it. I was watching this thing by myself. The votes were tallying. It was very close to even, and they were bouncing around, and I think it was a little bit behind. I didn't know as much as I know now about how the Congress works. I saw the countdown clock for the vote go to zero. When it hit zero, I looked at the voting on both sides, and there were more votes to cancel than to keep it.

For a few seconds I was like, "I can't believe this, they just canceled Space Station." Another 30 seconds went by and I realized it wasn't exactly a NCAA [National Collegiate Athletic Association] basketball clock. A few more votes popped up on both sides. Of course the clock was just sitting at zero, but there were still votes coming in. That went on for maybe a minute or maybe a little bit more. Finally whoever was chairing the session hammered his gavel

down and Space Station was retained by one vote. Many, many, many people, particularly the young people at JSC, have no clue it ever came that close to being canceled.

I think we actually had a tiny bit of reserve. A couple of votes. Because I think there were some territories that actually voted and their votes wouldn't have counted if it made a difference, that kind of thing. Officially up on the board, it passed by one vote. After that we seemed to strengthen. There seemed to be more bipartisan support, but that was the era that started CLAEDF's and BAHEP's trips to Washington. They were called Keep It Sold trips. This year, 2011, was the 20th year in a row. I don't know if it lines up exactly but pretty close to it. They still go up every year. I've gone the last four years. We still go up and visit legislators. This past year I think we visited approximately 335 representatives and senators out of 535 total. It's a pretty big number. Anyway that was my initial foray into the community I would say, the external community.

I mentioned a few minutes ago that Greg Hayes was looking for somebody to participate on the Exchange Council team and Jim Reinhartsen who was at CLAEDF recommended me. Then it dominoed after that, which is what happens. It's a little bit of the old, "the reward for hard work is more hard work." It wasn't so much that it was hard work. It was that if you're doing something as a volunteer, any volunteer will tell you if you're doing something as a volunteer and you do a pretty good job, somebody else is going to ask you to volunteer on something else.

For me the starting point was CLAEDF and then I went to the Exchange Council. Then somewhere along the line I got a call from [Susan H.] Sue Garman, who was George [W. S.] Abbey's Associate Director, and she said, "We'd like you to be the vice president of the Johnson

Space Center National Management Association [NMA]." I told her, "I'm not even a member of the NMA."

She told me that it's not a problem, "We can get you a membership." That ended up being one of the most enjoyable organizations I participated in. I'm still involved. It's probably ten years ago that I first got involved. I served as vice president one year and then president the next. Ever since, I've been an adviser as a former president to the board. They keep me on and I don't leave. I attend most of the board meetings and most of the luncheon meetings. Like tomorrow, [JSC Center Director Michael L.] Mike Coats is the speaker. That's usually our biggest luncheon meeting of the year.

The NMA organization has probably been the most fun organization that I've been part of. I think it was because when I was the vice president, I didn't even know how the whole operation worked. But [Brock] Randy Stone who was the Deputy Director of JSC was the president the year I was the vice president, so I got to know Randy really well. I would say one of the real joys—I touched on it earlier about the Exchange Council—was getting to know these civil servants who were our customers and our bosses on a personal level that had nothing to do with work. Turned out Randy and I both were [automobile] race fans and we had both raced. We ended up going to a race together one time.

One of the things that was interesting is that we would have our board meetings in the Center Director's conference room, the small conference room up on the ninth floor. When Randy's term ended and I became president we continued to meet there, because his secretary continued to schedule it for us. We continued to meet on the ninth floor. It was funny as a contractor to be chairing a meeting in the Center Director's private conference room. But JSC used the JSC NMA, I think particularly when Greg was the Human Resources manager, as a

leadership development organization. The people who were involved in committee chairmanships were very talented people. The ones that worked with me are now all director level or division chiefs. You could just see.

When I was the president it hit me pretty early on that my biggest job was to stay out of their way. Just point them in a direction and then get out of the way, because I had never been in an organization with so much talent. In a private company organization you have people who are stronger and weaker. You're dealing with those kinds of things, but these people were hand-picked and they just made things happen. It's actually one of the easier jobs I've ever had in leadership.

Those were the organizations that I was most heavily involved in. I'm trying to remember some of the others. I've been a member of a lot of other organizations, but not nearly as active. National Contract Management Association. American Institute of Aeronautics and Astronautics [AIAA]. American Astronautical Society. Part of it was they all take so much time that you select the ones that you're going to put most of your emphasis into. Actually I'm going to more AIAA events now that I've retired than when I was working, because I actually have the time. They bring in some really good speakers.

Speaking of AIAA, they once had a drive—I call it a drive—a number of years ago, it had to be at least ten years ago. Dr. Fred Dawn was a scientist in Crew and Thermal Systems Division in Building 7. He and I didn't work closely together but for some reason we just hit it off. The Houston chapter of AIAA was trying to increase the number of Associate Fellows that they had. I never considered myself anywhere close to being qualified to be an Associate Fellow of AIAA. Dr. Dawn was an Associate Fellow, so he could nominate others. They had this drive on and he wanted me to apply. I filled out all the paperwork, and I'm sure it was just again being

in the right place at the right time in the right environment, but I ended up becoming an Associate Fellow of the AIAA. It's almost embarrassing when I think of what most Associate Fellows of the AIAA are like. I feel a little bit guilty because I've been this Associate Fellow, but I could probably count on all my fingers how many meetings I've been to over the years. In addition to the NMA membership, it's the one membership that I'm maintaining since I've retired from full-time work. The other ones I'm just letting lapse because I'm just not active.

WRIGHT: I think you worked on the JSC Joint Leadership Team. Is that right?

SANZONE: I did, yes. The Joint Leadership Team [JLT], that wasn't so much a volunteer organization as it was a group General [Jefferson D. "Beak"] Howell [Jr.] formed when he became the Center Director. I'm going to zig for a second, because there was another organization that many of us were members of, and it was called the Southwestern Aerospace Professional Representatives Association, called SWAPRA. In its earlier days there were a lot of senior folks, maybe the general manager, the vice president, whatever, the head of local Houston organization, who would attend in addition to marketing folks from those companies. As the [Hamilton Standard] general manager in Houston I would attend those things. I'd been attending them for quite a while.

General Howell was working for SAIC running the safety contract. SWAPRA had a monthly luncheon meeting, and this particular one happened to be in Space Center Houston, I think. We had a table with eight people sitting at it. It was like two tables pushed together. There were eight people. Beak was down at one end and I was down at the other end. I can't say we were in the middle of a conversation, but we were at the same table, when someone came

into the room and paged him. My first thought was that's pretty unusual in these days of BlackBerrys. I couldn't remember the last time I heard somebody paged. He was paged. He left the room and he didn't come back. I was concerned that maybe something serious had happened, family, accident or incident.

I went back to my office and got on my e-mail, and about 20 after 1:00 I had this e-mail from one of our senior folks in Houston. It said Jefferson Davis Howell is the new Center Director of the Johnson Space Center, so he got called out I guess to make it official or whatever. I've kidded people about it. I said I was having lunch with Beak when he got named the Center Director. He always encouraged people to call him Beak. It's funny because we all call Mr. Abbey, Mr. Abbey. Beak was Beak to everybody.

Actually I'll share a little story. I don't think Randy Gish would mind or Beak would mind, but it ties in a little bit to the Joint Leadership Team. I heard this from Beak, and I also heard it from Randy, so I know it's true. Beak was running the safety contract for SAIC and he had all kinds of metrics. Randy Gish was running JSC Procurement and was, if not the fee-determining official, then at least the person who told the contractor what his fee was going to be for the award fee period.

Beak had kept all these metrics. By his account he was somewhere in the mid 90s, so he felt he should have a score somewhere in the mid 90s on his award fee. The actual score that he received from NASA was something in the 80s, probably mid 80s. I don't remember exactly what it was. He was disappointed needless to say, so he went to meet with Randy. He told him, "Randy, I've got all these metrics, and they show I'm performing at 95 precent, and you guys are giving me a score of 85 percent, I don't think it's right." So Randy explained, "Well, we do this and that." Basically he wanted Beak to go away, I think. Beak, being Beak, wasn't going to go

away, so he said, "That's unacceptable, I have all this data." I think they went around at least two rounds, maybe three. Randy said something along the lines of, "Beak, I'm sorry, I'm representing the government, this is what your score is, there's nothing more you can do about it." One week later Randy was working for Beak. I've heard Randy tell that story after the fact. It's a true story because Beak told me the same thing.

Although Beak had been a civil servant in the military, he had worked for SAIC for a number of years, since he retired from the military. He was the ninth Center Director, and he was the first non-civil-servant director. The first eight directors were all career civil servants. That was just their career path, and they became Center Directors. So for Beak, although he had years as a military general, the immediate time prior to him becoming Center Director was as a contractor, so he had a real sense of the challenges that the contractors have.

When he got over on site, one of the first things that he decided was that there was no way that he was going to be able to positively affect the culture of JSC dealing only with 20 percent of the total employees of JSC and not dealing with the 80 percent who were contractors. So he came up with this idea called the Joint Leadership Team. The Joint Leadership Team was comprised of approximately 50 people. They were his direct reports and the heads of all the companies, both the large companies and the small companies, whoever the senior executive was in the Houston area. That's how I became a charter member of the Joint Leadership Team. The first thing that we did was have a retreat up in The Woodlands for several days. It was pretty fascinating. I think we had one or two preliminary meetings, but we ended up having a two- or three-day retreat up at The Woodlands, and it was really "take-the-gloves-off."

To his credit Beak created an environment where people weren't afraid to speak their minds, which was really an important first step to be able to move forward. I remember this one

thing distinctly. First day we were there we were in subgroups, and people were telling their stories. They're sharing some of their frustrations. Particularly the contractors were sharing some of their frustrations with the way they, or more often some of their people, had been treated by some civil servants.

The irony here. One of the things that I learned and actually shared with folks is when they had done some surveys, and the contractors indicated that they were pretty displeased with the civil servants, was that it's not that—if it were 70 percent of the contractors being displeased. It was actually a pretty big number. I think it was in the 90s. It wasn't that 90 percent of the contractors are displeased with 90 percent of the civil servants. It's that 90 percent of the contractors knew one civil servant that drove them crazy, and that's how they voted. They could have dealt with 50 who were fine, but that survey was their opportunity to get that message across.

I think Beak said, "Let's find that person and fire him." We were having this roundtable discussion. Beak actually came into the group that I was in and joined us. I said to the group—he was off to the side—I said I've spent almost all of my career working with the EVA Office, the XA mail code. We've always worked as a team. I have not personally experienced a lot of the things that I'm hearing from other folks. However, I will say that we recently were a subcontractor to one of the major companies at JSC and I was asked to support a meeting with them over in Building 1. I said the only way I could describe the meeting was that the chairperson of the meeting essentially sent out a message that said, "I'm NASA and you're not." Of course there were a lot of heads nodding. Well, Beak took his finger and he pointed it right at me and for about two seconds I thought, "I think I may have crossed the line. Maybe I shouldn't have said that." At the end of two seconds what he said was, "Bingo." He had experienced the

same thing, so his message was that's what we've got to work on. That's what we've got to address as a group, as a team.

Well, that night I know we worked until late, it was hard work. I know our employees think we go up to The Woodlands and have a good old time, but we were working till like 10:00 at night. We had a very heated discussion over something, and people were tired. It was like 10:00 at night. I really was expecting for somebody to lose it. They didn't. The next morning I was walking up to the conference center from where we were staying. I happened to be walking up with Beak, just the two of us. He asked me how it was going, and I said it's going pretty well. I told him how I was in this meeting last night and I really thought that somebody was going to lose it, and I was surprised that they didn't. He paused and he said, "Tom, that's the thing about leaders, they don't have anything to prove to anybody else." I never forgot that. I don't think he remembers it, but I thought, "He's right." A lot of times the people who are making all the noise and creating the turmoil aren't classic leaders. The guys who are classic leaders are looking to solve problems and you don't solve problems that way.

That's how the JLT got formed. Then we created teams. It was actually the first time I got to work with Joyce Abbey. I joined the team for contractor/civil-servant relationship. I think there were something like four teams, but that was the one that I chose to join. Joyce was the facilitator. She did a tremendous job, so much so that when we came up with new teams several years later, I picked my team by asking Joyce which team she was going to be the facilitator for. She told me, and I got on that team.

This restructuring of the teams occurred after the shooting and the fatality on site [April 20, 2007]. Mike Coats and his folks wanted to refocus our efforts, so the team that I ended up on was a team that was looking at a code of conduct, but ended up being called expected behaviors.

I was cochairing that team with Natalie [V.] Saiz, the Director of Human Resources from JSC. So that ended up being rewarding.

It was a lot of work but it was very rewarding—not the least of which we got to deal with four different generations in the workforce, including real young people from co-ops, up to boomers like myself and even older folks who had worked Apollo, and then the in-betweeners, the Xs and the Ys—trying to get everybody to work together and try to understand how to get our messages out so that they were understood by all of these different age groups.

It was fascinating. Then I know when Mike Coats came on board as Center Director one of the things that he was most happy with was the fact that this Joint Leadership Team was already in place. I think he said if it wasn't here he would have wanted to create it, but it was already there. You know Mike. He's very much along those same lines. Of course, Mike spent more time as a contractor than Beak did, because he was 11 or 12 years or so with Loral [Aerospace Corporation] and Lockheed [Martin]. He came back to JSC very much with an understanding, from a contractor perspective, of the challenges that have to be met.

As a matter of fact—and I hope he doesn't mind me sharing this—when he first became the Center Director and we were having a meeting, it might have still been called CLAEDF—or BAHEP, whatever. We were having one of our Aerospace Advisory Committee meetings. Mike was the guest of honor and he was going to talk to us. There were probably 25 or so people there.

It was fairly common to have everybody introduce themselves at the beginning of the meeting, particularly if we had a new Center Director and he didn't know everybody. So we all got to introduce ourselves and say what company we were with. We got completely done and he was the last person. I didn't expect him to introduce himself, because we all knew who he was

and why he was there, but what he said was, "Mike Coats, NASA, 40 years, never turned a profit."

I've shared that story with people, because in those few words he told all of us that: "I know how difficult your jobs are, because I had a job like that as vice president of Lockheed Martin with the pressure to turn a profit and increase profits." While the civil servants at NASA certainly have their own challenges in meeting budgets, the one thing they don't have to do that contractors do have to do, certainly at the senior level, is to produce a profit. In those few words he spoke volumes of, "I know where you are and I appreciate where you are." That's another one of those things. I'll have to remind him of that the next time I see him.

So the JLT was and still is a really good organization. I can't think at the moment of any other group that I was in, but those are the ones that I was most active in.

WRIGHT: You've talked about working internally with your company and with the community. But you also had a lot of multinational dealings. Before we finished talking the other day, we started to talk about the Russian interfaces that you had. With your days of the Shuttle Program, you worked with people that were of the international crowd, not just the American space travelers.

SANZONE: My first exposure to foreigners, if you will, in the space business, and specifically to Russians, was in the Apollo-Soyuz Test Project era in the early '70s. I was still a very junior engineer, and I remember getting called into one meeting that was going on. I think there were some technical questions about our backup oxygen purge system, our 6,000 psi oxygen system. I think it was a fairly basic question, but they needed somebody that knew the hardware to be able

to answer the question, so I got called in. I remember how much it struck me how difficult it was, this language barrier. Language and culture. If we were all in the same culture and we were all speaking English, this question and answer would have taken less than a minute, but instead it probably took ten minutes easily. I was only there for a very short period of time, but I remember how much of a challenge it was.

So that was just a little taste that I had. Then years later when we got into Space Station, we had an American EMU, Extravehicular Mobility Unit, which was the American space suit and life support system that Hamilton Sundstrand manufactured. The Russians had their own space suit and life support system called an Orlan. We started working closer and closer and closer together. As a matter of fact—and I certainly wasn't in the middle of this, so it's vague in my mind—one of my bosses along the way in Connecticut was very visionary. He had done a lot of international business and had started companies for Hamilton in foreign countries including Russia. We had a company in Moscow called Nauka [Hamilton Sundstrand-Nauka], which is still there. He actually made some kind of deal with the Russians to lease a Russian space suit. At least I think that's the way it worked. I was nowhere near the middle of the negotiations.

But we, Hamilton, ended up with a Russian space suit. I remember bringing it to, or at least talking about it at an astronaut all hands meeting one Monday morning in [JSC] Building 4 and answering a bunch of questions. Because I think this was done on Hamilton's money, this wasn't a NASA contract or anything, we had [astronaut] John [W.] Young come over and get in the Orlan suit and try to compare it to an Apollo suit, and he made comments.

Then as the years went by we started—not just we Hamilton but we NASA—and the Russians started working closer and closer together on our two suits. JSC wanted to be sure that

while the Russians had the ultimate responsibility for their suit and design and performance and safety, because we the United States were going to put American astronauts in these Russian suits at times, NASA wanted to be sure that they had people who understood the suits well also, almost as well as the Russians did. That task ended up falling to Hamilton Sundstrand because of our responsibility to the EVA Office.

A growing number of our folks started traveling to Russia, supporting tests in Russia. We have guys that have made over 25 trips to Russia, spent as much as six months of the year over there, supported runs in their water tank, not the least of which was to establish a relationship with the Russians. One of our guys speaks fluent Russian, actually speaks five languages I think, including Russian. I was over there in 2001 with my boss at the time, [Edward M.] Ed Francis. This guy was there, and Ed recognized right off the relationship that he had established with the Russians.

This was something that I actually learned by reading some and through personal experience—the cultural difference between trust granted by Americans and trust granted by Russians in their culture. Americans tend to grant trust relatively easily, and you can lose their trust by doing something that is untrustworthy, whereas the Russians do not grant their trust immediately. You have to earn it over time, generally through establishing a relationship that grows over time, and then suddenly one day you find that they're actually trusting you. So different culturally.

I didn't have a lot to do technically with the Russian stuff, but we had guys who did and were going over there routinely. Matter of fact, the trip I made in 2001 was primarily because I had folks who worked in my organization that were over there all the time and I really didn't have a good understanding of where they were and where they were going. You hear about Star

City [Russia, Cosmonaut Training Center] but it's different to hear of it and go out there and actually see the water tank in operation. We were there ten years ago. [William S.] Bill McArthur was actually training for his [International Space] Station stint. Bill and my boss Ed Francis were classmates at West Point [Academy, New York], so I think that was one of the motivations for Ed to pick the time he went over there. But that made it interesting too.

The Russian space suit company name was [NPP] Zvezda, which translates as "star" in English. The one man that I got to know the best, and I didn't know him all that well, was Dr. Isaak Abramov. He was generally their most senior person at meetings over here.

Matter of fact, I'll tell a little story; I guess I'm already retired so I can tell this story. My boss was in Connecticut and he was going over to Russia. I told him I'd like to go and he asked why. I said, "Well, my guys are over there, I've never been over there, I'd like to see what they do. Plus I'd like to go visit some of our customers or our interfaces on their home turf." So he said okay.

I think it was two days before I was getting ready to leave on this trip. I went walking down the hall, looked in our conference room, and it was half full of Russians, including Dr. Abramov, who was not going to be in Russia when I was there, he was going to be in my conference room in Houston. So obviously I never said a word and went over to Russia, and did get to go to Energia and sat in a meeting. It was fascinating. It was a traditional Russian meeting with cookies in the middle of the table, and the Russians on one side, and us on the other, with interpreters. I think the deputy director of Energia was in the meeting. I wasn't saying a word. At the end of the meeting he offered a tour of their museum at Energia, which I had heard about, and some of the spacecraft.

My boss—for about five seconds I thought I was going to kill him—said, "I've already seen it." Then there was a short pause. He said, "But Tom hasn't seen it, and I can never see it enough. I love seeing it, so we'd be very happy to have you show us around." That was fascinating, absolutely fascinating, because Energia has done so much in the Russian space program.

So they took us on a tour. They have a private museum. It's not open to the public. They took us on a tour that was calendar sequential. The first thing we actually saw was the backup Sputnik. That hit me. Then we went down the line. They had a spacecraft with a stuffed dog representing Laika when they flew their dog in the spacecraft. It was a two-story museum area. We went down to the lower story, and they had larger spacecraft, including one that Alexei Leonov had flown in when he had done the very first spacewalk. Then for me the cream of the crop was, Yuri Gagarin's spacecraft was there. I'll never forget looking at that.

First when I saw the Sputnik I thought, this is what essentially started the industry that I've spent my whole life in—what would I be doing if it weren't for the Sputnik? Then getting to see Gagarin's spacecraft, the first human spacecraft, the very first spacecraft that a human flew in. It was really amazing.

I was in Moscow just a couple of weeks ago, maybe three weeks ago. Actually unbeknownst to me I wasn't supposed to do it, but I did it, I took a photograph of Gagarin's memorial plaque. My understanding is that Gagarin is buried in the Kremlin wall with several, maybe a dozen or two dozen, other Russian dignitaries. It has his name engraved on the wall, so I took a photograph of that and some guard came running over to me, "No photographs, no photographs." That was an experience.

Then I did sit in some meetings with the Russians. I mentioned last week I had met Aleksandr Aleksandrov. With what's going on right now with the Soyuz being grounded, the AIAA [American Institute of Aeronautics and Astronautics] news summary this morning actually has a story where he's quoted. I met him in our conference room in Houston one time, and made a mistake. I had been told early on that Russians appreciate it if you try to speak in Russian, so I spoke about all ten words of Russian that I knew.

He assumed I could speak Russian, so he started speaking Russian to me, and I couldn't understand him at all. I said, "Ya ne ponimayu po-russki, I don't understand Russian." Luckily we had a translator there. Then I ran into Dr. Abramov several times after that. I think I may have shared off-mike the story with you about when we went out to dinner one night at a meeting up in Connecticut. We were going through a technical review. Dr. Abramov was there along with several other Russians. The whole bunch of us went out to dinner, and it had to be 20 of us probably, people from JSC and Hamilton in Connecticut and Houston, and then the Russians.

I was taking Russian at the time, and I was a lot better than I am now. I sat next to Dr. Abramov, and I knew this cultural thing about how they like you to try to speak Russian. I tried to speak Russian to him as best I could all evening, but didn't get too much reaction. We had one of our guys who spoke fluent Russian, sit on the other side of him, so I had a safety net. He would fill in the blanks, of which there were many as we were talking. At the end of the evening we were walking out of the restaurant. It suddenly dawned on me that he wasn't going to be at the meeting the next day, he was going to fly back to Russia, but all the other Russians were going to be there. So I said goodbye to him in Russian, wished him well in Russian. He was someone who virtually never spoke English, but he turned to me and said, "Next time you speak

only Russian." I took that as a very big compliment. Unfortunately, my Russian declined in ability after that, so I wasn't speaking only Russian the next time I saw him.

WRIGHT: Can you talk some about how the suit evolved as the ISS [International Space Station] grew? Also, during Shuttle-Mir, Russians for the first time wore the American suit, and then, I was reading how the Orlan suit had some EMU components to it.

SANZONE: Well, we still use two separate suits on orbit. I'm personally not familiar with American components in the Russian suit. One of the things that you reminded me of is that in the early days of Space Station, NASA's intent was actually to design and develop a brand-new suit for Station. I think Lockheed [Martin] was working on that as prime contractor. NASA hadn't let a contract, but they had the contract for certain elements of Space Station, and they were working on that.

As has happened in some other programs and areas of NASA over the years, obviously the cost to develop something brand-new versus evolving something that you have is a lot more. Eventually I think what happened was Hamilton came forward as the prime contractor on the Shuttle space suit. They proposed certain things that they could do for the Shuttle EMU that would make it totally viable, more than acceptable for use on Space Station.

Eventually NASA made the decision to evolve the Space Shuttle space suit, so the Space Shuttle space suit is virtually the same suit that's used on Station. Maybe the most significant change that we made was in the way we absorb carbon dioxide, which in both the Apollo era and most of the Shuttle program was done with a chemical bed called lithium hydroxide. Of course on Shuttle we'd fly a couple of EMUs up, or three or four, and use them and then bring them

back down and service them or other ones, and take up another three or four suits on the next mission. That was easy to do on Shuttle, but for Space Station there was a concern about how we were going to get all this lithium hydroxide up there, enough to support all the EVAs we're going to do, which ended up being many, many, many for assembly.

So Hamilton and NASA developed a carbon dioxide absorbing technology called metal oxide. That's what we're using today on Space Station. It's basically some metal plates that absorb the carbon dioxide. Then after the spacewalk the metal oxide system is baked out in an oven and regenerated so it can be used over again. That's one of the most significant changes. The gloves continued to evolve really throughout the whole program to be more user-friendly.

One of the things that we had to do was certify the EMU for long duration. The original EMU was designed for a life of, I think it was 15 years if I'm not mistaken. Soft goods were, I think the soft goods were like seven years. Five or seven years. Then the hardware was designed for 15 years. We kept pushing the envelope, because as we would use it we would get more technical data that would show that we could use it longer. So we had to go through a lot of development activity to show that the suit could be used; I think we had to show it could be used 25 times without having to be refurbished.

If you talk to somebody who really remembers it they'd be able to tell you. But that was one of the big things, because for Shuttle we could fly it up, do a couple of EVAs and bring it back, and look at it and examine it and replace any worn parts. Suddenly we were in a position where gee, this thing is going to have to be left up there for a long time.

One of the significant things that went on leading up to the Shuttle retirement was the ability to actually replace components in the suit on orbit, to have astronauts be able to service the life support system, because it was not designed to be serviced in orbit, only on the ground.

The astronauts never touched anything, we never wanted them to unbolt the life support system or anything like that, so there were some changes done to make that easier to do. For example, fasteners were captured, so if you unscrewed a bolt it wouldn't float away, it would be captured, and you could take a component out. Then we'd have some spares. Obviously not the ideal thing; you'd still like to do it on the ground, but trading that off with having an inoperable life support system, they have the ability to do that. I hope we won't be testing that very often, but they do have the ability to do it.

WRIGHT: You were talking about the improvements you made to the gloves, including being able to improve them and enhance them where the temperatures didn't affect them going in and out of the sunlight.

SANZONE: There were two significant changes in glove technology. One was an evolving change, which just really never stopped, which was to make the gloves so that the astronaut could use them as easily as possible. One of the tradeoffs that you do with gloves—because ultimately you're getting down to the fingertips being the interface point that the astronaut is dealing with, dealing with Hubble Space Telescope parts, changeout or whatever, so the gloves actually have the least amount of insulation of anything in the suit. The suit itself, the arms and the legs, have a lot of insulation. The body produces heat, so we've never in our suits and life support systems had to heat up an astronaut, even when he's in an environment of minus 300 degrees Fahrenheit, because he's inside the "thermos bottle." His body is producing this heat.

We had a development test in the Space Environment Simulation Laboratory, the SESL, Building 32, in the thermal vacuum chambers, with Story Musgrave who was on the first Hubble

[Space Telescope] repair crew. We had him in a very cold environment, which was planned, because that's what they were going to be experiencing. He ended up getting frostbitten on his fingertips pretty badly.

It scared a lot of folks. Not just us, but oh my gosh, because this was going to be the environment that we're working in. So for the first time we actually developed glove fingertip heaters. We put these little heaters in the tips of the fingers and if the astronaut was in that kind of a cold environment, we could ask him to, or he could, on his own, activate these heaters. Throw a switch and actually turn these things on. It would provide some heat to his fingertips.

I'm happy to say that we never again to the best of my knowledge ever had a problem with it. People have had cold fingertips, but not frostbitten fingertips. So it's one of those things. It's one of the reasons that we test so much on the ground. It wasn't something we really expected to happen but certainly it was better that it happened on the ground than up there. I think it scared me and some others because we all knew Story pretty well, and he was very well trained for Hubble, and here we were with him with frostbitten fingertips, and was he going to recover? I think eventually he did, but it was pretty scary when it first happened, particularly when you saw his fingers.

WRIGHT: Talk a few minutes if you would about the importance of or the accessibility that the suit allowed for Hubble, as well as building the ISS and even repairing the Shuttle itself.

SANZONE: Well, I think I'd have to start going way back in the early days, even before my days at JSC. The very first American spacewalk was done by Ed White [Edward H. White, II, June 3, 1965]. I was still in college at the time, but a friend of mine, [H. Joseph] Joe McMann [Jr.], who

was both a customer and then later a coworker at Hamilton, just before he retired [from NASA] was on a very secret team of only three, four, five people in Building 7, Crew Systems Division, that actually developed the life support system that Ed White used. I think it was pretty obvious that they were hoping to beat the Russians to the first spacewalk.

But this was the heart of the space race, and the Russians beat the Americans by a relatively short period of time, month or so, something like that [March 18, 1965]. There was another EVA done during the Gemini program with [Eugene F.] Gene Cernan [June 5, 1966]. Again I only know this from history and talking to these guys, but Gene Cernan did an EVA and had an umbilical. He was outside the spacecraft. His visor totally fogged up, he couldn't see anything. The suit grew in volume. They came very close to not being able to get him back inside.

I talked to somebody who was involved, maybe one of the astronauts involved with the mission. He said they gave serious consideration to just cutting him loose. It was that close. So EVAs started out scaring people. You can imagine NASA management: "Oh, we don't want to go through that again." But, obviously when we went to the Moon, we had to get out and walk on the lunar surface.

When we got to the Space Shuttle—we had a problem on STS-5, so we didn't do the spacewalk then. Then we did the first one on STS-6. I think there was this uneasy feeling about EVAs, spacewalks, by NASA management, that they were risky, and of course it is more risky than being inside, and therefore maybe less is better than more. Again I didn't deal with this firsthand, but I think I heard some of it secondhand.

As Shuttle progressed, we started doing more EVAs, and confidence started increasing some. We even did satellite capture. When it got to the Station program, astronaut [William F.]

Bill Fisher and an engineer whose name was [Charles R.] Price did what was affectionately called the Fisher-Price study. They identified or estimated how many EVAs it was going to take to assemble Space Station. I wish there were an easy way to go look up the answer, because I'd like to see how close they came. People particularly in management were spooked, because it was hundreds. They were just scared to death. There's no way you can do that many EVAs. Obviously the odds start working against you.

So they looked at other ways to minimize, other ways of assembling Station that would reduce the number of EVAs that were required. Of course as I sit here today, the Space Station is now fully assembled and we can look back and see how well the EMUs performed. Just incredibly well, really, and they were integral to the assembly of Space Station. I don't know how they would have assembled Space Station without doing all the EVAs that they have, but to the point that EVAs, I think it's fair to say, were just totally taken for granted. It's like, "Well, let's just add an EVA here or let's do another EVA and go look at this."

Sometimes we'd have to remind ourselves that this is still pretty risky business, especially if you cut a glove or get hit by a micrometeorite or something like that. Particularly toward the end of the program, when the number of EVAs was just—we had a thing that we called the wall of EVA, when they were looking forward at how many EVAs we had done. It was a graph that showed how many EVAs we did this year, this year, this year, this year. Then you got to this point where it just looked like a wall you were climbing—I don't want to guess on the numbers, but an order of magnitude more EVAs than you had done prior. Or more EVAs in a three-year period than you'd done in the whole history of the space program.

That got people's attention I would say. I think it scared some people but it certainly got people's attention in the EVA world, so they looked at everything, trying to make everything as

reliable as it could possibly be. Ultimately, I think what the EVA folks did for spacewalking is what NASA did for human spaceflight. They made it look easy, and it's not, but they made it look easy. I guess that's the ultimate compliment if you take something that's really hard. I know Mike Coats even made a comment about it the other night at the Shuttle celebration, about how NASA makes this look so easy when it's not.

WRIGHT: I was reading Story Musgrave's book [Story Musgrave: The Way of Water]. In there he refers to the suit as a "potential body bag." A shocking statement, but for a minute you think about, as he says, it's risky business. Not only did NASA have more EVAs, but they made them longer. Astronauts were out originally for so many hours, and now it's five, six, seven hours. So it says a lot for your life support systems, of the vitality.

SANZONE: Yes, one of the things that was done early on, and I'll refer to Joe McMann again. One of his lines used to be: "Be sure to build reserve into the design but don't let anybody know it's there because they'll want to use it." So our designs to some extent followed his guidance, and we usually had the ability to do more than the specification said we could do. Like we had a seven-hour system and it is what it was really planned to be, but as you got towards the end of the seven hours, depending on the thermal environment that you were in and the metabolic rate that you were working, we could crank numbers that would show that we had enough oxygen where we could extend another 30 minutes or another hour. I think we got up close to eight and a half hours on one EVA. I don't think there's much left beyond that. But you're right. The guys could spend an entire workday outside doing stuff, be out there easily seven hours or longer. Considering they get in the suit earlier than that, it's a long day.

So one of the things that we and NASA generally did was if we had a mission that had multiple EVAs, assembly flight or servicing or something, we would generally alternate crew members, because your hands get tired. We'd have two astronauts go out on Monday and a different two on Tuesday, and then the Monday crew would go out on Wednesday, those kinds of things. One of the things that we learned and had the capability to do was to have some backup capability, like in the early days we started flying a third EMU so that if one of the first two failed we could utilize [the third one].

On STS-5 that wasn't the case. There was no plan to fly [an extra], and I don't think we flew it on STS-6 either, but somewhere down the line that decision was made. We wanted to have a backup suit on board if we have a problem with one. I think I already mentioned the suits are fail safe, not fail operational, meaning if you have a failure you can't continue. You won't lose your life because of the failure, but they're fail safe. You have to get back in right away, so this would give us the ability to have a failure, not have to cancel the EVA, and have an astronaut get in another suit, do some sizing adjustments, and still go out. Then of course later we ended up flying four EMUs because many of the missions had four astronauts who were doing EVAs on alternating days.

WRIGHT: Is there one remarkable memory more than others that you remember about something you didn't think the suit could do and it did?

SANZONE: There's nothing that jumps to mind. Probably more than anything it would be the general reliability, and it's somewhat ironic that on our very first EVA attempt we couldn't do it. We then went for decades with no significant problems.

Similar to the Shuttle, when you look at it, if you know anything about it you realize that the miracle is that it ever flies at all, that all this stuff works at the same time. The suit has a little bit of that too. It's not that it's magical that it works. It's that time after time after time after time it could be that reliable. It's not a specific instance, it's just that it became so commonplace, if you will. I think it's probably also neat.

I even know of a lot of astronauts personally that have done EVAs that that's—for those that haven't done an EVA they may not want to say this—but it's the pinnacle, doing an EVA. Jerry [L.] Ross, God bless him. He was on one mission where there wasn't a planned EVA, and he said to me, "You've got to help me come up with a reason to do an EVA." He loved doing EVAs. They all did.

I don't know if I shared with you Story's comment. I can't remember if it's in his book, but because of all the water tank training—when he went out and did the very first Shuttle EVA, first guy out the hatch on STS-6, he looked down somewhere. Not necessarily immediately, but he looked down on the Earth, and he said, "The pool is deep today." Anne Lenehan was the author of that book, and she interviewed me extensively for the book. I was actually at the book launching in New York, which was a treat.

But yes, Story, he called it the space ballet. Doing an EVA, called it a space ballet. He also said that he liked being in space but not getting to space. He'd say, "If you could 'beam me up, Scotty' and skip the launch, that's the way I'd get to space."

WRIGHT: Of course the Shuttle has retired, but the suit hasn't, it lives on, but to some capacity, as you mentioned being able to service it from the ground to space. Did you leave a plan for that before you retired?

SANZONE: Not me personally, but there were people that worked on it. The whole idea was to leave the EMUs that were going to be left on orbit in a position with spares and the ability to change out on-orbit replaceable items, to be able to be serviced on orbit, so that was worked very very hard for a number of years.

Now we're in the mode of time that will tell how all that planning worked, because this is the somewhat disconcerting part for an old EVA guy. There's not a planned American EMU EVA for another year—most people, even I, didn't realize it was that far off. I would tell people we're going to continue doing EVAs, but just not from the Shuttle, they're going to be from the Space Station. They won't be as often. I didn't know how much of an understatement that was when I said, "They won't be as often." Then one of the guys in our office shared in an e-mail the next planned EVA is August of 2012.

I'm sure there will be some EVAs in Russian Orlan suits. I think they've already had one since STS-135, but I mentioned before that you always have EMUs available for contingency use. I'm hoping that there's not a contingency where they have to use them, but if there is, that's when you really need them to work.

WRIGHT: You were kind enough to wear your shirt today with your EVA patch. I wanted you to share information about the patch and about the evolution of the patch itself.

SANZONE: Well, wearing this shirt was unplanned, but maybe it was serendipity here. The EVA patch was actually designed by my longtime boss, Fred Keune. He was an amateur artist, and NASA was into patches. He was trying to figure out, "What do I do with the patch?" He was

visiting with our company doctor in Connecticut one day in his office up there. He looked up on the wall and there was a framed [picture of Leonardo] da Vinci's dimensions of man [Vitruvian Man], which you've probably seen in other doctors' offices. He immediately said, "That's it, that's what I'm going to use."

So the heart of the patch is an astronaut in an EMU space suit with his arms extended double, if that's the right term, like da Vinci's dimensions of man. The original patch that flew for the first time on STS-6—or actually I guess it may have flown on STS-5 but actually was first used in an EVA on STS-6—had three stars on it. Those three stars were for the first American EVA by Ed White in the Gemini program, for the first EVA walk on the Moon by Neil [A.] Armstrong and Buzz Aldrin on Apollo 11, and for the saving of Skylab by the EVA done by [Charles P.] Pete Conrad [Jr.] and [Joseph P.] Joe Kerwin when they had to install the thermal shield.

For years and years we flew the patch with three stars. [G.] Allen Flynt was managing the EVA Project Office years later and decided that it was time to add two stars. The fourth star was for the first Shuttle EVA, so this would be the fourth program. We had Gemini, Apollo, Skylab, and now Shuttle. The first Shuttle EVA was by Story Musgrave and [Donald H.] Don Peterson. Then the fifth star was for the first International Space Station-based EVA done out of the Space Station airlock. Jim Reilly was one of the two guys, and the other one was Michael Gernhardt [STS-104, July 2001]. So those were the five stars.

I mentioned that I was in New York City at the book launching for Story Musgrave's book, The Way of Water. The five-star EVA patch had only relatively recently come out. I got to speak briefly at the launch party and one of the fun things that I was able to do was to present Story with a five-star EVA patch of which he represented the fourth star. This was particularly

meaningful to me, because after he did the very first Shuttle spacewalk, he presented a patch to me, and several other folks.

Actually at home I have—we haven't talked about it, but on the suits we have identifiers, red stripes to identify which astronaut is which. We learned fairly early on that two guys out in these white space suits both look exactly the same to us on the ground, so we put some red Velcro stripes on the suits. Story was EV1 so he had red stripes, and Don Peterson was EV2 so he didn't have stripes. One of the things that I have at home that was presented to us after STS-6 was an actual small piece of the red stripe off of Story's suit; it's in Plexiglas or however they do those things, so that's pretty cool. They call it a commander's stripe.

That's pretty much the story on the patch. I don't know when we'll add the sixth star, but hopefully in my lifetime.

WRIGHT: That would be something to look forward to. Many of the years that you were with Hamilton you were in management. We talked a little bit the last time about how you learned so much on the job. I was hoping that you could share with us, and you already have on some things but maybe some of the lessons learned you feel are important for management and for leadership.

SANZONE: Well, I've got a leadership presentation that I put together a couple years ago for an executive presentation at Hamilton in Connecticut. I gave it about a year and a half ago at a JSC NMA [National Management Association] luncheon meeting. Then I just did it again, virtually unchanged, a month ago at a leadership seminar that the NMA put on at JSC.

The first slide pretty much tells it all. The first slide says, "It's all about people." I think that is the key. If you think it's all about technology, and obviously we do a lot of technology and we need all the technology and we need all the technologists, but it's really all about teamwork. I think that one of the real highs of working at JSC is no matter what area you work in, and it doesn't have to be a technical area, you're part of the team that is accomplishing this mission. So more than anything else I would say it's all about people.

Actually on the slide in my presentation it has two photographs side by side. The one on the right is a flight crew, and the one on the left is about 15 or 20 people in the Mission Control Center holding the crew patch, the emblem, for that particular crew's mission. Obviously the one on the right, the group of seven on the right, can't do it without the group of 20 on the left, and the group of 20 on the left has a group of 100 behind them in the back rooms. Everybody in the back room has people in the Mission Evaluation Room, and then they have ties to contractors all over the country that make the hardware. It's an amazing network that ends up making this stuff look so easy. I've often said that to most people watching the mission the most brilliant person in the world has to be the CapCom because he's the guy talking to the crew. But he's the mouthpiece for all this stuff that's getting fed in.

There are other leadership things obviously in this presentation. Probably the one that I've seen people struggle with the most over the years, I learned about 20 years ago when I attended essentially a training session but it was really a working training session with some of our NASA customers. We were having some challenges on the team and our program manager in Connecticut pulled us all together—all of us in the leadership ranks. We went off for a couple of days at the United Technologies Leadership Center training center. It was called, "Leading A

Customer-Focused Organization," which ties to the people thing by the way, because customers are people and they all have their own personalities.

They gave us a big fat notebook and an instructor and we went through stuff for a couple of days. We got to talk a lot openly, and it was very valuable. But one of the things they gave us was a two-sided sheet, and it listed desirable leadership traits or something. It listed about 40 of them. I'm not sure I could tell you a single one other than number 30. I even remember the number.

Number 30 said: Supporting a decision once made even though you did not support it before it was made. I think that ends up being one of the most difficult things for people because you have very passionate people that work in this business. They are encouraged, virtually required, to express their opinions, particularly if they differ from your own. But eventually a decision gets made, because if we waited for everybody to agree with everything we would never fly. So eventually whether it's space or any kind of business, eventually someone in charge, a boss, makes the decision. It's at that point that you have to say,, "Okay, I got to speak my piece, a decision has been made, now I'm going to do everything I can to support this decision." I have seen people struggle with that over the years. I've seen people virtually destroy their careers because they couldn't do that, because if you're the boss you can't have your organization pulling in a different direction.

That's one of the slides that's in there. One of them is: delegate and hold accountable. The subtitle on that slide is: "20-year-olds got us to the Moon." Now we think that 20-year-olds are incapable of having responsibility. The key is to delegate to them, which is not easy to do. People have a real hard time delegating. But then hold them accountable. Those 20-year-olds that got us to the Moon, they were also very accountable for what they were doing.

Some of the things are obvious or no-brainers, but they're also things that people don't routinely do, or they'll hold back on delegating. One of the things that I've found personally is that a lot of people don't delegate until they have no other choice. When they delegate at that point, 95 percent of the time the people come through fine. So it makes you say even more so: Why don't you delegate earlier or more often? It's really fear of failure I think. A manager who's delegating fears that the person he delegates it to will fail, and then the manager will be held accountable. The buck stops at the top. That's part of leadership, it's recognizing who can do it and who can't and taking a chance with people.

I just had this flashback to early in my career. United Technologies Corporation was initially called United Aircraft and Transport. When I joined it it was called United Aircraft Corporation. We had a CEO [chief executive officer] around in the early '70s, a guy by the name of Harry [J.] Gray, who actually not only changed the name to United Technologies, but he changed it from an all-aerospace company to a technology company in that he bought Carrier Air Conditioning and Otis Elevator [Company] as two big companies to diversify the portfolio.

Under his reign there was a series of ads that were run in the *Wall Street Journal*. Full-page ads. I still have his book at home; the book is called *Gray Matter*. They weren't really advertisements, they were leadership messages. Full-page leadership messages. Then at the bottom it would just say United Technologies. One of the ones that I remember the most was: *Do you remember who gave you your first break?* Then it said: *Send him a letter today thanking him.* There's not one of us that doesn't remember who that person was. Maybe it was a teacher or a boss or someone else.

That one particularly struck me. I remember that I wrote a letter to Fred Keune, who I mentioned, who had been my boss for many years and my mentor. When he passed away a

number of years ago, one of the things they found was that letter that he had kept. Those are the highlights of leadership.

WRIGHT: Because there were days where it was challenging, what do you think was the most challenging time period of your career?

SANZONE: I thought about that a little bit. Actually there's relatively little doubt when I think back on it, but I didn't think that much about it at the time. At the time I didn't say, "Oh my gosh, this is the most challenging period of my life." You know what I mean? But it was in 1986. We had just lost the Flight Equipment Processing Contract [FEPC] of the suits. We had badge-swapped several hundred people from our company to Boeing. We were down to I think 26 employees. My boss of 17 years had decided to leave after we lost FEPC. I had been his deputy so I got to take over. We had just formed a brand-new local subsidiary, and the future was really bleak.

I have thought about it a little bit, and it was really I would say the spirit of NASA, the "don't quit spirit" of NASA, because when I think back on it, 25 years ago, it's like now I'd probably say I'm not up for this fight ahead, or for the challenges. I'm not military, so I shouldn't say, but I imagine it's like a soldier on the battlefield. You just keep fighting, you just keep fighting, you don't really have the option to say, "I'm done fighting."

I think at the same time it was, in hindsight, rewarding in that it wasn't me—I was the general manager, so I felt a lot of the heat—but the success that we achieved for this whole team, just pulling together, doing whatever it took and not quitting, which is really the NASA spirit I think. It really is.

Then, I don't want to say it's "number two" but it was more recent so it's clearer in my memory. It was when one of our folks dropped a Primary Life Support System. He didn't really drop it. It was in a fixture and he was doing something with it and it came out of its fixture and crashed to the floor, caused more than $1 million worth of damage. It literally had our business on the brink. Most of our employees weren't aware of how close we were to the brink, but our NASA customer, particularly in the Shuttle Program Office, particularly at the Center Director level, was very unhappy. That one is almost miraculous that we survived.

I just read something this morning about the Soyuz [rocket crash, August 24, 2011] and how heads are going to roll. Then there was something else in the government, maybe I read it in the newspaper—how this guy is getting replaced, and he's being moved. It's the default answer to a problem that occurs, "Okay, well, we'll just fire the guy who is in charge."

The guy who was my boss at the time, our vice president, Ed Francis—and I've thanked him more times than I can count for not firing me, because it was—I had been around NASA long enough that I knew what to expect. I knew the rules. I knew the unwritten rules of the game. If you're the GM [general manager] and something like this happens and the customer is unhappy, you've got to be able to go in and say, "Okay we replaced the GM," and that would appease everybody. To his credit and my survival, and I think it may have been his West Point leadership training, but he said, No, I'm not going to do that." I'm sure he got some grief for not doing it. Then ironically, we came out of the whole thing stronger than we went in.

I heard somebody say that the other day. I think maybe post-Challenger. We were stronger post-Challenger because of all the lessons we had learned. But those were the two most challenging periods in my career that I can recall. There were little ones along the way, but they were pretty small compared to those two.

WRIGHT: Sounds like it. We'd talked some the other day about Challenger and how it impacted the community. How did the loss of Columbia impact your group as well?

SANZONE: Ironically from a business standpoint Columbia—not just at Hamilton but I think at JSC—Columbia was obviously devastating, as was Challenger. The primary difference in the post-Challenger and the post-Columbia eras was post-Challenger we weren't flying at all for like three years. That was really really difficult. It was the most—I don't know what the right word is. I have told people that what I found was that people after the initial shock wore off, people griped about everything, because they had all this energy that they normally put into human spaceflight, and they weren't putting humans into space for almost three years. They griped about where their desk was and about their window, all this relative petty stuff, that once we got back flying again just totally disappeared.

Post-Columbia I was gearing myself up mentally for that same type of thing. What I found was that because we had Space Station and because we had people on the Space Station and we were still had humans in space, even though we weren't putting them up on the Shuttle, that aspect of it wasn't as difficult, the post-Columbia accident era wasn't as difficult as the post-Challenger era.

I think that I was virtually convinced that it was going to be the end of Shuttle. I didn't say this to my employees, but I was somewhat surprised we survived, just like I said, what do you do? You fire the boss. Historically something like that happens, well, we just won't do that anymore, we'll just remove that risk. So I was pleasantly surprised when we kept on going after Challenger. I think most people at NASA, particularly senior people, would have said there's no

way we'll survive a second accident. When that second accident happened I literally thought, "That's it."

But it goes back to that spirit of NASA and not giving up. It's amazing. I take people on tours sometimes at JSC and over to the Saturn V building. You see quotes from astronauts from 40 plus years ago about "if something happens I want you to continue on." That is the spirit of what we do.

We all get it. I think it's a lot harder for people who work in other industries and other locations to really understand it. It's hard. I guess it's literally cultural. It's just ingrained in our culture, this you don't give up no matter what.

WRIGHT: Is that part of the reason why you never went back to Connecticut to work? You chose to stay in Houston for 43 years.

SANZONE: I think it was --

WRIGHT: One long year?

SANZONE: Yes. When I came down it was for a one-year assignment, maybe a year and a half. I remember the very first project manager said, "Well, how do you like it here? I arrived in July. He was asking me in August or September. It was hot. I said, "Well, I'm not thrilled about Houston, but I really like the job." Then I've been lucky in everything I've ever done.

Somewhere before that year was out I was actually transferred from the field service department that I was in, which was routinely moving people around every year or two to

different parts of the world. I was transferred virtually without my knowledge into the space systems department, but by that time I was hooked. We were months, ten, nine, eight months from going to the Moon. I think I mentioned to you the article where the Hartford Courant guy interviewed me and I said that we would have worked for nothing. It was that kind of environment.

Yes, somewhere along the line I got invited, encouraged to go back to Connecticut. When a vice president invites you to go back, it's usually more than an invitation. I really thought about it. I can't remember exactly when it was now, but I really analyzed it like an engineer. I was single. I had some money in the bank. The biggest thing was that I was really happy in what I was doing. From a career standpoint if I wanted to be a vice president there was no way I was going to be a vice president in Houston and that was made clear to me. That if you want to progress in your career to really more senior levels you're going to need to come back to Connecticut.

I thought about it a lot. I really decided that my personal happiness and satisfaction in what I was doing was way more important than my title or anything like that. So I made the decision knowing that the most likely outcome was that I would get terminated, because you don't normally turn those things down. That was another time I was very fortunate that I kept trucking along.

Although the next time I went to Connecticut that guy, who I still stay in contact with, Fred Morris, a great guy, he said to me, "I didn't think you liked us up here." He and Story are great friends as well. He was the very first EMU program manager, very first one, and then he ran our department for a number of years. He and Story were born in the same hospital within like a week of each other.

WRIGHT: That's crazy.

SANZONE: Yes, and obviously they didn't meet each other until years later. Story grew up in Massachusetts. He was born there. So everything worked out, that's for sure. That's for sure. Yes, you'd be hard-pressed to find somebody that was more happy. I always tell people there were days I would trade in, but generally speaking it was just an incredible place to be.

But when I look what's going on right now and the uncertainty about the future, I want the people that follow behind me to have the same opportunities that I had. When I go visit the legislators in Washington that's exactly what I tell them. I say I was 22 years old when I got to work with the first guys to walk on the Moon. The 22-year-olds today know ten times more than I knew, and I want them to have the same kinds of opportunities. But those opportunities are more fuzzy now. When you're in the moment, it's when it's always the fuzziest. Hopefully six months or a year down the road things might clear up a little bit.

WRIGHT: I think that would be good news for people, present and past.

SANZONE: Yes it would. That's true.

WRIGHT: Are there other areas that you wanted to talk about that we haven't touched on?

SANZONE: You've done such a good job of leading things that I really haven't much more. I will tell one more story. I was talking about it's all about people, and then about the people that I

got to meet over the years and got to work with and interface with and just phenomenal leaders we had. But one of the things that was very—influential I think would probably be the right word—in my career was, and it came about in a strange way, definitely a circuitous route. My wife and I are both runners, and we've run a lot of marathons, and my wife was the president of the Bay Area Running Club for a number of years.

There used to be, there still is, a run but now it starts at Space Center Houston, but it used to start out of Gilruth Center. It was called the Lunar Rendezvous Run. It occurred every mid July, around July 20th every year. It's been going now for like 35 years or something. We always would try to get some celebrity, usually an astronaut, to start the race. This was back in the days when the Center was open to the public, and people from all over Houston would come. It wasn't uncommon to have 800, 900, 1,000 runners, so we would usually try to get an astronaut that would shoot the starting gun off.

My cousin [Dr. Robert] Bob Fitzmaurice was working in [JSC] Education/Public Affairs. This particular year, I think it was probably 1991, he said he would get an astronaut, "I'll take the action to get us an astronaut that'll start the run." So he reported back at our next planning meeting that he had gotten this astronaut named Nancy Sherlock who's going to start the run. I'm a little embarrassed to say this, but I looked it up, and realized, she's still an astronaut candidate. She's not even a real astronaut yet. That was my initial feeling. It was like, okay.

So I think it was probably the week of the race. We had had some successful EVA test. I can't even remember what it was, but I remember Glenn Lutz bought a keg of beer that we all got to share out at the park at the Gilruth Center. He invited a bunch of astronauts to join us, so we were out there. I don't know, there might have been ten astronauts, mostly EVA-related. So I saw this woman, saw her badge and saw Sherlock on it.

I introduced myself to her, and said, "Oh, I understand you're starting the race." That started a very close and long friendship that still lasts today. I can remember saying to her, "You need to be there about 7:30 a.m., because we do the wheelchair start at 7:45."

She said, "I'll be there like quarter to 7:00." I told her that she didn't need to be there that early. She said, "No, I'll help you set up the finish line." That definitely struck me.

There was actually another astronaut in her class, that class of '90, who I met that day, [William G.] Bill Gregory. He and I are still friends. He's out in Phoenix [Arizona]. Anyway, Nancy came and started the race. Then sometime after that, my wife ran into her in the grocery store or something. Then a friendship started developing. She had a little girl. Nancy was a single mom.

When Nancy made her first flight on STS-57, we were the guardians for her six-year-old daughter, Stephanie. My wife actually, because Nancy was single at the time, ended up filling the spouse position, flew to Cape Canaveral [Florida] for the launch and the landing. Because my wife was teaching and wasn't available, I got to participate with the other spouses as a sub[statute], and actually got to fly the mission simulator, only time I ever did that. We were at the [Florida] beach house the day or two before launch for the crew family barbecue. In a way it was fascinating because I had been at NASA for more than 20 years at that point, I had worked with a lot of astronauts, I had traveled with some, but I never had one that I considered a close personal friend. Through that relationship which still exists today, we were invited to her astronaut class parties, so I ended up knowing most of the members of the astronaut class of 1990, many of whom I still consider good friends today.

[William S.] Bill McArthur is one. Leroy Chiao and on and on. I saw a side of NASA that very few people ever see. Like I said, I'd been here 21 or 22 years. I'd probably heard of

the beach house, but when you're at the beach house just before the launch it's surreal. It really is surreal. Then you become very close with the other family members. It's a very, I don't want to diminish it by calling it a "club," but it's a very tight-knit group that shares a common bond.

WRIGHT: Very unique.

SANZONE: Yes, it's very unique. I can't remember if we already talked about this, but one of the things that happened on STS-57 was the SAREX, the Shuttle Amateur Radio Experiment. Long story short, through ham operators one day in Hawaii and another day in Australia they actually "hooked up" Nancy to our kitchen phone. She talked to both my wife and me, and primarily her daughter. So I took a picture of Stephanie, who was six years old, sitting on our kitchen chair with what seemed like a big phone in her ear. Then after the mission Brian Duffy, who was the pilot and was a member of our church, St. Paul's [Catholic Church, Nassau Bay, Texas], presented his slide show and film for the parishioners. When he came to this one photo of Nancy floating in the cabin with headphones on and a big smile on her face, he said, "This is my favorite photograph from the mission. This is Nancy talking to her daughter."

I said to him afterwards, "Hey Brian, I have the other end of that photo. I took a photo of Stephanie talking on the phone with a smile on her face." So he got me a copy of the photo of Nancy and my wife took both photos and had them put in a single frame. Then she put a brass tag or something on it and gave it to Nancy for Mother's Day. It said, "I love you, Mommy. Over." Because Stephanie was instructed to say the word "over" after every sentence she finished and she did. I still see the photos at Nancy's house.

We've been through a lot of good times and some more challenging times, particularly most recently. Her husband, Dave, passed away. He had become a very good friend of ours obviously. So it's the circle of life. So that's one element that I wouldn't want to leave out, because it ended up being so significant. Then she flew three more times. We were at all four of her launches and got to know her parents and her family members. So we literally feel about her just like family. Literally like family. So it's probably a kind of an intense element of family in the big JSC family.

One of the things that I'm recognizing more, I made a comment yesterday to somebody about this, I'm recognizing this more now than when I was working full-time. I recognized that I loved working at JSC, I turned down potential promotions in Connecticut, always enjoyed the people I worked with. But since I've retired and I've gone to some different events and seen different people—and maybe it's because I don't have other things that are bogging my brain down at work—I really realize how much I loved the people that I worked with, and still do.

WRIGHT: A part of your life.

SANZONE: Yes. So when you tell people at JSC it's family, they know what you mean. Choked up.

WRIGHT: It's okay. Through those 43 plus years there's a lot of paths that you've crossed with people.

SANZONE: Yes, that's true.

WRIGHT: A lot of good memories for you to think about.

SANZONE: Yes there are.

WRIGHT: They're not over yet. They're just going to be different.

SANZONE: No. That's really one of the blessings. I think I shouldn't end without thanking Hamilton for the career that they gave me. I talk about individual bosses, which were all important. But it's amazing to go through a career that's more than four decades long with one company and be able to say that I couldn't have been treated better. From the beginning to the end.

WRIGHT: That's amazing. Well, thanks for sharing your history and your thoughts with us. We appreciate it.

SANZONE: Well, it's been a real pleasure. Thank you for the job that you did. For being one of those family members.

WRIGHT: Well, appreciate that, thanks.

[End of interview]