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STEPHEN M. FRANCOIS
INTERVIEWED BY REBECCA WRIGHT
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WRIGHT: Today is July 22, 2008. This interview with Stephen Francois is being conducted at the Kennedy Space Center in Florida for the NASA Headquarters History Office Oral History Project. Interviewer is Rebecca Wright, assisted by Sandra Johnson. Thanks again for making time for us today. We know that you're currently the Program Manager of the Launch Services Program. However, you began your career with NASA serving as a propulsion and mechanical engineer during the Titan/Centaur Program. Tell us how you first came to work for the space Agency more than three decades ago.

FRANCOIS: Well, I was graduating from college, and just before I got out of college I had an interest in, obviously, aerospace engineering, and looked at NASA. But at the time it didn't look like there was much hope that you could get there. I grew up in the Midwest in Illinois. The idea of coming to Kennedy Space Center seemed like a long ways away, and not something necessarily you could do.

But I had filled out a form, a standard civil service application form, and sent it in back in March. Then I graduated in July. All I'd heard was a reject notice that said I didn't meet the minimum requirements, so thanks for your attention, but we'll get back to you if we ever think of you. I graduated from college with no job. At the time I grew up in a small town and worked for my dad driving a truck and hauling fertilizer to cornfields and wheat fields. So the day after I graduated, I went back to work for him.

About a week later, I come home for lunch, and Mom says, "Well, there's a guy from Kennedy Space Center called and wants you to call him back while you're home for lunch."

So I called the number, and the guy said, "Well, we had this training program we were going to start. We're hiring twenty new engineers, and we were going to do it in June. But we got delayed, and we've had one guy drop out. I was going back through my files and I found your application, and I want to know if you're still interested."

I said, "Well, what's the job?"

He said, "Well, it's a training program. It's six months training, you go throughout the whole Center, and at the end of the six months then we'll decide where you go." So he said, "I really can't tell you what the job is. It sort of depends after the six months."

I said, "Okay, but so I really don't know what the job is. It's six months and it's at Kennedy Space Center." I said, "Well, I need a little time to think about it." I got married just before I got out of school. I said, "Let me talk it over with my wife." I said, "How much time do I have?"

I remember clear as day it was a Wednesday. He said, "Well, the program is really going to start tomorrow. But if you could be here Monday it'd be okay. I think I can hold off, and as long as you were here then."

I said, "But it's Wednesday. You're talking about Monday."

He said, "Yeah, you just fly down here Sunday, and come to work Monday, and you'll be in."

I said, "Well, gee. I can try that." But I said, "I got one problem."

He said, "What's that?"

I said, "Where do you fly to? I got to figure out how to buy a plane ticket, because I've never been on an airplane. This little town I grew up in, I don't know who sells tickets."

He said, "Well, you got two days to figure it out." But he said, "Think it over and call me back tomorrow."

So I thought it overnight and talked to my wife. We said, "We have no better offer, and that's what we always wanted to do. I don't know what the job is, but it's in Florida, and I guess we can go try it." So I bought a plane ticket. The guy said if I could get to Orlando [Florida] he'd pick me up and get me to work Monday morning. So I came.

It turned out when I got here, in those days Kurt [H.] Debus was the Center Director, the first one. When we asked around, "What is this program?" The way it was always portrayed to us young engineers was this was a thought of Kurt Debus. He said in the old days in the German world when they had the factories that they always believed you brought the new engineers in, and the first thing you did is take them through every department in the factory and show them what that department did. And that the key thing was to find out who the people—what was the name in that department, and a phone number, and how to contact that person, so that wherever you went to work, if you decided, "Oh I need this done," it wasn't like, "Well, I don't know if anybody can do it," it was like, "No, I remember meeting so-and-so over here, and he does calibrations, or he does machining, or he does leak checks."

So they took twenty of us and broke us into groups of like four or five. Every day we would go to a different branch and spend a day, or in some cases spend a week, in a division. We had the luxury of for six months going—in those days the Apollo [program] was still going on. So we went through every spacecraft, directorate, division, branch, all the way down, then went through the launch vehicle thing.

Then the last six weeks we spent in design engineering, all the time having people tell us what they do, and meeting the people, and keeping a log of who you met, phone numbers, and what they did, and what went on in that area. At the end of the six months, it's never been done that I know of, but we were fortunate, they gave us a choice. They said, "Write down your top three places that out of the whole Center, where would you like to go?" Not, "Here's a vacancy, and here's the only openings, and you got to take this because that's the—" They just said, "Where would you like to go, and we will do our best to meet your top three. We won't guarantee we can meet your number one, but of the three you give us, we will attempt to place you in one of those three."

And they did. They accommodated all of us. At the end of the period, I picked a place that when I first went there it turned out the guy was looking for an electrical, and I was mechanical. But he said, "We'll train you anyway," and I said, "I don't think that'll work." So I went back to personnel, and said, "Maybe we need to rethink it." The guy told me, he said, "Well, what about ELV [Expendable Launch Vehicles]?" He said, "Those guys over there. They're unique, and they're a small group, and you might like that." I said, "It's been a long time, six months ago, it was like the first place we went." He said, "Well, go talk to them again."

So I went over and met the Mechanical Branch Chief sitting in the blockhouse at Complex 36. He said, "Yeah, I could use you. I only got a couple guys in the branch. We usually start the new guy out in the ground systems and the GSE [ground support equipment], and you learn it, and then you work your way up to the vehicle."

So I said, "Okay, it sounds pretty good."

I went back to the front office for ELV, and the director there said, "Well, what do you think?"

I said, "Well, it sounds pretty good. I think it's okay."

Apparently didn't sound very strong. So he looked at me and said, "Son, just make up your mind. It's either yes or no."

I said, "Okay, if it's that, yes." So I said, "What do I do now that I said yes?"

He said, "Well, turns out that they're launching. The group you're joining has got a launch tonight. So they're not in the office today. They're coming in at six o'clock tonight for the launch. It's about"—I forget, nine or ten—"o'clock at night." So he said, "You go home and get back here by six o'clock. We'll have somebody pick you up and take you out to the blockhouse." I'm thinking this is pretty good. Never been there.

So sure enough I showed up. The guy picked me up in the car and introduced himself and said, "We're running out to the blockhouse." We got to the blockhouse. If you've ever been in a blockhouse, it's the old dome, the old-fashioned, the kind you'd see in the Mercury days, the Atlas, because it was an Atlas/Centaur [rocket] we were launching. So here's this dome blockhouse, big blast doors. So we go in and there's about 200 people in the blockhouse, and they find you a chair in the corner and squeeze you in and give you a headset so you can hear what's going on. Of course if you've never heard one, the countdown is going on, they're calling out commands: "Yes sir," "No sir," "Ready." So it's quite impressive if you've never—being a kid off the street, off the farm, it's like, "Whoa, I've come to something different here."

That night we counted it all the way down. You started catching on to the countdown. But the thing that struck me was that about halfway into it they make this announcement in the blockhouse. "Attention, the blockhouse doors will be sealed." You're looking at the guy beside you and [I] said, "What'd that mean?"

He says, "Well, that's what they do. That big blast door you walked in, they move it over, seal the door, and you can't get out."

I said, "Why do we do that?"

He said, "Well, didn't you notice the vehicle is only about 300 feet from here? If it blows up, you're stuck here." That was when it dawned on me nobody mentioned rockets blowing up. Where I came from they all launched, and nobody said they blew up. So it's like, "What do you mean they blow up?" He said, "Well, it could."

So you find out if you're claustrophobic in a hurry then. But it worked out nice. We didn't launch that night. Weather got them. I said, "What do we do now?" The guy said, "Just come back tomorrow night. We keep doing it till we get it." So you go home, you come back the next night. The next night they counted it down the same. So you got two quick lessons in countdowns and launching vehicles. And we launched. That's a pretty neat experience. Sitting in a blockhouse, things start shaking and rumbling. Then I look around and I said, "What did we launch?" They said, "Oh yeah." At the time it was called Pioneer F—which they renamed Pioneer 10—which was the first spacecraft intended to leave the solar system, and the first one with a nuclear power RTG [Radioisotope Thermoelectric Generator] on board. So I figured out we did that. We're sitting in a blockhouse. We just heard fire and rumble and a rocket. So I said, "I didn't make a bad choice, this is pretty nice."

I was hooked.

WRIGHT: Pretty good way to start from the ground up.

FRANCOIS: Well, yes, it'll get you. Like I said, it'll get you hooked. So then the next day is like, "Well, what are we doing now?" They said, "Well, okay, we don't do that every day, but we have this new project that we need to go start." Because this was in 1972, March 2, 1972, Pioneer 10. So what the Branch Chief had told me was exactly right. He said, "We start you in the GSE [ground support equipment]." It turns out that in 1972 they had ultimate plans to launch Viking [Mars mission] in '75. So here we are three years away. NASA had taken back Complex 41 from the Air Force to build the Titan/Centaur rocket. The Titan was an Air Force heritage. Had the big solids on it. But Centaur was the high-energy, high-efficient upper stage. They wanted to put the two of those together. They'd never been put together before.

So you're going to integrate those two stages together with the intent of being able to launch Viking and then two years later launch Voyager [planetary explorer spacecraft]. Well, the whole launch complex had never had a LOX [liquid oxygen]/hydrogen Centaur stage on it, so everything had to be added. So it turns out starting that summer of '72 we went out to Complex 41 and everything had to get installed. All the liquid hydrogen systems, liquid oxygen systems. All the retract [retraction] systems. The air conditioning systems. The pneumatics. Everything that the Centaur needed had to be installed and then checked out and tested. So every day was like a learning experience. It was like every day you'd go out there and you had a new system that something was going on, and you got the schematics, and you go study it, and you go out in the field and say, "Yes, there it is, it's real." Trace it out and build it up. Then when you got there, you could turn it on and operate it. Contractor and you together, but as a new engineer it was like I said, learning every day.

You could just have a field day with—if you got tired of one, well, next day it was something else. You never got bored with just one thing. They let me—I say the young guy out

of school, like a year and a half out of school—I had that area, [it] was mine. The other guy was working the Titan, and there was only two or three of us out there. So it was yours to prove yourself and do what you want with. It just was a great experience. We spent a year or so, and we had a proof flight. T/C 1, Titan/Centaur 1, was a proof flight, which NASA seldom can afford these days. We actually had the luxury of flying one proof flight because Viking was so big. They wanted to demonstrate this new vehicle.

Didn't have too good of luck with the proof flight. It had a problem. But problems are where you learn from. Turned out that vehicle had a lot of new things on it. The thing that failed was the thing that was the oldest thing on the vehicle.

WRIGHT: That's interesting.

FRANCOIS: Yes. Had a new faring, new jettison system, new subsystems that we put on it. You could list a whole—but the one thing that failed was a boost pump that had been on Centaur since it was created and had never failed. This time it froze and never rotated. So the thing never did ignite. Took us six, nine months to go prove that. But proving it was part of the education. When you got done, you knew more about that Centaur and that integrated vehicle than you ever did even before you launched it.

But we came back, and that set the stage for launching a German satellite, Helios, which then reconfirmed that we were ready for Viking. The Vikings gave us a challenge we'd never had. Viking was supposed to launch ten days apart off the same launch pad. So when you listen to the [Space] Shuttle guys and turnaround times, and when you look at Ares [rockets] and how they're trying to launch off two pads and how many days apart—but for Viking we only had one

launch pad, but we built two vehicles up and literally had them to where one was on the pad and one was in basically the integration facility such that in one launch you could pull the launch mount back and roll the other one out. We had the schedule set up to do it in ten days.

We had some issues on the first one, so we wound up launching twenty-some days apart. On Voyager we wound up getting it down to sixteen days. It was interesting. All that crammed in a period of—the first instance I sat in the blockhouse was '72, and by '77 we'd launched seven Titan/Centaurs and launched Viking and Voyager. So it's like a cram course in five years.

WRIGHT: Did you find it to be an advantage to have a small group where you had a lot of opportunity to have hands on?

FRANCOIS: Yes. Loved the small group. I used to stay in touch with my folks I came to work with. By this time, they'd finished Apollo. You had the Skylab missions where they launched off the pedestal so they had to build that, and then the Shuttle was just starting. Those systems, in my parochial opinion, the systems were broke down to where one guy owned hydraulics, one guy might own pneumatics, one guy had this package, one guy had another system. In the ELV world we didn't have that many people. Our mindset was—for instance, by the time I got done, I had responsibility for the mechanical, propulsion, everything on Centaur. That meant the GSE and everything. So I wasn't subdivided. It just gave you a tremendous capability to get a breadth of knowledge. Instead of being an expert in just one thing you could—and it really gave you an appreciation of what we call system engineering today. Instead of just knowing one discipline, how it works, you could see how the different systems interacted.

Because it became important to me, if I was going to go troubleshoot my engine system, I had to know where the electrical signals came from. I had to know what instrumentation I had, what the pressure measurements told me, how the computer sent the signal, whether it was getting through or not. So that's what we typically call more of a system engineering approach. You got to know how everything works to figure out what part is breaking, versus sometimes you get so the guy looking at the engine just says, "Well it ain't leaking, and its integrity is there, the bolts are all tight, that's all I know." Yes it's good, but much more fun to do the whole thing.

WRIGHT: As the years went by, quickly you became Branch Chief of the Centaur Propulsion and Mechanical Branch and then later Chief of the Launch Operations Division. Share with us how your responsibilities grew, and then how some of those first aspects that you learned and felt worked well for you that you were able to apply as a leader, and then maybe some of the things that you changed under your leadership.

FRANCOIS: Well, again the point you made about a small group. A small group, you proved yourself that you were technically [competent] and you could reasonably think through things and work issues. You built your reputation on that. So when they were looking for Branch Chief—again branches in those days didn't have but four or five guys in them. So you more or less were—ability to work the technical issues was considered as—you learned the management after you got the job, if you will. So it is an eye opener to go from purely just the technical engineering to find out oh, I got to really figure out how to manage, even if it's four or five people.

It's nice to only start with four or five people. It's a lot easier. Especially if you're learning it on the job, it's much easier. So I felt I had that ability. I don't care what people tell you. Luck plays into it just as much as anything.

I'll set the stage for you. When we launched Voyager in '77, it was the last Titan/Centaur. You've got to remember the environment. Shuttle is coming along. Shuttle is going to fly in the next year or two. By Congressional [mandate], by direction of the Agency, Shuttle will replace every launch system that exists. There will not be any other launch systems. Said rather strongly, but that's basically the intent.

So we were supposed to be going out of business. The Titan/Centaur was done. The Atlas/Centaur was sitting there. We were supposed to be flying our last missions. Delta [rockets] was another team down the road from us, and they're likewise supposed to be going out of business. So I've got a group of folks who maybe got ten years' seniority on me, but they're sitting there saying, "I think it's time to leave. I need to get over on the Shuttle and find a good job. I better be looking ahead for my career." So here's where the luck falls in.

They go get aggressive and decide to go find new jobs. I'm sitting there saying, "I'm still a junior engineer. I'm still trying to get to be a [GS, Government Service] 13. I'm just now getting ready to be a manager. You're scaring me, but I'm not ready to move yet." So they moved, and it basically created a vacuum. You can become the best qualified candidate if everybody else leaves. It creates its own opportunities. So I'm like, "Well yes, I can stay here another couple, three years." I get that three years' experience, and probably then I'm better off if I have to move. But I'm better learning here than I would small fish in a big pond over there. Just stay. Well, the joke about ELV is it's been going out of business ever since. And here we are.

So we joke about the mentality that we're always—if somebody comes to you and says, "Well, you know your last launch is only three years away." We said, "That's good. Last year it was only two years away." It doesn't change. So the luck part was that because so many people left, we did bring a couple people in, but I had as much experience, and really made myself very competitive to be the Branch Chief. So it was an easy thing to take over.

It was a great place to learn. Like I said, at the point in my career, it was a great place to learn and develop some skills that you could use later. So by the time we got around to the Division Chief, again we were in this mode that we're getting out of the government owning the launch vehicles and us buying Atlas/Centaurs and Deltas. You now have the era of commercial launches. So by '87, '88, Commercial Space Act is starting to be talked about. Congress is saying, "You ought to buy commercial launches." You've had the [Space Shuttle] *Challenger* [STS 51-L accident] issue that says, "Okay, maybe Shuttle is not going to launch everything, although we're going to fix it and it's going to have its purpose, but we're not going to launch everything." You look at history and you'll see the Air Force jumped back in and said, "We're buying all the ELVs up." NASA was told, "You aren't buying ELVs, but you will buy commercial launch services. It's a new industry. You're going to foster that."

So all of a sudden we had to figure what does that mean, and how do you deal with commercial launch service. We had an Atlas group and a Delta group. The answer was well, you're not going to have these big groups anymore, you're going to get very lean and mean, because you're just going to be buying a service. You just need enough. The word "insight" came about. You just need enough people to have insight into what's going on. The answer, what's insight? They said, "Well, you go define that and work on it. But when you figure it out, it's fewer people."

So when we got ready to form up the Launch Operations Division, it was the old Atlas group and Delta group, which each had about forty people, let's say, in them roughly. The answer was forty plus forty is going to equal forty. So our challenge was to take the two groups, keep enough expertise, knowledge out of the Delta and the Atlas world to create one group who could do both with about forty people.

So you had to rewrite how you're going to do business and convince the people that we could do the business that way. Work with [NASA] Headquarters [Washington, D.C.] to say, "Is this what you have in mind? Will this be sufficient?" So it was an interesting time, because nobody had a textbook answer. You were writing it yourself saying, "I think this'll work." You take it to somebody and say, "Here's what I propose. What do you think?" They said, "Well, it's what I got in mind, but maybe it will."

WRIGHT: Can you walk us through part of that? How did you determine the priorities? How did you start doing what you ended up with?

FRANCOIS: Well, when they tell you you've got about thirty-eight people, and you know what you used to do—my part of the story is me and another guy that was working for me that I thought was a fairly decent thinker. Actually in those days we lived in trailers, we called them, the trailers out at the launch complex. We literally went in the trailer with a whiteboard. I said, "George, what do you think—if we only had one thing to do, what should we do first?" The idea was to build a scale. "Here's the things. If I can only do this, this is the first thing I'd do." Then, "What's the absolute things that if told I couldn't do it, I'd put on the bottom of the list."

So we sat there and said well, in our world, ELVs, the first thing is the spacecraft to the launch vehicle. Our investment is going to be in the spacecraft if we're buying this vehicle. So the investment is in the spacecraft. So our focus ought to be how do we know that the spacecraft interfaces, the electrical interfaces, fluid interfaces—how do we know that spacecraft fits on that vehicle and is going to be okay when we put it up there. Because they got into this thing, what are you going to approve and disapprove?

So we said, "Well, we want to approve all the documents that define the spacecraft to the vehicle. We want to approve the procedures that put it up there. If you're going to go up there and mess with our spacecraft, we want our hands and our fingerprints on that." Then we said, "Okay, but now what about the launch vehicle? For years we've owned it. We've told them every day what we like, what we don't like, what to change, when to change it, what part to put on by part number." We said, "According to these new rules of commercial, we're not going to be able to tell them that. But still what we want is we have the data, if we can get the data off the launch vehicle every day when they're testing it, we can go look at the data, and we're smart enough to know if something's working or not working. If it's not working we just tell them that this isn't working." So we set up a hierarchy.

We said, "First priority is we're going to look after the spacecraft and when it touches the vehicle. Anything that passes between those two we want to know it, and we want to have that procedure. Anything on the vehicle we want to have enough knowledge of it, we want to have freedom to go look, but we're not going to require owning it, signing it. But we're going to be smart enough to know what it's doing, that if it's wrong we're going to flag it to the contractor, and when we go to the readiness review and he asks us how we feel, we're going to say, 'We don't feel too good, because we've been looking, and that second stage hydraulic motor just isn't

right. We can show you what's wrong with it, and we're going to say no go on launch day.'" Because our ultimate authority we had—which scared everybody in those days, because you couldn't prove every step—our ultimate authority is we could just say we're no go on launch day. They said, "Boy, that's a lot of pucker. You're going to pucker up real tight on launch day if you wait that long."

We said, "But we're not going to wait that long. We're going to tell them up front. Now if they ignore us, then we just know the ultimate hammer we got is on launch day we just say we're no go." The principle was that if he knows we can do that, then he isn't a month out going to ignore you. He's going to say, "Well, if you're going to say that on launch day, let's talk about it now." Because it costs him money on launch day to stand down. So you found out the guy was motivated—the contractor being the guy—to talk to you and work out your differences.

So that became the foundation of what we called insight and approval. Insight was I could look at it, I could understand it, I could reach my own opinion, and I could share it with him. But I didn't have contractual authority to go tell him. But I could sure impress on him why this wasn't right. Approvals were yes, this is the old way. I'm going to actually sign this and tell you with a signature I'm good. So we limited what approvals were, and we defined. That was the starting point.

We built a short little set of charts of twenty five, and we went through and said, "Today we approve all the GSE procedures, today we do all the subsystem tests, today we report all the deviations." We said, "Tomorrow we're not doing those. In fact we probably won't even look at the GSE. Because we think when it's hooked up to the vehicle, we're going to look at the vehicle. If you look at the vehicle you can tell if the other stuff is working. Because if the

vehicle isn't filling up right, you're not tanking it right, the pressures aren't right, well, there's something. You can go look then where the problem is. So you can look at the vehicle data."

Then we said, "And when we bring our spacecraft out the week before launch, then we're going to approve if you don't put all the bolts in or something doesn't hook up right. We want to know, now we're going to interact with you." So we just took what we'd done for years and restructured it and just said, "Yeah, we'll back out, do it with fewer people, but we think we'll have the same knowledge when we get done." It was a debate.

I had guys work for me that said, "If you're going to do that, I quit."

I said, "Well, I don't want you to quit. You got great knowledge. I think you can get the same thing you're used to."

But a lot of them took real assurance. Said, "Well, I can't tell the contractor anymore, and I want to be able to tell him, and I want him to deliver the data to me, and I want him to owe me." He said, "He won't be able to do that in the future."

I said, "No, but you can still go get the data. You can go—" Because we had our own Hangar AE, I call it. But that's where all of our—independently we could collect the data. I said, "So I don't think we're losing anything."

But there was a real problem with some of the old timers that, "Look, I've always had my data book, I've always had my records, and you're taking them away from me, and I won't have the procedures, and they don't have to call me when anything happens."

I said, "No, but if you go out there you can find all that out on your own. Nobody can bar you from being there." So it was a real challenge. Frankly yes, we had a couple guys that just said, "I can't do that." We said, "Then fine. We understand. Nothing wrong with that. But this is the way we're going to operate. We need to all approach it with that point of view." So that's

what we started out and said, "The only way we'll know is go try it." So we started in '87, '88 writing that down. By '89 we tried launching the first commercial under that type of environment.

So as far as me, I feel like at least I was there when we laid the plan out and we got to lay the beginnings. I stayed with it till—in '89 we were talking about the first one. We launched the pseudo-commercial in '89. [In] '90 we were still launching one of the last NASA missions out of Vandenberg [Air Force Base, California] called COBE [Cosmic Background Explorer]. COBE is the one that the guy got the Nobel Prize for from [NASA] Goddard [Space Flight Center, Greenbelt, Maryland].

Once I launched COBE out of Vandenberg, I had a boss at the time who decided that I needed another opportunity. That's when he made me an offer I couldn't refuse, and that was to go to Shuttle. So I got to see commercial up to writing the first contracts and definitizing what we would or wouldn't do. It looked like it was working. I got pulled out for almost ten years doing Shuttle and [International Space] Station. So when I came back in 2000, I got to inherit what had grown from what we started.

As it turned out, it wasn't too much different than what we started. When I work today, my reference is very similar to what we were doing back then.

WRIGHT: Would you like to continue talking and come back to those ten years under the Shuttle, Station processing? We can do it either way. We can do chronology, or you can do your similarities now. So it's whatever you feel comfortable with.

FRANCOIS: Well, the only gap I left you—and I don't think it's that big. There was one other defining thing within ELV that changed what we were doing also. That is in the mid eighties, so say '82 to '83 through '86, we had an experience in ELV where we within the [Space] Agency tried to put Centaur into Shuttle. So we really had a mixture of the ELV culture and the manned culture come together, what I saw seriously for the first time.

Again I take it back. We'd come off Voyager in '77. We started going back to launching Atlas/Centaurs, the remaining ones, because we were going out of business. Shuttle starts flying, very successful. But one of the things, if Shuttle was going to do all the missions, there was Galileo and Ulysses coming up. They're high-energy planetary missions that were going to require something bigger coming out of the Shuttle bay. Obviously there was an IUS [inertial upper stage], which, if you look at it, that's a solid that was being developed. The Air Force was looking at it. But it doesn't have the energy and the efficiency that a liquid hydrogen oxygen stage of the Centaur did. So [NASA] Lewis Research Center [currently John H. Glenn Research Center, Cleveland, Ohio] owned the Centaur. They owned the program. We at KSC [Kennedy Space Center] were their operational arm, much like today's world in Shuttle and all.

So they made a proposal to figure out how to adapt the Centaur we had flown for so many years, because it had a good flight history and knowledge of how it was built. So the idea is how do you adapt it in order to put it in a Shuttle-type environment? The engineers of the world, simplistically was, "Well this is a vehicle that's flown for twenty years, it's got a great history, you don't need to do anything to it. Just adapt a few flex hoses and stick it in there and we're ready to fly."

Until you found the documentation world of the Shuttle, and found out there is no way that that thing is going to go together. But we spent three or four years and built two

Shuttle/Centaurs. I took Complex 36 and took one test stand and made it look like a Shuttle Orbiter bay. It had all the functionality. From a thermal environment, we had the same air conditioning flow rate, the same spigots and everything that's in the Orbiter, the same aft bulkhead, same check valves. We actually put the Centaur in it to make sure it would behave in that environment, and tanked it with LOX and hydrogen and went through a simulated sequence and everything. Took us twenty hours locked in the blockhouse.

So we were that far, and had done that in like the November/December time period of '85, and in '86 in January when *Challenger* went, we were sitting in the blockhouse doing electrical tests on the Shuttle/Centaur that was supposed to fly in May. When *Challenger* went, that became the end. Because Centaur had been debated—even though it was the existing hardware, it was still being debated will you ever fly it. It was a good debate. Once you get to know about the system, it was worth debating whether you ever should put that thing in there.

But when *Challenger* went, that ended the argument. Obviously the direction then was only use it for missions that require it, and you don't take that kind of risk. So they canceled the Shuttle/Centaur program. One of the things it did is the residual assets—being the [Pratt & Whitney] RL-10 engines and the flight computer and everything—became a wealth of inventory that Lewis Research Center creatively bartered, literally bartered, to the contractor, to put him in business for the commercial launches. So with the advent of commercial launches, the nice leg up was that with the cancellation of Shuttle/Centaur—basically Lewis went to them and said, "If you will give us two launches of an Atlas/Centaur under a commercial agreement, we will give you this residual hardware. That's our payment for that commercial launch service." So they literally deeded over an inventory of RL-10 engines and flight computers and bottles and all the hardware on the tank.

So again what's the luck of that happening? Commercial [launch industry] essentially got a nice start, and turned out to be a reinvigoration of ELVs if you will at that point. Of course the Air Force coming in, saying they're going to go back to buying vehicles, didn't hurt either. So all of a sudden ELVs went from, "Yes, you're dead, and you're going out of business," to, "Here you are again."

WRIGHT: Did you see your schedule change or increase after *Challenger*, because in between I know that you were rewriting your procedures as far as from the impact of the Commercial Space Act that was going to come in.

FRANCOIS: In parallel we were still launching the current vehicles we had. So we were still operating under the existing way while trying to envision how we were going to transition to the new way. So we had two or three launches a year at the time. It wasn't like we had a whole bunch stacked. Because again when *Challenger* went, we were supposed to be—other than Shuttle/Centaur, we were supposed to be going out of business. So we only had a couple, three launches anywhere left.

Now they gradually went and picked back up once we started remanifesting things from the Shuttle and started putting them back on ELVs. The manifests for ELVs started getting repopulated. Of course it takes a couple years before they come down to be on the launch site.

But anyway, that was the one gap.

WRIGHT: Well, that's a good one. Thank you for filling that in.

FRANCOIS: It was significant to the ELV world in my opinion. It changed us in a way because you learned what it took to live in the Shuttle world. There's a lot of similarities. One side would accuse the other that, "Oh, you don't do business the way we do." Or, "Oh, your safety policies are lax. You don't do the same level of stringency we do." I won't argue with anybody, but I'll just tell you, having lived in both worlds, they aren't that much different.

WRIGHT: Well, let's talk about the other world, because you were in one culture since you had arrived, which was 1971.

FRANCOIS: Spent eighteen years in one culture, and then went to the other one.

WRIGHT: So tell us how you became involved with that, because you were at a time right after *Challenger*.

FRANCOIS: Well, *Challenger* was '86. So we spent another couple, three years trying to get the ELVs started back in this different mode. We still had a couple launches due. By this time we'd merged the Atlas and Delta group, because even in the first fifteen years all I'd done was Titan/Centaurs or Atlas/Centaurs. Knew them, but never saw a Delta. They were another group down the hallway. But they were separate, and the Delta—remember, it launched out of Florida and it launched out of Vandenberg [California]. Atlas/Centaur never launched except from Florida.

So when we merged the two groups together, we had some Atlas/Centaur launches to finish. We had the core group to go do those. Then there were still a couple, three Delta IIs—

Delta Is in those days. But Deltas to go finish launching. One of them was off [launch pad] 17. So the guys that had been doing Delta taught us Atlas guys how to do it. Then we went to Vandenberg, which was a whole different experience.

If you've never been to Vandenberg, that's a whole other environment in itself because it's not Kennedy Space Center and it's not the Air Force Station here whatsoever. It's like a third entity. But a marvelous experience. We did COBE, which basically the challenge there was the launch complex at Vandenberg had not been launched off of for five years, because they infrequently launched out there. It turned out it'd been five years since they'd launched anything. Of course, in five years you start from scratch on all the systems to decide, "Are they good? How do I verify their integrity?" Of course people that live there will swear up and down, "We maintain them every day, they're perfect, they're ready to go tomorrow." Your answer is, "Let's check a few of them." Every time you check them, well, that seal has gotten old in five years. It's leaking. Maybe we need to fix those. Then you find some rust. You find regulators that don't work.

So we spent a year bringing the pad back up, which wasn't much different than what I did on Titan/Centaur. You're building. So building complex and operating them and learning how to validate. Said, "Hey, this is great. Did this once, this is fun." So we did that for a year, and then put the mission up and flew it.

At the end of COBE then of course we knew there was going to be a little bit of a drought till the missions that we were planning for commercial got through the pipeline and got to us. So that's when at the time the Director at KSC, the one Director owned both Shuttle payloads and ELVs. Because ELV was so small they just put it under the Shuttle Payload Carriers Directorate.

So he literally followed our launches, but then his other day job was all the payloads that go on the Shuttle.

So after COBE he said, "Hey, ELV world is changing, taking fewer people. Yeah that's your comfort zone, it's what you like, but on the other hand you got a long ways to go in career, and I think you need to come over here in the Shuttle world, and I got a job for you over here."

I'm like, "No, I'm sitting here. The guy in front of me I worked with all these eighteen years. If he retires I'm just going to stay around, and it's just a natural nice comfort thing. I'm going to follow him."

He said, "Let me help you. If he retires, you ain't going to get the job."

I said, "You can't say that."

He said, "Well, long as I'm here I can." No, he didn't literally. But the implication was don't count on that working out.

I had done it for eighteen years, and saw the manned world in the Shuttle/Centaur—you're always curious how would you fare in that world and what would it take. Like I told you, I don't believe there was that much difference, but the answer is you really don't know till you go try to see if there's that much difference. So there was a bit of curiosity on my part to go say maybe it's time to change. So I took him up on the offer. Basically came in. And at that point the group's responsibility was to take all the Shuttle payloads and do the offline processing and checkout and electrical test, interface test, and then be responsible for taking it out and putting it in the Orbiter. In the countdown if there was any activity, we followed the countdown. So I was still in the launch business. The countdowns weren't that much different, and the offline checkout of the payload was much similar to checking out what I'd done on Centaur.

But it was new and a new set of people and a much larger organization. You went from all of ELV, like I said there was forty people in the division, and probably of all the ELV there wasn't but ninety people. To get moved into a group that had 200 some people. And they'd been doing it for a long time. So they look at the new guy like, "Well, we've been doing it and you haven't been required, so just sit down and be quiet, we'll tell you when we need you." But that was all right.

WRIGHT: Once you got up and running did you start to make some changes? Or were there some areas that you felt you could use your prior experiences to enhance?

FRANCOIS: What I'd say is you found out you could influence people, because first thing is in our business it's, "Is he technically sound, does he know what he's talking about?" So when you go to meetings and people would start saying, "Well, we're struggling with this and that," and you could just interject and say, "Well, have you thought about that?"

They say, "Well, what do you mean?"

I say, "Well, if you think about doing this and this and this, I've found in the past that'll work."

They're like, "Oh, we hadn't looked at that." So you stand back and let them go look at it. Pretty soon they decide that worked.

Now I never was one to just stand up and say, "Well, let me tell you how to do it." It was more or less like, "Well, you're struggling with it, and I understand the problem, but it seems like maybe"—and it was subtle things. You could draw on your other experience and say, "When we did this we had an issue with check valves doing this and chattering, what do you

got?" "Oh, yes, ours does that too." Said, "Oh, okay, got a common ground." So the more you could prove people that you had a common ground with them, then they would come ask you and seek out your opinion. If you offered one, and you weren't alien or foreign to them, it was like, "No, he sounds like us." You get accepted.

So part of it was just offering opinions and saying, "What about this?" My big thing was just to get accepted. Say, "Okay, look, I'm not the alien, I didn't just drop off the planet, I didn't—" Because the big joke around here is the river. ELV is on the other side of the river. When we're over there, we never go on that side of the river. So I knew crossing the river you just couldn't come in and say, "Hey, I got it all figured out, you guys, let me tell you how it's done." It's like no. And you do, you respect the people. They've been doing a long time. They've put a lot of thought into it. So you're not here to tell them they've been doing it wrong. The answer is understand what they're doing, and then try to say, "Hey, there is one other way to do it. Maybe think about this. It might be easier." I had more success doing that. It wasn't a revolution. It was more or less just acceptance and work with the people.

WRIGHT: While you were there they began doing a couple of new things. One was integrating payloads for the Shuttle to go to Space Station Mir. Then also Space Station itself. So share some of those experiences of getting ready for the Shuttle to go to two different spacecraft.

FRANCOIS: Well, part of what I'd fill in for you is this group, Shuttle payloads, had the payloads, and in those world they considered the Station, as you imply, an extension of those payloads. Just another payload. So we had a small group that was focused on Station, but it was just like a small group looking at the next payload. Just happened to be Space Station. Well, we knew that

was going to get bigger and bigger. Station was going to become the lion's share of Shuttle, even back in '92, '93. So I'd only been in Shuttle payloads like two or three years when Station was obviously getting bigger and much more going to become the dominant user.

The unique thing that happened was in '93 they decided to redesign the Space Station, which has a story all to itself. Up until then I'd just been following Station as just another payload working as part of our group. We had a subset of people that we would check their schedule, see what they're doing, how is it coming. But the big turnaround was they decided to do the Station redesign in '93. One of the—I won't say ground rules—one of the things they did is they pulled a team up to Crystal City [Virginia] to form a red team. Bryan [D.] O'Connor wound up heading that. [Administrator Daniel S.] Goldin kicked it off. He came in, big—going to turn everything upside down, redesign it.

So they asked for people from each Center to come up and work on the red team. Bob [Robert L.] Crippen was the Center Director at KSC at that time, and so he picked a couple young folks out of Shuttle that are still here. They're great people. He called me and said, "I'm looking for somebody that maybe had a little more experience, but not somebody that's in the old Station Program, because that's not what they're looking for. They want somebody else. How would you feel about going up there?"

I'm like, "Hey, I don't know much about this thing, and I've stayed out of the fights over the previous Station, I don't know."

He said, "That's good. That's what they don't want—you'll be fine." But he said, "The requirement is you have to go to Washington [D.C.] for—we don't know—couple, three months."

So talked me into it. I said, "Okay, I'll try it."

So we went up. The redesign occurred in Crystal City. We got hibernated for three months. Met a lot of interesting people. That's very insightful. There's a crash course in politics and Agency hierarchy, and an eye-opener for a guy coming from ELV, because my life had been very calm and I didn't know much about Washington. So seeing Goldin come through every night at eight o'clock with George [W.S.] Abbey and company was very entertaining, because I had to ask people, "Who are they?" People would explain to you who they are. It was very eye-opening to find out who they all are.

WRIGHT: I'm sure you got a different version depending on who you asked.

FRANCOIS: [Yes,] depending on who you asked. I had a couple people I learned to trust that was what I considered fairly accurate. It was an education. So when I came home from that after six months, of course the idea was we redesign the Station, but one of the things they redesigned was the management approach. Their idea was we're not doing Reston [Virginia office], we're not having the standalone thing, we're pushing it back down. Again, they had come up with—I don't know whether it was over 2,000 people in the previous program, and when they came out of the redesign they said the total Agency commitment will be 1,000, and the commitment for KSC was 130. At the time KSC probably had—oh, I'm going to say they had over 200 people on the thing. They said, "Your number of civil servants is 130." So it's a radical—it's like, "Okay, how are we going to do this?"

So the Shuttle payloads, the way we'd been doing it, and the project office at KSC had just said, "Hey, we're going to have to turn this thing around or upside down somehow." So it became that eventually I wound up heading up a small group that started to implement. What I'd

done in Crystal City I had to come home and live with. So we started implementing how we would build our teams. At that time they coined the term IPTs [Integrated Product Teams]. Nobody knew what they were till then, but they came out of the redesign. That was the management structure we were all supposed to follow.

Boeing became the leading candidate for being the builder of the Space Station. Company wise, when they built airplanes, they had had this concept in the '93 range of integrated product teams. So we tried to recraft our project offices and our operations support and everything and group it together to create these, and we did. I got to wind up—help put that together and lead it then. At the time the Space Station processing facility was a new facility. One of the things the redesign debated was are you going to finish the Space Station processing facility, or are you just going to kill it where it is.

If you believe in the phrase "ship and shoot," you're supposed to build these things in the factory. The only thing you need them at the launch site for is two weeks to put them in the Shuttle and fly them. Some of us argued that that hadn't been done, and still hadn't been demonstrated, and was unlikely to happen. The SSPF [Space Station Processing Facility] was 50 percent complete or something. It's like you want to throw your money away, or it's a state-of-the-art facility, it's got flexibility, you could do anything you wanted. One of the fortunate things, I believe, is they left the SSPF alone and finished it. So by '94 the SSPF was almost finished. We were restructuring our management team at KSC. Me and a very good group of folks got to pull that together and take over the activation of the SSPF. So here's another facility you get to activate and all the GSE and bring it online. And it's a wonderful facility.

Having grown up in launch complexes where all ours [were] twenty years old [with] rust and corrosion, this was brand new. It was perfect. But if you're building a new facility, people

walk around and say, "What are you using it for?" Of course the first elements weren't going to show up for a while. So the early Space Station was, "Let's develop the experience with Mir." The beauty of that was the Russians had a docking adapter that would allow [Shuttle] to dock with it if you got it up there. Now the Russians owned it, but they had to bring it over here. You wanted to fly it up on the Shuttle so you could put it in the Shuttle and attach it and then revisit. So we offered up the SSPF as a perfect place to go bring that thing down, because hey, you want to bring a whole crew of Russian engineers in, you really don't want to put them with a bunch of other—export control absolutely will go crazy.

The SSPF was almost done. Cleanroom wise, access wise. There was nothing in it, but they didn't want anything. They said, "We'll bring everything." So it became to me an ideal situation to just give them a high bay. We gave them some office areas off to the side. Believe me, when they show up, they can bring everything. They brought the docking adapter, but they brought shipping containers of everything. They had every cable, every computer terminal. They had a map, and they laid it out, and we facilitated and helped. But it was a marvelous thing to watch them operate.

So they lived with us I forget how many months, but we prepared. So in a way we got a dry run of getting everybody to think as real payloads in the facility. We got to check out our systems. So we could always brag that the first payload through the SSPF was the Mir docking adapter and the Russians. From then on it truly was international. That was what Station was supposed to be.

Then our big challenge was when the elements from the US started showing up, was how are you going to stack them up in there? I used to go to reviews and show them briefings of, "Well, here's the high bay." The high bay was totally empty. The question was, "Well, you'll

never fill that up. You can't even begin to—if you could fill half of it up." Then we'd go back a year later. At one time before I left over there we had the node, the first Unity node was in there before it flew. We had the lab, US Lab was in there. We had two of the P6, the power modules and everything. We wound up getting the logistics modules for the Italians in there. When you got done you had trouble moving equipment around. You had to move something out of the way to get something through. So we went from people swearing we could never fill it to where we said slow down, we can't take it yet, we need to get something out before you can bring something else in.

That was fun. It was fun to see all that. We had the challenge of—the whole concept on Station was you could launch all these elements individually, and when you get them up there you're going to plug them in, and they're all going to be perfect. Everything's going to plug in, you just turn them on, and here they are. The answer was, but they won't see each other till they're on orbit. We raised that as a concern, and finally everybody signed up that you need to do something to hook all these things together before you fly them.

So one of the other challenges that we didn't have initially was how do you want to build enough equipment to link all these things together on the ground, because you physically can't plug them in together like flight, but you can build a lot of jumper cables and you can build a lot of interaction between them. You can make the computers think they're all tied together. So we invented what we called the Multi Element Integrated Test, MEIT. We got to run that on the first set of four or five elements that was here. That was fun.

WRIGHT: When you talk about you developed that, how did you put your team together to do that? Did you pull people out of the ranks that had already done it? Did you go back and look at

new ways of doing things? Share some of the details of how you basically just created something to make something for the future work.

FRANCOIS: Well, there's never a single thing. In this case I will always tell everybody we had a great advantage, because when we put that team together after the redesign we had really the full support of the Center, and we got the pick of really good people, people who wanted to do it, who had a past experience. We had our payload experience of folks that had been doing Shuttle payloads and everything and what it really means to test a payload. So we had the history and the knowledge to say, "Here's what we've seen, and here's the things that can happen." So we weren't just imagining it or trying to convince them of something we were postulating. We could actually go and say, "This is what really happens."

Now it didn't fit their budget, didn't fit their schedule, so there's always going to be resistance that says, "I really don't want to accept your story because it's going to take me out of where I want to be." But we said, "But that's reality. You just need to face." I would tell you the biggest guy that could make that difference was George Abbey. George had been around long enough, and he saw what they were doing. On one hand it's nice to say it's all ship and shoot, but he knew it'd never be that. So George used to come down to the high bay and walk through and say, "What are you doing to get ready for when it ain't?" I said, "Well, here's what we're proposing." He said, "Well, you better tell that story better." So we always knew that people saw it. We just had to keep packaging it and refining it to where people could finally accept it and see that this is what they really needed.

It took a year or so. It's frustrating. I had some really good people who had come out of the payload world. Some of them had come out of building the control rooms out there for

Shuttle. So they knew what it was like to get LPS [launch processing system] up and running. They'd been with the old Station long enough that they'd been arguing this. So you relied on them. Then we'd just keep polishing the story and coming back to every review. George would hold a review every three months, and so every three months you'd get yourself on agenda and say, "Let me tell you one more time why this is a really good thing." They said, "But we don't have any budget for it." "That's all right, but if you got a dollar, we could do this much." So you kept trying to break it in pieces to tell them this is what you're really going to need.

About that time—and I would say George Abbey was the other one that drove it—[Jay F.] Honeycutt was the Center Director. He asked Honeycutt to make a little bigger commitment to Station, because George knew to get the elements out of the factory he really needed to go get somebody in the factory and pull that stuff out of the factory. If you're waiting for it, it's not going to come. You got to go get somebody to get hold of it. He saw it in the Orbiter days when the Orbiter was stuck in Palmdale [California]. KSC sent a bunch of people to the factory and said, "It's time to move it." So besides my group, which was running every day on the site, they created a group headed by [John J.] Tip Talone, and Honeycutt made that commitment that we'll pony up another seventy-five people and put Tip in place, and Tip will be the guy that plants people in [NASA] Marshall [Space Flight Center, Huntsville, Alabama] and Canoga Park [California, Headquarters of Pratt & Whitney Rocketdyne, Inc.] and wherever they're building this hardware, and they're going to make sure that the problems are getting resolved, and when we ship them to the site that we're going to know what we're getting.

So with him, we had that going for us, and then his folks got on board with this idea that yes, I've lived in the Orbiter world, you got to have an integrated test, you got to test thing before you fly it. So the support base started growing, and with that support and them picking up the

flight we had other folks then with a breadth of background to say this is the right thing to do. It was. It always was the right thing to do.

WRIGHT: Do you feel it's proven itself?

FRANCOIS: Oh yes. They wouldn't give it up now. We did the first one and it found numerous things. So when you broke the configuration for next one, we said, "There'll be another wave of components coming down, we need to"—so there was an MEIT 1, an MEIT 2. Now if nothing else, the software and the computers interacting with each other, they can have the SIL [System Integration Laboratory] labs and they can go do it all and they can proof it, but we stuck it over there, and we found things that hadn't popped out. Everybody accepts it. It proved itself.

WRIGHT: We've talked a lot about the technical side of it, but want to share your thoughts of when you saw the *Unity* [Module] go up and mate with the *Zarya* [Control Module] for that time, and tell us about the experiences that—or the feelings that you and your team felt of seeing how well it worked?

FRANCOIS: Well, it'd been with us a long time.

WRIGHT: Like a friend of the family.

FRANCOIS: Yes, well, there's a time to launch things after they've been here a while. So yes. Anything takes that long, you begin to wonder, "Are we ever going to get there?" The fact that

we could get that one out and get started—because you always felt if you ever get the first one, the rest of them will follow. But it was like we're never going to get the first one. Because it sat in the SSPF for a while, and then there'd be a new problem come up, and, "Well, we're moving this," and juggle the schedules. So yes, I just felt good that if we could get the first one, then you say, "Okay, at least we broke through and the rest of them will follow now." So that was my sense. Just nice to get the first one off, knowing that that would get it started.

WRIGHT: Well, you did that. You didn't get to stay long in that area, because back at the beginning of 2000 you went back to ELV land. Is that like crossing the river, you go back?

FRANCOIS: The problem was I wanted to go back across the river because I kept thinking by that time they had moved enough folks over on the KSC property side that I didn't get to go back across the river.

WRIGHT: They changed it for you.

FRANCOIS: They fooled me. KSC reorganized in 2000. Roy [D.] Bridges [Jr.] was here. At that time we had launched the first one, and really again there was looking for efficiencies, they're trying to restructure. Really our group, the group that I'd headed up, and Tip's group, by this time all the hardware was showing up at the launch site. So you were starting to get two groups rubbing each other, and it was time to decide we need to merge them back together. When all the stuff is out in the factory and the field and they're half distributed, it's wonderful to have a

distributed group and another one home taking care of—but when everything starts showing up here, you got to consolidate. We knew that was coming.

The fortunate part for me was in parallel with what I'd been doing Station in those ten years or the other—the ELV side, the Agency had made a decision to really consolidate the program at KSC. Because in the eighteen years I'd previously done—the contracts, the money, the direction had all come out of either the old Lewis Research Center, which is now Glenn, or come out of Goddard, depending on whether it was Atlas or Delta.

KSC was just—and what most people say is classic role. You're just the launch site operations guys. We ship you the hardware, you take care of it. The Agency, again, because ELV wasn't that big, and they said we're looking for efficiencies, wanted efficiency, why don't we consolidate and have an ELV program, and we'll put it at KSC. So in '96 or so, before I was involved, they went to Lewis and said, "You will end, but we want some of your people. The people that want to really stay on the program, we want them to move to KSC." Some of the Goddard folks. You don't get them all. You never do. But they'd gotten a core. So in '96 the KSC team that I had known from the past had obviously evolved in ten years, and the LaRC [Lewis Research Center] guys that I'd known, some of them came, and the Goddard folks. They formed the nucleus of this ELV program.

The idea, again, was to do it for 150 people or something, keep the number down. Because if you counted Goddard and Lewis and KSC, I know close to 400, so the idea was let's cut that in half and move it to KSC. So they had been doing it started in '96 transitioning working it. By '98 they were launching and just got their feet on the ground. So when KSC was reorganized in 2000, the idea was we need some other folks that's got ELV experience maybe to join the team, and obviously some of the folks at Headquarters knew I'd had ELV experience.

They said, "Well, Steve is available." They would vote for that. KSC was like yes, he could do that, because Tip could stay there and I could move.

It was time. I'd done Station long enough. It's stressful. I don't care what anybody—that thing, that was stressful. So I'd gladly talk about going back to something I knew, because I always liked ELVs. If you're in it, you're just going to like it. So I said yes. So I came back, and we've really, to my mind, matured. In fact starting in '98 to where—because the challenge there was all the history at Lewis and Goddard had never been written down. So they knew how they did contracts. They knew how they had their process of reviewing things, how they did engineering reviews. They didn't write anything down.

So when you went to them and said, "Okay, ship me all your documentation," they said, "Well, here's the contract. What else do you want?" You go, "Have you got anything else?" "Not really. We can tell you how we did it, but we don't really have much." So you really don't get a whole—but again it's not a fault of them. They'd grown up since '58, '59, and here it is '98, it's forty years. They knew exactly what they're doing. But it's a little what you run into when you talk to people, there's a knowledge history transfer that's just tribal knowledge, and it's what they did. The old Cleveland group didn't always do what Goddard did. They're very similar, but they weren't the same.

So now we get the stuff handed to us in '98, '99. I come in in 2000. Everybody says, "Well, it's 2000 and you don't have this stuff, but you need to write it down." "You didn't ask the last guy to write it down, why are you picking on us?" They said, "Well, haven't you heard of ISO 9000 [International Organization for Standardization management standards], and by the way, you need all your processes written and you need flow diagrams and you got to have roles and responsibilities." It's like, are you kidding? But we did it. It turned out probably one of the

good things for us, because it made us think through, and because we had a merger of the old Lewis Research Center culture and Goddard culture and KSC culture. So instead of trying to say which one's going to dominate, which one wins, we just said forget who's winning, merge them together. We got to figure out how to do this, and the answer is what works. We'd grab one and said that works, use it, don't worry about whether it was Lewis or Goddard. This works, write it down, this is what we're following. We don't like it, we'll change it. We always had that flexibility that we can change anything, but we need to document what we're doing and follow it, and if it's not right we'll fix it.

We had some really good people that love ELVs and will do almost anything to make sure we fly a good mission. They'll write down what they're doing. Just don't try to inflict something on them and tell them, "Here's how you should change." The answer is, "Tell me what makes you successful and write it down. And we'll all look at it, and if we can improve it we will, but we'll take credit for what we do." We've stayed that way. The team has evolved, and we've added people.

WRIGHT: I think I read you have over 400 people, somewhere in there.

FRANCOIS: Yes, basically we float. We probably have 155 civil servants, and then we have another 200, 220 contractors.

WRIGHT: Different from that small group where you started.

FRANCOIS: Yes, a little different than thirty eight people. But one thing we use our contractor for is a lot of the heritage of ELVs rests with some of the guys who've been at Cleveland that retired. They live in the factory, and they got other jobs. We gathered them together. So that was how we kept our knowledge base is we just said our contract is unique, we're not just looking for any skill, we're looking for skill who has history and knows us. Now we know that won't last forever. So one of the things we've done over the last couple, three years I'd say, well even—when I first got here in 2000, the mantra was, "We've got to get everybody that's ever done it, and we've got to keep all the old guys. If we're looking for a new person, we only want to hire somebody who's had ten years' experience." You can do that for a while, but that isn't going to last long. Pretty soon you've either exhausted them or they're not available anymore.

There was always the other argument that, "Well, if we hire anybody new, it'll be three years before he can do any good." The first couple of years, that was okay, because we could still find people, but after a couple or three years, said, "You're going to have to change it, we've got to change our thinking." For the last five years—we'll look for somebody that's got experience, if somebody shows up on the doorstep we're not going to run him off.

But on the other hand we went out, and my Deputy at that time, who's now the Deputy Center Director at Cleveland, started recruiting. He found what we call the "fresh outs" [fresh out of college], and he brought in probably eight, ten, fifteen of those folks. I'll tell you right now I don't know what they're doing different in school today than when I went, but I can tell you those folks, you bring them in the group and I can guarantee you in six months or in three months they're doing stuff. This whole thing about takes three or four years to get anything done, sorry, that's long gone, that's an old story that doesn't exist to me anymore. These people are bright, they're fast. The tools that we're using—because we do not do just traditional ops

[operations] stuff like KSC, this group has to do the analysis, so we're doing thermal and vibe [vibration] and models. These kids come out of school, and they know the latest models, and they probably used half of them in school. So you take them up and show them our lab and say here, they say, "Hey, I'm right there with you." The next thing you know is they're running a subset for you.

We'll debate a little bit, but I can tell you the argument isn't near as strong that, "Oh yes, we've got to go find somebody who's got ten years' experience." I'll take a kid now. The ones we've got have been fantastic. So it changed one of my paradigms.

WRIGHT: That's good. You were just talking about how you're training. What are you doing to train them for the next generation of ELVs or just the future of what you're going to be doing in your area? How are you training them differently than you would have ten years ago? Or are you?

FRANCOIS: Well, I don't know. I'll say that honestly. Again I'm heavy into the—obviously my background was hands-on operations. I told you about living on a pad, doing this stuff, seeing it done. I still like that. We don't do that much of that. So I was concerned when I deal with my management, "How are you working? Because this is the way I learned, so what are you doing?" A lot of what we do now is analyzing data, and there is more of what Cleveland and Goddard did that I always knew was there but I didn't have firsthand, and that's the analytical part, the pure engineering of this thing. Actually running cryogenic models, fluid dynamics, figuring out environmental compatibility, electromechanical compatibility, what interference and radio, and a lot of that is analysis.

So what we've got is in that world we've got the core we set up with some really good folks—I think we got five Ph.Ds, which I never thought we'd ever have. I think it's at least five, we may have six or seven by now, but the point is more than I ever was used to. These guys are tremendous teachers. I watch them work. They do the work, they know how to do it, but they're wonderful at interacting with these young folks, because again they help recruit them, and they know what they're coming in with, so they know their abilities. And so they immediately put them into stuff that gets them involved. So I seldom see standing on the sideline, "Watch me do this," as much as, "Here's your part, get involved, and if you want to talk about it, come over and talk to one of the old guys, and he'll sit down and go over it with you." That's what I see. Not that I direct that, but that's what I see the folks doing. It seems to be really paying off.

They're involved in the launch ops piece, and they see us working the problems in real time, and so we're pretty open about doing that. We don't get closed-door three or four of us decide, "Here's what we're going to do." In today's world you're pretty open, and you have a conversation and you pass it on to everybody, "Hey, here's the logic we did that with, here's the strategy we were trying for, and that's why we took the position we did." I like to think that helps them see how we're managing versus—I don't know, but in my day there was a lot done behind closed door. My boss would get in there, he'd come back with an answer. "How in the hell did you get that answer?" "I don't know. We went in there and talked, and this is what we're doing."

I think today with checks and balances, the tech [technical] authority and dissenting opinion, I just think we make—I make more of an effort I know consciously to say, "Hey, here's how we're going and this is why we're doing it, and everybody needs to understand why, and if that don't fit, tell me." But in one way I think we're doing some of the next layer managers and

even some of the younger folks that's watching their manager operate, I think we're helping them see, "Okay, that's what's going on." So maybe when it's their turn they're going to say, "Okay, I remember what so-and-so did in that situation, and here's how they went about it." I'm hoping.

WRIGHT: You've been doing some pretty visible missions, the Pluto New Horizons and the Mars Reconnaissance Orbiter. Different maybe as you first started, but still very exploratory. So you don't look like you're going out of business any time soon. Do you have more on the horizon that you feel that this area is going to keep expanding?

FRANCOIS: There's the word now. This will continue. Expanding is always relative. I say that tongue in cheek.

WRIGHT: No, but it is. It's a good difference.

FRANCOIS: It is. Most people, "Oh well, we're going to be twice as busy next year as we—" Answer is we are typically five or six launches a year. We're built for seven or so. We're in balance with where the Agency's budget is. If you're building Constellation, there's only so much they can invest in the Science Mission Directorate [SMD]. We're really driven by that. We don't stand alone. We thought real hard when we made it the Launch Services Program, because we don't just buy vehicles and say, "We got them, and we're launching them whether you're on them or not." We're not quite that independent. We are a service. We try to carry that through that we've got a customer, and we're only as good as he is. If the Science Mission

Directorate budget goes down, then we know it's going to directly reflect on us. We also know that success might enhance the budget. So if SMD can be successful with those flagship missions and we're part of that success, then that's a good thing, both for the Agency and for us and for science.

So I think that's why you see a willingness of the people to just do whatever it takes to make sure we're successful, because we recognize that we're an integral part. We've got our responsibility, but there isn't an effect if we're not. Because there are so few dollars, and believe me, this world, you have one bad day and they'll remember it and it'll show up in a lot of ways.

WRIGHT: Takes a long time to recuperate off a bad day.

FRANCOIS: Yes. That's the only thing. I lead a group that's not—knock on wood—we've been very fortunate—and in their lifetime most of my folks haven't had a bad day.

WRIGHT: That's the good news.

FRANCOIS: That's the good news. I'd like to keep it that way for them, because I was around when I had a bad day. Bad days are no fun. I've been through several bad days.

WRIGHT: When you look at what it takes to put these series of five to seven missions up a year, it is very complex, because the missions aren't done overnight. You have years, and then one glitch can throw your schedule. Tell us about what you feel is probably the most difficult or the challenging aspect of your job, when you know that there's so many projects or programs that

are being parallel and stacked and staggered, and all those things that can throw you off balance in budget and schedule.

FRANCOIS: Well, and the other dimension is we got a fair variety of vehicles we're dealing with. If you go back to my old days of Atlas/Centaur, I had one vehicle. All I worried about was the Atlas/Centaur. If it was launching three times, that's all I worried about. When they created this program and merged all the ELVs, on any given day you can sit here in the office and we could be talking about the Atlas that's flying the Lunar Reconnaissance Orbiter mission. We could follow it up with a meeting to talk about IBEX [Interstellar Boundary Explorer], which is flying on a Pegasus [XL rocket] out of Kwajalein Island [Marshall Islands]. We could then shift to the Delta II program, which has the Air Force GPSs [global positioning systems] sitting in front of you working an issue that's going to hold up our Kepler missions. When you get done with that, you could talk about the cert [certification] for Taurus II, which is a new vehicle that's coming on that OCO [Orbiting Carbon Observatory] and Glory [satellite] are going to fly on in January and March next year.

All of them have a different supplier. They all have their own internal issues they're working. Yet our job is to see that you can integrate them together. Because our team—and we get stretched once in a while. We could go out in the field, and we could support if they materialized maybe—well, we did it on GLAST [Gamma-ray Large Area Space Telescope] and OSTM [Ocean Surface Topography Mission] here just this summer. We went out, launched one from the Cape [Canaveral, Florida], and nine days later launched one from Vandenberg. But that took some coordination ahead of time, and you had to clear the plate of anything else. Don't ask me to talk about a Pegasus problem. I'd say, "Wait till I get home, I'll talk to you later."

So a lot of times we constantly manage how we're mixing the launches. You can get them within thirty days of each other, it ain't bad. You get them within two weeks, and you start getting real nervous. You can put a Delta up against a Pegasus because one takes small team, Pegasus probably requires fewer people, Delta has pretty good size team. You throw an Atlas V in there with a Pluto New Horizons, it's a huge vehicle, a huge team, a lot of variety from Headquarters. So you aren't going to—so you're constantly assessing in your mind, "Okay, which two could I pair? But I can't pair these two, I can put these two close together, but I can't get these that close together because they're too big."

The customer has all kinds of stuff. The customer is building the spacecraft. He's got a contractor. You go to him and say, "To make it work on my side I need to move this guy thirty days, and the perfect place to move him three months," and he's like, "Are you kidding, don't even—you know what it's costing me to carry the contractor to have that spacecraft stored or waiting around for you guys, why aren't you right there when I need you?" It's a trade. Every day you make the trade. When you first start it, you think, "Well, all I got to do just once, and as soon as I write it down it's all locked in, and all we got to do then is just go execute it."

I can tell you, every day you can write it down, and you can lock it in, and about two hours later you can be revisiting something that might be going to change, and within about two weeks something will have changed. It's the nature of the business. It doesn't go away, but you just adapt it as "That's part of what I've got to—" But you get your whole team to where they don't get thrown when that happens. The whole team is built on we got to be flexible, we got to be a little bit agile. Just becomes one of the attributes that we're working this, and if something happens we just got to be able to flex a little bit and go work the problem, and then we'll look at what it does to the other things, we'll just have to adjust.

What we found over the last two or three years, because we're in a service and the customer is so reactive to what we do, it's driven the communication way up. Where in the old days you could say, "Well, I'll work it myself, and when I get it figured out I'll go tell the guy what I did." Between BlackBerrys [PDA, personal digital assistant] and e-mails and everything else, you've got about fifteen minutes on any given day to tell him what you did. From the time you find out a problem until you have him an answer, typically the dwell time is about fifteen or twenty minutes right now. That's if you're lucky. Creates a lot of overhead, and I'm not saying that's all good. I'm just saying that's a fact of the world we built.

WRIGHT: Then you have the reporting process the other way from what I understand. You report to the Assistant Associate Administrator for Launch Services. Is that at Headquarters? Then you have your management staff at Kennedy and your flight planning board.

FRANCOIS: Right.

WRIGHT: Then of course you work with the Air Force. It just seems like you've got a tremendous communication effort. What type of strategy have you put in place to make sure that all these people are kept up with everything that's changing so quickly as it is?

FRANCOIS: I'm not sure we're succeeding all the time. Half our strategic planning on an annual basis is trying to figure out how we can improve the communication, because as much effort as we put into it, we still find every so often we miss somebody. You've only got to miss one to upset the whole system. We literally do. We have an annual strategic thing where we sit down

and just start to put the normal day-to-day how are we doing, and one of the biggest things is communication. Try to work out the roles and responsibility with that office in Headquarters, because they're the frontline sitting there with the customer. So the idea is can we get them educated enough to where they can carry the flag on that front, and then we'll go focus on the contractor and the projects.

Because in this whole layered thing, if you take a spacecraft the way NASA builds it at Goddard for instance, they name a project manager. Now I want to go to the class he goes to, but I can assure you the class apparently he goes to tells him he's king and he's important and he needs to know everything and everything needs to go through him, because if he misses something he calls. So we have one group that day to day works with that project manager.

Well, then obviously if you have bad news, the project manager is going to go through the Goddard management. So you better have some interfaces at the flight projects office and the Deputy Center Director, because he's going to say, "What did you tell my project manager that had him so upset when he was in here in my office?" Then if we've got an issue and a launch is potentially going to move, we can't move in a vacuum, because there're two other players in the game, at least two, maybe three. You've got a commercial—and there are purely commercial launches out there who have a right to launch. And by the way you can challenge them, and believe me, they will go to the FAA [Federal Aviation Administration] and say, "Somebody's trying to preempt me and take me out." You will find out quickly that if you're costing him money he'll send you a bill for that, because his satellite is a revenue-generating satellite and he's on orbit, he'll tell you generates about $30 million a month. So if you want to move him thirty days, just send him a check and he'll be glad to. So you really don't want to do that.

Most of the vehicles we're using are shared by the Air Force and NRO [National Reconnaissance Office] and others and they've got their priorities. So as soon as you move, you picked up on—you've got the Air Force and other elements of the government to go communicate to find out—and they're dealing with the same thing you are. The good news is we're all in it together. So whether I'm trying to say, "I've got an issue I need to talk to you about," probably when I pick up the phone he's going to say, "Yes, I was going to call you first because I got one." So then the answer, "Okay, what can we do to help each other?"

So generally the community is motivated, and the contractor is trying to make everybody happy. Everybody is motivated, so how do we find a mutually satisfactory answer and communicate it to everybody? But we actually plotted out communication paths to say, "At this level this should be the communication. This level we'll take it on. Headquarters, this is what we're counting on you to do," because it's a parallel system, it's not a serial. In the old days you could count on it being serial. It didn't leave here till so-and-so told somebody, and it only went—today's world with communication capability, it's all in parallel, and it happens. So I always smile when somebody calls and says, "How did you get the word to him so fast, and I didn't hear?" I said, "I don't know how you could get missed in today's world." It's almost impossible to get missed. But I can assure you once the word goes out the first time, it's going everywhere.

WRIGHT: When I was reading that, it seemed like that was such a big effort of yours, and then like you mentioned a while ago the rising cost of doing business in parallel with the decreasing budgets within the directorate that basically finances—or helps finance—what you're doing. How much control or impact do you have over cost?

FRANCOIS: Well, we're held accountable for a lot of it, there's no doubt. I'm usually thought of as holding a whole lot more budget control than I probably do. Direct control, our group and our capability is funded by the Agency. That comes to me directly. Independent of missions or that, it's almost like if you want this many people, anticipating five or seven launches a year, then this is the capability you pay for, and the Agency invests in that. The Agency invests that capability. We try to manage to that that if we can do our improvements, upgrades and all within it so we're not—so we're trying to live on a fixed income.

The mission stuff comes out with the mission. So the launch vehicle and that comes out of the mission directorate budget. But I have to give them an input, say, "Here's what you can anticipate, here's the best deal I can get for you." So the part I have to influence is if we're working an issue on a vehicle and it looks like it's going to delay us, those are where the extra money come from, and that's what the missions see. The mission's worst fear is that I will have an issue that I can't solve and is going to cause them a huge impact, in which case they got to come up with more money.

So our effort on our side is to minimize that to where we can work our issue, but we can work it within the schedule we got and get to an answer. Our metric is that we don't cause them a problem. Now the contractor, when he builds the vehicle, can have a fleet issue and just say, "Hey, I got a bad vendor, he sent me bad hardware and we're going to have to rebuild it." I can't solve those. That's the ones we're going to have to just say, "Life wasn't good to us today," and we just got to go figure out what to do about it.

So we adopt the thing that says we look for technically adequate answers. You can't become so paranoid that you say everything has got to be absolutely 110 percent guaranteed. So

it's a fine line you walk, because that's the safe way out. The safe way is, "I ain't flying it till I just know that thing is absolutely my god no question in mind, everybody and his brother in the country would vote to launch that vehicle." You can't do that. So part of the things we've mutually tried to converge on between engineering and me and all the elements is what is a technically adequate solution that says the risk is low enough, we understand what's left, and this is sufficient and adequate to go fly. Doesn't mean we're cavalier, and doesn't mean we're just cowboys. It means that we thought it through, analyzed it, identified what we're doing, and consciously decided that yes, this is okay.

Because the cowboy says, "I don't care, I'm just flying." Then you can get the other guy that says, "Why, I'm going to gold plate this sucker," and, "My reputation on the line, I'm not taking any risks at all, you just keep working until I feel better." Well, he's no better than the cowboy. They're either one are extremes you can't stand. So the answer is find the middle ground, but be able to defend your rationale.

If you're coming up and saying, "This is adequate for flight," if you can defend that rationale and put it in front of folks and the folks said, "Okay, I understand your logic," that's what we're looking for. It plays back into the budget. If you don't do that, you'll drive the budget crazy.

WRIGHT: Yes, and yourself.

FRANCOIS: Oh yes.

WRIGHT: It wasn't too many years after you got into the position that there was a study released developing a strategic roadmap for the Launch Services Program [LSP]. The report stated that the market environment had changed dramatically, threatening your program within NASA, and potentially its existence, and recommended that the LSP move quickly to secure its role within NASA while diversifying its customer base and service offerings. How have you and your team had to respond to this suggestion?

FRANCOIS: Well, the things we've done is, again, we think in terms of a business environment…. We were created in an environment where there was going to be this huge commercial market, and the paradigm was that the government would buy off the margins because they had this other huge commercial market that all the companies were selling to….

So what we've done is said in that limited market we need to—and so I'd say we've learned to utilize this insight and approval more to our advantage to get more data available to us and pay closer attention….

The other thing we did is again, we've said we've got to learn to be—and that plan said, "Learn to be a little more flexible." Not every model is going to be NASA has a commercial launch, puts a satellite, does exactly what you're doing. The Agency every so often is going to do something a little different….

We said, "We have experience and we'll share it with anybody, we're not trying to hold out or say, 'Go away, you're not doing it the way we want to do it.'" We said, "Look, we would be glad to give you advice, go to reviews, listen to what's going on, and if something doesn't sound right to us we won't just jump in and say stop the train, but we would tell you you might want to ask a little bit more about that, and ask them why they did that, or why didn't they do the

analysis, why are they saying that's okay when it doesn't look like they did." So I've outlined and crafted MOUs [Memoranda of Understanding] and agreements with Goddard so that they know exactly, there's no miscommunication about [what we were doing for them]….

Again, if you're working an issue and seems like they're struggling with it and you want to call on me, I've got a door, you can call me, we can work out, and I could tell you they're doing what I'd do, it sounds like they're going right through the right steps, their system—and so we've documented those things. It's a little bit in response to what you reported there was you're going to have to be just a little more flexible in the environment, let the business environment drive you to where you're willing to do things a little wider spectrum than just narrowly saying, "Well, if I don't do it this way I don't want to talk to you." My answer is no, we'll talk. Because there may be more, though.

In the future the Agency is going to do—the really [high priority] satellites they put on, they're going to want us to do what we're doing. Now depending on how many of them they can afford, that could be a lot or a little. And it'll change. It'll change with time. There'll be a valley that says we get down to two or three, then all of a sudden somebody will go back into Earth science or something. That may generate its own requirements. But in between, if you've got a GOES or you've got a foreign cooperative, then why not offer our service? Why not be seen as the launch service provider for the Agency? We're chartered and we're paid for capabilities; why not offer it? The one thing I ask is let's just make sure we set the expectations that they don't think we're the guy on the white horse running in to save them. The answer is we have our limitations. We'll do, within our limitations, what we can for you. So let's not give them the wrong expectation.

WRIGHT: It sounds from what you're explaining it's a parallel effort, not an end run at the last minute. You want to be able to be there right along and offer information.

FRANCOIS: Yes. We've had a couple examples where we got called at the last minute and got surprised. We said, "We don't want to do that again." Yes, we had an agreement once on the NOAA [National Oceanic and Atmospheric Administration] satellites they used to fly on the Titan IIs out of Vandenberg. Goddard did them. It's a cooperative again. The Air Force launches it, NOAA does the satellite, but NOAA went to Goddard and said, "Would you put the two together?" When I came back in 2000, the folks here said, "Well hey, that's real simple, Goddard does it. We don't do much, we just have one or two guys follow the vehicle, and it's a handshake that we're really not there."

Three or four months before the launch, the Deputy Center Director at Goddard called me up and said, "Where's your people?"

I said, "My people told me they had an agreement with you."

He said, "Well, you are the Launch Services Program for the Agency. Where are you?"

I said, "Well, what are you expecting?"

He said, "I expect the same team that I get for any other launch."

I said, "This is a Titan II, you know."

"Yes, but still."

So we scrambled and said, "Okay, we have a little bit," and so we—but it taught us a lesson. We said, "Let's always make sure that our customer and us have the same understanding." This is a business, and we ought to just be upfront, and no sense getting excited at the last minute. Let's just up front decide here's what we're doing.

This works. That wasn't that big a thing to overcome.

WRIGHT: Good trial, I guess, to learn that lesson. I was going to ask you, because you've had about forty years give or take, although your areas have been very specific, you've had a lot of opportunity to learn. So share with us some of the most memorable lessons or maybe even the best or hardest one that you've had to learn during your career here that you'd like to share with someone else, or that you even apply in your position today.

FRANCOIS: Most of us in NASA—I say that most, that's always dangerous—most of us were engineers, if I have to judge. Most of us came up as engineers. A few of us decided we weren't going to be managers till it was inflicted on us. In light of that, the biggest change is accepting that you're dependent on other people. Engineers like to do it themselves. We all do. If I could get a preference, I'd just as soon go do this myself. Then I know it's done right, and I get to see it, and I'm real comfortable. My first [lesson] in being a Branch Chief and everything was I'd done everything that that branch had done, and then I had a bunch of people I was—the biggest thing was to back off and let them do their job.

I had been the Centaur propulsion engineer, and I knew the RL-10 engine backwards and forwards, and I could tell you the step in the procedure almost by memory. And the biggest problem was I gave that job to another guy and he used to come in and want to tell me what the problem was, and before he could get the problem out of his mouth I could tell him the solution. You really don't want to do that. You just finally had to learn that, "I need to let him do his job." I need to listen. If there is something wrong, then save it and say, "Well, wait a minute, I think

there's one other thing maybe you ought to go look at and I could offer," but quit cutting him off and telling him how you do the job.

So the real lesson for me was learning to depend on people and trust them, to say, "Go do your job, come tell me what you're doing. I want to know, don't leave me in the dark," but don't try to judge them or second-guess them or say, "I'm faster than you, it's a challenge to see if I can—" No, just let them go do it.

Initially that took a lot of patience, and you sit on your hands and you say a little more, wait a little bit. It gets easier. But there is some reward in that. This table we're sitting around, we can get a group around here, and it's really fun to hear them tell you what they're doing, what they've looked at, how they've troubleshot something, what they're thinking. "Oh, that's pretty good, you're doing all right." But just provide them support and say, "Yes, I think you're going in the right direction there, keep doing that." Or maybe, "That's all right, but have you thought about this while you're doing it?"

To me that's a little different. I grew up in the early days. Some of the managers I had, I'd learn to like them, but they were more of a, "Let me tell you what to do, son, and you get out there and do it and come back and tell me when you got it done, and then I'll tell you what else to do." It's a different way to learn. I don't like that as much as I like today a little better. I like letting the folks go think it through. I think they learn more if you think it for yourself than if you're just told every day here's how to do it, here's what you should do.

So learning that along the line. Can't tell you what day that occurred, but it occurs slowly. Doesn't occur overnight.

WRIGHT: Any other best practices or management principles that, as you're bringing up the next group of leaders through the Agency, that you'd share with them that are good ones to pass through?

FRANCOIS: I don't know if I'd do that quite well enough. Maybe just by demonstrating patience.

WRIGHT: You've been in a position where you've seen a lot of historic missions go up. Are there any that stick out in your mind as some of your favorites or the most memorable ones? Bring a smile to your face when you think about them?

FRANCOIS: Yes, well, if you read the bio [biography], you'll notice that Viking and Voyager are still in there. After thirty some years you'd think you'd change them out, but they were the first ones, so anything you did, the first one is that big. It is neat. I had to smile—we launched Phoenix last summer. Phoenix landed on Mars this last May. Nothing has landed on—I mean sat down as a thing with a soil sample and a big hole—since Viking in '76. So I got to do that one, and here I am thirty years later doing another one. So yes, those connect for me. There's something unique about the exploration of the planets, whether it's Voyager or New Horizons Pluto. That's like a rebirth of Voyager for me. It's like wow, here we go again, seven years to get somewhere and going that many miles and that fast. Sort of like finishing, because Voyager never got to Pluto. We didn't finish it the last time, I get a second chance to finish.

In the Shuttle world, I happened to arrive in '90. That was just months before Hubble [Space Telescope] was launched. The first ELV was Pioneer 10, although I didn't work it, I just happened to be there in time; it's like Hubble, I was just here in time. It was a great start. It's a

great reference to say, "That's fun. Now what else are we doing?" Chandra [X-Ray Observatory] comes along and some others. The Spacelabs were fun, but the big missions, the telescopes, were always—and you got to launch John [H.] Glenn, [Jr.]. He came back in time. Here I am. I grew up and came here in the Apollo era and saw some of the early—Apollo 15, 16, 17 just wide-eyed figuring I'd never meet—stayed long enough to see him come back.

WRIGHT: And you have so much ahead. Sounds like you've got plans for the future and working to keep this program from going out of business one more time.

FRANCOIS: Yes. The day I arrived in the E&O [Engineering and Operations] Building, after that launch, the next day I came to work in the E&O Building, and there was two other guys in the branch. One guy was sitting next desk over from me. He looked at me and hardly before he asked my name he said, "What are you doing here?" I said, "What do you mean?" He said, "Well, we're going out of business." I hadn't been on the job a week, and the first guy I met said, "We're going out of business." So anybody asks me do I feel bad, I said, "Oh no, I've been going out of business for thirty-seven years. Ask me in another thirty-seven, I'll let you know."

WRIGHT: Well, as our time starts to close down, are there any other thoughts that you'd like to add about any of the topics that we talked about today, or any other gaps that you might want to fill in?

FRANCOIS: I think you did pretty good.

WRIGHT: Well, thanks. Just a curiosity question. I know that you mentioned you had five to seven that you have that you could launch. How many do you have going all at one time? Projects from inception to launch that you're juggling on a whiteboard.

FRANCOIS: Oh, juggling? Anywhere from thirty to forty. The missions, the early ones you're talking about there, can start seven years out. So we'll be juggling some seven years from now talking about, to the ones that we've actually bought vehicles for to the ones we're actually on. Yes, we used to keep track of that, but any given time it's been as high as close to forty, but it can be anything from thirty to forty in a year that we're touching in some phase, either just talking about releasing an AO [announcement of opportunity] or a proposition for, to which ones are we contracting vehicles for versus which ones are in the launch queue the next three years. Typically we'll get the launch vehicle procured and everything two to three years out. So those last two or three is you actually got a mission, you got the vehicle identified, you're actually—but before that you're making trades of what vehicle would this go on, how would you advise the customer. So that whole spectrum could be seven to ten years, and it can be thirty to forty missions.

WRIGHT: Do you have a lot of them drop out during that time period for any reasons?

FRANCOIS: Some do. There'll be a trade. If SMD is trading, and they may decide to just not pursue one. But that's alright, they'll generally stick something else in its place.

WRIGHT: That's good. Well, we wish you luck, and we wish you to be busy until you end up going out of business. Like you said, maybe that'll be another thirty something years.

FRANCOIS: Yes. Well, thanks.

WRIGHT: Thank you.

[End of interview]