INTERNATIONAL SPACE STATION PROGRAM
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INTERVIEWED BY SANDRA JOHNSON
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JOHNSON: Today is August 6, 2015. This oral history session is being conducted with Michael Read at the Johnson Space Center in Houston, Texas, as part of the International Space Station Program Oral History Project. Interviewer is Sandra Johnson.

I want to thank you again for meeting with us today and taking time away from your schedule. You are the manager of the International Space Station [ISS] National Lab office, and in this capacity you lead the effort to utilize the International Space Station as a National Lab for scientific, technical, and educational purposes. Part of your job is to seek innovative partnering arrangements to ensure the greatest possible return on investment from the ISS to the U.S. economy and for the American people here on Earth. If you don't mind, just talk about how and when you first came to NASA, and when you first started working with ISS.

READ: I came down to Houston in 1989. I had been in the banking industry as a commercial and mortgage banker prior to that. I didn't see that going where I wanted it to, so I went back and got a master's degree. I was finishing off a master's in public administration when I had an opportunity to do a grad coop [graduate cooperative education position] tour here at JSC. When I came down here, I had two young kids under the age of three, was married, and had taken a temporary job making a pittance compared to what our coops make today. I was going to dare them not to hire me permanently.

I came down in ’89, and nine months later they hired me permanently, so I became a career civil servant at that time. I was hired into the Shuttle Program Control office, which fit my background and also my interests, and I spent, I guess, about the first six or seven years of my NASA career in Shuttle Program Control.

Basically, to me it was a license to ask questions, because we were responsible for integrating a budget for a technical set of services and a schedule to go along with that. So, we had a reason to try to understand everything that was going on with our technical org [organization] that we supported, and that, as a non-engineer, gave me the opportunity to ask a bunch of really smart engineers about what they did. I found out early on, a) there were no stupid questions, and b) people love to talk about what they do. I got a very good education from the hands of folks that had been around Shuttle, many of them since the inception. It was a very educational process for me.

In 1996, I was invited to come interview with the then-Deputy for ISS Program Control; that happened to be Mike [Michael T.] Suffredini. They were getting ready to start a brand-new payloads office in the Space Station Program, and they needed a business manager for it, and Mike was getting ready to go stand up that office and be the very first payload office manager. He and I hit it off; we’re just a couple of years apart in age, and very similar in our approach to work and mentality on work-life balance, and we both definitely tackle things head-on, but we also want to have a good time at the office, so we hit it off.

I took that position, and we ended up standing up this office from scratch. We didn’t know what we were doing at the time; we were given no road map. In fact, the office really hadn’t been coordinated very well with the people whose budgets and whose technical efforts we were going to be assuming, so part of our job was to educate the people that were impacted by

the decision at [NASA] Headquarters [Washington, DC] to go ahead and establish this office. So, it was a very unique time.

Prior to that office being established, the various science codes at Headquarters each had their own budgets, for space technology, for microgravity research, for aeronautical research. They each had their own budget, and each managed them separately, even though those investigations were all going to be done on the Space Station, which, in 1996, we hadn't even flown the first element yet; we were still two years away from that. What had happened was that a significant amount of the budget for the last several years for these various science endeavors was tied up in building hardware that was way too early, that was going to be ready before we could ever get it flown, but also a significant amount of it was not being spent.

At the time, Space Station was undergoing some delays of its own in development of our early modules. The Russians were having some issues with their FGB [Functional Cargo Block], and especially with their service module [Zvezda]. We were basically looking for ways to fund some of the additional technical challenges early in the Space Station Program, while getting the science put back on its proper schedule, getting the facility scoped to what we could actually accommodate. We were integrating them across the waterfront of research, instead of having them run by the individual research pathways without really any integration across the board. We then got them on a schedule when they could actually be manifested on a Shuttle flight.

In that first year, we literally did a round-robin tour coast-to-coast, with various NASA Centers that were doing the work. A typical meeting would go something like, "Okay, tell us what you're building, tell us how much it costs, tell us what your schedule is." Then we had to integrate it all together, and generally ended up saying something like, "Okay, these are the things we can't accommodate, you can't do a multi-rack furnace facility, we'll never be able to

support it; you can't fly it in three years, because we're not even going to have elements ready to accommodate it." We ended up putting everything on its appropriate schedule and appropriate scope, at the same time being able to carve out early money to assist in getting the modules actually built that were going to house these new research facilities, and then adding the budget back in the proper years, paying it back, if you will, on a schedule that we could actually support and that would meet their science needs.

I'd never had a job like that, where we weren't given a road map, and it was, frankly, a year later and we were still finding pots of money here and there that were part of what we were to inherit, but we just hadn't been given any knowledge of it at the time. Like I said, there was no road map, so we had an interesting first year; after that, we had our arms around the vast majority of it, so we were able to build a plan. But, that first year of that payloads office being established was quite a transitionary year for us.

I did that job for about two years, until we got it up and running and I was turning the crank on the budget, and I just couldn't do that anymore. I told Mike, "I've got to do something different."

And he said, "Well, come work for me directly," because I was matrixed to him (at the time I was in the program control world). I left program control in '98 and went to work for him directly in the payloads office. He'd asked me to do a job I probably wasn't completely qualified for, and it took me a few months to realize that I wasn't adding value like I had in the past, and to me it wasn't a job that I was going to be able to be successful at.

I frankly told him, "Mike, I've got to go do something where I'm going to be productive."

He said, "Okay. I'll sign your transfer, you just go find what you want to do." But he said, "I want you to think about this other job first."

I said, "Okay, what is it?" It was an increment payload manager job. I didn't know the first thing about it.

He said, "Well, go talk with this guy. I think you can do it, I think you'll be very good at it."

I said, "Okay, I'll go talk to him." So I did, and basically the Increment Payload Managers [IPMs] are responsible for integrating all the science that's going to be done during an increment, a period of time—right now it's a six-month period of time—when a certain crew is onboard Space Station. We hadn't flown the first crew yet, so we were building processes, we didn't know what we didn't know. It was clear we weren't going to get a lot of crew time, because we were in the assembly phase, and most of our crew time went towards the assembly of the vehicle and the build-out of the systems, and frankly just maintaining systems once the crew was onboard. But, there was two others also doing the IPM job, and one of them was assigned to increments one and two, one of them had increment three, so I was going to be increment four. Still very, very early in the crewed life of this program.

I took the job, and it turned out to be equal parts of an integrator and a debater, because we had to fight for every ounce of upmass, we had to fight for every minute of crew time, because we were basically the third priority; on a tier of top-two priorities, we were third, which means we didn't get much. Everything else was more important than payloads at that time, because we had to get the vehicle up and flying and operating.

I remember one time, in one of the very early flights I was working on—in fact, it's kind of funny. I was supposed to be able to watch these other guys, the first three increments, before I

had to get in the box and do my own increment. The job was also to be a member of the mission management team during real-time ops [operations], representing utilization in that forum. Well, we had some flights that got inserted prior to the first crew ever getting to the ISS, prior to the first increment payload manager ever actually letting me watch him to see how this worked. And they said, "Read, go see if you can get some upmass on one of those flights, because it looks like there might be a little bit available."

I said, "That's great. How do I do that?" As it turns out, nobody really knew. It involved asking, and then haggling, and griping, and finally, long story short, we ended up flying the very first payload to Space Station on [ISS Assembly Mission] flight 2A.2b. It was a nitrogen dewar [vacuum flask], it had some protein crystals in it, if I remember correctly, that were frozen, and then it just off-gassed and warmed up to the ambient temperature, and then they could grow in microgravity. That happened to be the very first payload ever transferred to Space Station, before we ever had a crew up there, and I was very pleased to have been part of that, considering I didn't know what in the world I was doing when I was asked to go do it.

One of the early increment management team meetings that I was at, there was a roomful of people, most of whom I didn't know at the time, and I asked a question. I still was not sure about what I was doing, and I asked a question, and the entire room went silent. I'm going, "Oh my goodness, I have just asked the dumbest question since dirt." It seemed to be an interminable silence; it was probably only a matter of seconds.

The increment manager looked at me and said, "Well, that's a real good question. I don't know why we're doing that." I looked around the room and it was like an epiphany for me, this is flight 2A.2b. Most of these people haven't been through this either. It was a real sense of relief for me, and I never worried about asking a stupid question again, even though I'm sure I

asked many of them. It didn't bother me, because I figured somebody else had the same question. But, it was a little worrisome for me as the new guy in the room, not realizing everybody else was basically a new person too.

We got through that, we got through increment 4. We had a very successful increment. I did increment 8 as well, was assigned to increment 11, and I realized I'd been in the payloads office too long. By this time it's about, I guess almost nine years in the payloads world, between being a business manager and working for the office directly. Suffredini had already moved on by that time; he had gone to be the head of the vehicle office, and then he was head of our mission management team, so he and I worked together during real-time ops during one of my early increments.

I knew I needed to do something different. Our External Integration Office that handled all of the international partner relations and all of the barters and negotiations with them had an opening for a detail, a six-month detail. I knew some of the guys up there, and I went and talked to them, and they were interested in having me work up there. So I told the Payloads Office, "You can backfill my job, you can give away my desk, I'm never coming back."

At that time, early in the ISS Program, payloads wasn't an afterthought, but it certainly wasn't very high priority. I refer to it now as the dark ages for utilization, because we had to fight for everything. It was getting to be tiresome. You can only do that for so long, and I, frankly, probably stayed a year longer than I should have.

I went to work in the external integration office, and immediately started working Russian negotiations, which suited me well. I'm from the Midwest; I learned to build relationships with people, to understand where they're coming from, but also to make sure you get what you need as well. It was not very long before I was leading the teams to Moscow to

negotiate a lot of operational barters and different trades, as well as establishing a contract with the Russian organization Energia, something that we had never had before. That was an interesting time as well, because we were trying to update a lot of our barters—we call it the balance of contributions with Roscosmos [Russian Federal Space Agency]. It was established back in '95, '96 with many, many things on both sides of the ledger that, as the name implies, balanced out. Yet it was time to update that, because there were things that had changed in the 10 years prior; there were things we needed, there were things the Russians needed that we really hadn't figured a way to document. This was like a treaty, it had to be approved by our State Department. So, going through and updating it was a big deal.

We spent about the first year I was in the External Integration Office working with the Russians to try to scope everything that both sides needed, but in doing so we realized we were going to have to figure out a way to value a lot of things that didn't inherently have any way of valuing them. Things like a kilogram of upmass on government vehicles. To this day, we probably couldn't tell you exactly what it cost to fly a kilogram on Shuttle. It all depends on how you accounted for the budget it took to fly it. We had the same issues with upmass on Progress, upmass on Shuttle at the time. Did we treat Progress different from Shuttle? We had to sort through a lot of problems. How do you value crew time? What's an hour of crew time worth? What's a cubic meter of stowage onboard the Station worth? Because there were things that we needed or the Russians needed that had to have a value. What's a kilowatt hour worth? We had to go figure out how to credibly put a price on those things that not only could be defended, but that you could get the Russians to agree to.

We decided early on that there would not be a difference in value, an implied difference in worth, if you will, based on who was providing it. So, a kilogram on a Russian vehicle versus

a kilogram on a U.S. vehicle would be valued the same; otherwise we would never have gotten any agreement with the Russians. We ended up pricing crew time based on the marginal cost of supporting a crew, which turned out to be about a metric ton and a half for the time they were up there; that's about a Progress vehicle worth of upmass. We said, "What's the Progress value? What's the value of that upmass?" We tied it back to upmass. We figured out what that was worth, divided it by the schedulable hours for a crewman over six months, and we came up with a number, about $55,000 per crew hour.

That was a credible, reasonable way to value it, and the Russians understood the symmetry of it. They understood that whether this is too much or too little is really not the question. The question is, can it be equally applied, and the answer was yes. So this negotiation for the update to the balance took so long because at that time, we had to go figure out how to value all of these different things.

Just valuing the stowage volume was an incredible chore, because there was really no good way to go about it, and that really came down to a negotiated amount rather than something tied to a metric or some base cost, like the value of a Progress to get to the value of crew time. Once we did that, it made every negotiation after that so much simpler, because we used those same values for the entire time I was in that position—and they're still using them today, with perhaps some escalation for inflation..

It was a very dynamic time, because we hadn't done any of this valuation during negotiation of the first agreement. We were trading things like, "They're going to do these modules and we're going to do those modules, and we're going to support their crew on so many flights." It was big things that could balance each other out at an obvious level. This was not

like that; this was a bundle of goods and services at the end that turned out to be, rough order of magnitude, about $1 billion each that we traded.

It took a year to do the negotiation; it probably took almost another year to get it through all of the approval processes at Headquarters and through the State Department. In fact, both sides agreed that we would never do that again. We will do the barters, but we're never going to update the balance again. We ended up with another very large, what should have been an update to the balance, probably about four years later, five years later. We had another omnibus package, if you will, of many bartered goods and services; we did everything except go through the State Department. In retrospect, we would've happily done that, but the Russians finally said they'd had enough, and we needed to start implementing it, otherwise it was going to be overtaken by events. We implemented it and we went on down the road, and nobody batted an eye on it. We sure had some interesting negotiations with them over those barters.

In '06 we knew we were going to be expanding the crew within two to three years. At that time it was a crew of three; we had just expanded from two to three post-flight after [the Space Shuttle] *Columbia* [accident, STS-107]. We knew were going to need some more internal infrastructure to support the crew, and the Russians had a very robust, very efficient toilet system in their module. Rather than us building a Shuttle-derived waste and hygiene compartment, we wanted to purchase a copy from the Russians, because you can double up on your sparing and be more efficient in your ops; the crew doesn't have to learn two systems. You were absolutely going to have to have two toilets onboard the Station, that much was obvious.

We worked hard with Roscosmos, the Russian space agency, to try to barter for that toilet, but they just weren't interested. It was going to be fairly expensive, and they just weren't interested. We said, "Well, what if we contract with Energia directly?" Energia's like our

Boeing, but it's got elements of our Mission Ops Directorate and [NASA] KSC [Kennedy Space Center, Florida], and it's their largest contractor. What if we contracted with Energia directly?

They said, "Well, that's never been done."

We said, "What if we did that?" And obviously we were going to need Roscosmos's approval, otherwise they could wicker the deal. Even if we signed it, they could make sure that Energia never performed, so we had to get their blessing right up front. We were told it can't be done. We were told by many Russians, and we were told by folks on our side that had worked along with the Russians, they said this would never happen. Roscosmos will never allow it, and the government won't allow it. We just didn't take that for an answer, we continued to press.

Alexey [B.] Krasnov, the head of the Space Station Program for Roscosmos at the time, finally blessed it, and I led a team over to Moscow in '06 to go talk with Energia and see if we couldn't cut this deal. We spent two weeks at an old hotel out on Energia's property, where each day we would spend all morning across the table from each other, negotiating, and then each noon they would clear the table and they would bring in a set-piece lunch, and we got to know them. We didn't really talk business at lunch, we talked family, we talked hobbies, we talked topical events, whatever was going on. By the end of those two weeks, we knew each other. It took about three or four days into the next, the third week, but we had a deal cut.

I think that was a major turning point for our involvement with not just Roscosmos, but with Energia, because it was a huge source of pride for them to have a direct contract with NASA. A foreign space agency had recognized their importance and the significance of the services and hardware they could provide. It was a huge deal to them, and it brought hard currency into the country, which was also a big deal. That contract is still in place. We scoped it broad enough that we could also acquire other goods and services through it that were within

scope, and it's been a very powerful vehicle for us to not just work with Roscosmos and have to filter through them, but, with their blessing, to be able to work directly with Energia. Since then, we've done agreements directly with [Yuri] Gagarin Cosmonaut Training Center, GCTC; we've worked with IBMP, their Institute of Biomedical Problems that does a lot of their human research; and it opened the door for a lot of direct agreements that didn't have to be under the umbrella of Roscosmos.

That was probably one of the more gratifying agreements that I was a participant in, and I was lead negotiator on that one, so it was fun to come back with a deal in hand, having been told it couldn't be done. In fact, the relationships we made during that trip have blossomed into good friendships that continue to this day. At the end of, I guess it was in about 2012, I had been a subject matter expert on the Russian stuff for quite some time now, and I was realizing I needed to go do something different. Suffredini called me one day and he said, "Hey, I want you to go back into the payloads office, and I want you to lead the National Lab."

I said, "Mike, I swore I would never go back."

He said, "I know, but things are different."

I said, "Well, let me think about it." And things were different. Mike had turned the program on its ear in the spring of 2012, to go from what had been the dark ages while we were assembling ISS—Shuttle retired in 2011, so we were just beyond assembly complete—and he realized it was time to pivot, it was time to now turn and support utilization as the primary goal for Space Station, because that, frankly, was why we built it. It was a research platform.

He reorganized the program to put an element of the payloads office into each other organization in the program. Whereas before there was an engineering integration office in the payloads office, there was a payload avionics and software in the payloads office, there was our

ops org in the payload office. There were all of these orgs that were encompassed in the payloads office, but what that did was, it almost made it so none of the other orgs had to support payloads, because they didn't own it.

So, he farmed everything out. We put engineering integration in the vehicle office; he put avionics and software in OD, in our avionics and software office for systems; he put the ops org in OC, our ops organization. Everybody now had a vested interest in supporting payloads, because it was part of their duties.

I saw that, and I said, "Hey, he's serious about the payload office being changed." Frankly, when I left in '05, the morale was not very good, because we were having to fight tooth and nail for everything, and we were literally a low priority. It wasn't intentional, it was just the fallout of what the priorities were of the program at that time: getting a vehicle flown. We were coming off of a *Columbia* accident that really set back our assembly, we were down to two crew members, so crew time was incredibly limited, and it was just a different time. So, coming back, it was a little trepidatious for me, but I found out that "never" is about seven years and some-odd months, as it turns out. I took the job, I went back.

It also interested me because the National Lab was set up to broaden the stakeholder base of ISS. It was recognized that NASA was not going to have a requirement for all of the crew time that we had available to us for utilization, or all of the upmass, or even all the onboard accommodations. We weren't going to be able to fund that much research, and frankly we weren't going to be able to support it. Congress, in concert with the Agency, in '05 had declared Space Station as a National Laboratory, just like we have terrestrial National Labs. Station was a non-terrestrial National Lab. They did that to get us to start looking to more broadly utilize it with nontraditional users. They reaffirmed that in 2008.

In 2010, they said, "NASA, we need you to step this up," because it wasn't going where they wanted. In 2010, they said, "Not only do we want you to operate as a National Lab, we want you to allocate 50 percent of all the resources you have available to you for research to operating this National Lab, and we want you to go select a nonprofit to actually do those operations." Not that they didn't trust us to do it, they were afraid that we were going to use it for our own ends, for our exploration ends, rather than the more nontraditional terrestrial benefits.

They were very specific with us on what they wanted us to do. We were to select a nonprofit that did not exist; it had to be a from-scratch startup. It had to be a single-function entity. It had to be operating only for the purpose of getting new users to the ISS, and we had to fund it. So, we held a competition, and we selected the Center for the Advancement of Science in Space, which was a startup that Space Florida sponsored, and CASIS is the acronym. We had just done that in 2011, they were brand-new.

In the fall of 2011, which was about six months, eight months before I took the job, CASIS was just getting started. My job was to help them get up and running, help them get plugged in to all of our ops processes, our planning processes, help them understand the capabilities we had onboard. But, more than anything, help them reach out to this nontraditional community, this community of other government agencies that may not have ever thought about using Space Station. NIH [National Institutes of Health] is one that they first targeted, and they've actually flown some stuff now. Other nonprofits, foundations, academia, but most importantly, to commercial entities.

We, collaboratively, have spent the last four years working to develop various ecosystems around the country, to target these pharmaceutical companies, materials,

manufacturing, some energy companies, things like that, "Hey, this is what we've done on Space Station. This is what it looks like you need. We need to be seeing if there's ways we can help you." It was a slow process, because it's not an inexpensive venture to do things on ISS, and these laboratories and pharmaceutical companies, they all have their targeted research and vested interest in what they're doing; changing that to start doing something in a microgravity environment is not the easiest thing to get them to start seeing value in. But, you persevere, and you push, and you cajole, and you berate sometimes, and you do everything it takes, but mostly what you do is educate.

That work is starting now to pay off, to where, with CASIS working on the demand side, driving new users to ISS, we're starting to see the beginnings of what might eventually be an economy in low-Earth orbit, and really that's the National Lab's goal, is to leverage the ISS—it's this wonderful vehicle—leverage it into something we might not even recognize from what our goals were 20 years ago. But it's vibrant, it's robust, it has new users that are using it in ways we didn't envision but that are absolutely valid. That's the demand side.

We at NASA are working the supply side. We don't have enough budget to fund upgrades to all of our capabilities. Many of those systems that we were working on developing in '96, '97, '98, I won't say they're obsolete, but they're certainly not state-of-the-art anymore. That was hard for me to accept when I came back into the payloads office, I'm going, "Oh man, these racks and these systems that we built and flew are now needing upgrades." But, we didn't have the budget to fund all of that. We started looking to industry and said, "Look, guys, if you'll develop this, we'll buy services from you. We may even pre-buy services to help you buy down some of the front-end financial risk, but we don't want to own the hardware."

That was a total change for NASA, and it was a very hard change for us, because we were used to specifying the hardware right down to the nuts and the bolts, we were used to sustaining it in a way we want it sustained, and then having the services available whenever we wanted them. We have successfully migrated away from that on a number of different research platforms that are operating on the ISS as commercially-provided services, which is a huge turnabout for us. In many ways, it's no different than what we did as an Agency with the selection of SpaceX and Orbital ATK to be our commercial cargo providers. It's their hardware, their vehicles; we buy services from them. We paid money up front to help them get through the development phase, but we recognized there was value to the U.S. taxpayer in having a robust economy and access to space.

One can argue whether that would exist at all without the government funding, but I would argue that the government is there to enable those things that are hard, if not impossible, for industry to do by themselves, because they can't afford to do it. The risk is too great. So we, as their primary customer, we funded some early milestones to help them through that development phase, and we're working collaboratively with them as we work through various technical issues. We've had an Orbital anomaly, we had a SpaceX anomaly, we worked through them. We had a Progress anomaly. We work through those things.

We now have six or eight different companies that are actually using Space Station to turn a business model. They've got research hardware, either up there or being developed to fly. We are buying services from them. It upgrades our capabilities, it adds gap filler capabilities for where we didn't have some of these accommodations that we needed, and we frankly found out that the new commercial participants, they wanted to see something that was more similar to what they had in their terrestrial labs, so we've developed a process whereby we fairly simply

certify COTS [commercial off the shelf]-type hardware to fly that they would then recognize, and its ability to use it is something similar to what they are on the ground. So, it helps their transition from doing terrestrial research to doing research in microgravity.

The most fun for me in this job is that it gives me the opportunity to help people see things that they might not have seen. To see potential partnerships, ways to participate with us that is different for them. We still struggle with some of our traditional contractors, because they've been building hardware to government spec [specifications], been paid to do it, and then are paid to build the next thing, and paid to sustain the next thing, for so long it's tough to convince them that there's another model there. But, a lot of the newer participants, newer space participants, they don't think like that. It's very gratifying to see them coming in and say, "You know what? I'm going to trust you, NASA. I'm going to trust you that you're going to buy services and you're not going to kill me with your integration processes and your safety processes," (which we're prone to do).

We're working through that with them. They're pushing us—we've encouraged them to participate, now we owe it to them to react appropriately when they tell us, "This is not working. You've got to help us with this process." It's pushed our system to be more flexible than what it was. I guess in the final analysis, that's really a win-win situation for both sides, that they have a new market to operate in, we have new goods and services, but now we're leaner in our processes.

And, it is a process. It's not an event that changes things. We are working through many process changes to enable them to be successful. Frankly, we have to educate our own people. This is why we're doing this. This is why we're spending this extra crew time to help troubleshoot this commercial payload, because it's important to us as an agency that they're

successful. Not that that investigation is successful; it's more that the company is successful, because it's bigger than one investigation, it's bigger than one event or activity onboard. It's important for the current participants and the potential participants to see that we're supportive of them. We expect them to be responsible for mission success, but we're willing to help them if it makes sense, and where we can. That pretty much brings us up to where I'm at today, is still in the National Lab office.

JOHNSON: That's great, a good summary. I have a few questions. One of them would be, we talked to NanoRacks [LLC], and Mr. [Jeffrey] Manber, and that was such an interesting conversation. They started that Space Act Agreement with NASA in '09, and I was just wondering what other type of contractual agreements do you have? Like you said, you've made some agreements with different companies, and his was an unfunded Space Act Agreement. Are there different variations in there and different types of contracts that you have with these companies?

READ: Yes. Yes, there are. I think his was the first Space Act Agreement we actually took to completion and then renewed. We renewed it last year. We use the Space Act Agreement to grant the real estate onboard Space Station. If somebody wants to fly something and it goes up in sorties and stays for a short period of time and comes back, we don't do a Space Act Agreement, we just handle that through the normal manifesting processes. But for somebody that wants to fly a facility, such as a NanoRacks facility, we'll do a Space Act Agreement with them, it's unfunded, but it's a very powerful document because it allows them to go to potential customers, and it allows them to go to potential funding sources, investors, and say, "Look, I

have this formal agreement with NASA. It gives me the right to develop this hardware, and they will accommodate it on Space Station, and then I will fly customers to it."

As the landlord of the vehicle, if you will, we want to make sure that the resources that we have at our disposal are going to the highest and best use. We want to make sure that there is a business model there for them to operate. If somebody wants to just fly something to be flying it, we're not interested. But, if they show us that there's a credible business case there, and that the hardware fills a gap or is an upgrade, then we're absolutely going to be interested in it. Some of them are flying hardware that they're not interested in selling services to the government.

Kentucky Space [non-profit consortium of private and public organizations] has a Space Act Agreement with us to fly basically a CubeLab system [small form-factor payload standard] that goes in an EXPRESS [Expedite the Processing of Experiments for Space Station] Rack Locker. They're doing that completely commercially. They have their own business interests, they have their own customer base. More power to them. NanoRacks has all of that, in addition to, they're interested, obviously in selling services to the government.

In addition to that Space Act Agreement, we have an IDIQ [indefinite delivery, indefinite quantity] contract with them. It's like a lunch menu: you want one of these, one of these, and two of these, you order it right off the menu. It's fixed price, it's a menu-of-services contract. That was the first one we ever had with any of our providers, and it allows us to buy services by the yard. So we want two CubeLabs, some CubeSat deployments, whatever it is, then we need some engineering work, we can buy that by the hour. With NanoRacks, and now several others, we've taken and followed that model where the Space Act Agreement grants them the real estate and lets them raise money, lets them get customers, but then the IDIQ contracts allow us to buy services from them.

Frankly, we treat it like a mini GSA [General Services Administration] contract, because other government agencies that don't have any way of building a relationship with most of our providers can transfer money to NASA as another government agency and utilize our contractual mechanism. We're also seeing DoD [Department of Defense] and other government agencies that want to do business with a NanoRacks, they come through our contract. It's worked out to be a very capable and a very flexible system for us, and we've had very good support from our procurement folks, because we've pushed the system a little bit to be a little different than what our traditional cost-plus contracts look like.

These are not cost-plus, these are fixed-price. They are commercial contracts in every sense of the word. They're no different than if you wanted to go do a commercial service with somebody completely outside of the government, you would negotiate a fixed price with them, and then you would have an exchange of funds for services. That's exactly what we're doing with them. Those are two of the agreements we use.

We have a third one, a cooperative agreement, it can be either funded or unfunded. These are generally funded agreements, where the government provides up to half of the total value of whatever the project is. It's another way for us to enable a new capability, but participate financially to help buy down that financial risk of a commercial customer developing it. We've used those quite extensively. They are more flexible than a contract, but they still provide the oversight. Most of these are milestone driven, so that as you develop whatever this hardware is, you don't get paid unless you meet a development milestone.

We're developing external platforms for material science under cooperative agreement. We've got a number of different capabilities that we have enabled through a cost participation. We have an external pointing platform, precision pointing platform, that can host up to four

instruments at a time. It allows a company that can't quite swing the full development cost themselves build has a capability that we're absolutely interested in having onboard the Station; but they maintain it, they sustain it, and they market it.

Which really is the most important to us. Now we have a new stakeholder, we have somebody with a vested interest in ISS and its longevity, and its capabilities, and its support. So many of the things NASA does, we educate but we certainly don't lobby, and we have a hard enough time talking with our staffers and members on the [Capitol] Hill. These private entities, they have no issues with that whatsoever. They are very good about educating as well, on how important the Space Station is to them and to their business model, and that resonates very strongly with the Hill because it's commercial. It is private industry creating jobs, selling services; it's not government funded. That's a pretty powerful message when you take that to your congressman and say, "Look what I'm building, look at the people I've hired, look at the growth."

NanoRacks is a perfect example. They're up to about 40 people now, most of them in the Houston area. In 2009, when they started—Jeff Manber will tell you—his first investors were Visa and MasterCard. He probably did tell you that. It's true, they started that on a shoestring, and they've gone through multiple rounds of investment funding now, and they are developing numerous different pieces of hardware that they operate commercially, and they're a very strong stakeholder, not only as an advocate for Station, but they're a good commercial success story. They've had their growth issues; they're a victim of their own success. They had so much workload coming in, so many new customers that they were struggling to hire people to be able to keep up with meeting all their milestones. But, that's part of the growth process, a good part.

That's part of what we have to recognize, too, if we want to do this commercial thing, it's not going to be just like it was with our traditional contractor partners. There's going to be some issues that we can't foresee, but we're going to have to roll with them, and we're going to have to be ready to adapt. I think it's been a learning experience on both sides.

JOHNSON: Sounds like it. And I know one of the issues, or one of the things that might have kept companies like pharmaceutical companies from doing research is the intellectual property [IP] issues. Does this model of companies coming in and making these agreements with NASA to basically rent space, does that alleviate those issues with companies that might be more concerned with intellectual property?

READ: That's something we've had to really finesse. By law, we have to reserve rights to the government for certain things. In reality, we've defined that quite narrowly, with our legal counsel's help, such that anything developed from data that was learned on ISS, but that was processed and studied on the ground, we don't feel like we have any rights to that. If someone found something on ISS while their investigation was up there, while they were doing real-time research, there's probably some gray area there that we haven't cleared up yet. We're actively working with Congress to put in a flat exception for non-governmental funded research on ISS. If it's traditional government grant funded, there's no question, we obviously maintain rights for our own use.

What we didn't want to do was to drive away the Mercks and the Novartises of the world to keep them from participating, because they might risk their IP, and frankly we've been successful. Both of those companies have flown a couple of times with us, Novartis doing

rodent research and Merck doing protein crystal growth. We have found ways to accommodate them, and that was one of the things that NanoRacks did in their Space Act Agreement, and we've tried to emulate that in additional ones, is make sure that we call out these things that are non-government funded, so that the IP does not revert to the government in any way, shape, or form.

JOHNSON: And another one of the things that, as you mentioned, the crew time, it does limit the amount of time that can be spent doing the research work, because they do have to do time maintaining and doing work on ISS. How much difference will it make once we can get a seventh crew member up there?

READ: Huge. It doubles. It doubles our available crew time for utilization. Because right now it's taking, just rough order of magnitude, about two people's worth of schedulable time to sustain the vehicle, to perform maintenance and to sustain all of the systems, filter cleaning, all of that stuff. We schedule 6 ½ hours a day for each crew, because they've got to get in a couple of hours of exercise, they've got their pre- and post-sleep time, where they're just getting ready for the day or just putting tools and stuff away at the end of the day, there's some planning and all that goes on for the next day. So, we only schedule 6 ½ hours a day per crew. So, for one crew over the course of a week, you've got about 32 ½ hours for payloads, and frankly, Mike Suffredini has set the floor at 35 hours, so we're averaging more than 35 hours a week. That's just been a change in the last 18 months or so, since we turned the program on its ear to support payloads. That was a big difference.

When we add one more crew member, you get another 32 ½ hours, because your sustaining is still the same, your system maintenance and everything is still the same amount of time. So, it will about double our available crew time, and that's a big deal.

JOHNSON: That is a big change, as far as getting things through there, too, and getting things on and processed.

READ: Well, crew time is our most limiting resource. Upmass is second, but crew time is very far out in front as the number-one most limiting resource.

JOHNSON: As you mentioned, this is a change for NASA, and the way NASA thinks as far as we were moving toward getting ISS built, and now it's such a shift to utilization, and part of that, the RISE team, the Revolutionize ISS for Science and Exploration, has been formed. Are you part of that team?

READ: Yes, we've definitely been participating. In fact, my office is one of the prime sponsors of one of the core processes that fosters commerce, obviously, between us and our commercial crew and cargo office. We're probably the ones in the program that touch more closely and more often our potential commercial partners. So yes, we have very much been a part of that. In fact, the payloads office in general has been a strong part of that effort, because it's all about leaning our processes and more focusing our processes so that we are supporting utilization. Not just having processes there because that's what we did in Shuttle, while Shuttle processes were what we did on Apollo, and that followed programs prior to that. It's like a railroad, why is it as

wide as it is? It's because that was the width of two horses back in the Roman days, that the width of chariot roads.

That's what we inherited for Station. We're throwing that all away and really taking a ground-up look at every process, every verification, every requirement, and going, "Why? What were we really trying to get at there?" In fact, I just heard yesterday that one of our major requirements books, we went through it top to bottom and ended up keeping 29 percent of what we started out with. That's pretty substantial. It's sad, in a way, that we've been having to operate under that for so long, but it's also a very positive story that we're serious about improving the effort that other people have to put in to work with us, and that's a pretty good deal.

So RISE, it's a process to improve the processes. It has been going on for about a year now. Suffredini basically established a RISE office and put Ryan [L.] Prouty in charge of that, to elevate it to the stature that it needed, in his eye, to make people realize he was serious, and now we're starting to push it into various orgs. The safety org has been one of the first, because that was where we got a lot of complaints. They've embraced it. It's still personality driven, which we need to get away from, but the Kool-Aid is being swallowed, and folks are recognizing that they need to get on board, and they are, to their credit.

JOHNSON: You've talked about when you were working with the Russian integration, and that was something you're really proud of. Is there anything during these years with the ISS Program that you would consider the biggest challenge of your career?

READ: Working with the Russians was a love-hate relationship, and I don't say that lightly. We never hated them, we just didn't always understand them, and they were skeptical of our intentions. Having built those relationships now over 20-plus years, that no longer is the case, but in the early 2000s, mid-2000s, when we were really trying to tackle some of these tough barters, that was difficult. Suffredini hadn't had a lot of experience with the Russians other than when he was doing the real-time mission management team chair. The Russians don't turn over people anywhere near like what we do. Their program manager, Alexey Krasnov, and one of the first deputy designer generals at Energia, Aleksandr Derechin, had a lot of experience with NASA, since the early '90s, when Russia came on board in '94. So, they had somewhat of a tactical advantage, just because they had the corporate knowledge, and boy, they were willing to use it, too.

That was a difficult time. We, as I mentioned earlier, had to really figure out how to value things, and we had to get their agreement on how to value things, and we had to make sure we weren't screwing things up for us in the future if we did something in '05 that we were going to have to live with in 2009, 2010. That was a difficult time, because there were things we had to have, and there were things we knew they needed to have, and yet getting through that big balance addendum was a challenge for us. It was literally a year of trips back and forth, both sides coming one way or the other, and countless hundreds of hours and thousands of people hours working through that. When we got done with that, I think we were all ready not to ever do that again. But, it was necessary, and we got through it.

JOHNSON: It sounds like through your career there seems to be a theme in these positions. You're coming into a position at a time things are really changing: setting up that payload office,

working with the Russians, and of course with the National Lab. Are there any lessons learned since your career at the beginning with NASA and till this time that you'd like to share, as far as some of those lessons you learned in that process?

READ: It doesn't suit everybody, but be willing to take a calculated risk. I never took a stupid risk. I took a lot of calculated risks. I came to NASA with nothing, no promises. I had back-to-back grad coop tours setup, yet I moved, I moved the family with two kids under the age of three. My wife didn't have a job, and we lived on a GS-7 salary at the time, which was not a lot, but I saw that as a calculated risk, not a foolish one. It paid off. It's paid off in spades. I've had a fantastic career with an agency I love and in an endeavor that has just been incredibly dynamic.

When I left Shuttle, I had a very good following in Program Control there, so coming to Station was a risk. To me, it was a challenge; I didn't see it as a risk. I was going to have to learn a whole bunch of new people, but the guy that hired me turns out to be the program manager some years later, and so Mike has been extremely good for my career. He's asked me to do some things that I wasn't sure I wanted to do, and some of them I don't think I did very well. Then I'd have to move and find something that was going to challenge me. I left Program Control in '98 to leave the budget world and go to the technical world. It was a huge change for me. I was told by the Program Control world, I was told that you're getting off this moving sidewalk, you're going to lose your constituency, you're going to lose your support. I thought, I can't do this forever, and I moved, and I never looked back.

To me, you position yourself without really recognizing that's what you're doing, and you do it by working hard. You do that by performing, and like I said, Mike and I hit it off well, because I would tell him when I thought he was wrong. Yet when he needed to make a decision,

I respected that that was his responsibility to do so. I figured the best that I could do for him was to tell him what I really thought given my subject matter expertise, of whatever that topic was, and that didn't always fit where his intentions were, but he always listened.

You have to build relationships with people, whether it's the people you're working for or with, or the Russians. We worked so successfully with them because we built relationships. We got to know them as people. We would go out to dinner with them when we were over there, we would get invited to their house sometimes; that's a very rare occurrence. But, we would have them in our homes when they would come over here. We entertained them more times than I can shake a stick at, but it's the way you get to know them. And they don't all speak English, and I certainly don't speak much Russian, but by the end of an evening, you realize, all of them here and all of us, we all communicated, we never had any issues, yet how did we do that? And it's just about getting to know people. So, take calculated risks and definitely build relationships, because you never know what that next job is going to look like. I've never known what my next job was going to be until somebody said, "Mike, I need you to go take a look at this," and I was willing to do it.

JOHNSON: Those lessons you learned working with the Russians, I'm assuming those applied with the other international partners that ISS works with?

READ: Absolutely. I had much, much less involvement with the other international partners. It's just not the way we were structured. We had folks that specialized in working with the Europeans or with the Japanese, two very different cultures from the Russians. I got assigned to work with the ones that most closely suited my own personality. When I was a kid, I was in

debate in high school, and so I did all of that, and I was accused by my folks of arguing with a fence post. And now they laugh, because I realized I'd found my fence post in the Russians. They're very good at negotiating. They are very good. I thoroughly enjoyed working with them. Many times it was me on one side of the table and six of them on the other side. I loved it. And they got to see my personality, I would tell jokes. They didn't always fly through the interpreter, because I use some Kansas euphemisms and things like that that didn't make any sense when it came out the other side, or they came out totally sideways. Everybody laughed at my inability to tell a joke, but they got to know me, and I did not hide when I was upset. I didn't hide when I was laughing with them, I didn't hide my emotions, and they started becoming more open with me as well.

After almost eight years of working with them, we had a very good working relationship, and I could cut right to the bottom line and say, "Look, guys, this is what we need." That was very, very different for them, because when we first started working with them, it was like you weren't going to get a deal done until after lunch on Friday before you left on Saturday. It was like, how much time do you have, because that's how much time it's going to take. Our meetings were much more efficient years later, where they trusted, as far as they could, they trusted what you were saying. We did the same with them, to understand what they really needed and where they were really coming from.

Many times, what you didn't realize until way late in the game was that they haven't been authorized to make a decision, to make a deal. They've been just sent out there to see how far they can get without ever being able to agree. That's just the stovepipe nature of authority over there, it is so closely held at the highest levels that many times the senior people that you were working with, they didn't even have any authority to cut a deal. The quicker you realized

that, the quicker you realized you don't need to be frustrated with them, because they can't change that.

I would say that the relationships I built with the Russians was a very unique thing. To operate in an international environment any time is a unique thing. It's sexy, it's enjoyable, you get to travel, but more than anything, you get to learn a new culture. But, to do it in support of something like the International Space Station? Oh my goodness. Sometimes you just couldn't believe what you were doing. You're over there, buying a toilet for Space Station, and when I told people what it cost—I think we ended up spending about $18 million on that and some other ancillary items we got with it—I would get comments like, "Oh, heck, I'd have built it for half of that."

And I'm going, "That's fine, you bolt it to the ceiling and show me it's going to work, because that's basically what you're doing in microgravity. That thing is not going to function like the one in your bathroom. "

And people then start to understand, "Oh yeah, yeah, you're right, you know, it's not going to be quite as easy as we thought."

I still maintain very good relationships with many of those folks, and so the people that came behind me to work in the external integration office, I still get called in to counsel with them a lot on how we got to such-and-such a number, or tell me what you guys meant when you did this. That's gratifying for me, because it says we did something important that's still in existence and still being worked. When our Russian colleagues come over to do a contract negotiation or a technical meeting or whatever, quite frequently me or one of the colleagues that worked with me during that period of time, we still host a get-together, and we help our people who came behind us to build those relationships in a social setting, because it's so important. I

still have a lot of good friends over there. I worry about them, given a lot of the restructuring and stuff that's going on in the Russian space industry right now, but we built some pretty close ties.

JOHNSON: And your career has taken a different trajectory. As you said, you started out in banking, and then to end up negotiating with the Russians to buy a toilet for the Station, and then working so closely with people that do science and researchers. That's interesting, starting out with a business type degree and then moving into NASA, which in NASA's environment is somewhat unusual.

READ: I have been very fortunate that I have been given the opportunities that I've been given. I'm not sure I was qualified to do some of the jobs that I was given to do, and maybe it challenged me to go show that this is possible. In the mid-'80s I was, at that time, in the mortgage industry and I looked around and saw guys twice my age doing exactly what I was doing, and I'm going, "I can't do this. I'll go nuts if I have to do this forever." I ended up quitting a good-paying job.

I took a graduate research assistantship to work on a master's of public administration. That was a risk. I quit a decent-paying job to make $600 a month as a grad student, but I hit the coursework hard. I hit it one summer, two semesters and another summer, and I was done. I had to finish my research paper, but it opened the door to NASA for me. I came down here and finished my paper, and it just set the stage for being in a position to have performed, but also to have somebody say, "Hey, look, I'd like you to think about this." Then it's all a question of calculating risk.

I think without question that the close relationship over 19 years that I've had with Suffredini has been extremely beneficial to my career, and I'd like to think I've been beneficial to what he's trying to do, especially when he was the program manager for the last decade. He expects us to go out and build those relationships and be independently successful, because it makes the program successful. He's given us a lot of autonomy to go do those things. Many times we would go over to Russia and set the stage for him to come in and finish the deal, because it flat wasn't going to get finished until the two program managers got together; that's just the way they operated. But, we would have the table set properly for him and have all the issues understood and have a good feel for the bounds of what each trade space was, and then he'd come in and make the deal and he's done. It's very efficient, and I thoroughly enjoyed that.

Without question, the close relationship that I've had with him has been very good, and probably opened those doors for me that are doors that wouldn't have been opened for somebody else with a non-technical degree. As you said, NASA is a technical organization. We value the math and the science, the engineering backgrounds.

I've learned that people don't know that I'm not an engineer, because I've had to understand how they work and how the integration processes work and everything. That doesn't mean I can do it; it means I can appreciate it and I can talk it. I think that building the relationships is something incredibly important—in fact, I've been asked to counsel engineers on the soft skills that really aren't taught. The engineers are great with the technical details, but the soft skills, the leading, the negotiation skills, the relationship building, the communication skills, both writing and oral, they're not taught. And absent that, you've got somebody that's going to be a really good journeyman engineer that's never going to make a project manager, because you

have to have all those interpersonal skills that are not taught, they're absolutely learned, but there's no way that's really set up to help them learn those skills.

I've got a lot of engineers that have worked for me, and I let them see how I operate with people so that they can get a feel for, "Oh, okay, this is the way we do this, and I don't have to be just technical, and I don't have to be just by the book." I don't think there is a book, very frankly. We are making an awful lot of this, this whole commercialization of space, we're making it up as we go. We have some ideas, we test them, they may or may not work, you tweak them, you go on and you do something else. We've got our commercial partners that are incredibly nimble, and they expect the same from us. We have to support each other.

But yes, I think I was given opportunities because it was who I knew and who knew what I could do, not what the sheepskin said or what my experience base said. It was based on somebody knowing me and saying, I think he can do that.

JOHNSON: And relationships are important, and the relationships with those commercial companies, and then how that's going to help, hopefully, with the length of time that ISS gets to stay up there. Depending on how long it stays there, what do you think the legacy, because at some point it will have to come down, or it will be changed somewhat, what do you think the legacy of ISS will be?

READ: Well, this is going to come as no surprise, given the speech I've just given about the international partnerships. Obviously, the legacy of the ISS is the strength of the international partnerships. Through multiple administration changes all around the world, through wars, through accidents, from *Columbia* to technical delays to recessions, it's that partnership that has

sustained the ISS. We have a commitment to each international partner, and each international partner is committed to all the others, and that's a treaty. That is an intergovernmental agreement. That's a treaty agreement that was ratified by all the partner nations' governments. Not just the space agencies, but the governments. Those things are not undertaken lightly, and they're less likely to be broken. Without question, it's the ability to operate in multiple cultures over multiple decades, through budget challenges and many other challenges, all the while continuing to support each other.

The beauty of ISS, wow, it's really just amazing. None of these pieces that were built by these international partners, touched before they got into low-Earth orbit. None of them. Yet they all made it. They all function, they still function; they're incredibly robust. Obviously that's the prime legacy. It's going to inform how we do whatever we do next, whether it be the Moon, whether it be Mars, whatever it is. I don't care, I don't have to know. I know what it's going to look like, though. It's going to be an international partnership. We will have probably new international partners. It's not unlikely at all to me that a China or an India would be a valuable partner, because no one country can afford to do this on their own.

Equally as important, and given my current role, I think it's quite likely there'll be a commercial partner that's a full vested partner, that will be responsible for some elements of whatever system we put together to go wherever it is we go. That's not a stretch at all. That, to me, would be the ultimate approval of what we're doing with this whole National Lab, to see a commercial participant as an equal partner, whether it be a SpaceX or Orbital or whomever, a Bigelow [Aerospace], who knows? Or all of the above. To be an equal partner in this next endeavor, that really would put the stamp of goodness on this whole commercial effort. ISS is a fantastic vehicle for research. We have a lot of research capabilities up there across a broad

waterfront, and there have been and will be more good research come out of it that benefits humankind.

While it's a good platform for research, we're finding it's an equally important platform, a test bed, for new business relationships. As I mentioned earlier, we've got people that are actually running a business using ISS. Nobody thought about that. We didn't have that as goal one back in the '90s when we were developing this thing. So, we're evolving it as well, not only from a capabilities perspective, but also from how we use it, how we envision it, how we see it operating. We're evolving that vision each day as we get new people come in and say, "Hey, what if I could do this? Can I do that?" And we're going, "I don't know." That's like the first question I asked 20 years ago, and the room went silent. Well, we do a little bit of that now, we're going, "Well, we're not sure. Let's go find out for you."

I think the legacy is equally important such that if we're successful, when ISS is done, whenever that is, there'll be a robust economy in low-Earth orbit that will be sustained commercially, the government will be a customer not an owner, and we won't leave low-Earth orbit just because we don't have ISS. We will have used the heck out of it when we had it, and used it just as much as the government did when we built the transcontinental railroad. The government had land. The transcontinental railroad was built privately. From both coasts, it was built privately, but we gave away land to incentivize it to be built. Now, we're giving away real estate on ISS. We're giving away resources in the form of upmass and crew time to enable people to develop something that doesn't exist. I think that's pretty cool.

JOHNSON: It's a new idea that's really not that new, we've done it in the past. That's interesting.

READ: It's a different vision.

JOHNSON: Well, thank you so much for coming in and talking to us. I appreciate it. Thank you.

READ: My pleasure.

[End of interview]