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COMMERCIAL CREW & CARGO PROGRAM OFFICE
ORAL HISTORY TRANSCRIPT

TIM BUZZA
INTERVIEWED BY REBECCA WRIGHT
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[The opinions given in this transcript are the opinions of the person interviewed and do not necessarily reflect the official opinions of SpaceX.]

WRIGHT: Today is January 15, 2013. This oral history interview is being conducted with Tim Buzza at the Headquarters of the Space Exploration Technologies Corp., or SpaceX, in Hawthorne, California for the NASA Commercial Crew & Cargo Program Office History Project. Interviewer is Rebecca Wright, with Rebecca Hackler. We thank you for squeezing us in this afternoon, we know you're busy.

Could you start please, by just giving us a brief background of where you came from and how you ended up with SpaceX, and your role in COTS [Commercial Orbital Transportation Services]?

BUZZA: Sure. I started my career at McDonnell Douglas [Corporation] after graduating from graduate school at Penn [Pennsylvania] State University [University Park], and was working on aircraft in Long Beach [California]. Then after about 11 years I moved to Huntington Beach [California] and worked on the Delta IV program. That's where I got introduced to rockets, and worked mainly on the common booster core, which was the first stage. It was a brand new first stage.

Worked that for about five years, and that's when the opportunity came up to join SpaceX. One of the founding members, Chris Thompson, and I had worked together at Huntington Beach in California. Between Chris Thompson, Tom Mueller, and Elon [Musk, SpaceX founder and CEO (Chief Executive Officer)], and then soon Hans Koenigsmann—they formed the initial core elements of SpaceX.

Then I was in a very close-proximity second wave where they were looking for other folks with different talents. In particular, I came from a testing background, so they were anxious to have somebody come on board to begin some of the engine testing. Then of course we moved into structural testing, stage testing, etc., mostly the high-level system tests and things like that. I did join the company in August of 2002, and am currently employee number five. Now we're over, I don't know, 2,500? More than five. I knew everybody's name back then.

It was great. I got to work at SpaceX from the beginning working on Falcon 1 [rocket], and I initially was hired in to run the testing. Because the test site in [McGregor] Texas became so similar to what a launch site should be like, I then was given the responsibility for the initial launch site at Vandenberg Air Force Base [California]. Then we moved to Kwajalein [Marshall Islands] and built a launch site there. Completed our Falcon 1 development in Kwajalein, and then moved on to Cape Canaveral [Air Force Station, Florida] for Falcon 9. Now we're also working on Vandenberg for Falcon 9 Heavy.

WRIGHT: Tell us your thoughts when you heard that there was a possibility that SpaceX may be becoming a partner with NASA as part of this new way that they wanted to do business.

BUZZA: We had actually been talking internally about a larger rocket, and also the idea of a space capsule. That was being discussed internally, along with finishing the development and flying out of the Falcon 1. It just seemed to be an amazing coincidence, but maybe it wasn't, that NASA and their interests were leaning towards commercial companies developing that type of technology, and we certainly had aspirations internally. It was really just a match made in heaven. We came together at exactly the right time. If it had happened a few years earlier, I think we were too young and didn't have enough experience, and really didn't have enough infrastructure to support that level of a program. I think the timing was impeccable for both sides. SpaceX really needed some help, and NASA was looking to do business a different way, so I think it worked out. As far as a timing perspective, it was seeded at exactly the right time.

WRIGHT: Were you involved with the initial putting the proposal together?

BUZZA: Yes.

WRIGHT: Talk about your thoughts. We understand that this was a very almost simplistic proposal. How were you able to move your ideas and thoughts and your expectations into something that was acceptable to NASA, so that you were chosen in that first round [of the COTS competition].

BUZZA: Certainly that was our concern, that we were a very small team, and we were still trying to prove ourselves on the Falcon 1. So we didn't really have what you'd call "street cred" [credibility] quite yet. I mean, that does help. We had enough to put into a proposal that could

show technically that we thought we knew the right direction for a next-generation rocket and a next-generation spacecraft. But we didn't have the staff and the time yet, frankly, to develop a proposal that was stacks of volumes. It really ended up being, like you said, a very condensed version of what some might think that original proposal may have looked like.

I think if you go back and review it, you'll find that it has all the technical merit that is needed to see that this company could actually do it. Really that's what I think got us through that proposal and award selection, is that it had some really good technical content. It was missing some of the things that you might see in the proposals of other companies that had been around doing federal contracts and things like that. It was missing a lot of what you might have seen in other large government contracts, but maybe in one sense that was a good thing, because it cut to the chase on what did we actually propose to do, and a very technical discussion. That was pretty exciting.

WRIGHT: Were you involved in answering questions from the evaluation process and the due diligence process?

BUZZA: Yes.

WRIGHT: Can you share with some of the questions that you received, that they were looking for?

BUZZA: I'm not sure I can actually remember specifically. Unfortunately, this was back in 2006.

WRIGHT: I know it's been a few launches ago.

BUZZA: I don't actually remember a specific question, but what I can tell you is people that were reviewing it came from an extensive, very experienced background in launch sites, launch infrastructure, boosters, rockets, and spacecraft. We were certainly faced with a tough challenge to try to answer all of the questions that came to us. I mean, it wasn't like we had already developed this technology and proven it. We were proposing to finish developing it, and that it would work. There were a lot of very difficult questions, and we did our best to answer them all. Looking back, I think we answered them all through the program, but we probably could not have answered them in the proposal phase to everyone's satisfaction. Fortunately, we still won the contract.

WRIGHT: The [Space Act] Agreement was set up to give you flexibility.

BUZZA: Absolutely.

WRIGHT: There was a Project Exec [Executive] that was assigned to SpaceX from NASA [Michael J. "Mike" Horkachuck] that would help when you needed help, or answer questions. Talk to us about that relationship and how that worked. What were the benefits, but maybe also the restrictions of working in that type of environment?

BUZZA: We've all gotten to know Mike quite well. When you go into a partnership initially, it seems like an "us and them" type thing. But along the way, as you get into the meat of the projects, and you get to actually doing the work, that tends to vaporize. That's certainly what happened with NASA and SpaceX in many ways, where the "us and them" mentality disappeared once we got "into the trenches," getting the work done that both sides proposed to do. Then it was just an "us."

If you watched that program develop, it became "us" more and more as we got deeper into the program, which was really exciting. We could initially look at it like, "Well here's a program executive from NASA, and he's asking for this information or that information." What we began to find along the way is that most of the time, the questions that they were looking to get answered were things that we did need to answer for ourselves, whether it was for NASA or for SpaceX, but it was for the program.

Then secondly, there's resources at NASA that we hadn't realized how extensive the knowledge base is. I mean, you would expect that, but we hadn't actually been able to use that before we got into the COTS program. Once we started to realize all these NASA Centers have a lot of technical expertise, when we would run into problems we could go, through the commercial Space Act Agreement, get lots of great help. It quickly transitioned from what might be viewed as a sort of contractor-NASA type situation, to everybody wanted this to be successful. There was no doubt that there was an extreme amount of helpfulness on the NASA side to make sure that SpaceX had every opportunity to be successful.

I think the Project Executive, Mike Horkachuck, would be viewed by most of us that went through COTS as a teammate, not as a program executor or overseer. Mike traveled with us all to the different test sites, to the launch sites. He spent a lot of time with us sitting through

all of the different meetings and helping us ferret out where is our risk, where's our concerns, what do we need to work on? There was never any feeling of backhandedness with the information that was shared, in terms of you get some information at an internal SpaceX meeting, and then it's used against you on the other side. It was always very cooperative, really positive experience with Mike.

WRIGHT: Talk about the milestone reviews. There was a time when the "us" and the "them" came together to discuss milestones, because that's how you got your payment. Can you share how those went, and how they progressed as you got closer and closer to meeting the end result?

BUZZA: Yes. I think when milestones tended to be paper-oriented, like a technical review, then you can get into some discussions on whether the technical content met the pre-milestone criteria, and it can be harder. I think when the milestones are physical, like you fired a first stage on a test stand, there's not a lot of argument whether you fired the stage or not. I know that there was a balance in the contract on all the milestones, between what is a paper milestone and what is some physical milestone. I always sensed that when we were dealing with something in a bit of a grey area, that it was always harder to get agreement on did we pass this certain milestone or not.

I think also there's a long history of what certain milestones—if you talk about a Preliminary Design Review or a Critical Design Review, what that may have meant in past NASA contracts, and maybe what it meant internally to us at SpaceX—I think there was definitely some learning on both sides about what is the right content for some of these pre-

defined reviews, as compared to other programs. What is the right, logical sense for this commercial program, and what we should have done at these level of reviews.

Again, once we got deeper into the hardware side of it, like actually bringing the vehicle to the launch pads, and the capsule finishing certain physical tests, there wasn't a lot of discussion. If the Dragon capsule had to finish an EMI [Electromagnetic Interference] test, well, it had to finish an EMI test. There wasn't a lot of argument on either side. Just trying to get it done.

I would say the milestones—there were some tough times because of schedule, as we all know. You can go back and look at the history books, and talk about what the original schedule was in the proposal, and what the schedule ended up. A lot of it was about when you're creating something new, it's sometimes hard to have that crystal ball to know what are the troubles you're going to run into as you try to get to the endgame.

NASA was helpful as we went into different struggles along the way in the program. They always tried to not be negative, and really held our feet to the fire, so to speak. They would always say, "Where can we help?" Like, "We want you to get over this issue as fast as we can and successfully, so what help can we throw at it?" I think from our side, we had to learn to accept the help along the way. We were on our own for our infancy, so we were used to being a bit internally self-centered. I think learning to accept some of that outside help was something that we had to learn.

WRIGHT: At least you're accepting it from an institution that had been doing it for a while, so that helped.

BUZZA: Absolutely.

WRIGHT: You mentioned the testing areas, and that Mike was here and there and everywhere. Was there a specific testing regimen that you had to go through as part of those milestones? Were NASA personnel there to make sure that these were being covered in a safe and reliable way, that they were expecting?

BUZZA: Yes, I think for all the large milestone tests—I can't say for sure that there was always a NASA representative, whether it was Mike or somebody that he delegated to. There were also a lot of tests that weren't necessarily linked directly to a specific milestone, that were viewed as important on the NASA side, and we were open to have them come out and witness it.

For example, if we did a stage firing in Texas, and Mike was down there witnessing that, it may not have been on a specific milestone, but he was definitely part of that process when needed. On the other side, one of the bigger milestones on the Dragon capsule was the EMI test. That's why I mentioned that. I know Mike was directly involved with all of that testing when we did it here in the factory.

WRIGHT: You also manage the team that takes care of Mission Control here. Can you explain how that works? Is the NASA effort involved in that, or is that a strictly SpaceX contingent that oversees that whole operation?

BUZZA: That may be one of the most significant areas that we had to partner with NASA. If you look at the launch site, you can view it as the booster's ride to orbit. We're not in proximity to

the ISS [International Space Station] when we initially launch, at a position where it would be viewed as a human safety hazard. When you think of it, the risk on launch is you want a successful launch. All of the safety aspects of that are governed strictly from the ranges, not necessarily from say NASA or Houston.

Obviously once we get on orbit and we start getting into what we call proximity ops [operations] with the Space Station, that's when one of the biggest partnerships that we had to form with NASA was birthed. Meaning Mission Control here in Hawthorne, and Mission Control in Houston, but a layer on top of that would be the [Aerospace] Safety Advisory Panel and things like that. It wasn't the idea that SpaceX could do whatever we wanted. We certainly had to meet every standard that any international partner—it wasn't even just the U.S. saying you could do what you want, it went international at that point.

We had to work very closely with the Mission Operations team in Houston. If you talked to John Couluris, who's our mission director [Senior Director of Launch and Mission Operations], you talk to flight directors in Houston like Holly [E.] Ridings, I'm sure they can tell you a lot of additional info of how they formed that partnership over the years. Those were the types of relationships at the different levels that forged the union between us and Houston. It took all three centers—Hawthorne, Houston, and the ISS, if you think of it as a center—to do this choreographing of the Dragon spacecraft to the Station. Not all of it was just procedural, though there were a lot of procedural elements. Not all of it was safety, not all of it was technical. It was the combination of all of those that had to be worked on together.

If you recall, there was a delay on the software side of the C2/C3 [COTS demonstration mission], on the first mission that was going to go launch with the ISS. A lot of that was just making sure that we had done the right due diligence in our software arena, which was linked to

safety, which was linked to Mission Control and so on. It was really both sides needing to get comfortable before we would say let's go launch. Nobody likes a delay, but both sides accepted where we were, and took on the challenge that until both sides get happy and are ready to do this together, then we're not going to go. When we did get ready, we went, and of course the results were very positive. That was just how the partnership went.

WRIGHT: It's a very nice, calm way of saying it was very positive. It was a good day.

BUZZA: Yes. I mean there was hard days, trust me. There were days when I'm sure that different folks in NASA may have been frustrated with SpaceX. I'm sure there were days that some folks at SpaceX may have felt some frustration in working with NASA. But if you're trying to achieve something of a first, those things happen. As long as you persevere, and you have respect for both sides, which both sides did, then it works itself out.

I remember it was a lot of stress and a lot of hard, long days that both sides were working. When we were trying to pass all the safety reviews on software and other documents before the C2/C3 launch, I know that the folks in Houston were pulling almost all-nighters, working through weekends. The same sacrifices that we were applying at our end, they were applying at their end. That was greatly appreciated.

WRIGHT: You also manage the cargo elements and the experiments. That's an area that didn't get a whole lot of attention, because of the other dramatic and important pieces of the mission. Can you talk some about that?

BUZZA: That was the whole purpose, right? We're not flying people, so it must be about the cargo. I think when we initially started the program, there was certainly a lot of excitement wrapped around "Could we get the rocket to work?" and then "Could we get the capsule to work? Could we actually dock with the Station?" In fact, early on in the COTS program, there wasn't a huge emphasis on mission critical cargo having to be delivered during the COTS phase of the contract. That was going to follow on in the CRS [Commercial Resupply Services] phase when we got operational.

As time waned on, and when they added the extra Shuttle flight—which bought a little bit of time because they brought up a huge amount of supplies on that last flight. The fact that we were spending a lot of effort to get the Station—then all of a sudden, CRS came into play a bit earlier than we initially thought. That was actually a good thing, because we got to learn about how to take delivery of the cargo, how to interact on how to pack the cargo. Getting the center of gravity of the cargo where we want it, the cleanliness aspects of the cargo and the capsule.

Those are all things that weren't initially a primary concern. Initial primary concern was get the rocket to work, get the capsule to work. We had to go learn what were initially secondary objectives early in the COTS program. I think now that we've entered the operational phase, that just helped us kick start the knowledge that we needed to have, the systems we needed to develop.

Then our own internal sensitivity to the requirements of cargo, and really getting to understand what is the emphasis on cleanliness, and what is the impact of that? What is the emphasis on contamination, the outgassing, all these different things that we do with cargo. How we pack it, how we train the astronauts to unpack it. These are just all things that we had to

mature into. We're pretty excited about it. Cargo going up, I can tell you, is a lot easier than getting cargo back.

Packing cargo in a nice, clean capsule at Cape Canaveral in the clean room, and then heading up to Station and unpacking it in zero-g [gravity] seems pretty simple compared to when we get it back. We've got to keep this stuff powered, and we've got to maintain certain environmental conditions. We've got to go out in a ship and recover this stuff, and then it's got to continue that process all the way to where it ends up at our Texas facility, where the final bags are unpacked.

There's early cargo, there's powered cargo, and then there's the standard cargo that we unpack in Texas. That whole process had to continue all the way back. Our Texas test site's pretty excited that they're actually the last stop on a mission. That's it, the mission ends in Texas. A lot of the rocket is started in Texas, so I think they take great pride that the mission ends in Texas. They unpack the cargo and give it to NASA, and that's where our handoff is.

WRIGHT: That's pretty interesting, thanks for sharing that.

BUZZA: Our facility near Waco [Texas], in McGregor, is where we do the final unpacking of the cargo. Then we do the capsule decon [deconstruction] work, clean it up.

WRIGHT: I guess it's becoming a fuller site, because like you said, you started out just using it for testing.

BUZZA: Yes, Texas has transitioned. Initially it was really a rocket research center, we did our propulsion and development there. The primary reason was you want to be out somewhere that you can light rocket engines and not have too many people complain. Then it did structural testing for the large scale stages.

It still is our primary research site for large scale development, but it also has a production center. A large portion of our production hardware flows through Texas for acceptance testing, and then on to the launch sites. On top of that, Dragons retire in Texas. There's a couple of Dragons there at any given time.

WRIGHT: That's neat. SpaceX has this persona of less bureaucracy and more simplicity. The impact of working with NASA over these last five or six years—do you feel that SpaceX has been able to retain that culture? Or do you feel like your company has been impacted by the ways that you've had to do work in order to meet the standards that NASA wanted as part of this agreement?

BUZZA: We've definitely changed to some extent, but I don't think in any far-reaching negative way at all. Certainly when you're a small private company, and you're launching something like a Falcon 1, the initial contracts that we had were structured with not very much oversight. It was really move as fast and as quickly as you can to develop this technology. We came from that, and I think we carried that same philosophy through COTS.

We were able to hire more people to do some of the—I call it due diligence. People use the word bureaucracy, but what it is, there's sort of a risk versus reward curve. You can spend a lot of money and do a lot of things that somebody might call bureaucratic. But really it's a

balance of how much of that overhead you carry, and how much of that work you do, and then how much risk you carry forward into the launches and some of the missions. That is always a balance that's out there. Some very risk-adverse organizations that are carrying very expensive satellites are going to push for a lot more oversight and insight, and all those types of things that they look for.

That's really what NASA was doing, but I would say they adjusted their thinking dramatically based on the structure of the contract. NASA very quickly, up-front—from the top-down, which is continued forward from Charlie [Charles F.] Bolden [NASA Administrator] to Bill [William H.] Gerstenmaier [NASA Associate Administrator for Human Exploration and Operations] to Mike [Michael T.] Suffredini [ISS Program Director] to Alan [J.] Lindenmoyer [Commercial Crew and Cargo Program Manager] and Kathy [Kathryn L.] Lueders [ISS Transportation Integration Office Manager].

I think of all the folks that we've worked with, and I've had the opportunity to talk with to great extent, have carried that philosophy that "Yes, we think we have certain things that we're going to impose on you that will make a better program." But they also recognize that they wouldn't just impose things that they wouldn't find were of value. I think at times we had to learn that same thing, that some of the things that we were being asked to do actually in the end did provide mission assurance, and were of great value to the program and being successful.

I think it was the right mix. I don't think we hit it wrong on either side. If NASA had asked for nothing, that wouldn't have been appropriate either. I don't think that they ask for anything excessive beyond the value of the contract, and the purpose, the underlying theme of the contract, which was developing commercial capability.

WRIGHT: Before we run out of time, I was going to ask Rebecca if she had some questions.

HACKLER: You have your facilities here, the test facilities in McGregor, and you launch out of the Cape. Can you explain a little about the rationale behind where those sites are?

BUZZA: Yes, let's see. When Elon decided he was going to get into the rocket business, he was originally up in the [San Francisco] Bay Area [California] because he was working with PayPal [Inc., online money transfer service], and he did end up here in Los Angeles. Part of that is because there is an aerospace center here in Los Angeles. There's all the old school companies: TRW [Inc.], Northrop Grumman [Corporation], McDonnell Douglas, [The] Boeing [Company]. You just can drive down in El Segundo [California] and see them all up on the buildings.

I would imagine that he felt there was a good talent pool here. It was a great place to start an aerospace company. That's really why we ended up originally in El Segundo. We ended up here in Hawthorne due to this facility being here, but it's close enough proximity in the southland of California that you can attract the same amount of talent. I believe that our existence here for the main facility is because of the long history of having a base of engineering and technicians to support the operations.

I was involved with the downselect for where to find a test site, and we did have some alternatives in like the Mojave [Desert]. We looked at places like White Sands [New Mexico], we looked at Stennis Space Center [Mississippi], which is a NASA facility, and then we ended up in central Texas. I think part of it was is we were a commercial company, so we were looking for a commercial site, and when we found Texas, it happened to have a lot of the right

ingredients. It was in a pretty moderate weather area. It isn't too hot or too cold, you can operate year round.

Hi, Mike.

MIKE HORKACHUCK: Are you recording?

BUZZA: Yes. You can stay, come on in and sit down.

It had all the right ingredients that we were looking for. It was a remote enough location, but close enough. You're two hours from Dallas/Fort Worth [International] Airport, so it really worked out well to establish a test facility in central Texas. Obviously when we went to find launch sites, we did start at Vandenberg [Air Force Base, California], and we did develop the capability for Falcon 1. I think because of us being sort of a new, unproven launch company, there was nervousness at the range, and eventually the NRO [National Reconnaissance Office] told us we weren't going to launch from there.

We went off to find a place where we could do development with launch, like we did with test. We had to branch out from California to find a place to go and test the rockets, and that happened to be Texas. We did branch out and find a place, Kwajalein, which is an Army test range [Ronald Reagan Ballistic Missile Defense Test Site], and we were able to test the original orbital launches of Falcon 1. Then we quickly realized that we had to do this bigger rocket [Falcon 9].

The logistics of going halfway around the world by water, and having a rocket that was effectively nine times as big as the one we were already operating, which wasn't easy logistically, led us to start looking at the existing, traditional places to launch rockets. Cape

Canaveral certainly is traditional, and they launch a lot of rockets there. We had actually talked to them initially about the Falcon 1, but I think the size of SpaceX and the size of the Falcon 1 program, and the fact that it was really an initial test program, wasn't well suited to go to Cape Canaveral. I think Kwajalein was the perfect spot.

But once we had gotten to the Falcon 9 the Cape was the right spot. When we lobbied and successfully gained access to [Launch] Complex 40, that was the beginning of the relationship with the Eastern Range. Because that's a heavy lift launch site, and there were really no other sites at the Cape that could support a Falcon 9 other than Complex 40. There's other sites like Complex 36, or with Atlas, but none of them were big enough for Falcon 9. Once we got 40, that really secured our spot to launch from there.

HACKLER: I'll ask this question now that Mike's in the room—how much do you feel that overall your partnership with NASA influenced the design of the vehicles?

BUZZA: Elon Musk is our chief designer. I think between himself and the technical design teams, they came up with the initial concepts of the size of the vehicle, how much propellant's on board, what the engine thrust is going to be, two stage rocket, that kind of stuff. The Falcon 9 was really developed on the Falcon 1, the same exact principles that we applied to the Falcon 1 were just extrapolated into the Falcon 9.

I don't think there was any change in direction on the propellants that we used, the mixture ratio of the engines, the fact that we use a two-stage rocket, the fact that we used common domes. I think some of those core fundamentals had already been ingrained in us from what we wanted to derive from, which was the Falcon 1.

HORKACHUCK: We had to jump from the Falcon 5 [five Merlin engines] to the Falcon 9 [nine Merlin engines], because we had no use for a Falcon 5.

BUZZA: Yes, right. If you look back in history, the first larger rocket was a Falcon 5, and then that soon became the Falcon 9. I would suspect Mike's correct, that when we started talking about what the capabilities needed to be of that rocket heading into the COTS—when we were doing the contract proposal, that's when it switched to a 9 in order to get the mass of what was then developing, which was the Dragon capsule.

I would say that some of the initial fundamentals were probably driven to make sure we could meet the intent of the contract. This contract was what was going to help us develop the Falcon 9, so it had to do the COTS missions. That certainly had a big role in how the vehicle design ended up. I think you can then look deeper down into all the small stuff, and I'm going to have a hard time identifying them all.

But there's no doubt that through years of working together, fingerprints of meetings and discussions with NASA have ended up on the rocket. Like where there was a selection of a particular type of material on Dragon, due to certain regulations on outgassing. I don't have a list in front of me that says where I think NASA had a fingerprint on the design of the rocket. We worked together for so many years, it's all over it.

HACKLER: One of the goals of the COTS program was to open up new commercial space transportation markets. In your view, have you been able to open up any markets? Any new customers as a result of this partnership with NASA?

BUZZA: I don't know if it would be considered a primary effect or secondary. There's no doubt that we had to develop a booster to put the Dragon into orbit. So that booster, once developed, certainly has other uses that aren't related to flying a Dragon, when you put a fairing on it and things like that. When you say did it open up a market—as you start to develop a transportation system, there's no doubt that that same system is being leveraged to launch commercial satellites and government satellites. And possibly other commercial Dragon missions, if you talk about things that we call DragonLab.

There's no doubt—we didn't build the Falcon 9 and the Dragon and it's only used by NASA for CRS missions. It's a vehicle that's being designed with a breadth of capabilities and customers in mind, and trying to make sure it meets all of them, whether it's Air Force, science missions, or NASA cargo and crew.

WRIGHT: Was there anything else you can think of that you'd like to add?

BUZZA: Mike, we had a good conversation earlier when we were talking about this. Mike and I have worked together from the beginning. Like I've been saying throughout this discussion, I think that SpaceX is a better company for having worked with NASA. I always felt that the amount of interaction was at the right level. Mike and his team recognized the initial purpose and intent of the contract, of helping to develop capability on the commercial side, yet definitely made sure that the things that we were held accountable for—whether it be via the contact or certain other technical items that we had to address with NASA—and we just worked through all of those.

The key was by the end it was an "us" thing or a "we" thing, not an "us and them." That was the best part. In the early days when you would discuss who has access to what information, or who's coming to different meetings—that all disappeared as we got into the thick of heading through the missions. Which when you look back, seems like it went fairly fast. At the time it didn't. We look back and go, "Wow, we just whizzed right through that!"

By the end—we could have an anomaly at the launch site, and there was Mike and I and Hans sitting in a room talking about, "What are we going to do?" Not necessarily how are we going to out-report to our superiors, it was really "What are we going to do?" Then we would outbrief each of our different management teams after that. That was the nice part, it became just such an element of teamwork.

WRIGHT: Well, thank you. We know you got to get back to the rest of your team, so we won't keep you any longer.

BUZZA: All right, well thank you.

HACKLER: Thank you very much.

[End of interview]