TESTing Voice Interview

With Lt Col Zachary T. Schaffer,

418th Flight Test Squadron Commander

Edwards Air Force Base, CA

On 19 May 2021

AT 1040 PDT

MURPHY.JOHN.T.1032425581 Digitally signed by MURPHY.JOHN.T.1032425581 Date: 2021.06.29 13:18:28 -07'00'

JOHN T. MURPHY, NH03, DAFC
HQ AFTC Historian

SCHAFFER.ZACHARY.THOMAS.1234263850 Digitally signed by SCHAFFER.ZACHARY.THOMAS.1234263850 Date: 2021.06.29 09:07:21 -07'00'

ZACHARY T. SCHAFFER, Lt Col, USAF
Commander, 418 FLTS

The opinions and facts expressed in this interview are those of the speaker. These comments have been transcribed as they were recorded during the interview. Unless otherwise noted, no attempt has been made to check or correct dates and other facts mentioned by the subject. The opinions are those of the subject and do not necessarily represent those of the United States Air Force or the Air Force History and Museums Program

MURPHY: I'm John Murphy. I'm the Air Force Test Center Historian doing a TESTing voice interview with Lt Col Zachary T. Schaffer. Today is 19 May 2021 and it is about 10:40 Pacific Daylight Time. So, Sir, can you provide some background information, you know, your time in Air Force Test Center, maybe your educational background, your interests?

Schaffer: Absolutely, so I'll give you my little quick bio. So, I grew up in Pennsylvania, went to the Air Force Academy. Majored in aeronautical engineering there, graduated in 2003. From there went to pilot training at Vance [Air Force Base, Oklahoma]. After pilot training got qualified in the C-17 and flew C-17's operationally for about four and a half years out of Charleston Air Force Base [South Carolina]. Got picked up for test pilot school from that assignment. Came out to Edwards was in class 10A so started in early -- 2010 for test pilot school. Did that for a year, came to the 418th for my first Test assignment. After that flew C-17, KC-135 and C-5 flight test there. After that I got picked up to be KC-46 initial cadre for a detachment from the 418th. So I went up to Seattle and did KC-46 testing for about two and a half years. Then came back here to the 418th proper again for two years as DO [Director of Operations], a year running KC-46 Test Team and rounding out two years of command. So, in actuality, if you count the (indiscernible) as part of the 418th, I've been part of the 418th for just shy of a decade now.

Murphy: Long time.

Schaffer: A long time working mobility flight tests.

Murphy: Right.

Schaffer: Within the Test Center.

Murphy: So your first experience with Test was after you --after I guess --

Schaffer: Test Pilot School was like my introduction to what Test is and then here at the 418th for my -

Murphy: What kind of background -- did you have any kind of background or knowledge of Test prior to that?

Schaffer: Nope, just what I had read. Truthfully I found out about Test Pilot School from one of my pilot training instructors who was a TPS grad. So he had kind of mentioned it as a thing and that's kind of where I heard about it and thought it was interesting. Then just kind of kept reading about it and it seemed neat. I'm an engineer at heart and a pilot and it was a good way to meld the two together. So I applied and never looked back.

Murphy: Okay, great. So what would you say -- I guess you probably just answered that one. So is that what attracted you to the Test?

Schaffer: Yeah, I mean I think it was. It was truly the ability to -- I went to school to be an engineer. I did not go to the Academy to be a pilot. I went to the Academy because it was one of the best aeronautical engineering schools in the country. It was after I was there that I really realized that being a pilot was a thing. So I made that decision that I picked pilot over engineer

at the time thinking that I had killed off the engineering piece of my career for a while because I mean, I wasn't going to be an engineer for the Air Force. Then lo and behold there was this opportunity to kind of like pull back to that engineering piece and so -- yeah. It was that -- being able to be an engineer, being able to go do something new and make a difference kind of thing that was really the appeal.

Murphy: Okay, great. So your initial involvement in the Test Enterprise, how did that affect your personal or professional ambitions?

Schaffer: It was very refreshing getting to this community. So I was coming out of Charleston, it was the heyday of OIF [Operation IRAQI FREEDOM] OEF [Operation ENDURING FREEDOM] at that time. I mean, my first year in Charleston I think I was gone 290 days out of the year and the operational pace wasn't any better than it had shifted. I was getting older so I did more desk jobs so maybe I was only gone like 180 days a year the other couple years. It was a brutal operational pace in the mobility world at that time. So TPS was hey, get to go do something different, but applying -- I hadn't talked to a ton of people so I didn't really know what the other side looked like, but I got to the 418th and it was a very predictable schedule. I was doing work that I both enjoyed and had a passion for -- working with great people. So I came in thinking that I'd come in, probably just to do Test for a tour or whatever and try to get back to AMC [Air Mobility Command] because that's what I knew, but it became very quickly apparent that what happens here at the Test Wing, within the Center is special. I really enjoyed the work and the people. The massive civilian population was, to me, a bit of a fresh air from the just grind of pure military. It's different, right? But I was getting to interact with people with way more of a diverse background and that was enjoyable to me too. It didn't take me long to be like oh, I like this, this is where I want to stay. So from what it changed my career aspirations was really just the like oh, I like working the acquisition side and I think I'm going to fight to stay here. Which obviously thus far has worked out really well for me. So that's about it. I guess that's how it changed it.

Murphy: So now, do you have any stories? Can you talk about maybe some of your most memorable --

Schaffer: I've got all kinds of stories.

Murphy: experiences?

Schaffer: Trying to think through some -- so, some neat ones that I've been a part of personally that I guess I'm proud of that I've actually flown -- we did all of the certification drops for the NASA [National Aeronautics and Space Administration] Orion recovery parachutes. Working with NASA over the past like six years here and I've flow quite a few of those. I got to fly the first successful one way back as a Captain, which was awesome, but at the time it was just the job. I mean, it's unpressurized, high altitude air drop. We were going up to all the way unpressurized to 35,000 feet. Which requires all kinds of people to sign off on the approvals and stuff because I mean, it's not a forgiving regime up there. To go do that at the time, it was neat just doing it because that was like air dropping something from a C-17 that you just don't do operationally. So that part was neat, but as I reflect back -- we're finally getting there, right? I

mean we're not far off from that Orion crew capsule doing its first manned flight. It's going to be a special day to watch all of those parachute systems that we tested and watch it contribute to U.S. space resurgence and everything. So that's certainly towards the top of coolest things I've done. Lots of little programs that were neat and different. Most of them are C-17 just because I'm a C-17 guy so that's what I flew the most of for the first part. Lots of fuel savings initiatives as we were going through the lean budget years came through. We did a neat one, it's called Surfing Aircraft Vortices for Energy, but the whole point was putting the wingtip of a trail formation aircraft into the wake vortices of the lead aircraft to gain fuel efficiency just like geese do when they fly in a V. Got to do all of the development for that and then go proof of concept to Hawaii and back. To take something that sounds wacky and way out there and then go prove -- we proved almost a 10 percent fuel savings for that particular aircraft. It was a really neat opportunity. Just because a lot of times in Developmental Test you get stuff and you're not luck enough for it to like work really well all of the time. So it was a good one to work well. Another air drop one that's really cool -- it's an enduring mission that we have is we support the Missile Defense Agency dropping ballistic missile targets. I did all of the buildup to it because what were the biggest ones we drop were about 70,000 pounds, which is about 30,000 pounds above the tech[nical] order limit for the C-17 to drop anything. So there was a lot of buildup that I got to do and I went up to Seattle to go do KC-46 stuff and thought that I was never going to actually get to do any of the real stuff, but then I did coming back -- finally get to actually go do one. To go -- the one I flew was out of Guam, but – you know, go out in the middle of the Pacific, go fly – integrate into this massive Missile Defense Agency exercise. Then air drop a live ballistic missile target that comes out of the plane, settles under the canopy, releases, then actually ignites, launches into space and then gets targeted and shot down by the Missile Defense Agency. To go take a C-17 and go launch a missile into space is a pretty cool thing to do.

Murphy: That is cool.

Schaffer: We've done seven or eight as a squadron to date. So getting to do all of that is really cool. Then being there for the first flights -- or the first stage of tests for KC-46, you know, I've had the opportunity to do a bunch of little firsts there. I was actually flying the C-17 for the first fuel transfer to a C-17 from the KC-46. On the first time we made contact I was there. Did the first all NVG [Night Vision Goggle] aerial refueling where both jets were completely blacked out and we did it all on NVG's to test out a new capability. First -- I was there for the first drogue contact with the F-18 making a contact on the drogue system KC-46. Then all kinds of other little things in between, but just spending two and a half years at a fledgling system going through its paces. I mean, we all know KC-46 I mean it's not out of the woods yet, but it definitely had its stumblings through the beginning part. That's a generational opportunity, especially on the mobility side to see that. So that's one I'm really, really proud of.

Murphy: Okay.

Schaffer: I pretty much covered all of that stuff.

Murphy: All right, well great. So now looking back if you knew then what you know now, would you still be as gung ho for the Test Enterprise?

Schaffer Absolutely. I can't -- it's been nothing but fun the whole time. Which is why I'm still here, right? Like I could have picked different career paths and done a bunch of different things, but no it's been spectacular.

Murphy: All right, great. How much collaboration between other agencies, or even other sites, do you see or experience?

Schaffer: Man, it's the name of the game in Test. The Test Wing in our unit -- yeah, we have some capabilities, but I mean as the reorg[anization] happened with Test Center there's a lot of collaboration across Test, but there's even more collaboration across all of the different stakeholder because you don't – to be effective you really have to know a bunch of people's intent so that you can actually provide them what they want, right? So developmental Test we're all about providing the data so that people can make decisions. This is what I preach to my guys and girls is just that you have to understand what they're trying to do with that decision. You have to understand where their vision is because if you don't, you don't know which questions to ask a lot of the time. So a lot of conversation with LCMC and the Program Offices to make sure -- they're the ones paying our bills and they're the ones that we want to make sure we're getting them the data they need. Keeping invigorated and this is the other fun part is staying engaged with that -- our AMC brethren, right? All of the people actually out flying missions every day and not understanding what it is that they need and what they want. So all different manors of where we reach out and have those conversations, but it is an absolute constant stream of phone calls and emails back and forth. It's part of a strategic thing we put together what we call the stakeholder universe. Which is just a list of all the different contacts and entities that we engage with and here at the 418th and global reach we covered almost seven MWS's and a whole bunch of stuff. So we got -- my list is like 56 just to get the leadership level of engagement there. So, I mean yeah, there's constant engagement and almost all of those are outside of the Test Enterprise. I'd say at least two thirds of them are outside the Test Enterprise.

Murphy: Wow, okay. Do you have any problems, 1 like do your stakeholders convey their vision pretty clear? So that you can pass down, or is it kind of cryptic?

Schaffer: Each organization is different, some are better than others. Some you really have to pull, some give you more than you ever could imagine, but overall I don't know I think it's like anything else. If you work on the relationship it ends up being a really solid relationship. I think for our main customers I think we're in a really good spot right now. I think we've established that rapport such that we get that good guidance and good intent from them and at the same time they expect us if we don't understand something to reach out to them and they're really good and responding and stuff like that. Yeah, I mean it's not easy and it's not always good, but it's workable almost always.

Murphy: Can you kind of compare that from when you started in Test? Is it a dramatic difference from a decade ago to today? Just a little bit -- every year it gets a little bit better?

Schaffer: Yeah, so I don't know. It's interesting because as I've stayed in Test I've kind of risen up. So the points of contact are different and so I don’t -- my relationship as a squadron commander talking to mid-level leadership stuff is probably a different relationship than my

Captains and Majors have to their counterparts. I do think that there has been a deliberate -- man, starting back -- I think I was a Captain back 1 then, you know, a deliberate push to extoll the value of DT [Developmental Testing], right? I think the Test Center as a whole has been pushing that for a very long time. I know General Azzano's (Christopher P., Air Force Test Center Commander) still working it. So I think I can -- I perceive that I see fruits of that labor a little bit. I would never declare victory on it, but I think so. Case in point -- I'll give an example. We've always talked about early developmental test involvement and early programs and stuff like that. I've got --we've been working with this SAOC program, which is Strategic Airborne Operations Center, which is the E-4B doomsday plane recapitalization effort. Those guys reached out to us almost a year ago to start integrating and figuring out and talking test. They don't even have a developed acquisitions strategy yet. It's very, very early, but they're doing the right things. When I asked their O-5 [Lt Col] like what motivated you? Why are you guys doing this -- what I think is the right way when I just don't know that it happens? They reference just some talking going on at LCMC [Life Cycle Management Center] and just you know, like hey, we're trying to do lessons learned. We're getting the message that DT involvement early is beneficial. So how pervasive that is I have no idea, but I have a very solid data point that says somebody got it. So that can't be anything but encouraging, right?

Murphy: No, absolutely. Is there one thing - if you could --is there one thing that you could change? There could be more than one.

Schaffer: No -- well, so I picked one and it's the one I think everybody feels. I think everybody does to different extents depending -- but so I would change the law and or interpretation of the law of how major range and Test facilities are funded. Currently the way the money flows down we're very much an RBA [Reimbursable Budget Authority] centric organization. Such that most of my funding comes from my customers and a very small piece of it is my budget to own. Different organizations are a little different in that you've got the 411th that's 100 percent RBA. They're completely funded by the SPO and the program office. I have a bunch of customers across a bunch of different airplanes. So just from a practical manor managing that money is complicated because I've got core sets of pilots, core sets of flight test engineers that work across all of that. So the accounting of hours to the different programs and stuff is complicated. All workable and all of that, but where I would want to see it changed is more us have a base budget and provide a service that then they come and use. Then the Air Force prioritize who gets to use us when. The reason I say that is because we've got all of this drive to be more agile and to go faster and the current money --fiscal constraints, honestly keep us from doing that half the time. I've got numerous examples of small, ABMS [Advanced Battle Management System] experimental type stuff that come and want to work with us, but I don't have a budget to pay engineering man hours to help them. So if they can't come with money, which almost all of the small things don't come with money, or enough to pay for us. I essentially have to be like hey, I can give you a pilot because I can give you my military guys for free, but I can't really support you without you bringing me money. Which then leads to the whole formal agreement to transfer money and all of that stuff, which works for big acquisition programs. It does not work for the rapid development stuff near as smoothly as it should. So I think that's way, way above my pay grade and I live within it, but if I were to change one thing I think funding us to a full

level to get fully capable would provide a lot more flexibility in DT. Now I'm sure it would generate a bunch more problems and it's asking for money which is always hard, right? That's -- I guess that would be my change.

Murphy: So in your purview as the squadron commander, have you heard -- is there any talk of this anywhere?

Schaffer: I don't think so, no. I mean, I've had it explained to me so I understand why I'm in the position that I am in, but I've never heard of any meaningful conversation trying to change it. It's -- I mean, it's Congress. So, I mean, it is no joke-- well, it's law and then DOD [Department of Defense] interpretation of law. I mean, I think it can be changed, but I don't know the advocacy is there. Maybe I'm -- my unique perspective makes it more impactful to me than others I don't know, but as far as barriers to being agile it's probably my biggest one.

Murphy: Right, okay. So what have you seen as your greatest challenge in the Research Development Test and Evaluation Enterprise?

Schaffer: So two -- one we just kind of talked about is resourcing. So money most of the time Developmental Test ends up towards the end of a program's development, right? So money-- Program Offices is normally getting tight. I've never -- well, I shouldn't say never -- most of the time it's not so much we can't do it. We fairly often have conversations of well, we can only do 80 percent of what you think we really should do because we don't have the money that's part of it. The manpower piece is probably the harder part. Edwards in particular is a challenge at times to recruit talent and maintain talent. Then on the military side we struggle – I mean, and this is Air Force wide. We struggle with pilot retention and also struggle a little bit on the active duty engineering side. Just because all of their leadership opportunities -- there's some in Test don't get me wrong, but almost all of the ones in Test are if you go to Test Pilot School. So any of the other engineering talent that comes in here there's very few Test engineering leadership opportunities. So all of their leadership opportunities are back in the Program Offices and other engineering areas. Which is fine, but that means you don't get to build a decade's worth of people working in test here on the engineering side near as often as you do the pilot side. So giving that experience to the Test engineering side is also a challenge. So that's the resourcing side, the other big challenge is what I said I think we're getting better at, but it's still communicating the value of Test to the greater Air Force. I think we're making strides in LCMC, I'm not so sure that we're making strides to the MAJCOMs like AMC. Having been here I have all sorts of unique insight I've been with 46 for a long time and I had an inside spy, if you will. Somebody that flew here with us and then went back to AMC for an assignment to do initial cadre with KC-46. As we were identifying some significant deficiencies with the KC-46, what he was hearing on the AMC side were things like why is Test doing this to us? Why won't they just give us the airplane? Why -- and things like that. Which is similar to things we would hear from the Program Office at times past as well. Most of that is chalked up to the nature of Test. It's not often everything works perfect. We go, yeah it did what it did and we hand it off, but almost inevitably we're putting together really complicated systems and we're trying to do new things, right? Things just aren't going to work all the time and it takes one sentence for me to say the boom on the KC-46 worked perfectly. It takes me 20 pages to explain what pieces

aren't working with enough detail that they can actually put together a way forward to go fix it. So our test reports always come across incredibly negative and so people at the Program Office - I mean, I get it they take it personally it's their program. Nobody wants to be told that their stuff doesn't work, but it's the reality of what we do. I think it takes a lot of effort and relationship building so that you can provide that feedback. It's just like giving your supervisee feedback, right? You need to give them the real feedback, but you need to develop your communication method so that it doesn't feel like you're telling them they're worthless the whole time. So that's really hard and I think that's really hard for DT because our sole point is to tell people that stuff doesn't work. That's what we're here for. I just think that's really -- it's really a challenge to do that and get people to keep coming back to you. You keep giving people uncomfortable conversations people stop talking to you and it's the same kind of thing. It's showing -- like I said I think LCMC starting to change, but it's getting AMC to understand that hey, yeah we're saying it doesn't work right now. Yeah, we're delaying your program and it's going to take you longer, but we're also not handing you something that you're going to give to some brand new Senior Airman that's going to go have no solid capability. We're not going to hand you a KC-46 and then night one of the war kicks off and you realize you can't give gas to anybody. We are doing that due diligence for you. I've never had a conversation one on one with anybody that's unfamiliar with Test where I haven't been able to get that point across, but I think as an enterprise our touch points are so limited back to those bigger fields that it's hard. So I always appreciate the senior leadership involvement because I think if you get that message across at the four star level, three star level and the two star level then as issues and stuff comes up they also become our advocates down the other match com chains, but it's definitely a challenge.

Murphy: So just from Colonel Schaffer's point of view because it's been a long time they've been talking about getting the value testing out and maybe it doesn't seem like it's working yet. So from your point of view do you think it's ever going to work, or is it just resistance from those who don't understand?

Schaffer: I think you can communicate it. I think it's imperative and I think where you can really make it stick is within AFMC. It like -- I mean, I do believe that there is a path to get LCMC and all of them to be in lock step with what DT is and what it needs to do. I think the MAJCOM piece is going to be a constant thing that needs to happen, it's just turnover, right? You'll get onesie, twosie, but you're just -- the line pilots, the line load masters and operators in AMC, they're never going to hear about Test they just get a system and go use it. It's not until you get to staff, until you start getting in the upper levels where you even hear about Test level not making it for the vast majority of people. So I think that one's got to be a more recurring effort than it is. I don't think you said it as a like we can cross the finish line and wipe are hands and be like nope, we can stop doing it. I think you just have to continually take the opportunities to communicate it.

Murphy: All right, great. So now how do you feel – General Brown [USAF Chief of Staff], he has a philosophy accelerate, change, or lose. How can that best be applied to Test?

Schaffer: I think it's just continuing to ask the hard questions about the way we've done things in the past. I actually think fiscal constraints aside I think we are an enterprise that is pretty

adaptable. We rarely get things that are rinse and repeat from what we've done before, right? F-35 is not the F-22, is not the F-16. So I think we're used to changing what we do. Where I think -- and this is more a greater Air Force problem than it is just to us, but, I mean, it's human nature to rely on what we've done in the past as a building block, but it's taking that time to challenge all of those assumptions that you're bringing in. I know -- it has nothing to do with us, but I know a few years ago there was a solid just stop and look at how we're using Chase on flight Test in general within the Test wing. Looking at it and -- to me, being an outsider who doesn't really do that much the surprising result that came back from that look was hey, we've looked at this again, and we used to use Chase for a whole bunch of things because the system under Test didn't have all of these capabilities. Now we probably don't -- the control room maybe didn't have as much capability, whatever it was, but now we're looking at it -- we're actually probably increasing the overall risk to the Test by having Chase there versus not. So they had like this dramatic reduction in when they would use Chase on Test. I think its big paradigm shifting things like that that you just need to continue to look at, right? Then maybe someday you go oh, nope, we need Chase again because of what we're doing and that's totally fine, but it's not settling for -- this is the process that we go from an idea for a Test to writing the Test report and here's how the Test planning, safety planning goes. We've seen it here for KC-46 and for VC-25B, two of our bigger programs. We've looked at what our current process is. We've looked at what we need to do to integrate with the contractor and make that happen and then we've tailored that process. We've gotten nothing but support the whole way through the leadership chain to do that, but I mean its required waivers to all of the Test planning regs[regulations] and all that stuff. So as long as we have an environment where that's possible, as long as we have leadership support to go do what we need to do within reason then I think we're right there. I think, you know what I mean? Give us our timeline and give us what you need and AFTC, the test wing, my squadron man, we've got brilliant talented smart people. So I think we're there now. Is the greater acquisitions for large acquisition programs there? I don't know I think it's the same type of thing and back to the same money problems that, you know, at some point stuff's written in law and you then you can't change it. Yes, you can waive anything, but when you're running up against actual federal law, yes, you can change it, but in five years, right? So can you get there? I think we're seeing it you've got the RCO [Rapid Capabilities Office] running a major program, or a bunch of major programs and all kinds of stuff. So I think you're seeing us --what I would consider working around the edges of that and trying within the constraints that we're stuck with to do that. I mean, I think we've talked to -- there's been talk of major acquisition reform for a long time. I honestly think that's what gets us there, is opening up the flexibility. It's a bit of a Pandora's Box and I think it's really hard to think about that because there's so many different things. I don't know if there's a better solution out there, but there's probably a faster solution. I think that's where we really started seeing it. I think within the Test Enterprise I like to think we're somewhat agile. I'm sure there are plenty of things we can do better. I think acquisition as a whole is very law based and that's not their fault, that's what they have, but I think it's very hard for them to be flexible and agile in that regard.

Murphy: Okay, great. So we talked about a lot of topics, did we -- did I miss anything? Is there -- would you want to make any additional comments on something that we didn't touch on?

Schaffer: I want to hit one more just as a -- this is Colonel Schaffer's personal opinion and not a reflection of anybody else's, but I've lived through KC-46 developmental Test. I've lived through the beginnings of VC-25. Both of those programs were acquisition strategy, firm fixed price with commercial derivative aircraft with a desire to maintain FAA certification as much as we can. I think those acquisition strategies, they have worked from a financial standpoint. I think where we stand right now on KC-46 is I think the government paid about four billion for development and I think Boeing, because of how they bid it, paid about four billion out of pocket for development. So I definitely don't think there's an argument that we didn't save money. I think there's probably a strong argument though that it has delayed us by years in fielding a fully capable system. Firm, fixed price contracts are tricky because you get what you get and the contractor because they've already gotten all the money that they want is very incentivized to resist change at all. Which is okay, I mean, we go in knowing that, but when you run into things when you're trying new technology like a vision system for the boom. They get it wrong, they're going to lock in and they're going to resist change, like they'll play chicken with it right up till the end and that's what we saw. We're finally on a path to fix it, but I mean we told them that the vision system wasn't going to work at Milestone C on a KC-46 and we didn't have a plan to fix it until after we've delivered the first jets. So that's where I'm saying we're putting in years. Now, there's all sorts of ways to fix that. So I'm not saying firm fixed prices like, never do it, but that's one major detractor to firm fixed price that I definitely think needs to be considered for anything that has any sort of technological risk on it at all. At least you need a method to go back and add scope, or the government to pay more money if they want to fix something. I don't know, however you want to do that. The second piece is the FAA certification piece, which sounds really good on paper. It sounds like taking a lot of credit for things that Boeing would have already done. The KC-46 is a 767 derivative. They already have 767's flying for airlines and cargo companies everywhere. So of course why wouldn't we want to do that? Frankly, for some of the stuff that makes sense – for KC-46 the contract language was to the max extent possible, FAA certified. What we learned was that the FAA will surprisingly say they can certify a lot of things that trickle over into the military side of things. So we've made a lot of compromises on KC-46 in display presentations and defensive systems and things like that. Where the FAA is like no, we can certify it, but now you're going to make all of that FAA standard. Well, the way you display **RWR [Radar Warning Receiver]** returns from different sensors and stuff like that is not --it's a very standardized presentation, but is definitely not vetted through the FAA. So they don't like the color red on things because reds and yellows mean warnings and cautions and stuff like that. Good on them they have a very good methodology to standardize a cockpit for commercial airliners. So when you deviate -- the further you deviate from being a commercial airliner, the more out of sync your requirements are with the FAA and if you walk in having to do FAA stuff, again you just leave potential work fighter capability on the table for whatever benefit. VC-25 is doing the same thing. On the FAA side they're way closer, right? One, yes, we're putting a lot of military stuff on, but it's -- the primary job is still flying people and stuff from point A to point B. Which is way closer than passing fuel and having boom and drogue systems and stuff. Sorry, every time I get the opportunity I feel obligated to say my piece on that one. So I think that's an interesting one. It's actually an interesting one that we're having with that SAOC program that I told you now because yeah, they're flying A to B, but they're also

doing a whole host of other stuff. So we've had a lot of conversations of -- yes, there's still ways to leverage a lot of the FAA stuff because we also -- I mean, why reinvent the wheel, it's a commercial airplane? Softening that language and the Program Office is providing themselves an out so they can kind of pick and choose what they want to do FAA versus what they want to do military and stuff like that is important. Anyway, that's my two cents on that, but I think other than that I've pretty well talked about everything.

Murphy: Okay, great. That was good two cents. Thank you for your time. This concludes the interview.