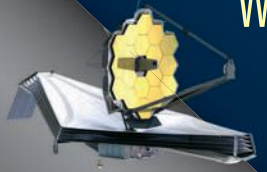


FAA's Monteith on space regs

Protecting 8LS from prop gases

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SPACE RESCUE



Human spaceflight's Achilles' heel — stranding customers without a rescue plan **PAGE 22**



**YOUR ARTEMIS I
MISSION GUIDE**



WAYNE MONTEITH

Wayne Monteith at the Space Symposium in Colorado Springs, Colorado, in August.

Space Foundation

POSITIONS: Since 2019, head of FAA's Office of Commercial Space Transportation, or AST, its designation within the U.S. Transportation Department, where he oversees a 117-person office that licenses commercial space launches. 2015-2018, commander of the 45th Space Wing of the U.S. Air Force (now Space Launch Delta 45 under the U.S. Space Force) at what is now Patrick Space Force Base in Florida. 2009-2011, commander of the Air Force's 50th Space Wing at what is now Schriever Space Force Base in Colorado. 2007-2008, director of navigation warfare in the Office of the Secretary of Defense overseeing GPS and related programs.

NOTABLE: At AST, has overseen a quarter of the 417 launch licenses granted since the division's creation in 1984, including the first FAA license of a crewed mission to orbit in November 2020 when four NASA astronauts were launched aboard a SpaceX Crew Dragon to the International Space Station. During his three years leading the 45th Space Wing, granted final approval for 66 launches and 23 booster landings from what is now Cape Canaveral Space Force Station in Florida. Retired from the Air Force in 2018 with the rank of brigadier general.

AGE: 61

RESIDES: Alexandria, Virginia

EDUCATION: Master of Science in national resource strategy, Eisenhower School for National Security and Resource Strategy in Washington, D.C., 2007; Master of Science in business administration and general management, Lesley University in Massachusetts, 1994; Bachelor of Science in geography, University of New Mexico, 1989; Associate of Science in computer programming, University of New Mexico, 1987.



Space safety regulator

When passengers reach space inside privately owned and operated spacecraft, they do so backed by U.S. government launch licenses that do not include a safety blessing from regulators. A Congress-imposed moratorium, or learning period, prevents FAA's Office of Commercial Space Transportation that Wayne Monteith leads from regulating suborbital and orbital human spaceflights until late 2023, but the increasing number of tourism jaunts similar to the one William Shatner and three others took last month aboard a Blue Origin capsule could make the case for ending the learning period much sooner. I spoke with Monteith via Zoom about whether the U.S. can afford to wait. — *Cat Hofacker*



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Q: FAA's definition of a "commercial space vehicle" doesn't account for whether these company-owned and operated rockets and capsules get government funding. Should it?

A: For us, essentially if it's not government then it's commercial. If you look through the manifest, you'll see that the way we're transitioning is there are even government payloads that are contracted on commercial rockets that we do regulate. When I started out in the rocket business, that never happened. When the government has much more oversight of the rocket manufacturing, there's a sense that you can control the manufacturing process, you can control the reliability of the vehicle. But over the course of decades we've shown that that's not always the case. One of the things that government has to be careful of is they want to buy COTS, commercial off-the-shelf products. That's great because then theoretically you've got all of the development and a lot of the nonrecurring engineering costs done upfront by the company. If you come in, though, and now you dictate what that COTS product should look like, it's no longer COTS. You can't say, "I want to buy this widget, but this widget has to be blue; it's got to be 4 centimeters on each side; it's got to weigh a certain amount or produce a certain amount of energy." What we're seeing is a greater acceptance on the government side to actually use COTS-type products — for instance, Falcon 9. The Department of Defense and NASA both contract with SpaceX to get payloads to orbit without additional requirements on those rockets.

Q: There's now a growing number of tourist flights aboard privately owned and operated vehicles that AST is not permitted to regulate for passenger safety. Should the moratorium be lifted before 2023?

A: Number one for us at AST, it's all about safety. FAA is a safety organization, so to the extent that we're allowed to regulate something, we're going to do it very well. From that perspective, when you go back to when the office was given the statutory authority to regulate the space tourism industry, Congress immediately put in the learning period, or what we call a moratorium, back in 2004. At the time, because it was a nascent industry without a whole lot of activity there, that made a certain amount of sense. Here we are 17 years later, and it's probably time to start asking ourselves, "What are we still hoping to learn?" NASA has been flying humans for 60 years, and we've got three U.S. companies right now flying nongovernment astronauts. On the other side of the coin, we've got to ask, "How much longer are we willing to accept as a nation this level of risk?" The risk is that a significant portion of the flight envelope is not regulated by AST from a personal safety perspective. What helps me most is clarity, so will the moratorium sunset on 1 October of 2023 or not? If it's going to sunset on that date, that gives me time to start working on the next iteration of regulation, hire enough people, to get fully engaged. But what will be unhelpful is if we don't know what the status of that moratorium will be until we get deep into 2023. Bottom line: If it sunsets, great; if it doesn't sunset, fine. We'll continue to operate like we do today.

Q: By not ending the moratorium early, it seems like there's a significant risk that these tourist flights won't result in a serious injury or loss of life.

A: So as I look into my cloudy crystal ball, I see one of four things that would drive a change in the current regulatory construct and potentially drive the learning period to be sunset. Number one is sheer cadence: Is it 50 launches a year? One hundred launches a year? There's probably a magic number out there at which folks would no longer be comfortable if we exceeded that and we didn't have more regulatory certainty. That could come either from government or could come from industry or could come from paying passengers. Number two is number of providers. The launch companies we deal with today we know are safe, but that doesn't guarantee all future companies will be. The third driver is the sense of the people going up, the passengers: Am I going to pay this amount of money — fill in the blank depending on which company you fly — without a guarantee that I'm

“Here we are 17 years later, and it's probably time to start asking ourselves, ‘What are we still hoping to learn?’”



▲ SpaceX's Crew Dragon Resilience splashes down in the Atlantic Ocean in September with the four passengers of the Inspiration4 mission. Monteith cites the 72-hour-flight as an example of how the Congress-imposed learning period limits FAA's authority: The agency licensed the launch and landing, but "the 69 hours in the middle were unregulated," says Monteith.

Inspiration4

actually going to arrive safely? When you get on an airplane, you don't think about arriving safely to your destination; you just assume you will because the safety is regulated. And then the fourth driver is what you alluded to, a catastrophic failure. So the way we're set up right now, I don't regulate the design of the spacecraft, but if we have a catastrophic failure [in space or on the ground], we do have the ability within statute to go in and look at that and recommend direct design changes post an anomaly, or what we call a near miss. But short of that, I can tell you that we have validated that the space vehicle will operate in the environment that it's designed to operate in; I can tell you that your family on the ground will be safe; but I can't certify your safety as a passenger. We do not certify these spacecraft like we do in the aviation industry.

Q: Using the investigation into Virgin Galactic's airspace violation during the July flight as an example, how does this limitation of authority affect the information AST has access to during investigations?

A: We have full and open access to all information that's available to the company. When a mishap investigation is initiated, we oversee the investigation,

depending on what the nature of the mishap is. We oversee all facets of the information, and if we do not believe that the company has looked at the right material or provided the right data to us, we simply ask for more. Our FAA inspectors sit in on these meetings; they sit on all the technical interchange; they sit in on the anomaly analysis meetings. I personally review the reports that come in and keep updated on these things as they progress. But it's also important to keep in mind that what we're looking for are things that impact public safety. We're not directly looking for things that lead to what we call mission assurance or mission success — so if there is a mishap and the rocket is lost, as long as it failed safely, that's OK.

Q: In other words, you're looking to make sure the rocket didn't rain down debris on a kindergarten school, not that it delivered its payload to orbit.

A: Right. So from a public safety perspective, if it fails safely then we can actually clear the company to start operating again even before they're done with the full investigation of what may have led to, say, a satellite incorrectly deploying. All of our focus right now is on safety, not on making sure that the



mission went the way it was supposed to. That would put me in the business of helping business make more business, and that's not what we're here for. I'm a safety regulator.

Q: But because that moratorium limits the safety regulations AST is allowed to make, are you concerned that undermines your authority with these companies?

A: Not at all. Number one, we have a tremendous working relationship with these companies. Number two, they clearly understand our role. And number three, at the end of the day, if a company is not abiding by the terms of their license — in this case we'll talk a launch license — we can either send them a strongly worded memo, depending on what the level of their violation is we can potentially fine them, we can suspend their license, which means they can't operate, or we can revoke their license, which means they can't fly at all. And so they clearly understand that they need to meet the regulatory requirements. As I mentioned earlier, they're not unsafe companies; there is no business case to be made for being an unsafe company in this business and continually blowing things up or dropping a rocket on a neighborhood. They want to be successful. Even though we

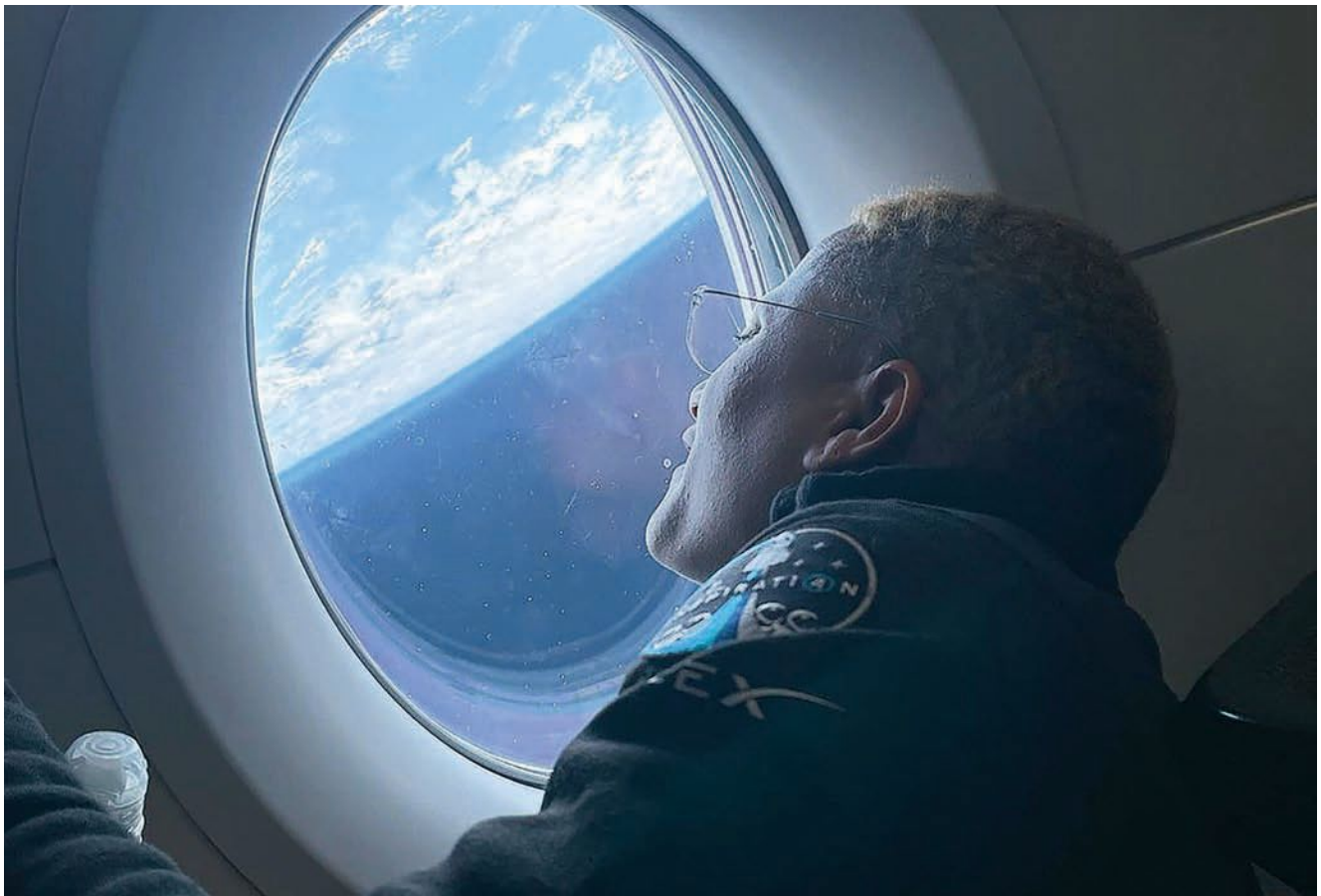
don't regulate the safety of the humans on board directly, we do monitor all facets of the mission. In the case of Virgin Galactic, we did a thorough oversight because it involved an airspace violation. We were able to leverage other agencies within the FAA, principally our Flight Standards Organization and our Air Traffic Organization. The three of us working together looked at all the events that surrounded that violation to determine what happened and how to prevent it from happening again.

Q: So when the moratorium does expire, what's the end goal for regulating the space tourism and commercial space industries at large? Some equivalent to FAA aircraft certification?

A: You can have a couple of assumptions — one assumption could be you're very similar to aviation and you're to look at everything: You're going to look at environmental systems, you can look at people. There's a tremendous spectrum that you could look through to regulate the safety of the people on board. It could be a much lighter touch too. A lot of that will be driven by Congress and what actually goes into the statute. As far as certifying vehicles, that is one of the things that we're looking at being more aviation-like. That will also depend, though, on cadence. Right now,

▲ Actor William Shatner climbs out of Blue Origin's RSS First Step capsule that took him and three others to the fringes of space and back last month in Blue Origin's second flight with people aboard. A Congress-imposed moratorium prevents FAA's Office of Commercial Space Transportation from making regulations about the capsule's design to ensure the safety of passengers.

Blue Origin



▲ Inspiration4 passenger Sian Proctor gazes out one of the four windows on SpaceX's Crew Dragon Resilience. FAA's Office of Commercial Space Transportation was responsible for overseeing Inspiration4's launch and landing, or about three hours of the 72-hour flight.

Inspiration4

we license vehicles and we license operations as opposed to certifying vehicles, which works really well right now because of the low cadence. I talked about at what point do you get so many flights that it makes sense — the certification process is sort of the same thing. Let's say Virgin is flying 200 times a year. At that point, does it make more sense to certify that vehicle, or does it make more sense to stay on the path that we're on, licensing the operation? We'd have to look at the pros and cons of that and do what makes the most sense, from both a regulatory perspective and an industry perspective. And it might be different for different companies based on how they operate. One of the things that we have done earlier this year is our new Part 450, the Streamlined Launching and Reentry Licensing Requirements. That took us from a prescriptive approach to regulation — where not only did we tell you what the requirement was, we told you how to meet the requirement — to a performance-based model where we tell you what the requirement is and it's up to you to tell us how you're going to meet that requirement. What that does is it enhances safety, but what it really does is open up the aperture for innovation; it allows U.S. companies to continue to lead the world in the sector while not reducing safety. On the flip side, it also puts an additional burden on my organization because now we've

got to figure out whether or not these proposals actually meet the safety requirements. It's quite a different mindset for my team, and so we're still working through that, but at the end of the day, we've got to approve their solution. That lays the foundation of how we'd like to look going forward, because one of the concerns industry has is that AST will promulgate regulations on human safety that will cover a wide range of vehicles. Well, we do that today. Our new Part 450 regulation can handle Virgin Galactic, Virgin Orbit, Blue Origin, United Launch Alliance, Rocket Lab, SpaceX, Relativity Space, Aevum. All of these different companies can be handled under this new regulatory construct or framework, and we would look to develop human spaceflight standards the same way: performance-based enough that we accomplish the safety goal without limiting their ability to innovate.

Q: It seems the aircraft certification analogy only goes so far because there are some big differences in terms of the envisioned flight cadence, for instance.

A: Yes, the scale is quite a bit different. If you look at the National Airspace System in 2019, there were almost 10.4 million flights within the aviation industry. Compare that to about 30 rocket flights. The other thing that I think is important to keep in mind is that

in aviation, you don't have a single large company designing, manufacturing, maintaining and operating a vehicle like we see on the commercial space side. The rules are set up differently for the different aspects of aviation safety, whereas in my industry it's all within the same company. In the space industry, almost everything is being done in house, and so it really lends itself to a different regulatory approach.

Q: Can you elaborate on the planning AST is doing now so it's ready to lay out new regulations in 2023 once the moratorium expires?

A: What I want to do is make sure my organization is prepared so that we aren't the limiting factor in the ability for Congress to make a decision to sunset that moratorium. The foundation for future rule-making will be the best practices and the guidelines for crew safety that we started in 2014. We continue to work with particularly NASA on making sure these things are up to date, but the next big step will be standing up the Aerospace Rulemaking Committee. As we stand up this organization, we'll start bringing folks together from industry to discuss how we are going to be doing this and what makes the most sense. My experience doing Part 450 was that the approach that suboptimizes the outcome is trying to do this all too quickly. It was a herculean job getting Part 450 promulgated. Start to finish, it was about 2½ years when normally it would take about seven years, and so what you had to sacrifice was a lot of the upfront work and the interaction with industry. I want to avoid both of those with human safety rules. I want the time to do this right, and I want the time to work closely with industry to get this as right as possible. So we're already talking to our industry operators on how this would look; we're looking internally at how we do this from a performance-based perspective so that we can handle the different operating concepts, from suborbital to orbital — and potentially, cislunar at some point when these craft go around the moon. One of the things that I find fascinating with the current construct is if you look at the Inspiration4 mission from a regulator's perspective is that it was about a 72-hour flight, but I was only responsible for about the first 12½ minutes as the capsule traveled to orbit, and then I was responsible for about the last three hours as it prepared for landing. The 69 hours in the middle were unregulated. Now, is that good, is that bad? That's for Congress to decide, but there are a lot of things that can go on in those 69 hours, and some things could go on that do not have a good outcome.

Q: As launch rates increase, how do you balance the need to grow the office while staying agile enough to keep pace with the industry?

A: In the last three years, we averaged about 30 launches a year with 108 people. This year, fiscal

2021, we closed out at 59 launches with 117 people. That's almost a 100% increase in work with a 9% increase in personnel. I joined AST in January 2019 after I retired from the Air Force, and I started during a government shutdown, so I had a lot of time to think. So we did a major reorganization of the office; we aligned like functions, we brought more accountability and responsibility within the organization, and we set up a construct that could scale. We essentially got all the right people in the right boxes. Then we looked at all of our internal processes. When we're licensing one or two launches a year or a month, you can be pretty darn inefficient and it doesn't show up, necessarily. When you're doing a license launch about every five days, it shows up real quickly if you're not efficient and effective at what you do. We addressed that by taking a look at all of our processes, where we were losing time, and we continue to look at that. That's how we've been able to keep up without a tremendous increase in staff so far. And now that we've got this construct set up, I can look forward and go, "OK, if we double again, how does that impact operations?" We're also doing things like starting the process to move to electronic licensing. You would think in the 21st century, we would have something like that now, but when I showed up, we were still accepting a lot of paper products and faxes. So you have to change all of these things, and you have to get folks not just externally, but especially internally, to embrace change so that we can prepare for the future, we can maintain our safety posture but not become irrelevant. The worst thing we can do is throttle industry because we haven't looked forward.

Q: Looking to the future, if this explosive growth of launch and space tourism comes true, could it be necessary to move AST out of FAA and make it its own office under the Department of Transportation, as it was originally?

A: There's a possibility of that, but it'll be decided way above my level. Depending on how the industry develops, I think there's some sense that if you can make a business case out of the space tourism part, then the next logical step may very well be suborbital point-to-point travel. If you can go from New York to Sydney in half an hour, that might not be bad. The industry will drive a lot of this, but eventually there may be a need to fully recognize this as a separate mode of transportation. Right now the Department of Transportation is set up under different modes: You have highways, you have rail, you have maritime, you have aviation. While AST is part of aviation right now under FAA, there may come a point in the future where it makes sense to designate space as a separate transportation mode within DoT. But I don't see that happening immediately. ★