

Video Transcription

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Government keynote presentations video

[39:15]

Thank you for the introduction of where I work. I'll probably pinpoint a little bit more for those of you who don't know the large infrastructure of the FAA. I'm glad to be here to kick this off. I'm excited to be here with so many top technical minds, engineers and visionaries all working to develop and advance the autonomy for military and civil vertical takeoff and landing applications. I think the Technical Symposium — this is my first to attend, so, thank you — certainly provides a unique opportunity for the designers and innovators, investors, regulators, and infrastructure providers to share knowledge and work towards advancing the VTOL evolution we're seeing.

Mike [Hirschberg, VFS Executive Director] already provided a really good opener on VFS and the organization's activities and accomplishments. Let me start by commending and congratulating the Vertical Flight Society for its leadership and for pioneering the work in vertical flight. You hosted the world's first eVTOL technical meeting in 2014, you've launched the world's first eVTOL newsletter in 2016 and the first dedicated eVTOL website in 2017. Also, in 2022, VFS provided indispensable support to the Vertical Aviation Safety Team, the VAST activity, at the 2022 Global Conference, so, thank you. I really appreciate and congratulate you on the contributions to vertical flight innovation and safety.

Let me start off and say I'm here as the regulator. I don't have any flashy slides. I'm just going to be here — you just get me — and I'm going to be laying out the requirements because that's what we do, it's the expectation as a regulator. I'll also lay out what we are doing to help you meet those requirements. Hopefully, by the end of this, you'll see that we are really striving towards helping. But you know that old saying: 'I'm with the government and I'm here to help.'

Many of you may know the FAA in a general sense as an organization, but some may not, and it is a large organization. I'll pinpoint where aircraft certification sits. As Mike already indicated, we're responsible for the continued operational safety, the certification production of the aircraft and products we produce. It's mostly a technical organization of engineers, scientists, inspectors, and flight test pilots as well as other experts who do all that overseeing of the design and production and airworthiness certification.

Aircraft certification sits within one of the five lines of business within the FAA — Aviation Safety Organization is the line of business we're within. There's also the Air Traffic Organization, Airports Organization, Commercial Space Transportation and our Security and Hazardous Materials. As I indicated my organization is the one that, after the NASA research and innovation activities, comes into me to set the requirements and then you have to comply to those and you have to show that compliance to us.

First off now, happy to be here. It's good to be in Arizona although it's a little bit nipier than I expected it be, so I'm sure that many of you are feeling the same way. I was holding my my tea to keep my hand warm.

The can-do spirit and the free enterprise system that we have here in the US has fostered a dynamic environment in this world of innovation. You and your innovative products and business models are the evidence of that. At the FAA we recognize that the fierce global competition to lead the world in the VTOL technology and market share and we all share a goal of maintaining US leadership in this aviation sector — in this aerospace sector I'd even say.

In this global race to be the first and to be the best in the VTOL technology we cannot compromise on safety. As you all dive into the wonders and challenges of the automation and VTOL technologies over the next few days, let us all today — industry and regulators alike — recommit to the eternal vigilance in the pursuit of aviation safety. As PK [Parimal Kopardekar at NASA] mentioned, safety cannot be compromised.

As we embark on what is exciting and challenging, the eVTOL evolution as we'll call it, allow me to be both the indispensable regulator, but also a voice of inspiration. With regard to safety, safety management, and safety management systems, you probably all know that there's SMS out there, and you may already know what SMS is, but let me give a quick one-on-one.

Safety management refers to a set of principles, processes, and measures to prevent accidents, incidents, and injuries. First and foremost, safety management is a commitment that drives an organization's culture. It requires a top-down, organization-wide approach to managing safety risk and ensuring the effectiveness of the safety risk controls. To help ensure safety outcomes amid the pressures of off days, of the normal business cycle, safety management requires being wired for safety, structured for safety, and deeply committed to safety. It involves every employee and the entire work culture in between.

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The commitment to safety forms the foundation for an organization-wide approach to managing the safety risk and ensuring effectiveness of the safety risk controls that are put in place. This all becomes operational through a safety management system: SMS.

Recognizing the need for industry to bolster the safety management performance at an organizational level, the FAA is taking steps to increase the use of structured SMS in the aircraft design and manufacturing environments. We're pursuing an SMS regulation across a broader

section of aviation consistent with the international standards and practices. In fact, on the 11th of January, we published the SMS Notice for Proposed Rulemaking in the Federal Register and the comment period is open now until mid-march. There have been requests for extensions which are being considered. Take the opportunity to comment, look at the regulation, and see where we're opening the scope of SMS across the industry.

As a part of that effort, we're drafting policy and guidance to support the development new SMS programs across these sectors. At the FAA, we see SMS is one of the best tools in our toolbox. As we've structured our safety management system voluntary program, we have that in place to provide procedures and requirements to those who would like the opportunity to voluntarily implement SMS if it's not even regulatorily required of you.

Here's my SMS pitch to you: Whether or not SMS is required for you, having a structured organization-wide approach to managing safety risk that is solidly based on positive safety culture is not just a good way of doing business in a high-stakes aviation industry that we're in, but really the only smart way to kick it off. Safety culture is crucial as I said.

Amid the eVTOL evolution, all of us are on the cusp of something new and very exciting. But full of new risks and new ways for people and systems to fail. As you well know, just one catastrophic failure could set the entire venture back. To make the analogy of Teddy Roosevelt's 1901 foreign policy pitch, 'speak softly and carry a big stick,' let's say this: be prudent and carry the biggest, most robust safety management stick you can carry. We're all working diligently at the FAA to get this right and I encourage you to do the same.

[46:32]

I also want you to know that the FAA knows what investors, innovators and operators want most from the FAA: predictability. I hear it a lot, I like the same thing. I can't help myself, I'm an engineer — tell me what you want to do, give me a schedule and I'm going to try to get there. I have good news. With the unwavering focus on safety that we have, the FAA is working to give you that predictability. This is key for the VTOL section that we're working in to maximize the ability to innovate, produce and contribute to the growth and vitality of the economy.

On this point, for predictability and this audience, the FAA's approach to powered lift I'm sure has come to mind. We called it a "shift," many of you called it a "U-turn" — I get it. For those that are working with us in the certification, there was a change. But let me provide some context to that and it'll give those that are not familiar with what FAA does in certification some idea of where we're working and how we're working and thinking.

As the FAA looked ahead at granting design and operational certifications of winged VTOLs, it became more and more apparent that such aircraft may not easily be certified or operated as airplanes under Part 23 going forward. Airplanes generally don't take off vertically or have a transition flight regime. The continued pursuit of this approach would encounter too many obstacles for the logical and efficient introduction of the winged VTOLs in our National Airspace

System. We needed a pathway for applicants to obtain the necessary design and operational approvals from the FAA.

I'll just say it: I've worked in aircraft certification — I started my career there 31 years ago — and I always thought of the vehicle, of just what I needed to do for my cert requirements; those people that operated were separate. But as you move into the organization, the FAA and within aviation safety, they're so intertwined and intermingled — you can't take them apart. We see that even more now. In May, we announced that we were modifying our regulatory approach for the certification so that it would be more applicable for when we get to the operations of those powered lift aircraft.

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We'll now type certify the powered lift aircraft under a special class process which is already within our regulatory framework under 21.17b. This uses a portion of the performance-based airworthiness standards that are contained in Part 23 for small airplanes. It'll now include also what was previously called “special conditions,” but those will be included in the overall design criteria.

We made this adjustment to provide a solid foundation on which to regulate this dynamic realm of industry. It's worth noting that the regulatory framework for powered lift already exists and this refined approach is consistent with the international standards. As we're going to be moving forward together, the FAA is now implementing an ambitious strategic plan to get your powered lift and special class rotorcraft operational as soon as possible.

The task before us is straightforward but it's also monumental. In a very short time frame, the FAA must certify the powered lift and special class rotorcraft, we're going to approve those operations, we're going to safely integrate the VTOL into the airspace, and we'll maintain the remarkable level of safety the public expects from the commercial flight.

The good news is that the FAA is both ready and equipped for this challenge. Within the FAA, my organization specifically is working with the applicants to establish the essential criteria for the eVTOL. I'm pretty happy with the progress that we're making at this front. On November 8th of last year, we published the proposed airworthiness criteria for Joby Aero, the model JAS4-1 powered lift aircraft, and on December 20th, 2022, we published similar proposed airworthiness criteria for Archer Aviation's Midnight. There are many other eVTOL projects in the pipeline, all of which will benefit from this initial work.

The Federal Register notice confirms that the FAA's intent to use special air-specific airworthiness sections from Part 14 CFR — like I said, it's under 21.17b — to provide an equivalent level of safety to the existing standards and this will be for this new special class of aircraft.

The FAA is currently reviewing the public comments that have been submitted on these airworthiness criteria since the commentary period closed in December. There are about 50

commenters with over 400 comments specifically submitted, so the final airworthiness criteria will be issued once we complete our review and the disposition of those comments. We expect it to happen pretty quickly from the operational side of things. The FAA is also updating the relevant regulatory language. On November 21st, the FAA proposed a rule to update the air carrier definition to add powered lift operations to the regulations so that it'll cover the types of operations envisioned such as airlines charters and air tours.

This rule lays out the foundation and it will allow operators to use those aircraft in those operating requirements. It seems simple, but by not having powered lift defined, it's not able to be operated. So, one quick rule change. And running parallel with this other good work, the FAA is conducting an ambitious all-out agency effort to develop the essential operating rules for powered lift. As you well know, it does little good to have a type certificate, you can't fly your aircraft. We were going down that path and we weren't thinking about what happens once you get the TC. You don't want to have something nice and a framed on the wall, you want the aircraft in the air.

Powered lift can take off like a helicopter, transition to forward flight and then land like a helicopter. We must establish new criteria for these powered lift pilots whether in the aircraft or on the ground. As we accomplish this a task, the FAA is developing a special federal aviation regulation, a regular tool called an SFAR, that will enable the integration of powered lift aircraft into the NAS by defining the regulations for pilot certification and the operations.

The SFAR is a temporary regulation by nature, although they can be renewed and extended for a period of time — we see that we have a lot of SFARs that are still out there for many, many years. But for this powered lift SFAR, we'll establish our initial regulations for those powered lift pilots and ops. It will give the global community a chance to gain experience and lessons learned and the data collected from that will help serve as the basis for the permanent regulations that we expect, as well as industry consensus standards that we would expect to see going forward.

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Rest assured we're working diligently to meet these goals and we have not been idle over the years. We've been working on this for quite a while. For a period of time, I was the director of the office of rulemaking many years back, and we'd already initiated this rule, this plan and program; it just took a little detour getting it out, but we're there. It's good to see it's moving along, and it hasn't been far from our thoughts over the years. Even while we need to establish the pathway to allow these operations, we are really putting things in action.

While we know rules can be long in coming — because I've been around them a long time — I'll share the insight on how we will help to meet these goals and how, as a safety-focused regulator, we'll keep pace with the speed of the private sector innovation. We know the FAA's shift away from prescriptive rules is not easy. You can go in the regulations, and it'll pretty much tell you exactly how you're supposed to meet it because the rules in certain airworthiness sections took lessons learned, add a rule, add something to handle that problem, that issue.

What we started to do is look at how cumbersome that can be, and we really started to evolve to performance-based regulation and guidance. You saw that as I mentioned in Part 23, where we went from 700-odd provisions down to 50 provisions. It makes it harder in some ways, but it also makes it easier because it allows for innovation. But it does also require industry's commitment in an area to build consensus standards.

In our shift away from perspective to performance-based, we will be looking at the safety outcomes itself and the industry consensus standards that will support that as a means of compliance. This model will allow us to be more agile with the standards and also flexible with regards to means of compliance.

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I will say it's not a panacea — it takes work. You can have a performance-based standard with an outcome, but it means industry has to come together and decide what means of compliance is appropriate. This, as I said, means that you have to do your part and you have to continue to innovate not only on the designs but also on those means of compliance. Industry consensus standards need to be established or updated and continually keep pace with innovation ideas and that needs that be certified.

As we pursue the optimal level of FAA engagement in accordance with the safety continuum, this is really looking at the appropriate balance of safety risk with the certification oversight my organization is really focused on making FAA certification as efficient as possible as our safety-focused mission requires. Amid all this innovation, the FAA has a proven track record of safely certifying and integrating new and novel designs and safety-enhancing technologies in the NAS.

Sometimes it gets forgotten, but we do it. ADSB, emergency auto-land systems, UAS integration and operations are just a few recent examples. In August of 2022 we gave the initial approval for a certification basis of a navigation system for a fixed-wing aircraft which is envisioned to move towards autonomy via phased approach in the future. In September of 2022 we also published new design guidelines for vertiports as part of the essential infrastructure that will support AAM aircraft. Also in September, we issued a type certificate for the Matternet M2 drone, the first non-military uncrewed aircraft to achieve a TC in the US. Two months later we issued the first of its kind production certificate for that M2 model. So, TC process — think of Boeing down to UAS — we're learning to scale it. We still have a lot of work to do in the learning process, but we are making achievements there.

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Despite perceived regulatory gaps that inevitably characterize rapid change environments, our ongoing certification work is possible because we can leverage our current regulatory framework. This allows us to do the technical policy specials that can develop the project-specific regulatory requirements tailored fit to the unique aspects of each of the designs. I think this flexibility will come in the form special conditions to add or unique awareness criteria for the special classes we discussed earlier.

Rest assured we're not stopping and we're going to continue to work to ensure that we're evolving and using our flexibilities to achieve the safety goals in the most efficient manner and trying to be timely and predictable in that.

In addition to this agility that we're doing through our regulatory framework we've also put together some unique resources to assist. In 2018, Aircraft Certification established a means to coordinate with industry on emerging technology in advance of the application for a type certificate. This was in order to allow us to engage early in the design phase and strive to reduce the certification time frame. While there's still a lot of work to be done as we improve the internal processes to address this new avenue, we did it so we could keep pace with innovation: having a bird's eye look at what's coming in, what are we seeing, how do we start to develop that policy in cooperation our other government partners. This gives us an opportunity to start to prioritize where we need to make those changes.

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It was to be an approach to identify and bridge those regulatory gaps that we encounter when we want to seek those design approvals and be able to prioritize those. We're currently right now engaged with 70 companies with innovative projects that are cover various stages of maturity. The projects range from hydrogen fuel cell propulsion to highly autonomous cargo UAS, supersonic aircraft, etc. We're working with as well about 26 powered lift and special class rotorcraft projects. There's a lot of activity that's on our plate at this moment.

Another great and often unknown resource that the FAA has is the senior technical experts program: we call it STEP. It's an agency-wide mission-critical resource providing the FAA world-class expertise through a cadre of senior scientists in such VTOL-relevant technical capabilities as the cabin safety and crash dynamics, aviation fuels and wake turbulence, advanced composites, aircraft computer software and artificial intelligence, fatigue and damage tolerance, flight deck human factors, high energy electromagnetic effects, and safety and risk analysis.

These are all of — they used to be called SISTAs — STEP available as resources for internal use within the FAA as well as external activities. These scientists provide invaluable expertise, and they also collaborate with our researchers and scientists around the world as we're advancing technology and safety.

The other resource we have is the William J. Hughes Technical Center in Atlantic City. It's another great resource. We just completed a \$2.5M upgrade to the Tech Center's laboratory and this is where we'll be doing some research on electric propulsion systems. We're going to leverage the unique facility that the FAA has there to provide testing capabilities that many small companies may not be able to afford. The research will include such things as altitude temperature humidity testing, the sort of environmental factors that must be taken into account to ensure electrical propulsion systems perform as intended as they are meeting the safety requirements. We intend that the safety research completed from this upgraded

laboratory, from developing the test methods for establishing endurance for EPS or even looking at fall protection, this will all be shared with industry at large.

Finally, through our strategic partnerships, the FAA is also able to leverage the larger research budgets and test facilities of NASA and DOD. Thank you for being great partners to us. It's a privilege here again to be able to share the stage with so many leaders from DARPA, NASA and the US Army. There's great collaboration going on between the government entities. They're all helping to advance this eVTOL evolution as we're going to it.

I know many of you are actively collaborating right now with NASA and DOD and you'll hear more from them here throughout the conference. Since 2016, there's the Agility Prime and National Campaign that has provided companies with access to flight test facilities and restricted airspace. This collaboration has helped significantly accelerate the development of advanced air mobility technologies. It's also allowed my staff to be able to observe and gain knowledge so that we can ensure that when we get to the certification phase, they have the right expertise in place.

We're learning to align this research program with NASA's research. Work is being done by the NASA Advanced Air Vehicle program, as well as coordinating with DARPA and the Army through the FAA's teams at the Hughes Technical Center. The goal of all these collaborations is to obtain additional data and lessons learned that will enable us all government industry alike to save valuable time and resources in producing test processes, policies and products.

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Before I shift gears and talk about automated systems, I want to also speak to those of you who work mainly in the rotorcraft sector. As you may know, my early work with the FAA centered around rotorcraft certification, so my result roots really reside in the sector. In fact, I saw a couple familiar faces when I was in the ACO that are still here from flight test organization, so it's good to see the history continuing.

I've been pleased to see the collaboration between the FAA and the rotorcraft industry. As we partner for growth and safety throughout, we've been using the US Helicopter Safety Team, or the USHST. While we may have many other areas of engagement, this team of volunteers represents a valuable resource and promotes voluntary measures in the area of safety, equipment, operations and maintenance. I think the USHST has developed and promotes data-driven helicopter safety enhancements that industry can implement voluntarily. I encourage you all to visit their site the website and take advantage of the many resources available to you there. The video has a website landing page — “56 seconds to live” — and it's a pretty powerful and sobering reminder of what's at stake when we talk about vertical flight operations. The Team will be rolling out the next round of safety enhancements this year. I look forward to how these enhancements will introduce risk mitigations, implement better training procedures and practices, and continue incorporating safety management systems, SMSs, into their operations.

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Given the name of the conference — the 2023 Autonomous VTOL Technical Meeting — let's talk about automated systems for a second. The FAA is doing its part to take automation to the next level, including our collaborative work through the industry consensus standards committee as I mentioned earlier. Various committees are working on standards to support the safe introduction of artificial intelligence, machine learning and automated systems into the emerging aircraft.

There's also good work being done to develop standards for engineering simulators that can be used during the development, the certification of the highly integrated systems and the highly automated aircraft. In this new realm of flight, the FAA is also doing what we call the “crawl, walk, run” approach in terms of automation in the NAS. Again, we have to get this right.

We're considering high levels of autonomy in our rulemaking efforts and recognizing that it's a big industry demand. Here's a snapshot of a few of the things that we're working — highlights of the automation and aviation. In the transport category, about 93% of the flight function on a commercial airliner has turned to automated components. The autopilot is engaged pretty much the majority of time of the flight. The FAA is evaluating proposals from applicants on these concepts now that are called “reduced crew concepts” such as extended minimum flight crew operations and single pilot operations. All of these will be based off of systems — autonomy, automation. In general aviation fixed-wing aircraft, we have had an emergency auto-land system since 2020 and the FAA is currently evaluating proposals for autonomous aircraft navigation systems. As I said, we're working on design criteria in that realm.

In rotocraft, as with GA, we're evaluating designs, calling for ground-based pilot concepts and autonomous operations. And as you know well, many powered lift aircraft are highly automated. For example, on takeoff many eVTOLs are designed to achieve a steady hover with no input from the pilot. That's something new, it's definitely not like a helicopter, it's a lot of work. For UAS as well, automated drones are making package deliveries right now in various cities across the US.

Clearly, automated systems are already here and changing aviation. Yet, the very same automated systems that bring new benefits can introduce new vulnerabilities and safety risks. Consider from an example — and we don't typically try to make comparisons between other modes of transportation, but I'm going to reinforce my call to be prudent and carry the biggest, most robust safety management system stick you can — Metro trains in Washington DC are capable of autonomous operations they have been for quite a number of years. But they've been operated manually since a fatal accident in 2009 I think it was. And this was due to an anomaly in the track circuit signal, so there's a lot of systems we have to consider there. These trains are on the ground, on rails and they're still struggling with the software, the associated elements and the human interactions with them. The introduction of automated systems can have unexpected safety and operational consequences and as PK had said, these are complex systems and I'll have to re-emphasize that here.

Fly-by-wire eVTOL represent the most innovative and complex design ever submitted to the FAA for civil certification in my perspective. Drastically fewer parts and reduced hazards — such

as no liquid fuel — and the safety redundancies are there, but these are still highly complex systems. In our collaborative efforts to integrate the new VTOL aircraft in the world's most complex airspace, that's already going to be an enormity of a task to take on. You must show and the FAA must find that the new avionics control systems, cyber security, electric motors, rotors, battery, battery charging, battery management, and pilot training and workload that goes along with this and all their interrelationships that they provide an equivalent level of safety to the existing standards. Through our great success over decades, we have set a very, very high safety bar. The safety of emerging aviation technologies will be measured against that remarkable success for the commercial aviation industry.

I'll wrap up here by saying where I began talking about our can-do spirit and safety. Despite the obvious hurdles that we have to clear, the VTOL evolution is here. Congress, industry and the FAA are each doing their part to get the VTOLs flying as soon as possible. Amid this exciting and challenging VTOL evolution, the FAA is working diligently to advance the innovation and promote safety.

I hope my comments will help bolster your confidence in these three essential areas and that we are developing the regulatory framework to help get you flying. The FAA has the resources and the expertise to certify the products to get you flying and the FAA has the mandate and the mission to ensure that the risk has been properly mitigated before you fly. I encourage each of you and your respective companies to adopt and maintain a safety management commitment and workplace culture focused on managing the safety risk. And with that focus on safety, and as we advance this dynamic sector, the FAA will keep pursuing the optimal level of safety, while we also work to be agile efficient and predictable in our own safety mission. Thank you for having me here today even without flashy slides, but glad to see you all.