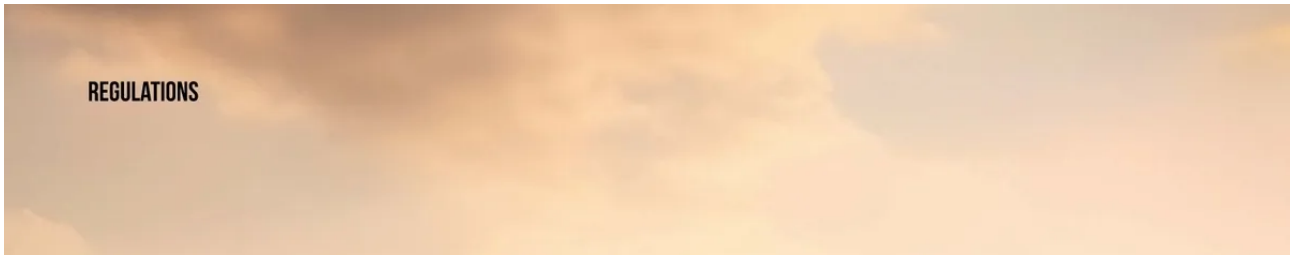
Aerospace TESTING INTERNATIONAL

SHOWCASE 2024



1 // Developers of eVTOL aircraft anticipate the first applications for air taxis will be in urban environments

NAVIGATING

NAVIGATING CERTIFICATION FOR ADVANCED AIR MOBILITY

EASA and the FAA have significantly progressed certification regulations for eVTOL aircraft in preparation for their introduction to markets

// JULIA NORSETTER, REED SMITH

The Advanced Air Mobility sector is poised for sustained growth and offers a plethora of opportunities to aerospace professionals who are considering including in their portfolios eVTOL aircraft and associated elements.

According to a study published by analysts this year, the global AAM market is forecast to be worth more than US$68 billion by 2032, supported by a projected annual growth rate of around 35% between now and 2032. Over this time, it is anticipated that AAM operations will grow increasingly complex – from piloted to remotely piloted, to autonomous flight. Each of these phases will bring new requirements related to safety and certification testing.

DEVELOPMENT STATUS

Impressive flight demonstrations of eVTOL aircraft lead many people to conclude that large scale eVTOL production may soon start. Although advanced operations such as remote piloting and autonomous aircraft are not likely to be introduced for several years, piloted operations are set to start in 2024 in various locations worldwide, such as at the 2024 Olympics in Paris.

OEMs, consumers and investors alike are closely following certification processes, wondering what it will take for an eVTOL aircraft to take flight. OEM prototypes demonstrate that the technology exists, but the regulatory environment is yet to be fully established.

Many regulations are still under deliberation, but it is important to note that regulators have made significant progress toward permitting commercial eVTOL flights. This is especially true as it relates to aircraft certification.

AIRWORTHINESS

Most eVTOL aircraft OEMs have their immediate sights set on achieving Type Certification. Although Type Certification is an important component of flight readiness, it does not alone render an aircraft ready to fly in the USA and EU. An aircraft also needs a Certificate of

Airworthiness, which includes a Type Certificated aircraft, produced by a manufacturer with Design Certification, flexibility to use objective-based certification requirements that do not favor a specific kind of aircraft.

Airworthiness, which includes a Type Certificated aircraft, produced by a manufacturer with Design Certification, and approval that the aircraft in question is safe to fly.

Type Certification processes involve ground testing of components, systems and entire aircraft and flight testing. An OEM must prove an aircraft meets design intent, durability and safety requirements at an acceptable level of risk.

During Type Certification the OEM and the regulator first agree on a certification basis, or the section of aviation safety and performance regulations that will apply to the OEM's eVTOL certification. Second, they agree on how the OEM will demonstrate compliance with the applicable regulations.

There is no single method that an OEM must use to demonstrate compliance. Some regulators will use performance-based processes. The OEM may present its compliance plan for the regulator to review and approve, if appropriate.

Third, after achieving an agreed-upon means of compliance, the OEM engages in hundreds of hours of testing to demonstrate compliance with the applicable regulations. Finally, the regulator verifies the tests performed by the OEM and issues the Type Certificate.

Sophisticated Advanced Air Mobility (AAM) OEMs have already begun Type Certification processes, sometimes concurrently with the FAA and EASA. These two regulators have developed different processes for the Type Certification of eVTOL aircraft.

EASA'S APPROACH

EASA has designated VTOL as a new type of aircraft to be regulated by a process outlined in its Special Condition for VTOL aircraft (SC-VTOL). SC-VTOL draws from several existing regulations, most notably CS-23 for normal-category aircraft. SC-VTOL also contains elements from SC-27 for small rotorcraft, since EASA determined that VTOL aircraft may have elements of both fixed wing design and rotorcraft design.

Crucially, the regulation is supplemented by means of compliance documents, which provide OEMs with the necessary details on acceptable ways to comply with SC-VTOL. According to EASA, this new regulation provides the necessary flexibility to use objective-based certification requirements that do not favor a specific kind of aircraft.

FAA CERTIFICATION

Although the FAA initially announced its intent to certify most eVTOL aircraft under Part 23, the US equivalent to CS-23, it switched course in 2022 when it decided to certify eVTOL aircraft under Part 21.17(b). In doing so, the FAA designated eVTOL aircraft as a "special class" of aircraft ("powered lift"), resulting in a change to the certification process.

Part 21.17(b) permits the FAA to certify eVTOL aircraft by designating provisions of other certification processes, such as normal and transport category aircraft and rotorcraft, that it finds applicable. The FAA publishes Special Class Airworthiness Criteria for OEMs applying for Type Certificates, which allows other industry OEMs visibility into applicable regulations. The performance-based airworthiness criteria are unique to the applicant and conform to the design particularities of that applicant's aircraft.

REACTION

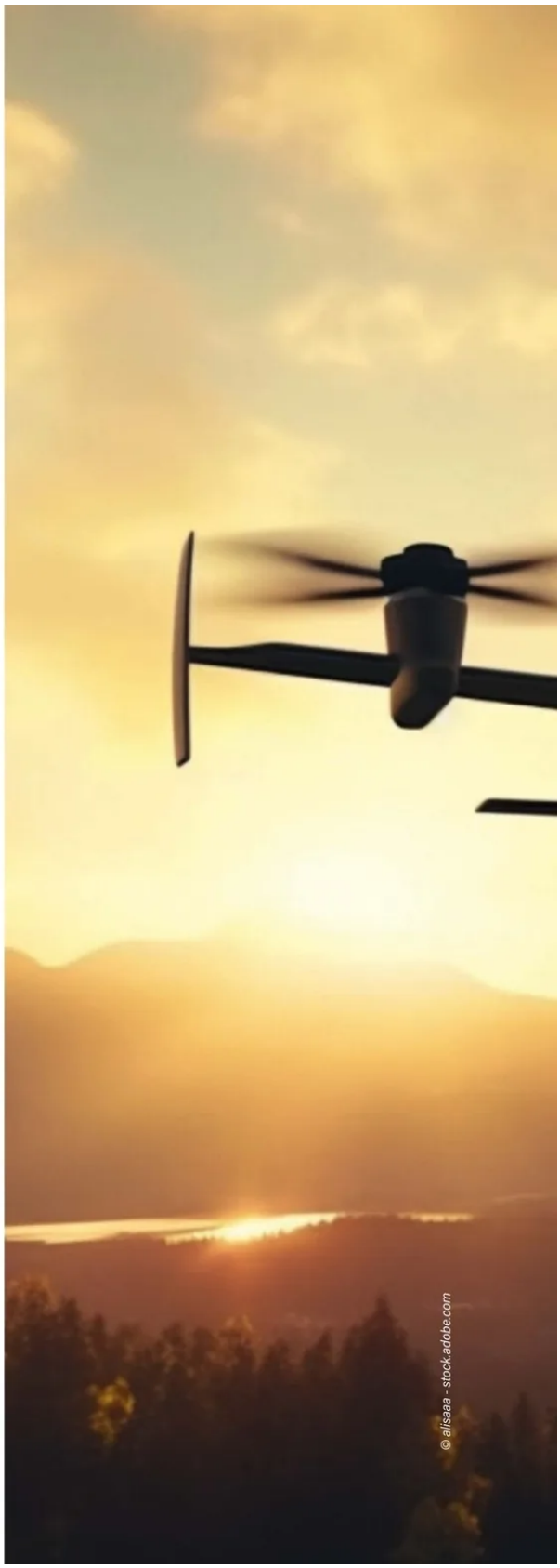
The Type Certification processes of FAA and EASA have many similarities, but certain differences between the two entities' processes have caught the attention of the aviation industry.

One such difference between FAA and EASA regulations is each entity's requirement relating to the likelihood of a catastrophic failure condition. EASA's processes require an eVTOL OEM to substantiate that the likelihood of a catastrophic failure is ten to the minus nine, or one in a billion flight hours. This is the standard applied to transport category aircraft like commercial passenger airliners and is generally considered the most stringent standard.

FAA, by contrast will apply to eVTOL aircraft the safety continuum for small airplanes and helicopters. This approach takes into consideration the size and complexity of the aircraft. This means that some aircraft may be required to demonstrate the likelihood of catastrophic failure at ten to the minus eight, or ten to the minus seven – one in 100 million, and one in 10 million flight hours, respectively.

Clearly, this numeral still requires the OEM to demonstrate that catastrophic

"EASA'S PLAN WILL ARGUABLY ALLOW FOR FASTER PILOT CERTIFICATION, WITH CERTIFIED PILOTS LIKELY ONLY NEEDING A NEW TYPE RATING"




REGULATIONS
“REGULATORS HAVE MADE SIGNIFICANT PROGRESS TOWARD PERMITTING COMMERCIAL EVTOL FLIGHTS”
2 // eVTOL aircraft developers have run test programs while discussing certification rules with regulators
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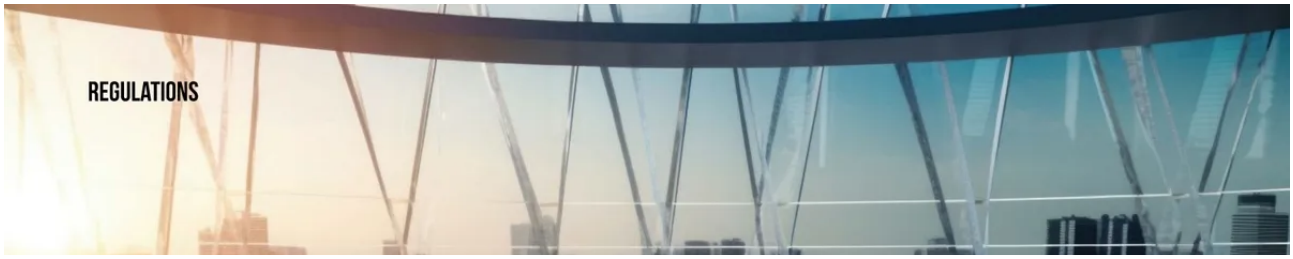
REGULATIONS

3 // eVTOL aircraft will require new infrastructure including vertiports and ground control stations

failure is highly unlikely. Still, the public and industry cannot help but compare the two numerals, with some concluding that the FAA's approach renders an aircraft less safe. The FAA responds that operational limitations attached to a certified eVTOL aircraft will render the likelihood of catastrophic failure the same as that of EASA.

Moreover, the FAA considers the possibility that the higher standard of ten to the minus nine could in fact be counterproductive for safety, by precluding the use of new safety-enhancing technologies. OEMs have also noted that EASA's requirement may require more flight demonstration hours, which can be a cost burden for aircraft OEMs unfamiliar with the certification process for large transport category aircraft.

Another, more obvious grievance cited by OEMs is the two agencies' failure to reach an agreement harmonizing the regulatory processes between the two agencies. Only select OEMs will have the financial means for dual certification with both FAA and EASA. This could prevent newer manufacturers from entering – and surviving – in the AAM market. Nevertheless, methods of accreditation have effectively occurred for legacy civil aircraft, so there is reason for optimism regarding VTOL regulations as well.

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OPERATIONAL RULES

Next up, regulators will need to enact rules relating to operational requirements and pilot certification. Without operational rules and a certified pilot, an AAM aircraft with a Type Certificate cannot fly. Both the FAA and EASA have released initial plans for the operational rules VTOL will follow, as well as pilot certification requirements. Unsurprisingly, initial AAM operations will loosely follow the established regulations, such as FAA's Part 91 rules for general operations.

The two regulatory bodies differ with respect to their proposed plans for pilot certification. The FAA intends pilots to receive a new powered-lift category rating as part of AAM licensure.

In contrast, EASA's plan will arguably allow for faster pilot certification, with certified aeroplane or helicopter pilots likely only needing a new type rating to fly an AAM aircraft.

Industry reaction to these two sets of standards has been mixed, so expect to see a variety of amendments as the regulations are processed and are published by the respective safety agencies.

SUPPORTING THE SECTOR

Significant progress has been made in the AAM industry, both from a technical and regulatory standpoint over the last several years. Nevertheless, the market is still arguably in a nascent stage, when all the pieces that need to come together for the industry to take flight are considered.

In addition to airworthiness certification, operating rules and pilot certification, significant work still also needs to occur in infrastructure development. In addition to the physical infrastructure, states and regions will need to ensure community acceptance of the value and safety of AAM aircraft.

Thanks to global interest in environmental sustainability and the potential reward of reduced urban congestion for communities, support for the AAM industry extends beyond the aviation industry to environmental and government stakeholders. Stay tuned for further developments in the AAM industry, including the necessity of testing engineers to help drive the path to success. \\

Julia Norsetter is transportation policy and analysis lead at global law firm Reed Smith