Australian Government
Civil Aviation Safety Authority

Future of Aviation

Ensuring Safety of Novel Aircraft Designs, Technologies, and Infrastructure

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The Opportunities for Innovation

Electrification of Aircraft.

- Electric Propulsion Units, eVTOL, electric CTOL, Retrofit
- Redefining some of the constraints of traditional aircraft design.
- Rotors, wings, and other structural elements are not required to be isolated or considered as separate systems. They can be deliberately coupled to produce desired effects.

Advantages to Aircraft Design:

- Distributed electric propulsion units allow the development of unique aircraft configurations which are no longer constrained by the location of engines.
- Performance: high torque, flat torque curve, low weight.
- Reliability: significant reduction in moving parts.
- Environmental: no emissions, less noise.

Our Way by James Baban

International Alignment

Type Certification rigor is commensurate with the risk of intended AAM operations such that acceptable safety standards are met while also fostering industry innovation.

Type Certification:

- Regulators work collaboratively to maintain the high safety standards inherent in the type certification process.
- Use of Industry consensus standards to promote international alignment in the type certification of AAM.
- Collaboration and exchange of type certification data from the State of Design to the Validating Regulator.

Validation:

- Streamline validation activities to minimise duplication of effort.
- Establish risk-based approach to validation utilising acceptance practices for low-risk validation items.

International Alignment

Work to do:

- Alignment of process and standards between major international Regulators type certifying AAM. Minimising divergence improves standards development and streamlines international validation.
- Develop and evolve performance based certification standards, proportionate to risk, that facilitate industry innovation. Including: remotely piloted AAM, cyber security, single operator multiple aircraft, and autonomous AAM.
- Consideration of rapid configuration changes (modifications).
- Integration of Systems of Systems – common concept of operations.

Collaborative Approach:

- The incremental Crawl, Walk, Run approach necessitates a collaborative approach between the OEM, the type certifying Regulator, and the international Regulators conducting validation.

CASA Approach

CASA is an outcomes based Regulator and will work with Applicants utilising the flexibility inherent in the Civil Aviation Safety Regulations to introduce and safely operate aircraft employing emerging technologies in Australia.

Type Certification.

- CASA is an early adopter of recognised international standards and industry consensus standards to enable to type certification of emerging technologies.
- CASR Part 21 is aligned with 14 CFR Part 21 including the Part 21.17 regulation
- CASA invokes type acceptance principles when the aircraft is type certified by a recognised country. This includes AAM type certified by the FAA.
- Active in international AAM working groups promoting alignment between Regulators.
- Working in collaboration with the FAA on a type certification project using the FAA Durability and Reliability methodology.

CASA Approach

Flight Operations:

- CASA is introducing a ‘regulatory sandbox’ to facilitate the expeditious development of innovation aviation technologies and associated operational activities.
- The regulatory sandbox provides a mechanism for CASA to identify suitable regulatory approaches and develop these on an enduring basis.
- CASR Part 11 provides various mechanisms to introduce additional specified regulatory conditions based on an assessment of an acceptable level of safety.
- Practically, these mechanisms include *Exemptions*, *Instruments*, and *Directions* where CASA can introduce appropriate requirements for the safe operation of AAM in Australia.

International Partnerships:

- Established Bilateral Aviation Safety Agreement with the FAA (Airworthiness).

Safety Considerations

Safety Case based on Redundancy:

- Probability of failure safety targets are met by fail safe designs incorporating system redundancy. AAM can be considered an integrated system of systems and should be assessed with this in mind rather than via a federated approach.
- Places increased reliance on the system safety assessments underpinning the type certification effort.

Automation:

- AAM invokes high degrees of automation at the aircraft level and the aircraft system level.
- The pilot and the automation are now a pair in making judgements regarding the operation of the aircraft. This partnership is trending towards automation.

Human Factors:

- The human-machine interface is changing.
- Not only what technology will do for us, but also what technology will do to us.

Development Assurance

- Industry best practice for Development Assurance of aircraft and aircraft systems, such as ARP4754A, address the trend in system design of an increasing level of integration between aircraft functions and the systems that implement them.

- The systematic application of Development Assurance techniques increases confidence of the certifying and validating Regulators that errors in requirements or design, and integration or interaction effects have been adequately identified and corrected.

> *"Complex systems and integrated aircraft level functions present greater risk of development error (requirements determination and design errors) and undesirable, unintended effects" (APR4754A)*

Wadna First Flight by Kristian Coulthard