Australian Government
Civil Aviation Safety Authority



Certification and Approval of Innovative Air Mobility aircraft

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Areas of focus

Advanced Air Mobility (AAM) – e.g. eVTOL

- Harmonisation & Regulatory Enablement – NAA Roadmap, ICAO
- Certification challenges – eVTOL & distributed electric propulsion
- Innovation in Light Sport Aircraft (LSA)

Uncrewed Aircraft Systems (UAS) – or RPAS

- Non-certification approval pathways (AusSORA)
- Challenges of higher SAIL level operations

AAM

Civil Aviation Safety Authority



Image Credit; AMSL Aero



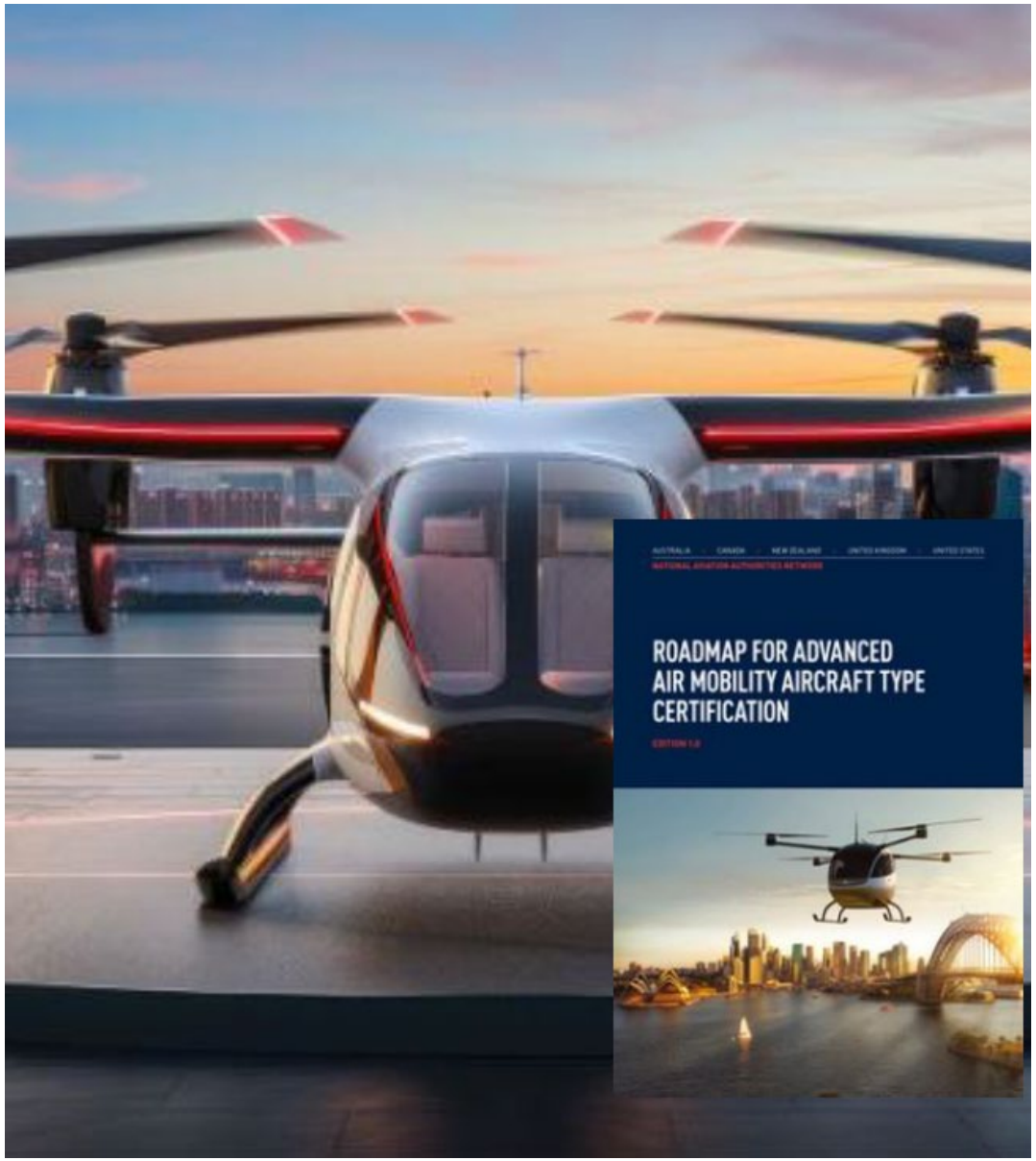
Vertical Aerospace VX4 (Valo)

Image Credit; Vertical Aerospace

Harmonisation

We are pursuing international regulatory alignment and harmonisation

- Promote acceptance and transferability of novel aircraft e.g. powered-lift eVTOL
- **NAA Network Roadmap for AAM Type Certification and Type Validation** (Published June 2025) – 5 authorities



AAM Roadmap Principles

- **Balanced** approach to safety and innovation
- **Harmonised** approach to type certification / type validation
- A **collaborative** model – driving alignment; particularly through the use of **multi-authority validation**
- **Incremental** response to advancements – “crawl, walk, run”
- **Bilateral** agreements – creating new agreements and extending existing agreements to encompass AAM

ICAO Airworthiness Panel (AIRP)

Working Group 2 (Initial Airworthiness):

- Addressing aircraft “not currently classified under Annex 7”
- Exploring new Standards (SARPs) for Annex 8 (Powered-Lift Aircraft)
- Aircraft-level Cybersecurity

Working Group 4 (Aeronautical Products):

- Developing amendments to Annex 8 for Electric Propulsion

Certification challenges – AAM / eVTOL

- Airworthiness Standards & Means of Compliance (MOC)
- TLOS / safety objective: Differences in FAA & EASA approach
- Battery / electrical systems challenges: cell qualification, assembly & integration (automation), thermal management (incl. gradients), thermal runaway / fire suppression, sensing / BMS / electrical contactors/isolators, software (SW) and complex electronic hardware (CEH).
- DEP challenges: Electric motor design and qualification aspects, DEP ←→ flight control law integration (not “just” propulsion), FCL degradation, simplified pilot controls and HMI







Table 2 – Relationship for Powered-lift Certification Levels, Severity of Failure Conditions, Probabilities, and Functional Development Assurance Levels

Failure Condition Classification	<- No Effect ->	<--- Minor --->	<--- Major --->	< Hazardous >	<Catastrophic>
Effect on aircraft	No effect on operational capabilities or safety	Slight reduction in functional capabilities or safety margins	Significant reduction in functional capabilities or safety margin	Large reduction in functional capabilities or safety margins	Loss of aircraft
Effect on flightcrew	No effect on flightcrew	Slight increase in workload that involves crew actions well within crew capabilities such as routine flight plan changes	Physical discomfort or a significant increase in workload or in conditions impairing crew efficiency	Physical distress or excessive workload impairs ability to perform tasks accurately or completely	Fatalities or incapacitation
Effect on occupants excluding flightcrew	Inconvenience	Physical discomfort	Physical distress, possibly including injuries	Serious injuries or a fatal injury to a single passenger or cabin crew member	Multiple Fatalities
Probability Classification	**No Probability Requirement**	**Probable**	**Remote**	**Extremely Remote**	**Extremely Improbable**
Powered-Lift Certification Level 1B	No probability or FDAL requirement	$<10^{-3}$ FDAL D	$<10^{-4}$ FDAL D	$<10^{-5}$ FDAL C	$<10^{-6}$ FDAL C
Powered-Lift Certification Levels 1A and 2B	No probability or FDAL requirement	$<10^{-3}$ FDAL D	$<10^{-4}$ FDAL D	$<10^{-6}$ FDAL C	$<10^{-7}$ FDAL B
Powered-Lift Certification Levels 2A and 3B	No probability or FDAL requirement	$<10^{-3}$ FDAL D	$<10^{-5}$ FDAL C	$<10^{-7}$ FDAL C	$<10^{-8}$ FDAL B
Powered-Lift Certification Levels 3A, 4A, and 4B	No probability or FDAL requirement	$<10^{-3}$ FDAL D	$<10^{-5}$ FDAL C	$<10^{-7}$ FDAL B	$<10^{-9}$ FDAL A

Note: Quantitative probabilities and FDAL. Numerical values indicate an order of probability of failure range and are provided here as a reference. A qualitative analysis is allowed to justify minor failure conditions.

FAA: Level 2A → 10^{-8}/FH → **FDAL B**
*FDAL B = DAL **B** + DAL **D** … or DAL **C** + DAL **C** (ARP4761 App. P)*

Note:

Section 8. Safety Objectives (a), the following notes are updated. Changes are highlighted in blue colour for reader's convenience.

Section 8. Safety Objectives (b), reference to ARP4761 is replaced by EUROCAE ED-135/SAE ARP 4761A.

Note A In general no considerations of the system architecture for an FDAL (IDAL) reduction are acceptable, as the FDAL classification in Table 5 already constitute a proportionate approach. An alleviation is granted to additional members as referred to in ED-135/ARP4761A Appendix P, where the following applies: For Category Basic 1 and 2, when at least two members are contributing to a given failure condition they should

be assigned at least the FDAL (IDAL) defined in Table 5. Other additional members should not be assigned lower than FDAL (IDAL D).

Note D: The applicant is not expected to perform a quantitative analysis for minor failure conditions. It is underlined that a compliance statement is also expected in the SSAs or FHAs for those failure conditions.

EASA: Category Enhanced → 10^{-9}/FH
FDAL A. No IDAL reductions.
(EASA MOC-5 VTOL.2510, p.21)

Innovation in Light Sport Aircraft (LSA)

FAA MOSAIC expands the current sport/recreational LSA model

- Key MOSAIC changes: 2-seat LSA powered-lift aircraft (eVTOL / “PAM”), 2-seat helicopters, expanded LSA aeroplane category (‘performance-based’), opportunities for adoption of novel technologies e.g., DEP and simplified flight controls.
- ASTM developing consensus standards (MOC)
- CASA intends to **maintain alignment** with the FAA LSA scheme
- Opportunity for “non-TC” powered-lift aircraft
- Example LSA R&D activities – e.g. Jabiru EP, JabX (UAS/RPA)

UAS / RPAS



Image: Carbonix

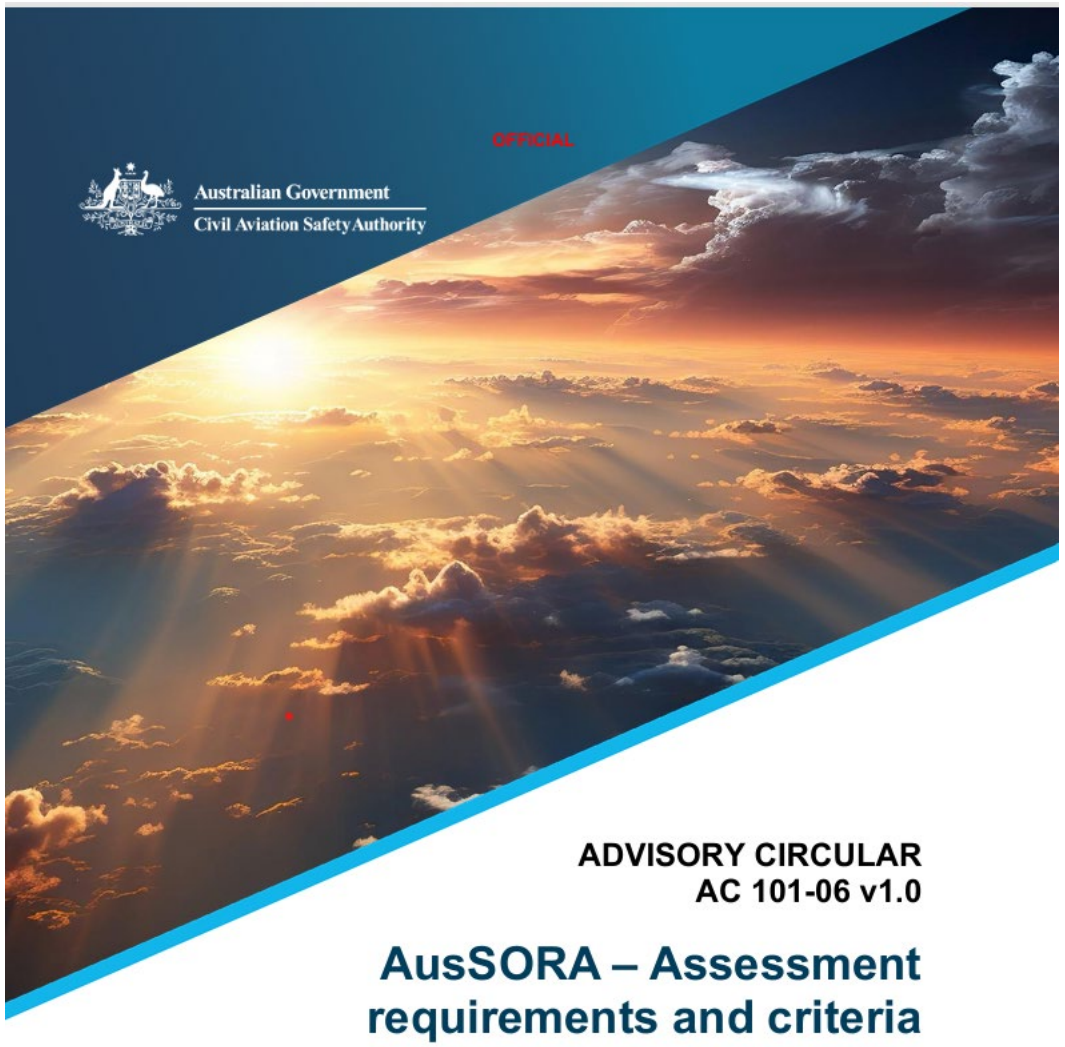


Feb 2026: First Australian SAIL III

Image: Carbonix

AusSORA

- CASR Part 101, BVLOS etc.
- CASA has recently published **AC 101-06 on AusSORA**
- AusSORA closely aligns with JARUS SORA 2.5 (current)
- CASA has also published **Annex A to AC 101-06**, providing guidance on Airworthiness operational safety objectives (OSOs)



AusSORA – ‘Airworthiness’ OSOs

OSO	Title	I	II	III	IV	V	VI
OSO 2	Manufacturing	-	-	L	M	H	H
OSO 3	Maintenance	L	L	M	M	H	H
OSO 4	**Airworthiness Design Standards (ADS)**	-	-	-	L	M	H
OSO 5	**System Safety & Reliability**	-	-	L	M	H	H
OSO 6	C2/C3 Link	-	L	L	M	H	H
OSO 18	Envelope Protection	-	-	L	M	H	H
OSO 24	**Environmental Qualification**	-	-	M	M	H	H

Challenges of higher SAIL Operations

- Increased focus on **airworthiness** objectives (OSOs) – from SAIL III onwards
- Shifting thinking from operational aspects, to **design** and **assurance** aspects
- Manufacturer involvement (→ access to **design data** / reports / evidence)
- **'Low' robustness ≠ 'No' robustness** (→ declarations rest on evidence!)
- Recall that SORA requires a 10x (=10^1) reliability improvement per SAIL level increase



Image: Carbonix

OSO 5 – System Safety & Reliability

- Goal: **an assurance argument** that that required operational failure rate (airframe loss rate) target for the intended SAIL is met.
- Perform an Aircraft- and System-level FHA (AFHA/SFHA)
- Use of qualitative vs quantitative approaches
- Note: SORA requires **no single failure for catastrophic FC's** at SAIL V or above
- **Redundancy** is probably the single most effective way to address reliability and assurance requirements, across all SAIL levels.
- **Reliability**-based arguments can be challenging (esp. for COTS!)
- Considering **exposure** can be helpful (→ 10^{-X} *per flight hour*)

OSO 4 – Airworthiness Design Standards

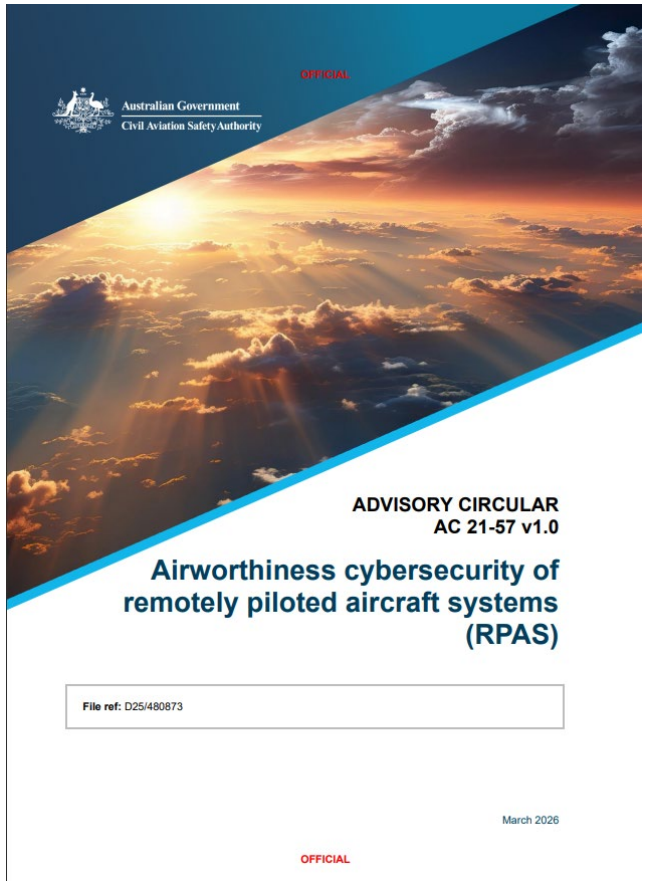
- Goal: a positive **assessment** of the compliance of the RPA design to an **appropriate** airworthiness design standard (ADS)
- At varying levels of robustness, from SAIL IV (‘Low’) to SAIL VI (‘High’)
- A range of potentially suitable ADS depending on robustness and size/weight of platform
- Examples: ASTM F2910-22 (“small UAS”), ASTM F3298-24 (“lightweight UAS”), ASTM F3563-22 (“large fixed-wing UAS”), EASA SC-LUAS / CS-LUAS / CS-LURS, CASR Part 23/27, etc.
- Assessment of ADS compliance is **not certification**
- Access to design data / supplier co-operation is critical, particularly for higher SAIL approvals

OSO 24 – Environmental Qualification

- Goal: a statement of compliance based on evidence that the designer has **assessed**, **tested**, and **substantiated** the aircraft can safely operate in all **relevant** environmental conditions
- At varying levels of robustness, from SAIL III (‘Medium’) to SAIL VI (‘High’)
- Establishing and publishing **operational limitations** as appropriate, e.g. AFM.
- Primarily using **test-based** approaches and following recognised standards
- **Analysis** and **simulation** may also be useful, in places.
- Basic environmental conditions to be tested may include: temperature (range and variation), altitude, humidity, vibration, power input, voltage spike, etc.
- Depending on operation and SAIL, may also need operational shock, lightning, HIRF, RFI, ESD, waterproofness, fluids, sand/dust, fire, etc. (Very case dependent).

Airworthiness Cybersecurity for UAS/RPAS

- CASA has recently published AC 21-57 on *Airworthiness Cybersecurity of RPAS*
- Guidance primarily intended for RPAS designers and manufacturers.
- Additional RPAS cybersecurity guidance targeting the needs of **operators** will be delivered in a future update to AC 101-06 (SORA).





Questions?

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