EASA
European Union Aviation Safety Agency

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SC-VTOL Bird strike combining the Airframe and lift/thrust system approaches

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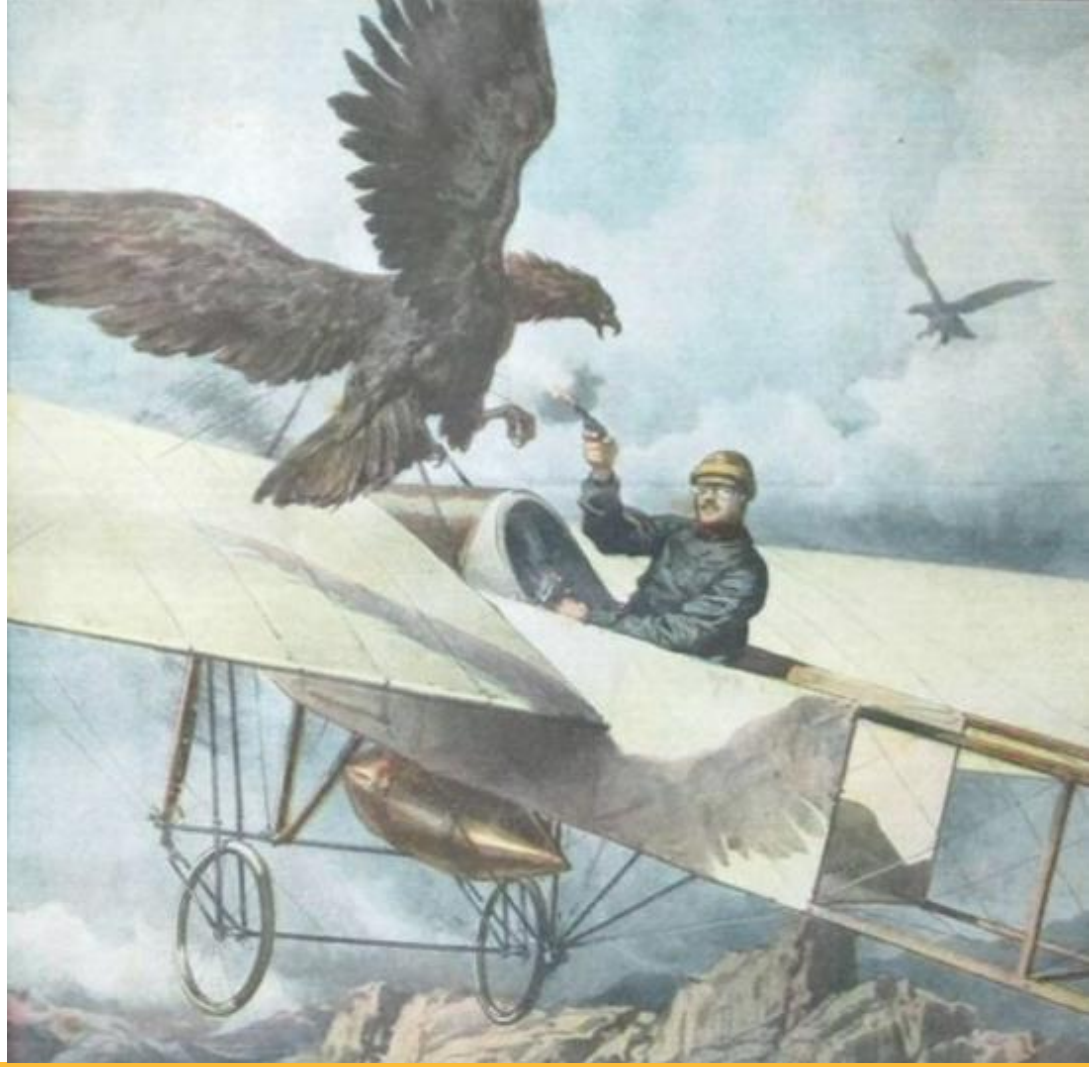
« Live and let die! »



Eugene Gilbert in Bleriot XI
attacked by eagle
over Pyrenees in 1911

Source: https://en.wikipedia.org/wiki/Bird_strike

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What is the issue?

Bird strike in the SC.VTOL

SC. VTOL.2250 Design and construction principles

- (f) The aircraft must be designed to ensure that **after a likely bird impact** the capability remains to conduct:
  - (1) a controlled emergency landing (CEL) for Category Basic with a maximum passenger seating configuration of 7 or more; or
  - (2) continued safe flight and landing (CSFL) for Category Enhanced.

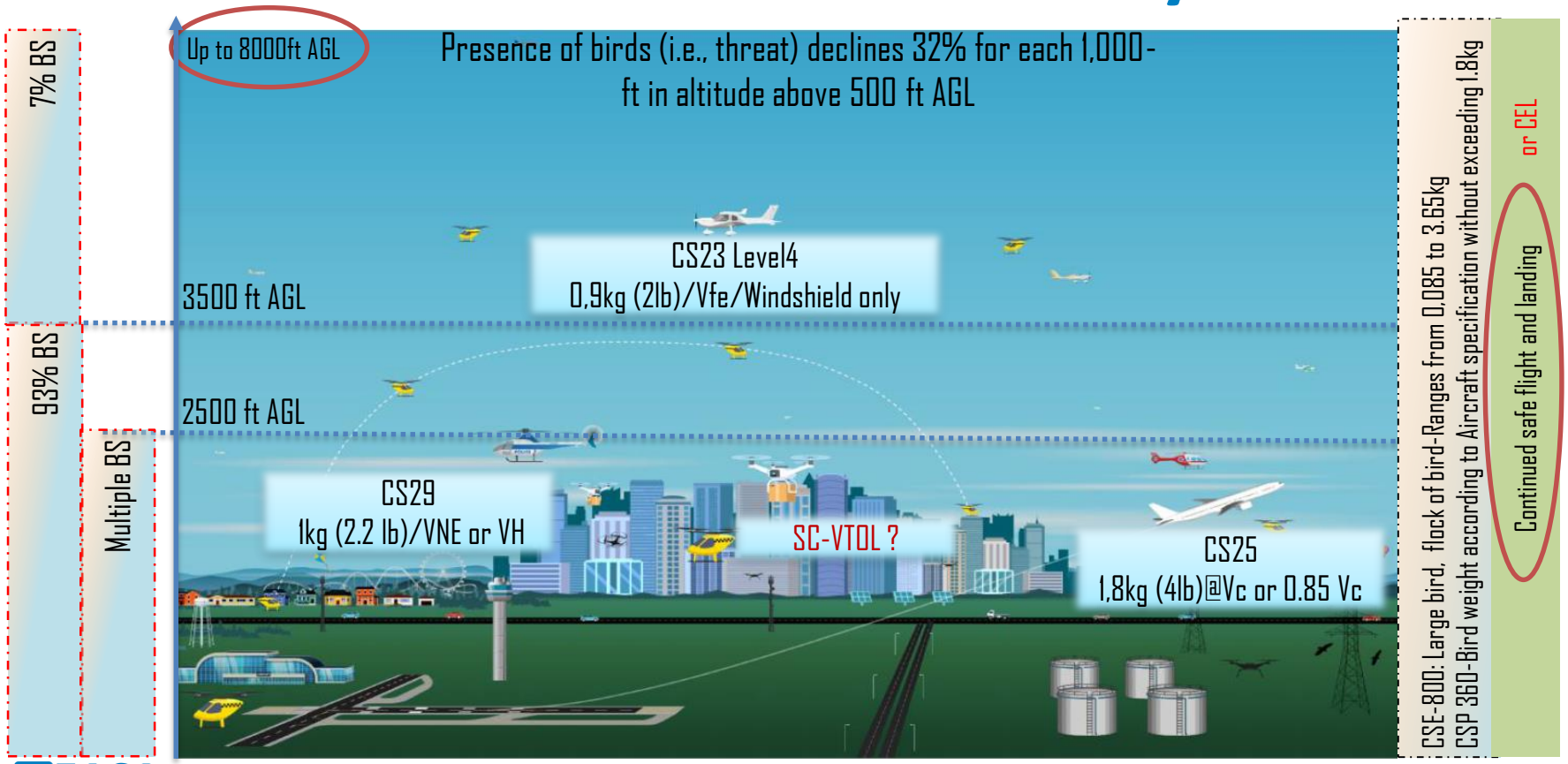
SC.VTOL.2320 Occupant physical environment

- (a) The aircraft must be designed to:
  - (3) protect the occupants against serious injury due to breakage of windshields, windows, and canopies.

SC.VTOL.2400 Lift/thrust system installation

- (b) Each aircraft engine, propeller and auxiliary power unit (APU) must be type certified, or meet accepted specifications**.**
- (c) The applicant must construct and arrange each lift/thrust system installation to account for:
  - (1) all likely operating conditions, **including foreign object threats**;
  - (3) **likely hazards in operation**, including hazards to ground personnel;(…)

Bird strike and Urban Air mobility



Source: https://www.mitre.org/sites/default/files/publications/pr-18-0154-4-urban-air-mobility-landscape-report_0.pdf

Occupant protection-Reinforced windshield

Source: https://www.nationalgeographic.com/news/2013/11/131108-aircraft-bird-strikes-faa-radar-science/

Bird strike resistant windshield and supported structure

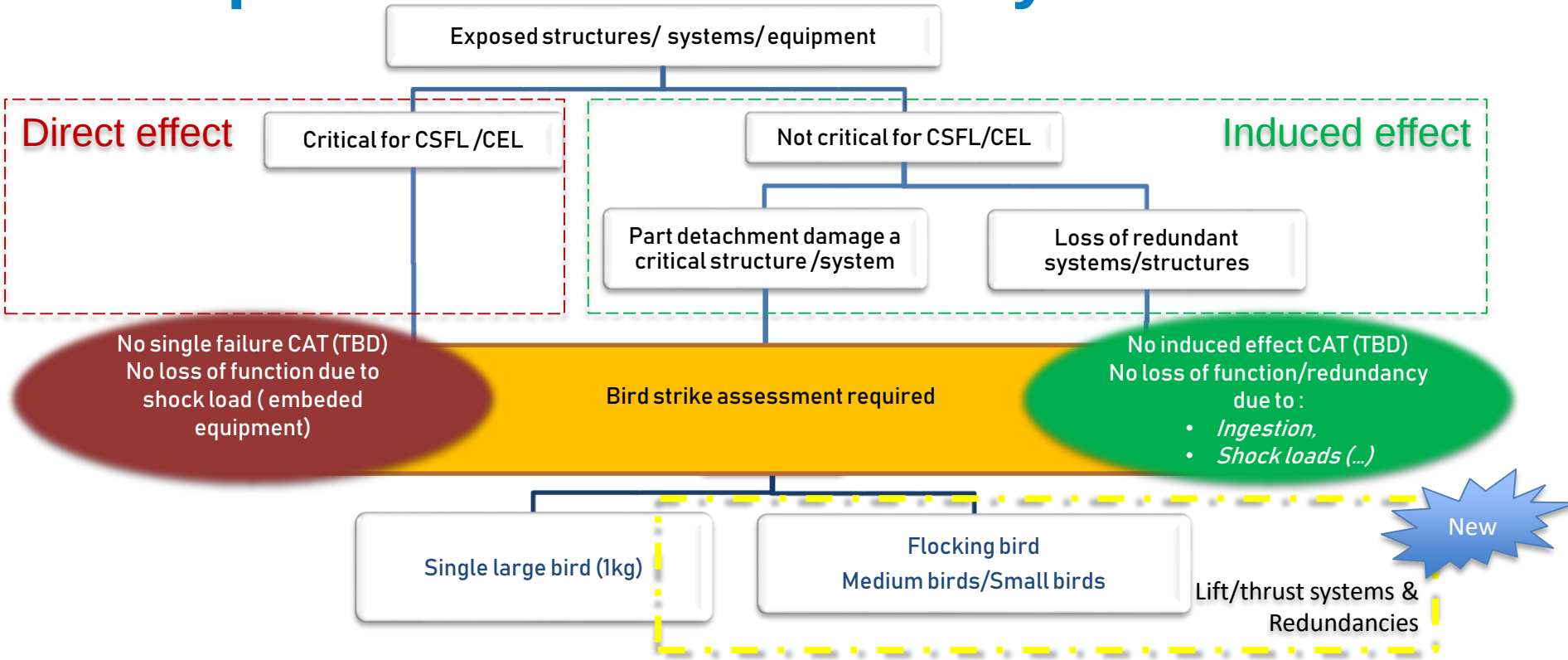
- No windshield penetration after impact with a 1kg (2.2lb) for maximum VTOL speed
- No windshield breakage (**SC.VTOL.2320)**

New

Exemption

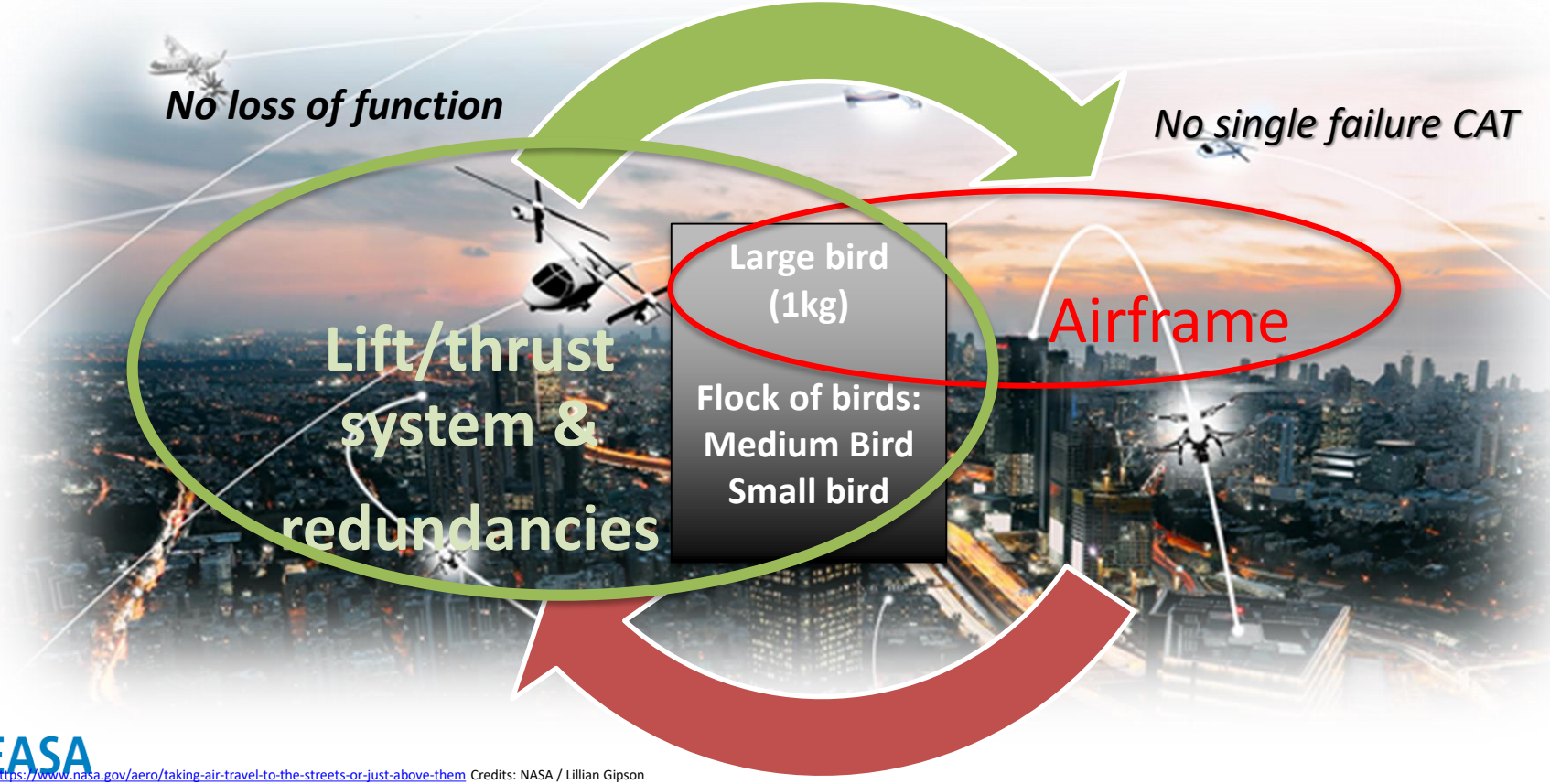
VTOL with maximum speed ≤ 50kts

VTOL protection -Hazard analysis



Bird strike assessment required at the speed corresponding to the most flight critical configurations
Compliance demonstrated by test or by analysis if correlated by representative tests.

Consistent approach-Bird size

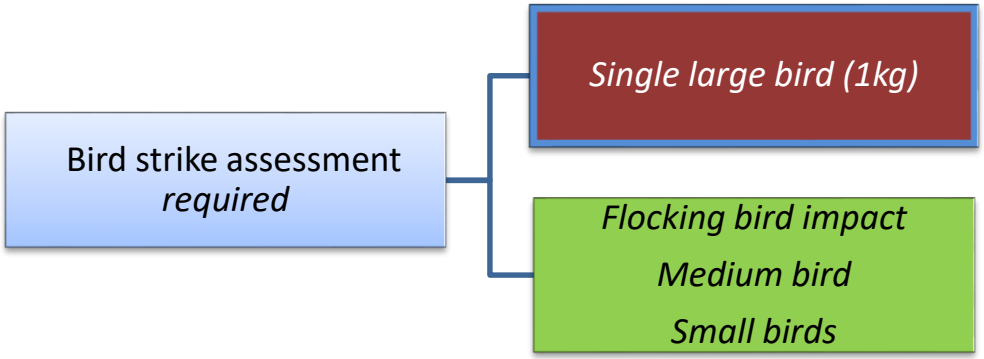


Source: https://www.nasa.gov/aero/taking-air-travel-to-the-streets-or-just-above-them Credits: NASA / Lillian Gipson

Consistent approach for Lift/thust systems & redundancies

Objective: To address the ingestion of large, medium and small birds, and also the effect of the impact of such birds upon the lift/thrust system and redundancies

Example: Control surface activated by redundant actuators



CSFL/CEL

CSFL/CEL, No loss of function

No loss of function

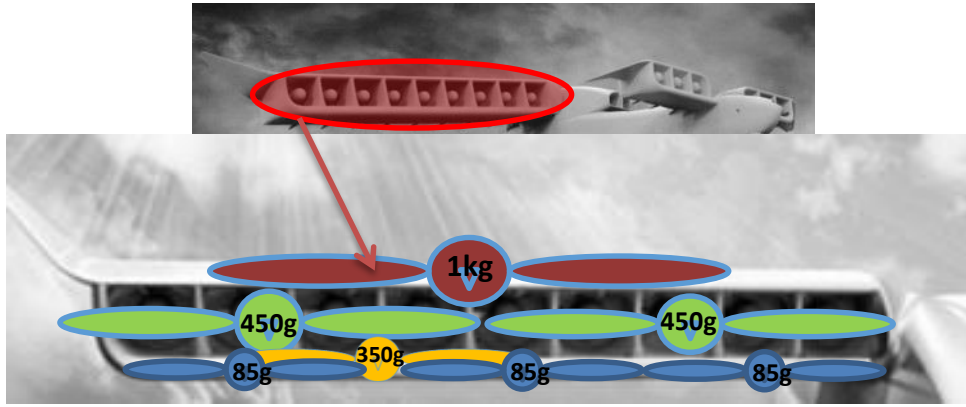
Flocking bird impact: Conservative approach

No loss of function of the element impacted after a single impact with a medium sized bird of 0.450 kg.

Alternative approach

Example: **Lift/thrust system**

Scenarios evaluating multiple bird impacts distributed across each structure or system can be proposed by the applicant considering medium birds (see table A) and small birds by analogy to CS E-800 approach
(Guidance in AMC SC-VTOL.2400 (c) &AMC – EHPS.290*)



CSFL/CEL, No loss of function

CS 27/29

CS23

CS25

Thrust and lift system inlet area (A) m2	Number of birds x mass of birds kg
A < 0·05	none
0·05 ≤ A < 0·10	1 x 0·35
0·10 ≤ A < 0·20	1 x 0·45
0·20 ≤ A < 0·40	2 x 0·45
0·40 ≤ A < 0·60	2 x 0·70
0·60 ≤ A < 1·00	3 x 0·70
1·00 ≤ A < 1·35	4 x 0·70

Table A-Medium birds

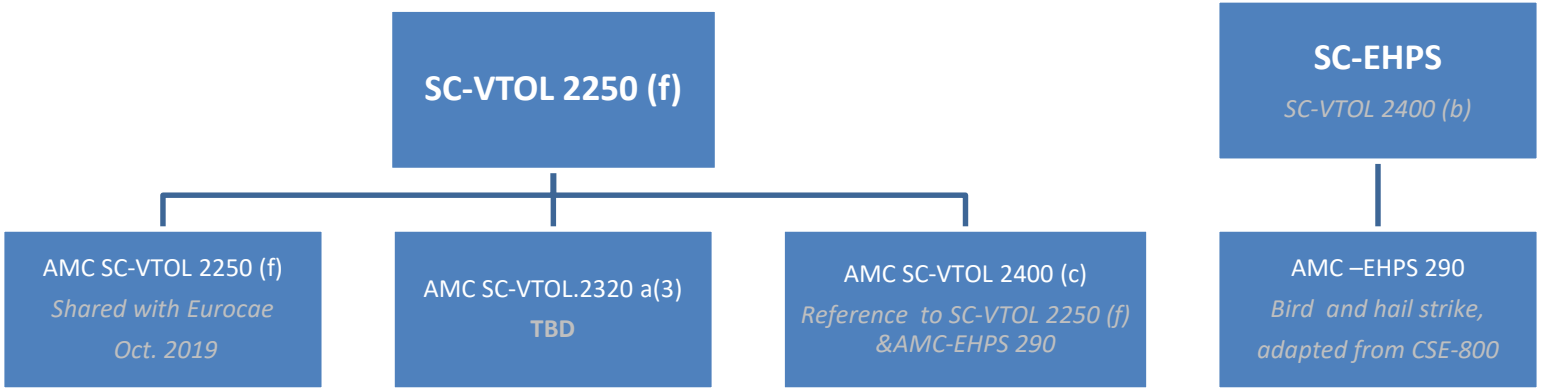
EASA *see next slide

Source: https://www.slashgear.com/darpa-vtol-x-plane-moves-into-phase-2-design-with-aurora-flight-sciences-04430277/

Conclusion

The AMC SC.VTOL2250(f) on Bird strike requirement benefit from the experience gathered on manned aircraft certifications and is tailored to address VTOL specificities, including a consistent approach between the Airframe and Lift/thrust systems.

SC and AMC chart



SC : Special condition, AMC: Accepted Means of compliance, EHPS: Electrical Hybrid Propulsion System

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Thank you
Any further question?

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