Aircraft Type Certification considerations

Urban Air Mobility

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Sample Applicant – Air Taxi, Inc.

- Commercial Air Taxi Service
- Optionally Piloted Aircraft (OPA)
- VTOL and Wing Borne Flight Capability
- Distributed Electric Propulsion System
- Fly by Wire Flight Control
- Up to Four Passengers
- 120 Knot Cruise Speed
- Composite Fuselage
Regulator Interest

FAA Internal Study
May 2012

- Historical review
- Technology survey
- Gap analysis

“While still in the early stages, electric aircraft could become viable for use by the general public within the next five to ten years.”
Certification Option

- **Part 23**
  - Airplane Category
    - Newly reconfigured allowing more flexibility for new technology

- **Part 27**
  - Rotorcraft Category
    - Prescriptive requirements based on traditional helicopters

- **Part 21.17(b)**
  - Special Class - for nonconventional aircraft
    - For which airworthiness standards have not been issued
At least three TC projects underway

- Ranging from 10 lb. to 6,000 lb.
- Manned and Unmanned

TC process for electric propulsion system (Part 33, 35, etc.) needs to be determined

- Certify EPU as part of aircraft TC under 21.17(b) Special Class
OPA considered Unmanned (UAS) for purpose of earning a Type Certificate (TC).

FAA Aircraft Certification Office (ACO) is gateway.

UAS TC process starts with aircraft description and concept of operations.

UAS over 55 lbs. follow same airworthiness requirements as manned aircraft, as applicable, under Part 23, 27, 33, 61, etc.

UAS safety mitigations through Operational Risk Assessment on BVLOS, see & avoid, comm. failure, lost link, etc.
UAS Type Certification

§ 21.17(b) UAS Process Flow (DRAFT)

STAGE 1
- Start
- Operation 1.1
- Product 1.2

STAGE 2A
- Risk Class Classification
  - Kinetic Energy based (UAS AC 21.17(b), RC 1-6 2.0)
- AEH DAL (A-E)
  - Risk Class Based (UAS AC 21.17(b)) 2.1
- Basic Design Requirements
  - Risk Class Based (UAS AC 21.17(b)) 2.2

STAGE 2B
- Basic Equipage Design Requirements to Mitigate
  - 14 CFR Part 91 2.3

STAGE 3
- Define Risk 3.0
- Risk Acceptable?
  - NO
    - How to Mitigation
    - Develop Requirements
      - Existing Rules/Orders/ACs
      - Federal registry and public comments 3.4
      - Federal registry and public comments 3.5
      - Publication of Special Condition Certification Basis 3.6
    - End Issue Type Certificate
  - YES
    - Human Hazard Risk Assessment 3.1
    - Document "No Human Hazard Safety Impact Statement 3.2

Acronyms & Abbreviations
- AC: Advisory Circular
- AEH: Airborne Electronic Hardware
- DAL: Design Assurance Level
- RC: Risk Class
- UAS: Unmanned Aircraft Systems

Product Re-Design or Operational Revisions
FAA - Safety Continuum

- Level Of Cert Rigor
  - Part 25 Transport Category Passenger Aircraft & UAS Risk Class 6
  - Society’s Demand for Safe Outcomes
  - Large Part 25 Business Jets
  - Part 23 Commuter Aircraft & UAS Risk Class 6
  - Part 23 Business Jets
  - Part 23 Light Jets, Twins, & UAS Risk Class 5
  - Part 23 Single Engine & UAS Risk Class 4
  - Light Sport Aircraft & UAS Risk Class 3
  - Amateur Built
  - sUAS Risk Class 1&2
  - Models
  - Societally Accepted Risk & Desire for Low Cost

Zero Risk
No Operations
No Innovation
Aircraft category

- FAA ORDER 8000.71 – “Hybrid Lift denotes a heavier-than-air aircraft that is supported at vertical takeoff, vertical landing, and low-speed flight by the dynamic reaction of the air against its rotors or thrust and in horizontal flight by the dynamic reactions of air against its wings (i.e., the tilt-rotor aircraft).”

Safety requirements 21.17(b)

- Part 23 – Wing borne aspects
- Part 27 – VTOL aspects
- Part 33 – Propulsion
- Part 61 – Noise

Risk Class

Software design assurance level (DAL)
Means of Compliance

- *Means of Compliance* – A detailed design standard that, if met, accomplishes the safety intent of the regulation.

- Existing regulatory language

- Industry consensus standard

- Applicant proposal
Electric propulsion certification under FAR Part 33/EASA CS-E/CS-22

- Needs overhaul like Part 23/CS-23
- Means of Compliance –
  - Design under ASTM F39.05 (WK47374)
  - Integration under ASTM F44.40 (WK41136)
  - Propulsion energy storage systems (ESS) under ASTM F39.05 (WK56255)
Means of Compliance for FAR 33/CS-E

Basic design first
- Motor, controllers, disconnects and wiring and monitoring gauges and meters.

54 Stakeholders – FAA, EASA, NASA, industry

Weekly telecons, 38 drafts so far...

Will Support Current Applicants

End Goal – Rewrite of FAR33/CS-E
Current requirements for verbal communication and see & avoid
  ▪ Pilot in cockpit
  ▪ Virtual pilot (RPAS)
  ▪ Alternate means

Community noise and over-flight sensitivity

Available landing areas, turn around speed

Dense traffic in urban areas
Food for Thought

- What are the highest hurdles for UAM?
  - Aircraft Certification
  - Access to the NAS
  - Landing Areas

- What will gain public acceptance the fastest?

- Can there be certification options for UAM that are less burdensome?
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Thank you