UAS Type Certification

Durability & Reliability Means of Compliance

Presented to:  ASTM F38

By:  James D Foltz  
Manager, Programs & Procedures  
Policy & Innovation Division  
Aircraft Certification Service

Date:  November 2019

Federal Aviation Administration
Type Certification

• Title 49 U.S.C. § 44701 directs the FAA to promote safety of flight of civil aircraft by prescribing minimum standards
• Our current process and requirements have been developed over the course of more than 50 years of certification experience
• Reflects decades of aviation lessons learned
  – Accidents
  – Incidents
• Type certification is an enabler for more complex UAS operations beyond part 107
Managing Risk for UAS

• Certification manages risk through “Safety Assurance”
  – Confidence a proposed product or action will meet FAA safety expectations to protect the public
  – FAA risk-based processes are well-proven

• Certification is an acknowledgement that FAA requirements are met for:
  – Aircraft, Aeronautical Products, Airmen, Mechanics, Controllers, Operators, etc.
UAS Type Certification Evolution

• UAS TC projects have been in work since 2013
• It’s been a continual learning process and evolution
  – FAA has moved to performance-based requirements like 14 CFR part 23 Amendment 64
  – Have had 2 major revisions of draft UAS TC AC
  – Challenges in defining certification basis and MoC’s
  – Although no §21.17(b) UAS TC’s have been issued, multiple projects have progressed to have airworthiness criteria published in the Federal Register
What is the Durability & Reliability MoC?

• At the FAA UAS Symposium in June, AIR discussed a framework for utilizing reliability as a means of compliance for the certification of smaller UAS
  – Means of Compliance have evolved through decades of type certification
  – Reliability demonstrations were once heavily utilized
  – Utilizing analysis and other techniques became more efficient and cost effective for manned aviation
  – For smaller UAS, reliability as a MoC is an effective way to demonstrate compliance
Overarching Principles

- UAS Type Certification remains under §21.17(b)
- No exemptions to 14 CFR Part 21 required
- Production Certificate will be required
- This effort will help inform the Part 21 Update Rulemaking Effort
Means of Compliance

- For smaller UAS, reliability as a MoC is an effective way to demonstrate compliance
- We’ve had many applicants request to utilize reliability as means of compliance for TC’s and 107 waivers
- D&R MoC utilizes verification & validation versus traditional $10^{-X}$ probabilities
A Safety Continuum

- MoC requirements and FAA oversight commensurate to risk
- D&R MoC has broader applicability to smaller UAS
- Larger, higher risk UAS will utilize traditional manned certification requirements as appropriate
3 Elements of D&R MoC

**Durability & Reliability Demonstration**
- Demonstrating UAS reliability commensurate with risk through testing
- Test cycles representative of end state conditions

**Likely Failure & Specific Demonstration Tests**
- Induced failures and specific tests where operationally-representative cycles alone may not provide sufficient detail

**Design Requirements Checklist**
- Design requirements to mitigate additional hazards that cannot be mitigated by test alone
Industry Consensus Standards in D&R MoC

- The D&R MoC invokes several industry consensus standards, including those by ASTM F38
  - F3322-18 - Standard Specification for Small Unmanned Aircraft System (sUAS) Parachutes
Testing Requirements – D&R MoC

- MoC specifies specific test objectives, required criteria, and evaluation criteria must be met.
- To meet requirements, applicants develop own test plans and test cards.
- An industry consensus standard for a test plan/test cards to meet the objectives of the MoC would be a SIGNIFICANT help for applicants.
Performance Based Airworthiness Criteria

• D&R MoC used to show compliance to airworthiness criteria
• Performance based airworthiness criteria developed in conjunction with D&R MoC
  – Performance based requirements allow for greater agility in accommodating innovation and new technologies
Increasing Levels of Prescription & Detail

Airworthiness Criteria
• Performance based requirements – establishes outcomes that must be achieved; allows flexibility in how the applicant or approval holder achieves the outcomes

Durability & Reliability MoC
• Specifies specific test objectives, required criteria, and evaluation criteria must be met

Industry Consensus Standard
• Test plan/test cards providing technical details to meet the D&R MoC test objectives, required criteria, and evaluation criteria
• An example could be useful
Status of D&R MoC

- FAA is utilizing this methodology with applicants now
  - Including package delivery companies
- Working on expanding the methodology to encompass more design features
- Long-term plan is to publish airworthiness criteria and MoC in Advisory Circulars
  - Would like to recognize additional industry consensus standards in AC’s
Questions?
TCCA Regulatory Update

Nov. 6 2019
ASTM F.38 Fall Plenary
What have we done?
CAR Part IX Operational

- Scope: RPAS with MTOW <25 kg operating VLOS below 400ft;
  - Equivalent of FAR 107 + Over People;
- Requires registration of RPAS with TCCA;
- Two Operational Categories: Basic & Advanced:
  - Each has independent licensing and training requirements; and
  - Advanced has additional operational responsibilities and requires RPAS with a Manufacturer’s Declaration.
- Advanced Operations are those in controlled airspace, near people not associated with the operation, and over people not associated with the operation;
Part IX Manufacturer Declarations

• Declarations required for Advanced operations;
• Declarations identify manufacturers who have Declared their RPAS capable of meeting the technical requirements in CAR Standard 922:
  • Performance based standard identifying system level Safety Objectives;
• Part IX Div VI identifies the responsibilities of Manufacturers who have made Self-Declarations.
• AC 922-001 identifies means of compliance to safety objectives and Div VI requirements (previously provided to F38 via e-mail).
• Multiple ASTM standards identified as MoC for various requirements in Appendix A of the AC.
Special Flight Operational Certificates (SFOCs)

- For operations outside of VLOS, MTOW >25 kg, or above 400 ft an operator must apply for an SFOC.
- Foreign operators must apply for SFOCs.
- RPAS Centre of Excellence in each region process applications.
Operational Risk Assessment (ORA)

• Applying for BVLOS or operations with RPA >25 kg requires an operational risk assessment to be completed;

• Draft advisory circular AC 903-001 provides TCCAs interpretation of an acceptable ORA process (previously sent to F38 via e-mail):
  • Based on the JARUS SORA principles tailored for Canadian context;
  • Approving routine BVLOS operations via this methodology.

We want to Improve! Send us your comments on the ACs!

TC.RPASInfo-InfoSATP.TC@tc.gc.ca
sRPAS Operations in Canada

- **48,930** accounts created.
- **561** accounts are associated with Flight Reviewers.
- **139** Declared RPAS. 99% Controlled Airspace, 68% Near People, 35% Over People.
- **14** Declarations for RPAS modifications.
- **~5000** SFOCs either issued or in processing.

**Drones Registered by Month**

**Total Drones Registered: 35,686**
Where are we going?
RPAS Traffic Management

• RPAS Traffic Management Action Team is driving the Canadian approach to integration
  • Industry and Government group chaired by TCCA and NAV CANADA.

• Canada is adopting a risk-based multi-phased approach to traffic management using the SORA model established by JARUS
  • Provides risking methodology for Airspace Encounter Categories (AEC)
  • Sets minimum technical requirements for performance levels within each AEC

• 12 AECs identified in the SORA though only 10 apply to Canadian airspace

• Canada has organized the 10 AECs into three groups called Operational Settings based on use cases – Urban, Rural and Airport
  • Operational Settings encompass almost all the relevant AECs for Canada

• Establishing supporting services for these AECs will advance the system toward full integration with ATM
AEC Associated Performance Levels

AEC 12

AEC 11, 10 and 5

AEC 6, 4 and 3

AEC 9, 2 and 1

Performance Level 0-1 (Optional-Low)

Performance Level 2 (Medium)

Performance Level 3 (Med-High)

Performance Level 4 (High)
RPAS Traffic Management - Notional Services

- Registration/Remote ID
  - Registration
  - Remote Identification
  - Access to Op Private Information

- Flight Preparation
  - Requests, Authorizations and Directives
  - Aeronautical Information
  - Supplementary Information
  - Flight Planning
  - Geo-Fencing
  - Strategic Conflict Resolution

- Surveillance/Tracking
  - Situational Awareness
  - Activity Reporting
  - Surveillance Information
  - Real-time Positioning/Tracking
  - Conformance Monitoring

- Contingency Management
  - Emergency Reporting
  - Notifications/Alerts/Warnings
  - Incident/Accident Reporting
  - Authorization Change
  - Dynamic Geo-Fencing

- Flight/Conflict Management
  - Traffic Information
  - Conflict Advisories
  - Capacity Management
  - Navigation
  - Dynamic Conflict Resolution
  - Dynamic Rerouting

- Communications
  - Comms Service & Monitoring
  - Control Comms
  - Automation Mgmt
  - Interface with ATM

* Performance Level (PL) depends on the degree at which the service is being provided
In support of industry research, TC authorized the operation of two test ranges, and created research and development priorities to help guide private sector investment.

Publication of regulations for small RPAS, 25 kilograms or less, operated VLOS.

Creation of two test ranges for R&D.

Pilot projects for public safety organizations, pipeline surveys and drone delivery concepts.

Increased international presence in standards making forums like the International Civil Aviation Organization (ICAO), the Joint Authority for Rulemaking of Unmanned Systems (JARUS), RTCA, and ASTM International.

Plan to accelerate regulatory development for BVLOS operations in Canada.

Creation of seven research and development priorities to help guide private sector investment and dialogue.

Increased bilateral dialogue on how to certify advanced systems.
Standards Priorities

Challenge: How can we improve our guidance material to recognize industry best practices?

- VLOS:
  - Remote ID;
  - Design and Construction;
- BVLOS:
  - Traffic Management;
  - Design and Construction;
  - DAA; and
  - Autonomous systems.
Questions?
ASTM TCCA Team members

• F38.01 Airworthiness:
  • Craig Bloch-Hansen (UTM);
  • Tom Hastie (D&C); and
  • Paul McKay (DAA).

• F38.02 Operations:
  • Craig Bloch-Hansen (Autonomy); and
  • Olivier Bellehumeur-Genier (BVLOS).

• F38.03 Personnel:
  • Craig Bloch-Hansen