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UAS Maintenance: A Critical Component in Maintaining Airworthiness

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Maintenance is a critical component in maintaining airworthiness, which in turn, impacts safety

- Statement of the Problem
- Literature Review
- Inadequacies and Gaps in Current Requirements
- Conclusions and Recommendations

Statement of the Problem

- The issue of maintenance for sUAS and particularly scheduled maintenance is not well understood
- A qualitative exploratory research approach in the form of a literature review and corresponding gap analysis was completed to gain insight into the question of the need for formalized sUAS maintenance procedures.
- The effort was completed through an examination of the current information available from regulators, original equipment manufacturers (OEMs) and owner/operators to gain insight into whether gaps exist in some of these efforts, namely the requirement for a scheduled maintenance program.

Literature Review

- Current Legislation for Maintaining Airworthiness – Manned vs. Unmanned
- Importance of Scheduled Maintenance Programs
- Role of Component Reliability Data
- Current Incident and Accident Data Reporting Methods
- Operational Commonalities and Differences

Current Legislation for Maintaining Airworthiness – Manned vs. Unmanned

Small Unmanned

- Recreational/hobby use: Special Rule for Model Aircraft Section 336 (adhere to community-based safety guidelines; Academy of Model Aeronautics (AMA)
- Recreational/commercial use: Remote Pilot Certificate, operate under Title 14 CFR, Part 107

Manned

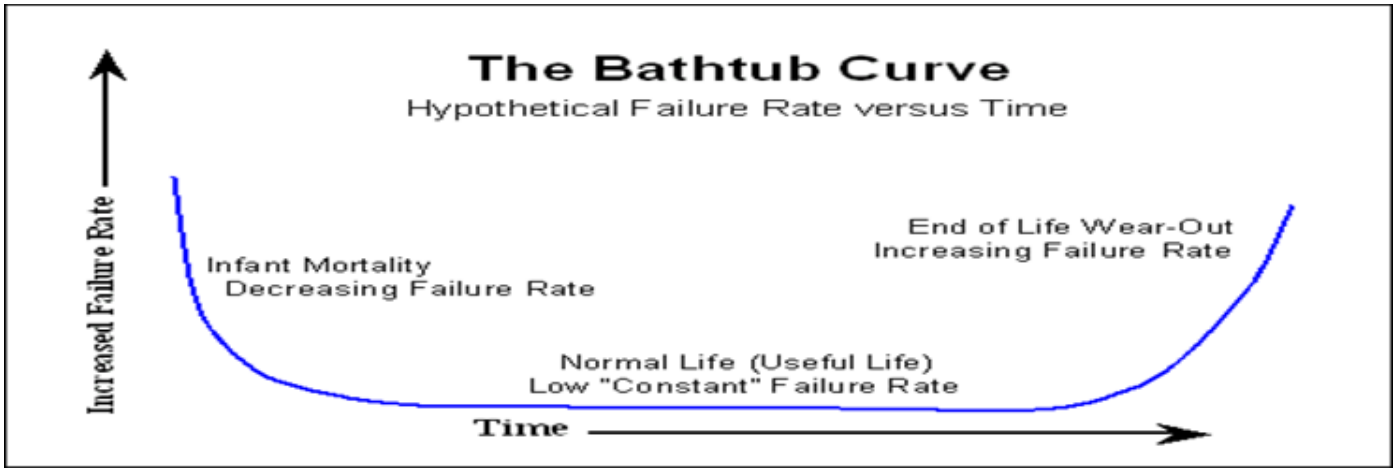
- To operate a manned aircraft in the National Airspace System (NAS) a certificate of airworthiness is required
- Effective as long as required and preventive maintenance are performed in accordance with Title 14 CFR, Parts 43 and 91

The Importance of Scheduled Maintenance Programs

- Required to maintain airworthiness
- CFR Title 14 does not prescribe specific maintenance activities; the regulations require operators to develop a maintenance program according to Original Equipment Manufacturer (OEM) information and Maintenance Steering Group 3 (MSG-3) guidance provided in FAA AC 121-22C
- Evolved from fix-and-fly to a preventative approach; Maintenance Steering Group (MSG) process [manufacturers, operators, suppliers, and the FAA]

The Role of Component Reliability Data

- Data has driven manned aircraft maintenance actions from a fly-fix-fly approach to the component that operates for years between repairs or replacement. The bathtub curve below provides a typical representation of the results of the data collected over time for a part or component.



Current Incident and Accident Data Reporting Methods – Manned Aircraft

- Estimates of component reliability depend upon predictive data as well as historical data from failure rates (accident and incident data). OEMs of manned aircraft provide predictive data for maintenance, but OEMs of sUAS generally do not, either because failure data is not available, or because competitive pressures discourage disclosure of this information.
- Manned aircraft pilots are required to report accidents to the NTSB and the FAA. These reports result in safety bulletins, recommendations, new regulations, or Airworthiness Directives (which improve overall safety).
- Voluntary reporting of regulatory violations or other occurrences that could impact safety: NASA's Aviation Safety Reporting System (ASRS).

Current Incident and Accident Data Reporting Methods – Unmanned Aircraft

- UAS operators must report mishaps that result in serious injury, death, or substantial damage to a manned aircraft to the NTSB.
- UAS operators must also report any serious injury, loss of consciousness, or damage to property in excess of $500 to the FAA.
- However, battery fire, lost link, fly-away of the vehicle or total destruction does not have to be reported
- 2017 report published by the FAA (August 2015 to January 2016), 519 incidents involving unmanned aircraft were reported. 36.2% could be classified as close encounters, or an instance where a pilot declared a “near midair collision”, while 63.8% were sightings or incidents where an unmanned aircraft was within sight of the pilot, but did not pose an immediate threat
- Growth in demand for sUAS could compromise safety

Operational Commonalities and Differences

- In spite of shared airspace, design and manufacturing standards, aircraft systems, and maintenance tasks all differ considerably between manned and unmanned aircraft. These differences affect UAS maintenance and airworthiness, which may in turn affect safety.
- Unlike manned aircraft, at this time there are no design and manufacturing standards or requirements for small UAS (Ley, 2016).
- While there are proposed maintenance requirements for sUAS that are intended to establish some baseline for continued airworthiness and maintenance (ASTM F2909-14; Ley 2016), none are explicitly required by the FAA.
- sUAS maintenance includes hardware, software, and firmware issues. Updates do not follow same process with manned aircraft (avionics)

Inadequacies and Gaps in Current Requirements

- The lack of design and manufacturing standards, the absence of continuing airworthiness requirements, and the requirements for subsystems that have not been proven in manned aviation has implications for safety.
- Accident and incident data related to unmanned aircraft, combined with the growth of the unmanned industry, further support the need for an established maintenance program framework.
- The inclusion of component reliability data in this process utilizes established measures which have been validated by the manned aviation industry. Such a program supports operational efficiency, reliability, and safety.

Conclusions and Recommendations

- Consolidated incident/accident data repository which provides more accurate component reliability information: Aviation Safety Information Analysis and Sharing (ASIAS) repository, would provide an optimal opportunity to consolidate critical information (FAA sighting reports, Section 333 exemptions, and Maintenance & Repair (M&R) information).
- Require OEMs to assist in the development of maintenance planning documents: An industry steering committee (ISC) that is made up of operators, manufacturers and regulators, work together to follow AC-121-22C (MSG-3) and create a scheduled maintenance program, culminating in the maintenance review board report (MRBR) which is the basis of the MPD.
- Extend FAA scheduled maintenance activities for unmanned aviation: Current regulations only require sUAS operators and remote pilots to maintain airworthiness. That state of airworthiness is left up to the operator and as such, is completely subjective based on the knowledge of the operator.

QUESTIONS?

References

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