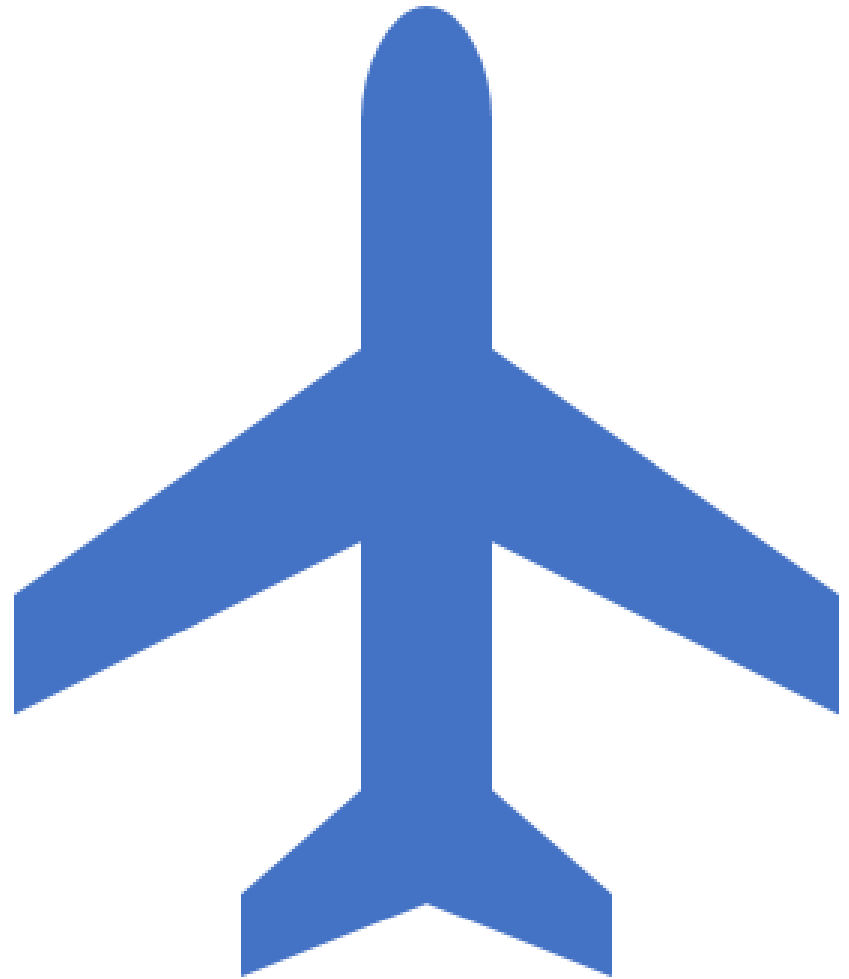


Research, Engineering and
Development Advisory
Committee


Subcommittee Report - Aircraft Safety (SAS)

Terry McVenes, SAS Chair
April 14, 2022



SAS Meeting March 1-2, 2022 Agenda

- SAS Membership Discussion
- Overview of August 2021 F&Rs
- Update on FY2024 Portfolio/Revised Process
- Domain Portfolio – 11 Budget Line Items
 - Aircraft Safety Assurance (4)
 - Digital Systems and Technology (1)
 - Environment and Weather Impact Mitigation (2)
 - Human and Aeromedical Factors (2)
 - Aviation Performance and Planning (2)
- FAA Budget Update – Beth Delarosby
- AFWWERX Agility Prime and Dual Use Aviation Technology – Tom Meagher, Lt. Col., USAF
- SAS Member Presentations
 - Aviation Cybersecurity - Dan Diessner
 - Physiology Monitoring of Aircrew for Prediction and Detection of Performance Impairment – Dr. John Crowley
 - Insights in the AAM – Greg Bowles
 - Update on Boeing's Perspective on Aviation Technology Trends

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SAS Meeting March 1-2, 2022 General Comments

- First Meeting of our Expanded SAS Industry Membership
- First Use of SAS Input Template
 - Read Ahead Material Provided to SAS Members
 - FAA Training for SAS Members

Finding #1 – AI and ML Research

- Ongoing industry research has a need for regulatory guidance on the use of these technologies in a safety critical context
- FY2022-FY2027 Research Plan only funds two AI/ML research activities in FY2024 and two AI/ML research activities are unfunded
- SAS agrees that research results are needed by FY2025 or sooner
- No roadmap for the publishing of regulatory guidance on AI/ML
 - Benefits for safety critical applications
 - Evidence needed to ensure intended function is performed

Recommendation # 1

- The SAS recommends FAA prepare and publish a phased roadmap for AI/ML research and development required to formulate AI/ML regulatory guidance.
- The AI/ML roadmap should inform industry on the sequence in which the FAA plans to release regulatory guidance on methods and procedures to (1) certify systems of various Design Assurance Levels (criticality), (2) certify AI/ML based on various types and sources of AI/ML training and testing data, and (3) procedures for updating AI/ML models in previously certified systems based on updated training and testing data sets.
- The REDAC SAS recommends that the FAA consider the ***Integration of Civil Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) Roadmap, Appendix A: UAS Integration Research & Development Plan*** as a template to following in developing an AI/ML Research & Development Plan.

Recommendation # 2

- The REDAC SAS recommends that the FAA place a priority on continuing to make points of contact/ government authorized representatives available to participate in AI/ML standards developing organizations activities, such as SAE G-34 /EUROCAE WG-114, Artificial Intelligence in Aviation, to facilitate a more rapid exchange of information on AI/ML technologies and related-certification issues between the FAA, industry, and academia.
- It is further recommended the FAA continue its strong collaboration with the DARPA Assured Autonomy and Air Force Agility Prime programs.

Recommendation # 3

- The REDAC SAS recommends that the FAA include in its research on how run-time assurance methodologies can be certified and used in conjunction with AI/ML assurance to ensure safety.

Finding #2 – Aeromedical Research on Fatigue

- REDAC SAS notes that the FAA is conducting valuable aeromedical research into genes and genetic markers as they relate to fatigue states and postmortem analysis
- Industry and the DoD are conducting research into the safety and operational value of sensors (wearables and others) and technology to predict and monitor pilot fatigue, workload, incapacitation, and other indications of human performance.
- Industry is also researching the use of sensors in the cockpit to assess pilot fatigue, drowsiness, and sleep conditions.
- These technological advances have the potential to dramatically enhance safety in aspects of civil aviation
- FAA research into pilot state monitoring and interrelated changes to cockpit automation technologies which may affect aircraft automation and control, should inform the development of appropriate flight standards.

Recommendation # 4

- The REDAC SAS recommends that FAA Aeromedical, Human Factors, and Flight Standards regulators and researchers develop a joint RE&D plan together with industry and additional relevant U.S. Government agencies to address the introduction of pilot state monitoring technologies, related decision-making algorithms, and automation technologies into the cockpit.
- The plan should include the development of flight standards and airworthiness criteria for these AI-based and other safety enhancing systems, which will interact with pilots' physiology and psychology during flight in new and potentially intrusive ways.
- The research should determine the potential benefits, as well as possible hazards of pilot state monitoring and related cockpit automation technologies, and potential effects on current regulatory requirements for flight and duty times, crew operations, and crew complement.

Finding #3 – Digital System Safety: Software Development

- Challenges of balancing the complexity of innovative technologies with the ability of traditional software development processes to validate the safety designs and implementation of those technologies.
- Unclear if focus of future research is on the development of new software processes or if it is focused on the evaluation of architectural performance and results.
- SAS agrees that further research is required to develop alternative means of software assurance for the lower end of the safety continuum. There may be platforms where this may or may not be acceptable based on the risk criteria of the operations.
- Identifying specific use cases would be beneficial to ensure the usability or applicability of any alternative means of assurance so that applicants design their software to meet the appropriate levels of compliance.

Finding #3 – Digital System Safety: Software Development

- The SAS further finds that the identified research output of developing a new mechanism to map risks and development approaches is unclear in the context of currently issued FAA software assurance guidelines for durability and reliability means of compliance and airworthiness for categories 1 and 2.
- This current FAA guidance coupled with on-going software standards development activities which are scheduled to be completed in 2023, makes it uncertain as to timing of this research activity that is not programmed until FY2024.
- More recognized and supportive software performance standards currently in development will be enhanced by FAA research into new and novel methodologies.

Recommendation # 5

- The REDAC SAS recommends that the FAA more clearly defines the focus and applications of this research output in terms of software development, hardware evaluations of performance, validation and verification of complex systems, platform applicability.

Recommendation # 6

- The REDAC SAS recommends that this research activity be conducted before FY2024 so that the results can influence current FAA certification guidance and industry software development standards work that is already in progress.

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SAS Meeting March 1-2, 2022 Final Comments

- Expanded SAS Industry Membership is Yielding Results
 - Broader technical expertise
 - Enhanced quality of our F&Rs
 - 2 additional members
- Input Template
 - Positively received by the SAS
 - >200 records received by FAA
 - Positively received by FAA in starting their FY2025 R&D planning development cycle

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SAS Meeting

Next Meeting:

August 9-10, 2022

FAA Tech Center

February 28-March 1, 2023

RTCA Headquarters

Questions?