RTCA

Research, Engineering and Development Advisory Committee

Subcommittee Report – Aircraft Safety (SAS)

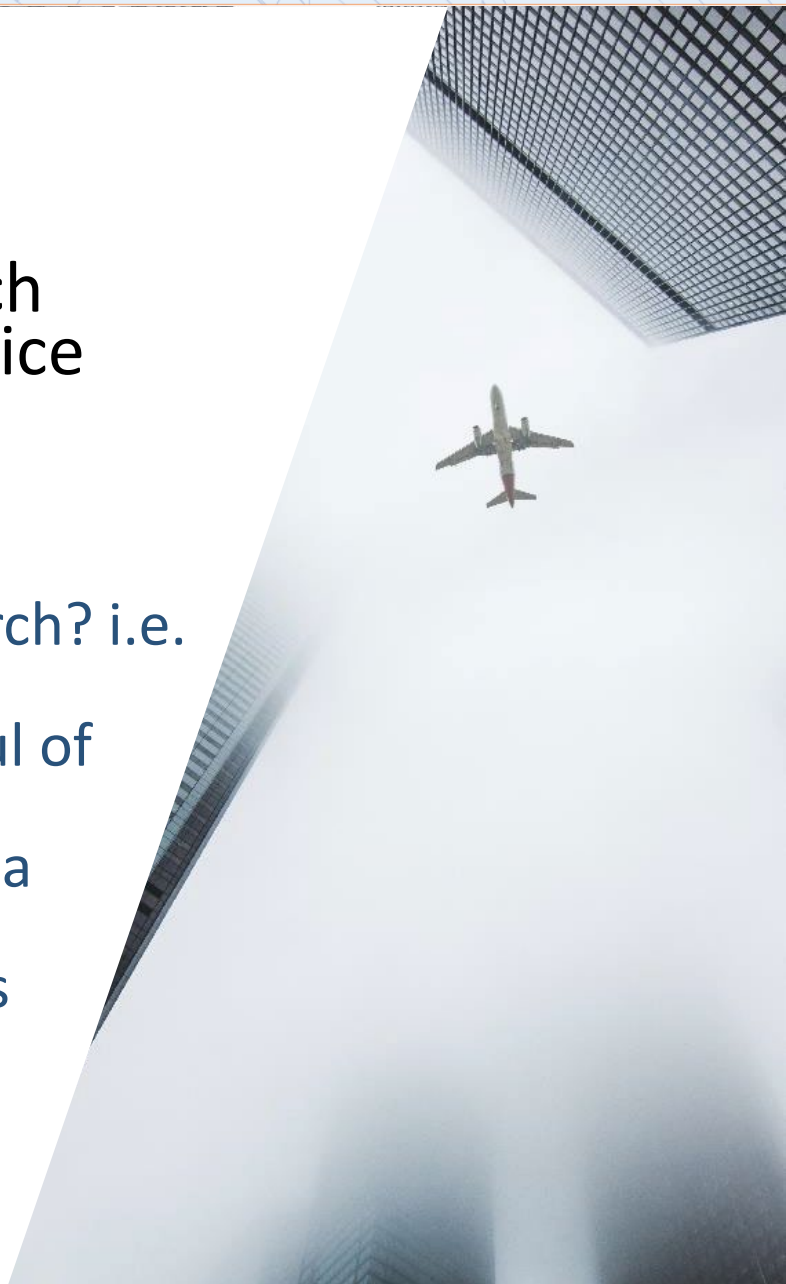
Terry McVenes, SAS Chair

April 12, 2023

SAS Meeting 28Feb-01Mar 2023 Agenda

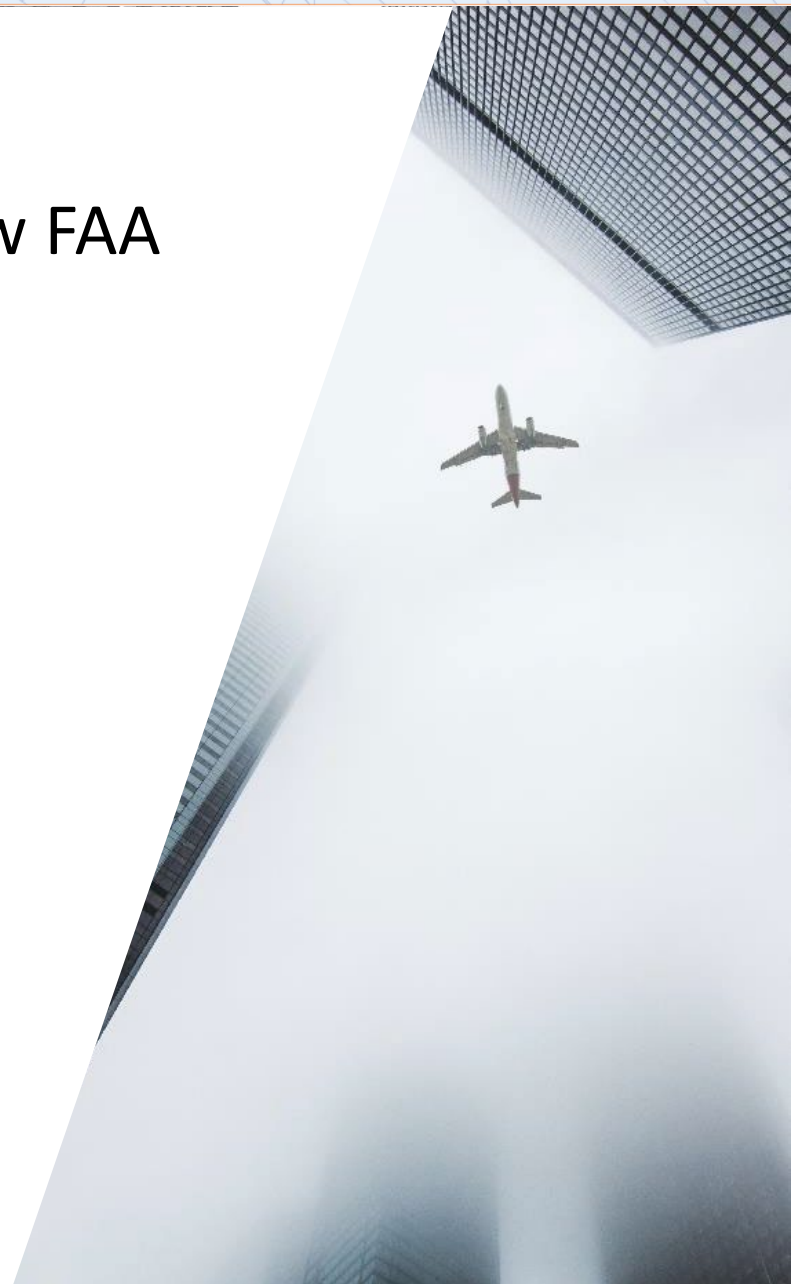
- Hybrid – Virtual/In-Person at RTCA HQ

- February 27 - Discussion: Aircraft Certification Research Strategy – Bruce DeCleene – Aircraft Certification Service
  - Organizational Goals
  - Research Goals
  - Technology Certification Readiness
  - What are the characteristics of effective or impactful research? i.e. How would you define success?
  - What industry and technology trends should FAA be mindful of when developing a research strategy for aircraft?
  - What research objectives would you like to see reflected in a research strategy for aircraft?
  - How do you see the REDAC SAS committee engaging on this research strategy going forward?



SAS Meeting 28Feb-01Mar 2023 Agenda

- Overview of August 2022 F&Rs
- Phased Roadmap for AI & ML - Dr. Trung T. Pham (new FAA Chief Scientist & Technical Advisory in AI/ML)
- Update on FY2025 Portfolio Revised Process
- FAA Budget Update - Beth Delarosby
- Review of FY2025 Portfolio Domains
  - Aircraft Safety Assurance
  - Digital Systems and Technologies
  - Environmental and Weather Impact Mitigation
  - Human and Aeromedical Factors
  - Aviation Performance and Planning



SAS General Observations, Findings & Recommendations

- Two (2) General Observations

- Four (4) Findings and Recommendations
  - Wearable Sensors and Aircraft Automation Technology
  - Cyber Resiliency for Digital Safety Systems
  - Use of Digital Twins for the Development and Lifecycle Support of Aircraft Systems
  - Hydrogen Powered Propulsion

SAS General Observations

- Appreciation for the FAA's follow-up action on our previous F&Rs on the development of an AI/ML roadmap
  - Hiring of Dr. Trung T. Pham – Chief Scientific and Technical Advisor (CSTA) for Artifical Intelligence
- Value of receiving read ahead material and early pre-meetings

Finding #1 - Wearable Sensors and Aircraft Automation Technology

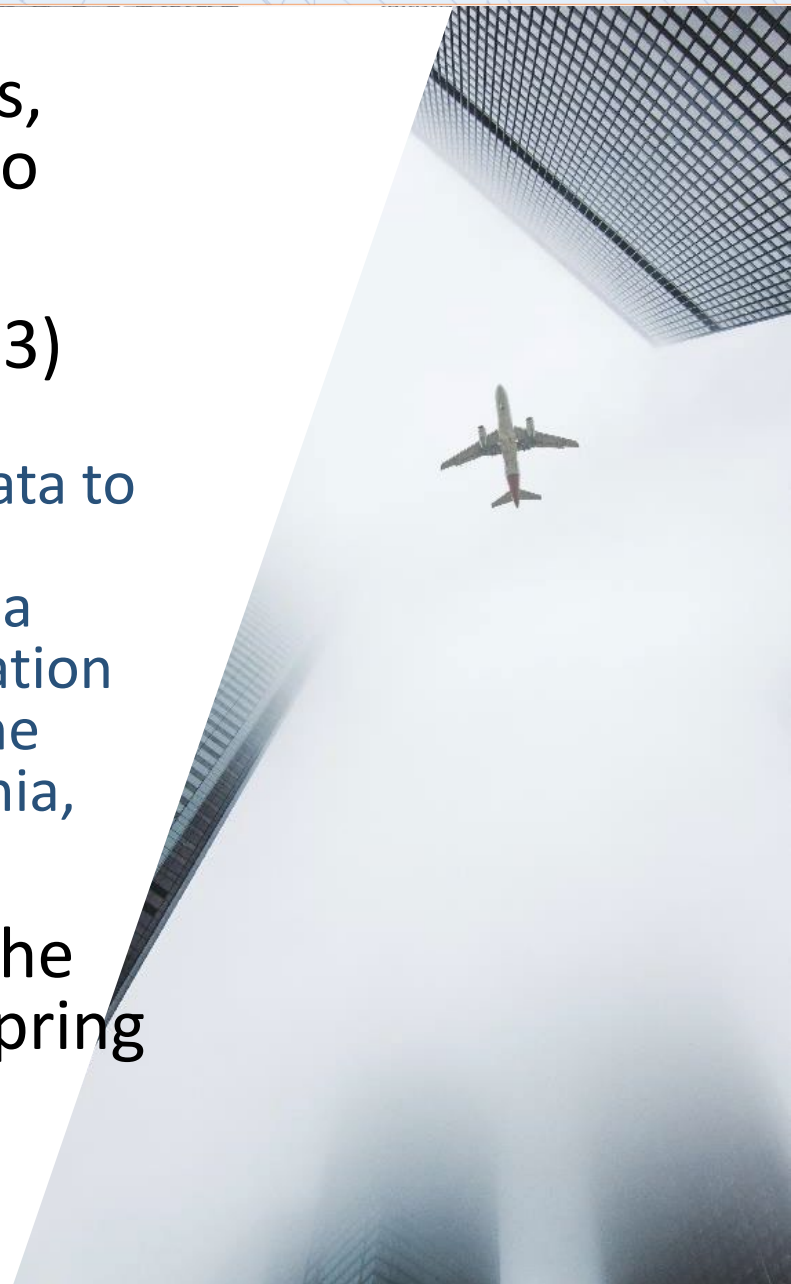
- Various applications of new technologies – research gaps

- Pilot performance monitoring and pilot health monitoring
  - Potential for detection and prediction of degraded performance
  - Allow pilot to safely return to cockpit with a variety of medical conditions

- Bring together aeromedical, human factors, aircraft certification and other related stakeholders
  - Develop system requirements
  - Evaluate system performance

Recommendation #1

- Assess the potential applications of wearable sensors, physiological monitoring, and “scalable autonomy” to aviation operations and safety.
- FAA develop a research plan/roadmap within three (3) years
  - Provide the certification authorities sufficient technical data to develop regulatory guidance for the technologies.
  - This should include a multidisciplinary team consisting of a minimum of aeromedical, human factors, aircraft certification researchers and certification authorities, and leverages the considerable work in other government agencies, academia, and industry.
- The Committee requests a briefing on the status of the research plan at the SAS meetings in Fall 2023 and Spring 2024



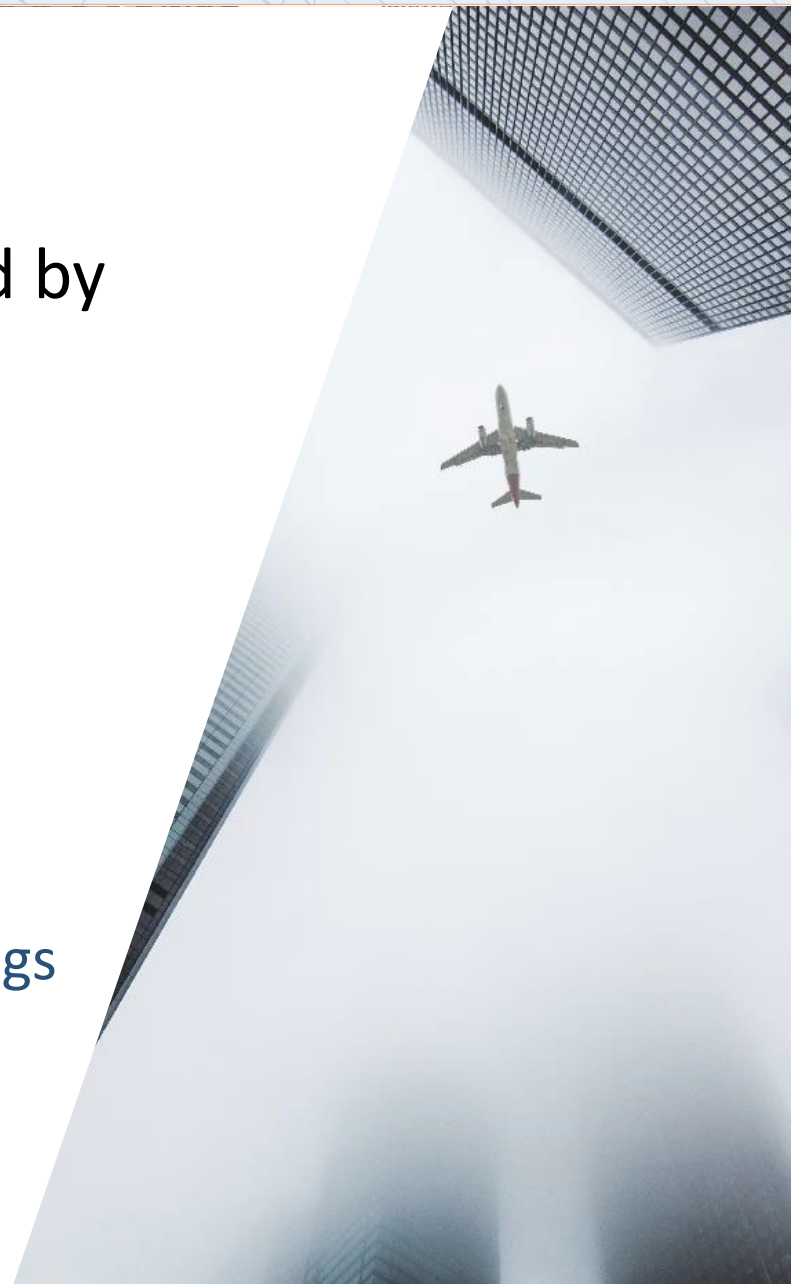
Finding #2 – Cyber Resiliency for Digital Safety Systems

- Emerging transition to new air/ground data link technologies
  - Internet Protocol Suite (IPS) which will provide strong cryptographic controls to aeronautical data links used for Controller - Pilot Data Link Communications (CPDLC)
  - Automatic Dependent Surveillance – Contract (ADS-C)
  - Air/ground applications

- Emerging technologies provide strong cryptography protection to safety communications
  - Unknown research into responsibilities for monitoring the logs of cyber events to detect intentional or unintentional attacks on safety communications networks

Finding #2 – Cyber Resiliency for Digital Safety Systems

- Many unanswered questions
- Intrusion detections occurring at ground IPS peers and by similar technologies within aeronautical data link sub networks
- IPS standards being finalized this year at ICAO, RTCA/EUROCAE and AEEC
  - Require the IPS system components to collect logs of cyber events
  - No regulatory guidance pending on how and when those logs should be transferred and to whom



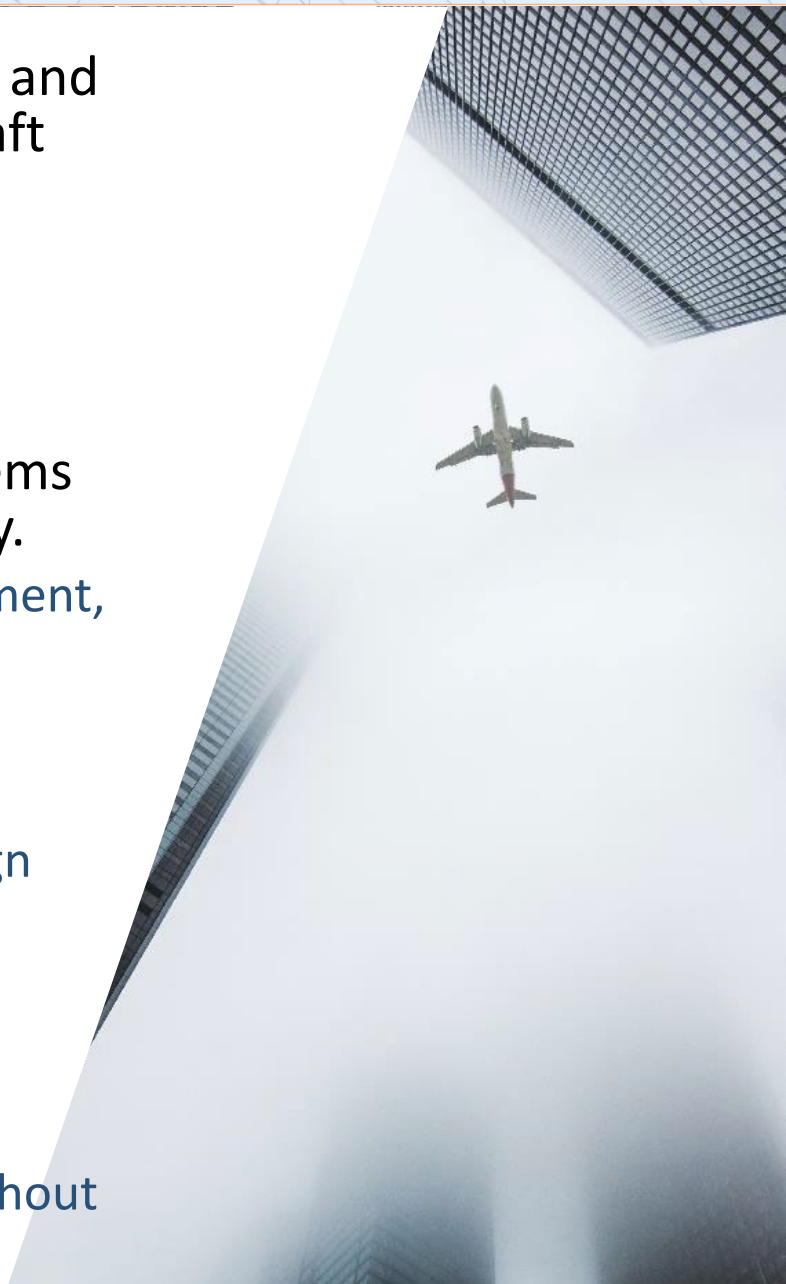
Recommendation #2

- FAA should expand the research currently being conducted on BLI A11DS, Digital Safety Systems, to include data link communications cyber resiliency research
  - Establish the relevant regulatory cyber-attack reporting requirements for industry actors who will be implementing data link communications technologies

- Relevant regulatory cyber resiliency requirements should be published concurrently with the publication of IPS technology performance regulations
  - Avoid costly modification of IPS avionics systems that industry would encounter to implement cyber-attack reporting requirements after the IPS systems are initially deployed

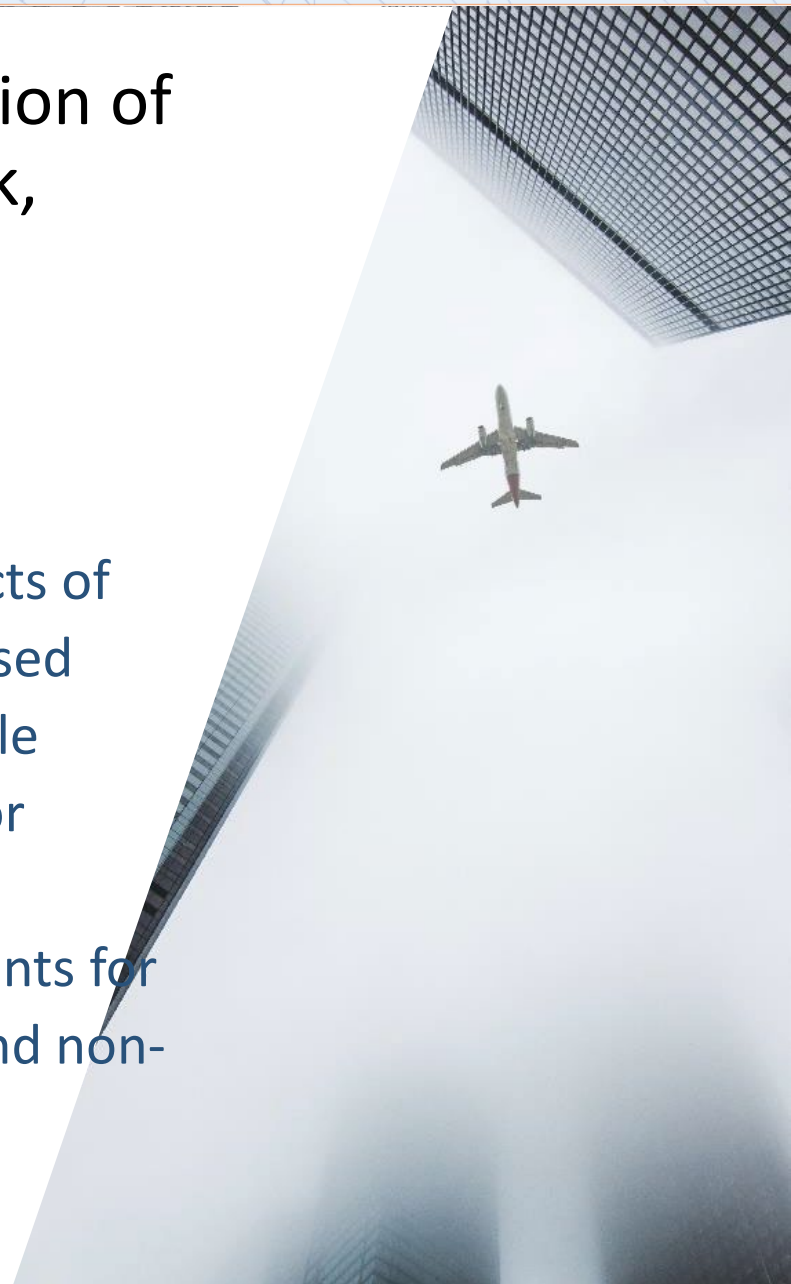
Finding #3 – Use of Digital Twins

- FAA research on the application of Digital Twins for the development and lifecycle support of aircraft avionics systems in consideration of aircraft certification & operational credit
- Topic of the Digital Twin can apply to many areas for aircraft:
  - Propulsion and Fuel Systems (A11B), Software Digital Systems (A11DS), Continued Airworthiness (A11E)
- Ongoing maturation of technologies to support aircraft avionics systems Digital Twin capability is proliferating across the aircraft OEM industry.
  - Incorporates model-based systems engineering, model-based development, and auto-code generation based on system functional requirements
- Ability to create a fully virtualized airplane electronic systems environment early in the design cycle
  - Utilized to verify functional operation of the airplane systems and design
- As the airplane moves from development to service,
  - Provide high fidelity simulations during the operational lifecycle of the airplane
  - Evaluation of aircraft health monitoring applications
  - Ongoing analysis of continued airworthiness and security issues throughout the service life of the airplane



Recommendation #3

- FAA should conduct further research on the application of Digital Twins to aircraft systems to include flight deck, CNS, propulsion systems and all onboard/offboard networking & data comms
  - Look across the SAS portfolio for use regarding both aircraft certification and operational credit
  - Develop roadmap of certification application to different aspects of the aircraft engineering development lifecycle, from model-based engineering, development, design implementation, and lifecycle operations such as applicability to aircraft health monitoring for operational credit.
  - Address model maturity, verification, and validation requirements for digital twins to show regulatory compliance for both normal and non-normal functional operations of the systems



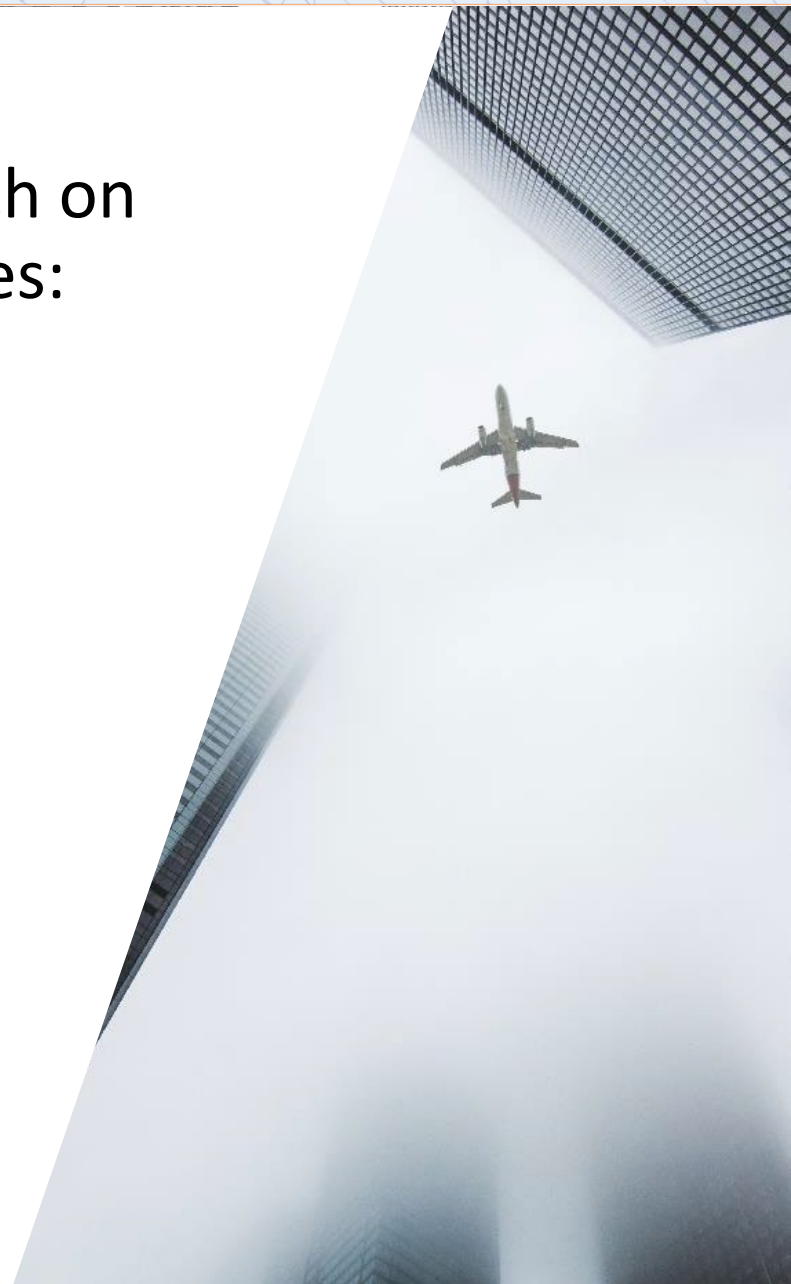
Finding #4 – Hydrogen Powered Propulsion

- Industry is evaluating the potential use cases for hydrogen powered propulsion systems

- Especially relevant for Advanced Air Mobility platforms, but also applications being studied for legacy propulsion systems

Recommendation #4

- The subcommittee recommends further FAA research on hydrogen powered propulsion systems that addresses:
  a. Fire and leak detection and safety
  b. Storage capabilities, both on the ground and airborne
  c. Items applicable to aircraft health monitoring
  d. Carriage and transportation of hydrogen cells
  e. Future applications
  f. Certification readiness



Next SAS Meeting Date

- August 8-9, 2023
- FAA Tech Center - ACY

- Questions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