

FEDERAL AVIATION ADMINISTRATION
REDAC Subcommittee on Aircraft Safety (SAS)
2018 Fall Meeting Minutes
July 31 – August 1, 2018

The 2018 Fall REDAC SAS Meeting was held on July 31 and August 1 at Pratt & Whitney's Customer Training Center, 400 Main Street East Hartford, CT 06108. The meeting agenda is attached in Appendix I. Attendee sign-in sheets are attached in Appendix II. In the morning of the 2nd day of the meeting, attendees visited Pratt & Whitney's Middletown facility and United Technologies Research Center's Additive Manufacturing laboratory. This document summarizes discussions and activities that occurred during the meeting. The meeting resulted in five findings and recommendations (F&Rs), which have been included as part of the official REDAC Chair's submission to the FAA. All presentation materials are available and can be downloaded through the FAA REDAC website.

DFO: Eric Neiderman

Note Taker: Hossein Eghbali

Day 1 – July 31, 2018

Introduction/Opening

Subcommittee Acting Chair, Mr. Chris Kmetz, and SAS Designated Federal Official (DFO) Dr. Eric Neiderman, jointly kicked off the meeting with brief opening remarks, which were followed by introduction of SAS members and all attendees.

Research Landscape and Strategic Direction

Ms. Shelley Yak, Director of William J Hughes Technical Center, presented an overview of a new concept known as research landscape. She focused on research and development drivers, management goals and objectives as well as REDAC's role and assistance in developing strategic vision. She talked about the legislative background, i.e., US Code Titles 42 and 49, for the FAA research program. She highlighted the importance of collaboration and partnership domestically and internationally as well as importance of maintaining international leadership.

Ms. Yak then introduced the concept of research and development landscape, which is different from a plan in that the landscape concept focuses on issues, trends, and emerging technologies that are driving research as well as research areas being conducted by industry and FAA nationwide. The research and development landscape should capture and be reflective of the FY19 Administration Research and Development Budget Priorities, i.e., OMB Memo M-17-30, as well as the DOT's Strategic Plan Goals 2018-2022. She mentioned that the objective is to ensure understanding of the broader research efforts nationwide and develop an effective and holistic FAA research portfolio that is complementary to the research being conducted by industry.

The Director then talked about the FAA's National Aviation Research Plan (NARP) and mentioned that the NARP goal is twofold: (1) better communication, e.g., NARP redesign and results-focused annual

review; and (2) more effective planning and execution of the research program, which needs input from all stakeholders to balance near-term and the longer-term strategy.

Participants then discussed as to how REDAC can assist with development of the research landscape, at what level of detail the research landscape should be developed, how to understand what the aviation community sees as issues and what research is being conducted by industry, how the FAA can leverage industry's research, how the REDAC can help identify the aviation community's drivers, needs, activities as well as investments, and finally how the FAA could use the upcoming 2019 REDAC meetings to develop Aviation Community R&D landscapes.

At the end of discussion, participants agreed upon to dedicate the next two SAS meetings toward development of research landscapes.

ACTION: The SAS DFO will prepare a draft landscape prior to the Spring 2019 meetings and seek the committees' comments and assistance to improve it during the meeting.

Update on the Full REDAC Meeting from Last April

The SAS Acting Chair, Chris Kmetz, presented highlights of the full REDAC meeting held in April 2018. The highlights were:

- The NARP is in the process of being redesigned and published. When the NARP is released, it will be reviewed by the Subcommittee.
- The Cybersecurity plan that was released in June 2018 will be updated annually based on new developments including, but not limited to, incorporating links to the budget.
- All subcommittees have been asked to provide feedback on the Unmanned Aerial System (UAS) plan at the Summer/Fall full REDAC meeting with a summary due by November 1, 2018. He mentioned that the focus is on making sure there is no duplication in research being conducted in industry and the FAA. This is aligned to the Technical Center director's R&D landscape concept.
The trends associated with new entrants was front and center. Complexity and systems of systems. How the technical workforce of the future is maintained.

Office of Aviation Safety's (AVS) FY21 Strategic Guidance

Mark Orr, AVS R&D manager, presented the FY21 strategic guidance. He mentioned that there were a few changes in the guidance, which was in the draft status and awaiting Associate Administrator for Aviation Safety's (AVS-1) signature. The strategic guidance supports the sponsoring offices for developing R&D requirements. The sponsors could use the strategic guidance - which includes examples of safety hazards, risks, and safety issues - to drive AVS research needs as well as when considering where to apply research resources. Mr. Orr mentioned that the strategic guidance was not a checklist of specific projects and that, in summary, the strategic guidance:

- Provides examples of safety hazard and risk data for the sponsoring offices to consider when developing research requirements,
- Supports implementation of Safety Management System (SMS) processes,
- Lists emerging risks for aviation safety,

- Describes the process for identifying system-level safety issues (new compared to FY20 strategic guidance),
- Considers key technology Areas in which FAA has provided research leadership,
- Provides the hazard Paredos from the Commercial Aviation Safety Team (CAST), General Aviation Joint Steering Committee (GAJSC), and Helicopter Safety Team,
- References the requirement to identify long-term research (new compared to FY20 strategic guidance), and
- References OMB Executive Memo M-17-30 (new compared to FY20 strategic guidance).

SAS members expressed their concern that the supporting data included out-of-date information, such as Commercial Aviation Safety Team's (CAST) 2011 ranked risks that was being referenced in FY21 strategic guidance. Mr. Orr replied that these Pareto charts were provided by the CAST, GAJSC, and USHST representatives and do represent the current hazards. Mr. Orr described the FAA's Hazard Identification Risk Management Tool (HIRMT). In addition, there was a concern that the FAA was making investments in tools that have not been seen by the REDAC. SAS members asked Mr. Orr to describe as to how the AVS identifies emerging safety issues and challenges where there is no historical data. Mr. Orr answered that this was a challenge but the FAA's safety management systems help AVS look out ahead and to develop safety cases.

R&D Budget Update

Mr. Mike Gallivan, Manager of R, E & D Financial Management presented the FAA R&D budgets. Full FY18 Appropriation at the level of \$188,926,000 was signed on March 23, 2018. Mr. Gallivan mentioned that Congress was currently looking at multiple mini-omnibus bills. While FY19 RE&D request is \$74M, House approved at \$180M and Senate approved at \$191M. A conference committee will be held to finalize the budget.

Mr. Gallivan then described the differences between House and Senate language. The House Committee recommended \$8,318,000 for Unmanned Aircraft Systems (UAS) Research, an increase of \$5.0M above the budget request to support research and development activities to accelerate safe integration of UAS into the national airspace. In addition, the Committee believes that an unmanned aircraft system (UAS) traffic management (UTM) network is critical to safe integration in the National Airspace System (NAS) and innovative uses of beyond visual line of sight drone operations, such as package delivery, infrastructure inspections, and precision agriculture. Mr. Gallivan mentioned that the FAA shall submit the research plan required under Section 2208 of the FAA Extension, Safety, and Security Act of 2016 (Public Law 114–190) by September 30, 2018 and demonstrate pilot program use cases by December 31, 2018. Upon completion of the demonstration project, pilot program research and development will be transferred to the FAA Air Traffic Organization so that all UTM development efforts are consolidated and industry UAS Service Suppliers can build and deploy a UTM network. He mentioned that the Committee recommended that FAA promote research and demonstration activities for counter unmanned aircraft systems (CUAS) to protect airports and the NAS as the FAA accelerates its efforts to safely integrate UASs into the national airspace. In addition, Committee recognized the critical and unique role the FAA UAS Test Sites serve in perpetuating technology innovations through safety and operational needs to safely integrate in the NAS. As such, the test sites must be on the forefront of the technology and the adoption thereof. The Committee recommended the FAA grant specific beyond visual line-of-sight (BVLOS) authority. The Committee also directed FAA to use its test sites, research efforts, and pilot programs to develop systems to detect and mitigate unauthorized UAS that interfere with firefighting

efforts. The Committee also directed FAA to report on these efforts no later than 120 days after enactment of the Act.

The Senate Committee recognized the valuable role of the Center of Excellence (COE) in assisting the FAA in a host of research challenges associated with integration of UAS into the NAS. The Committee recommendation included \$24,035,000 for UAS research, equal to the fiscal year 2018 enacted level and \$20,717,000 above the budget request. Of the funds provided for UAS research, \$12,035,000 was directed to support the expanded role of the UAS Center of Excellence in areas of UAS research - including cybersecurity- agricultural applications, beyond visual line of sight technology, and studies of advanced composites and other non-metallic engineering materials not common to manned aircraft but used in UAS. The Center of Excellence shall establish a UAS safety research facility at the Center to study appropriate safety standards for UAS and to develop and validate certification standards for such systems. Of the total funding, \$2.0M is for the Center's role in transportation disaster preparedness and response, collaborating with institutions that have demonstrated experience in damage assessment, collaboration with State transportation agencies, and applied UAS field testing; and \$10M is to support UAS research activities at the FAA Technical Center and other FAA facilities. In addition, the Senate Committee believes that creation of a UTM system is critical to safe integration in the NAS and for innovative uses of BVLOS drone operations, such as package delivery, infrastructure inspection, and precision agriculture. The Committee is concerned that FAA is not acting with sufficient urgency to meet its statutory obligations under section 2208 of the FAA Extension, Safety and Security Act of 2016, which required the agency to develop a research plan for UAS Traffic Management (UTM) development and deployment. In executing section 2208, the Committee encourages the FAA to coordinate the three programs that serve as building blocks for commercial development of a UTM system: The nationwide Low Altitude Authorization and Notification Capability (LAANC) program, the UTM Pilot Program, and the UAS integration pilot program. The FAA should also coordinate with state and local law enforcement agencies to test the prevention of unsafe operations that could affect critical infrastructure or personal safety. The Committee directed FAA to submit the research plan no later than December 31, 2018, including milestones for the deployment of a full-scale UTM network. This work is essential to overall UTM development efforts, which will allow industry and UAS service suppliers to build and deploy a UTM network that advances the safety of our national airspace.

Regarding alternative fuels for general aviation, the House Committee provided \$1.9M for alternative fuels for general aviation. This program received \$7.0M in fiscal year 2018 and is proposed for elimination in the budget request. Funds are provided to complete the testing and certification activities under the current test program and to support the current personnel required for operations and equipment needs of the lab. However, the Senate Committee recommendation included \$7.0M for research that supports alternative fuels for general aviation. Funds are provided to complete testing and certification activities under the current test program and support the current personnel required for operations and equipment needs of the lab.

Mr. Gallivan briefly described the House and Senate language on other research areas. FY2020 target is \$74M, which was delivered to OST in June 2018. FY2020 budget is currently in the OST evaluation stage and it is not public while in the review stage. He also mentioned that current FAA reauthorization is approved through September 30, 2018 and there may be a series of extensions before a new FAA reauthorization is approved.

An Overview of Commercial Space Transportation Research

Dr. Paul Wilde of Office of Commercial Space (AST) provided a general overview of AST research portfolio and how it may relate to safety. He mentioned that the rapidly accelerating commercial space industry has brought about the need to build a more agile and responsive research portfolio. The portfolio includes four research areas, i.e., Research Area 1 (RA1): aerospace access and operations, Research Area 2 (RA2): aerospace vehicles, Research Area 3 (RA3): human operations and space flight, and Research Area 4 (RA4): industry innovation.

The program goals of RA1 are: safe integration of air and space traffic management; improvement in analytical and computational methods to evaluate safety of uninvolved public and property, and improvement in spaceport interoperability and development of necessary spaceport industry infrastructure resources.

The program goals of RA2 are: improvement in vehicle safety and risk analyses and management, including knowledge of all safety-critical components, systems of the space vehicles, and their operations, as well as improvement in the manufacturability, assembly, operational efficiencies of vehicles, systems, and subsystems.

The program goals of RA3 are: to identify and reduce avoidable risks of human spaceflight as well as to facilitate the continuous improvement of the operational safety of human-carrying vehicles (during both launch and reentry), and spaceports.

Finally, the program goals of RA4 are: to develop improved criteria for evaluating public safety (such as performance based requirements for the protection of public property and critical assets); to encourage growth of evolving space industry sectors through relevant economic, legal, legislative, regulatory, and market analyses and modeling; to support effective policy decision-making in the accomplishment of the dual regulatory and promotional missions of FAA AST; and to provide a better understanding of the relationship between governmental policy, innovation adoption, and industry growth.

The following questions and answers were exchanged during the presentation:

Q: Is there a standard risk level process for the commercial flight safety?

A: There are published quantitative level-of-risk criteria, which is only for people not on the rocket.

Q: How much funding annually is allocated for the R&D?

A: It was approximately \$1M per year. However, the budget has been increase to around \$2M for the past few years. It is increasing in the President's budget request to \$4M by FY20. However, this budget is barely keeping up with industry.

Q: What is the biggest gap?

A: The biggest gap is to work out a plan to integrate rockets in to the NAS. Protecting aircraft currently requires closing large areas of the NAS. For example, the Falcon Heavy shut down East Coast airspace for about four hours. To minimize disruption to the NAS, MITRE is evaluating a time-based flow management for the rocket launch window, which currently is a two-hour window. The key is the timing and having enough advance notice to get the timing of the launch right.

Artificial Intelligence and Machine Learning

Mr. Chuck Howell of The MITRE Corporation presented an overview of Artificial Intelligence (AI) and Machine Learning (ML). He mentioned that there was not a single definition of AI that is universally accepted by practitioners. Some define AI loosely as a computerized system that exhibits behavior that is commonly thought of as requiring intelligence. Others define AI as a system capable of rationally solving complex problems or taking appropriate actions to achieve its goals in whatever real-world circumstances it encounters.

Howell then described AI, ML, and Deep Learning. AI is the engineering of making intelligent machines and programs. The ML is the ability to learn without being explicitly programmed. Machine Learning uses data to figure out what to do by searching for the model that best describes the data. There are three types of ML: unsupervised, supervised, and reinforcement. Supervised is based on labeled data. Unsupervised is based on non-labeled data. Reinforcement learning is an iterative loop and the output is either strengthened or weakened. The reinforcement is based on an interaction with either the world – simulated or the real world, which does not require huge volumes of labeled data. He mentioned that dramatic advances are happening in reinforcement.

Deep learning is the specific architectural approach. It is a cartoon model of how nerves work with no real coherent theory of how this happens. It is described as “alchemy.” This is a big challenge for safety assurance. The other challenge for safety assurance is that there is not an algorithm being tested using deep learning. There is a much attention being paid to explainability and interpretability. He mentioned that the focus on robustness was even more important with AI. There is a need for tools and techniques to handle the robustness of off-nominal cases. The fundamental gap is preserving confidence over time and making it robust. He mentioned that the focus of paper entitled “Concrete Problems in AI Safety” is on advancing the field of AI instead of confidence on deployed systems over time.

The following questions and answers were exchanged:

Q: Don’t have integrity for applications with critical safety systems; where might these show up for FAA certification? What research needs to be done to implement these systems if they are valuable?

A: AI is part of the safety case for sense and avoid in UAS operations.

Q: How will the agency certify the AI systems? What are the limits of what could be accepted under DO178-C? Is there a modified standard?

A: this is an emerging issue.

FY2018 Portfolio Review

Mark Orr and Eric Neiderman lead the group discussion on FY2018 portfolio. Mr. Orr presented an overview of the budget by program area and FY with totals and contract funds. FY19 funds are based on the \$74M budget request that was based on the OMB target. Participants discussed the adverse impact of limited FY2019 budget, i.e., \$74M, on ongoing research projects across each of the BLIs. However, it became clear that the participants simply will not have enough time to go through adverse impacts of FY19 budget across each BLI during the meeting. The FAA was tasked to study the adverse impact and consequences of limited available budget in FY2019 and FY2020 across the BLIs and document them for SAS. The FAA also agreed to provide a draft R&D landscape and identify the research priorities in the context of the R&D landscape including the ones that are funded and are not funded.

The participants continued reviewing the FY2018 portfolio progress report that was submitted to SAS members ahead of the meeting during which FAA participants provided answer to questions on FY18 accomplishments.

Unmanned Aerial Systems (UAS) Update

Claude Jones and Sabrina Saunders-Hodge provided an update on UAS research. From the SAS members' perspective, the progress made in UAS research has been slow and the FY18 portfolio did not match available funding levels for UAS in that not all available funds were spent. Participants noted that grant awards to Center of Excellences (COEs) now go through DOT for review and approval, which is having an impact on the timing of awards. It was not clear for SAS members what research will be conducted using the remaining UAS funds. The SAS committee expressed their intention to write a Findings and Recommendation for UAS.

SAS Members of Review of UAS Research Plan

Background: On April 16, 2018, Research, Engineering and Development Advisory Committee (REDAC) was tasked to review the FAAs UAS Integration Research Plan, which is classified as For Official Use Only (FOUO), and that the FAA will make subject matter experts available to the REDAC upon request. To that end, the SAS members held a separate session with limited FAA participation to review the FAA's UAS Integration Research Plan at the end of first day of SAS meeting.

In general, SAS members did not find the FAA's UAS Integration Research Plan comprehensive enough to address UAS research needs and expressed some concern about the execution of the plan as it was not clear for SAS members what organizational position was responsible or accountable for the plan and its execution. It was not also clear for SAS members whether or not the plan was developed by taking into account industry's UAS activities or perspective on UAS safety issues or certification needs. There was concern about the organization of the plan as mapping of research areas to each other or the BLI has not been demonstrated in the plan. Acting SAS Chair took an action to prepare a response to the full REDAC based on SAS members' comments on the plan.

Day 2 – August 1, 2018

Participants toured Pratt & Whitney Middletown facility and United Technology Research Center (UTRC) - Additive Manufacturing Laboratories in the morning. The SAS meeting resumed at 11AM.

Industry/Academia Partnership- the Aerospace vehicle Systems Institute (AVSI)

Don Ward, the Aerospace Vehicle Systems Institute's (AVSI) Chief Engineer, presented an overview of AVSI mission, objectives, and projects. AVSI's mission is to address research issues in a collaborative manner rather than as a consortium. The idea for the possibility of linking several industry members to conduct cooperative R&D under the protection of the National Cooperative Research and Production Act of 1993 was discussed in 1997 between The Boeing Company and Texas A&M College of Engineering. The Boeing vision was to use AVSI as a vehicle to work with experts throughout the

industry (Commercial and Defense), academia, and elsewhere where everyone will benefit by leveraging resources and developing an improved ability to work together.

AVSI is currently classified as a Departmental Center within the Aerospace Engineering Department, which makes it legally a division of the Texas Engineering Experiment Station (TEES), which negotiates all agreements on behalf of AVSI. However, AVSI reports through the Aerospace Engineering department. AVSI offers three levels of membership, i.e., full membership, associate membership, and liaison membership, which represents the industry. The different categories of membership represent different funding levels. AVSI offers a range of participation levels that provide different levels of benefits for different needs.

The current AVSI projects are: Mitigating Radiation Effects on Avionics Systems, Wireless Avionics Intra-Communications, Commercial Off-The-Shell (COTS) Intellectual Property (IP) Guidance Development, In-Service Reliability Program (ISRP), Testing Methods for Shape Memory Alloy Materials, and Machine Learning. More information is available at www.avsi.aero.

Update on Aeromedical Research

Stacey Zinke, Branch manager in Civil Aerospace Medical Institute (CAMI), presented an overview of Protection and Survival Research Laboratory. The objective is to prevent accidents and incidents through mitigating hazards. She mentioned that the focus is on the survival factors of occupant protection, time available for egress, and speed of egress. She talked about the recently completed research projects, ongoing research projects, and upcoming FY2019 research projects. She was asked if any research was being conducted on seat pitch. The answer was the FAA is working on the models for predictions including seat pitch information.

Phil Kemp of Bioaeronautical Sciences (AAM-610) provided an update on bio-aeronautical sciences research, which included forensic sciences and biomedical sciences. He mentioned that the research team has developed a test to identify twenty two Benzodiazepines in one test and they have begun publishing an annual report on forensic toxicology. The biomedical sciences team is looking at functional genomics to provide an answer to questions such as if it is possible to predict fatigue before a pilot gets in to the cockpit. To that end, they are working to identify genetic markers for fatigue and hypoxia. He also mentioned that a large multi-year sleep deprivation study has just been started, which will provide greater insight in to fatigue.

Runway Friction Research

Paul Giesman of FAA's Aircraft Certification office provided an overview of a white paper developed by the FAA's Technical Working Group on Aircraft Braking Friction. The Working Group was established based on recommendation from REDAC Subcommittee on Airports to review completed and on-going research projects on runway braking performance and provide recommendations regarding the direction of future research on runway braking performance. The Working Group includes representation from the FAA, academia, manufacturers, and other industry/consultants that are developing runway braking friction assessment technologies.

Mr. Giesman described the runway condition and braking performance data for the Midway airport accident on December 8, 2005, which led to changes in the industry in terms of measuring runway friction. He mentioned that NTSB recommendation A-16-023 that recommends the FAA continue to work with industry to develop the technology to outfit transport-category airplanes with equipment and

procedures to routinely calculate, record, and convey the airplane braking ability required and/or available to slow or stop the airplane during the landing roll and recommendation A-16-024 that recommends the FAA if the systems described in Safety Recommendation A-16-23 are shown to be technically and operationally feasible, work with operators and the system manufacturers to develop procedures that ensure that airplane-based braking ability results can be readily conveyed to, and easily interpreted by, arriving flight crews, airport operators, air traffic control personnel, and others with a safety need for this information. He also mentioned Commercial Aviation Safety Team's (CAST) Safety Enhancement 222, which is geared to outline research to be conducted by the aviation community (government, industry, and academia) to enable development, implementation, and certification of on-board aircraft system technologies to assess airplane braking action and provide the data in real time to the pilot, other aircraft crews, air traffic controllers, and the airport operators.

Mr. Giesman described that recent landing overrun accidents on wet runways have raised questions regarding validity of current wet runway stopping performance requirements and methods documented in 14 CFR Part 25.109(c) and AC-25-7C, which was developed based on analysis of data collected during NASA's flight tests in the 60s and 70s.

Mr. Giesman then described recently completed and on-going research projects on runway braking performance as well as the gap analysis that was completed by the Working Group, which resulted in the following recommendations:

- Test aircraft similar in type to a B-737NG/A320 should be obtained with the following characteristics:
 - Airworthy
 - Fully modulating anti-skid system
 - Test speeds of at least 140 knots ground speed
 - Appropriate sensors and data systems to support braking tests
 - Ability to directly measure and record braking forces/coefficients
- Testing facility with an available runway with the following criteria:
 - Minimum 8000' / 150' wide
 - Test speeds of at least 140 knots ground speed
 - Built in wetting capability
 - "Slippery when wet" section
 - Good runway outside of test section
 - Possible to vary surface to some degree
 - Simulate micro/macro texture for wet issues
 - Winter conditions
 - Capable of testing with aircraft having similar size/weight as B-737-700 or A-320 – runway loading
- Establish a working group:
 - FAA should establish a working group to support the design and construction of the above-mentioned test facility
 - Test surface design: Construction of the test area should include recommendations regarding;
 - Type of material such as concrete or asphalt.
 - Design of surface such as smooth, grooved, porous friction course (PFC), or other.

- Validation method such as comparison to known poor runway conditions as documented by recent studies and measurement by ground friction devices.
- Testing protocols regarding:
 - Test safety issues
 - Standard test plans
 - Equipment – cameras, friction devices, water measurements and controls
- Coordinate with Society of Aircraft Performance and Operations Engineers (SAPOE)/ASTM Standards: The FAA should commit to continued participation in the SAPOE/ASTM standards effort on obtaining friction information from operational aircraft. Recommended participants are:
 - Flight Standards (final implementation group for operating standards)
 - Transport Standards (sponsor of original research and organization responsible for on-airplane certification requirements)
 - Technical Center (future research discussed in this paper which supports implementation of this effort)
- Suggested Research projects- FAA should commit to supporting the following research with the above resources
 - Proof of concept testing for new technology
 - Airplane as friction measuring device
 - Airport surfaces
 - Development of new certification methods for aircraft braking recording – inferred vs. measured
 - Investigate aircraft wet runway braking performance that falls below FAR 25.109(c) levels.
 - NTSB issue
 - Validate when existing models are accurate

Subcommittee members expressed some concerns about implementation costs of recommendations versus their benefits as well as to why the FAA cannot lease an aircraft and contract out the flight tests. In addition, SAS members suggested performers consider to use BigData techniques instead of costly flight tests. Mr. Giesman described the rationale behind the need for flight tests. Sub-committee will provide an F&R on the approach and recommendations.

AIR Innovation Center

Mike Romanowski of FAA's Office of Certification (AIR) led a discussion on the FAA's innovation initiative and how it loops back in to the research strategy. He described as to how the FAA is understanding where the industry is heading in terms of innovation and how to provide certification service faster. Romanowski described the recent reorganization in AIR Directorate, which is now a functionally aligned organization in which certification and manufacturing are each aligned under one leader. The policy is to communicate and work with companies well before they bring a product for certification. Commitments made in the early engagement process have to be honored throughout the process. Early engagement will carry forward in to certification, and it is seen as risk reduction for the industry/company. He mentioned that there are currently about 60 early innovation projects.

Mr. Romanowski mentioned that the FAA can leverage work being done in industry to avoid duplication and the gaps are where the FAA can focus its research. These issues are not emerging out of fleet safety data. This is a more top-down research formulation. A question as to what are the implications for international leadership was raised. The answer was that the FAA is working with European Aviation

Safety Agency (EASA) and others as well and that the FAA would like the agreement on a product to be accepted internationally as well.

Alternate Fuels for General Aviation

Peter White, manager of Alternative Fuels Program Staff, provided an update on the Piston Alternative Fuels Initiative (PAFI) research. Mr. White mentioned that the EPA has been sued to make an endangerment finding against lead in GA fuels and that leaded AvGas is now half of all lead emissions. An Advisory and Rulemaking Committee (ARC) was formed that led to the formulation of the PAFI program. The mission of PAFI is to evaluate candidate unleaded replacement fuels and identify those fuels best able to technically satisfy the needs of the existing aircraft fleet while also considering the production, distribution, cost, availability, environmental, and health impacts of those fuels. The PAFI is a consortium of government and industry.

Mr. White then described the wide range of engines and aircraft that are involved in the PAFI testing, which is designed to represent the entire fleet. The aircraft and engine testing is currently on hold while issues uncovered in testing are being investigated and solutions to mitigate impact to the fleet are being developed and tested. Mitigation solutions will be evaluated in August/September timeframe and plans will be revised as needed. White mentioned that the program completion has slipped from 2018 to early 2020, based on the current plan. In addition, the FAA and industry are currently working with Congress to expand or create new statutory authorization for fleet wide transition.

After the PAFI presentation, participants briefly discussed the next meeting's agenda. A suggestion was made to present the prioritization process and a description of how the prioritization process is being modified to address the emerging issue discussed during AIR innovation center topic. A briefing on Urban Air Mobility or a briefing on supersonic and hypersonic and supersonic was also suggested for the next meeting.

The next SAS meeting is scheduled for March 5-6, 2019 at The MITRE Corporation facility in Virginia.

2018 Fall REDAC SAS Meeting

Agenda

July 31-Aug. 1, 2018

Dress code: *Business Casual*

Location: Pratt & Whitney, Customer Training Center, 400 Main Street
East Hartford, CT 06108 U.S.A, customertraining@pw.utc.com, 1-860-565-8600 (see direction document)

Telecon: Dial In Access: (USA Only) **888-924-3230** or **888-335-6670**

Dial In Access: (Direct Dial) **609-916-1975** or **405-225-2375**

Participant Passcode: **654520**

Instructions: Call the Dial-in Access number listed above.

When prompted, enter the Passcode followed by the # key to be connected.

WebEx: <https://aviationresearch.webex.com>

Meeting number: 998 687 005

Meeting password: **redac**

Click [here](#) or type/copy the following WebEx address to join the meeting directly:

<https://aviationresearch.webex.com/aviationresearch/j.php?MTID=m220c13ca3de8527eabc30f2648b69b9f>

Site Info: See Page 3 for Parking/transportation and lodging information

July 31, 2018 (Tuesday)

| Time | Topic | Presenter(s) |
|---------------|--|--|
| 8:00 – 8:30 | Arrival | Customer Training Center (CTC) |
| 8:30 – 8:45 | Opening Remarks/Purpose of the Meeting | Eric Neiderman |
| 8:45 – 9:05 | Research landscape and Strategic Direction for R&D | Shelley Yak |
| 9:05 – 9:20 | SAS Chair Opening & Report on REDAC Meeting | Chris Kmetz |
| 9:20 – 9:35 | AVS FY21 Strategic Guidance | Mark Orr |
| 9:35 – 9:50 | FAA Budget Update | Mike Gallivan |
| 9:50 – 10:05 | Comfort Break | |
| 10:05 – 10:45 | Review of SAS Recommendation and Draft Responses | All |
| 10:45 – 11:15 | R&D in commercial space | Ken Davidian and Paul Wilde |
| 11:15 – 12:00 | Artificial Intelligence (AI) and Machine Learning | Chuck Howell from Mitre |
| 12:00 – 1:00 | Lunch | |
| 1:00 – 1:30 | FY2018 Portfolio Accomplishments: Fire, PS, SIC, & AI ¹ | Mark Orr/Eric Neiderman |
| 1:30 – 2:00 | FY2018 Portfolio Accomplishments: SDS/ASISP, CASys, CAStr, & CAFP ² | Mark Orr/Eric Neiderman |
| 2:00 – 2:30 | FY2018 Portfolio Accomplishments: HF, SSM, TAS, & Wx ³ | Mark Orr/Eric Neiderman |
| 2:30 – 2:45 | Comfort Break | |
| 2:45 – 3:00 | FY2018 Portfolio Accomplishments: AM, & UAS ⁴ | Mark Orr/Eric Neiderman |
| 3:00 – 3:45 | Update on UAS Research | Claude Jones/Nick Lento/Sabrina Saunders-Hodge |
| 3:45 – 4:15 | First Day Review – Homework Assignments | |

¹ Fire, PS, SIC, & AI: Fire Safety, Propulsion Systems, Structure Integrity – Composite, Aircraft Icing

² SDS/ASISP, CASys, CAStr, & CAFP: Digital System Safety/Aircraft Systems Information Security Protection, Continued Airworthiness – Systems, Continued Airworthiness – Structures, & Catastrophic Failure Prevention

³ HF, SSM, TAS & Wx: Human Factors, System Safety Management, Terminal Area Safety, & Weather

⁴ AM & UAS: Aeromedical Research & Unmanned Aircraft Systems

2018 Fall REDAC SAS Meeting

Agenda

July 31-Aug. 1, 2018

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|---------------------|--|--------------------------------------|
| 4:15 – 5:00 | Subcommittee caucus discussion on UAS Research Plan | SAS Members Only |
| 6:00 - Group Dinner | First & Last Tavern Glastonbury (21 Rankin Rd., Glastonbury) | Reservation for 25 under Chris Kmetz |

Dress code: *Business Casual*

Location: Pratt & Whitney, Customer Training Center (address and directions to be provided)

Telecon: Dial In Access: (USA Only) **888-924-3230** or **888-335-6670**

Dial In Access: (Direct Dial) **609-916-1975** or **405-225-2375**

Participant Passcode: **654520**

Instructions: Call the Dial-in Access number listed above.

When prompted, enter the Passcode followed by the # key to be connected.

WebEx: <https://aviationresearch.webex.com>

Meeting number: 998 687 005

Meeting password: **redac**

Click [here](#) or type/copy the following WebEx address to join the meeting directly:

<https://aviationresearch.webex.com/aviationresearch/j.php?MTID=m220c13ca3de8527eabc30f2648b69b9f>

Site Info: See Page 3 for Parking/transportation and lodging information

August 1, 2018 (Wednesday)

| Time | Topic | Presenter(s) |
|---------------|--|-------------------------------------|
| 7:00 – 7:15 | Arrival CTC for Bus transportation to P&W Middletown | See footwear requirement document |
| 8:00 – 09:00 | P&W Middletown Tour | Chris Monnes |
| 09:00 – 09:40 | Bus transportation to P&W campus, UTRC | |
| 9:40 – 10:15 | UTRC Additive Manufacturing COE Tour | Tom Skiba |
| 10:15– 10:45 | Bus transportation to CTC | |
| 10:45 –11:00 | Comfort break and/or buffer for potential delays | |
| 11:00 – 11:30 | Review Day-1 homework, feedback, etc. | Chris Kmetz/Eric Neiderman/Mark Orr |
| 11:30 – 1200 | Industry/Academia Partnership - AVSI | Don Ward |
| 12:00 – 1:00 | Lunch | |
| 1:00 – 2:00 | Update on aeromedical research | Stacey Zinke and Philip Kemp |
| 2:00 – 2:45 | Update on Runway Friction Research | Paul Giesman |
| 2:45 – 3:00 | Comfort break | |
| 3:00 – 3:30 | AIR Innovation Center Initiative | Mike Romanowski |
| 3:30 – 4:00 | NextGen- Alternate Fuels for General Aviation | Peter White/ Ken Knopp/ Dave Atwood |
| 4:00 – 5:30 | SAS F&R discussions and feedback/Closing remarks | New chair/Eric Neiderman/Mark Orr |
| 5:30 | Adjourn | |

2018 Fall REDAC SAS Meeting

Agenda

July 31-Aug. 1, 2018

Meeting Site Info: Lodging, Transportation, & Parking

Recommended Lodging:

Hilton Garden Inn located at 85 Glastonbury Boulevard, Glastonbury, Connecticut. Early reservations are recommended. Government Rate is \$125 plus fees and taxes and is lower than UTC rate. Verify rate when booking.

<http://hiltongardeninn3.hilton.com/en/hotels/connecticut/hilton-garden-inn-hartford-south-glastonbury-BDLGHGI/index.html>

Other Lodging options: (Call for rates)

Homewood Suites by Hilton located at 65 Glastonbury Boulevard, Glastonbury, Connecticut.

<http://homewoodsuites3.hilton.com/en/hotels/connecticut/homewood-suites-by-hilton-hartford-south-glastonbury-HDFGBHW/index.html>

Hartford Marriott Downtown located at 200 Columbus Boulevard, Hartford, Connecticut.

<https://www.marriott.com/hotels/hotel-photos/bdldt-hartford-marriott-downtown/>

Homewood Suites by Hilton Hartford Downtown located at 338 Asylum Street, Hartford, Connecticut

<http://homewoodsuites3.hilton.com/en/hotels/connecticut/homewood-suites-by-hilton-hartford-downtown-WNDHWWH/index.html>

Identification requirements (required at lobby of every facility):

- o All visitors, including U.S. persons and non-U.S. persons, will be requested to show proof of citizenship and photo identification prior to entry into the P&W CTC.
- o For U.S. citizens, accepted documents for proof of U.S. citizenship include: valid passport, original U.S. birth certificate, certification of Birth Abroad (Form FS-545), Certificate of Naturalization (INS Form N-550 or N-570), Certificate of Citizenship (Form N-560), active government CAC card (not retired). An Alien Registration Card I551 (Green Card) can be provided to confirm U.S. person status.
- o For non-U.S. person, accepted documents for proof of citizenship include a valid passport. For Canadian citizens, a Canadian Enhanced Driver's License can also be used as a valid form of citizenship.

Also, see Footwear requirements and directions to P&W CTC documents

Research, Engineering and Development Advisory Committee (REDAC)
Subcommittee on Aircraft Safety
S/F 2018

July 31-August 01, 2018

July 31, 2018

| Name | Affiliation |
|---------------------------|--------------------|
| Joseph Breen | FAA |
| Michelle Yeh | FAA |
| Jorge Fernandez | FAA |
| Daniel Brock | FAA |
| Patrick T. | FAA |
| Jimmy Bruno | FAA |
| Philip Kemp | FAA |
| Stacey Zinke | FAA/CAMI |
| Donald Kauffman | Honeywell |
| Ken Knopp | FAA |
| Christopher Courtin | MIT |
| Jim Lignugaris | FAA |
| Jim Mangue | Delta Airlines |
| Mark S. Orr | FAA |
| Eric Neiderman | FAA |
| Chris Kmetz | Pratt and Whitney |
| David Pollard | Boeing |
| Dr. R. John Hansman | MIT |
| John Crowley | US Army |
| Shelley Yak | FAA |
| Peter White | FAA AVS |
| Mike Paglione | FAA |
| Hossein Eghbali | FAA |
| Chinita Roundtree-Coleman | FAA |

Via Telephone

| Name | Affiliation |
|--------------------|--------------------|
| Starr Forrester | CAMI |
| Chuck Howell | MITRE |
| Mike Gallivan | FAA |
| Paul Krois | FAA |
| Steve Ecker | FAA |
| Frank Wondowlowski | FAA |
| Alanna Randazzo | FAA |
| Angela Campbell | FAA |
| Paul Wilde | FAA |
| Katrina Avers | FAA |

August 1, 2018

| Name | Affiliation |
|---------------------|--------------------|
| Joseph Breen | FAA |
| Terry King | FAA |
| Daniel Brock | FAA |
| Michelle Yeh | FAA |
| Patrick T | FAA |
| Jimmy Bruno | FAA |
| Philip Kemp | FAA |
| Stacey Zinke | FAA |
| Donald Kauffman | Honeywell |
| Ken Knopp | FAA |
| Chris Courtin | MIT |
| Michel Hovan | FAA |
| Hosseini Eghbali | FAA |
| Jim Lignugaris | FAA |
| Mark S. Orr | FAA |
| Eric Neiderman | FAA |
| Chris Kmetz | Pratt and Whitney |
| Dr. R. John Hansman | MIT |
| David Polland | Boeing |
| Shelley Yak | FAA |
| Jorge Fernandez | FAA |
| Peter White | FAA |
| Mike Romanowski | FAA |