

Research, Engineering and Development Advisory Committee (REDAC) MINUTES

Meeting Date and Time: 4/14/2022 – 10:00 AM **Meeting Location:** Virtual

Purpose	REDAC
Facilitators	Dr. John Hansman, <i>REDAC Chairperson – Massachusetts Institute of Technology, Professor of Aeronautics & Astronautics</i> Ms. Shelley Yak, <i>REDAC Executive Designated Federal Official – Director of the FAA William J. Hughes Technical Center</i>
Note Taker	Mark R. Hale

Presentation: Welcome Address and Opening Remarks

Presenters: *Dr. John Hansman*, Massachusetts Institute of Technology

Director Shelley Yak announced the public meeting notice as required to start the meeting. Dr. John Hansman then opened the meeting with administrative comments and thanked attendees for their participation. Dr. Hansman thanked the committee for working hard in the virtual environment and was hopeful that regular in-person meeting would resume in the future.

Presentation: FAA Welcome Address

Presenters: *Ms. Shelley Yak*, Federal Aviation Administration

Ms. Shelley Yak addressed the Committee with her opening remarks from the FAA’s perspective. Ms. Yak addressed the COVID-19 pandemic and remarked that the FAA was beginning the return to the workplace in the coming weeks.

Ms. Yak discussed the infrastructure bill and highlighted some important areas of funding contained within it. She then remarked about the number of retirements and transitions that have occurred in the last few months, including the FAA Administrator. She noted that Captain Billy Nolen is currently the acting FAA Administrator.

Ms. Yak mentioned research opportunities in Sustainable Aviation Fuels (SAF) and the replacement of leaded fuel in the piston engine fleet. Similarly, she stated that there is increased interest in engine technologies, such as electric propulsion, reducing noise and emissions, and sustainable facilities. She also remarked that Commercial Space is continuing to grow, as are Unmanned Aircraft Systems (UAS).

Ms. Yak concluded her remarks by stating that she spoke at each REDAC Subcommittee meeting this season requesting feedback related to managing the changes that are occurring at the FAA. Dr. Hansman asked if the same turnover levels were being seen among Research and Development (R&D) staff. Ms. Yak emphasized that for now the R&D staff turnover is thought to be the same as pre-pandemic levels. She stated that the coming months will add much more insight into this topic.

Presentation: Subcommittee Report – NAS Operations

Presenter: *Dr. James Kuchar*, Massachusetts Institute of Technology – Lincoln Labs

Dr. Kuchar presented the agenda from the most recent NAS Operations Subcommittee and spoke about several deep dive presentations given to the Subcommittee including the Extensible Traffic Management (xTM) framework, UAS Integration research, Beyond Visual Line of Sight (BVLOS) Aviation Rulemaking Committee (ARC) rulemaking overview, and the UAS Traffic Management (UTM) Implementation Plan overview.

Dr. Kuchar spoke about the Subcommittee’s first general observation on the FAA’s overall R&D architecture and swim lanes. The Subcommittee acknowledged the FAA’s great work in response to evolving community needs and the FAA’s forward-leaning posture to address Air Traffic Services (ATS) challenges. The Subcommittee requested a briefing on the Enterprise Architecture and the alignment of research activities to operational improvements, particularly those associated with the info centric NAS.

The Subcommittee’s second general observation was that it was unclear how UAS NAS Integration activities are connected with, coordinated, or informing other Research Engineering & Development (RE&D) efforts. The Subcommittee requested additional briefings that would provide higher-level visibility of the overarching RE&D roadmap.

Dr. Hansman asked if separation standards requirements were being researched for UAS corridors. Dr. Kuchar responded that this was something that needed to be examined. Ms. Yak offered to share the UAS-AAM Integration Research Plan with the REDAC, in an “Official Use Only” capacity for comment. The REDAC agreed that this would be valuable.

Mr. Kuchar presented the Subcommittee’s four Findings and subsequent Recommendations. The Findings and Recommendations related to the topics of conventional and emerging Air Traffic Management (ATM) services, UAS weather research coordination, Weather Technology in the Cockpit (WTIC) Program scope, and WTIC Program experimental design.

The conversation concluded with discussion of unique UAS/AAM related weather requirements and future research needs including UAS/AAM corridors.

Presentation: Subcommittee Report – Environment and Energy

Presenter: *Mr. Ian Redhead*, Kansas City International Airport

Mr. Redhead briefed the scope of the Environment and Energy (AEE) Subcommittee’s meeting starting with an overview of meeting accomplishments. He stated that there were numerous successes realized locally and on the international front that are directly linked to research that was completed by FAA’s Office of Environment and Energy (AEE). He reiterated that the Subcommittee was pleased that the current Administration has made a commitment on climate change through executive Order 14008 on tackling the climate crisis.

Mr. Redhead stated that the Subcommittee is pleased to see that the AEE research is producing results

that are intended to answer impactful research questions. In particular, Mr. Redhead pointed out the critical nature of SAF research that is being done.

Mr. Redhead concluded his presentation with four Findings and subsequent Recommendations from the AEE Subcommittee related to SAFs, the need for continued public-private partnerships in these research areas, continued support for U.S. leadership at International Civil Aviation Organization (ICAO) Committee on Aviation Environment Protection (CAEP), and the continued prioritization of Noise research. Mr. Redhead informed the Committee that he would draft a Finding and Recommendation related to understanding staffing levels, and expertise needed on staff, to address the increasing amount of work that is required by the FAA's AEE Program.

The FAA's Mr. Laurence Wildgoose (Assistant Administrator for Policy, International Affairs, and Environment) addressed the Committee and thanked them for their continued dedication. He reiterated the importance of SAF to reduce aviation emissions in the near and far term and the importance of public-private partnerships.

Dr. Jim Hileman (FAA, Chief Scientific and Technical Advisor for Environment) stated that the engagement in public-private partnerships, and particularly the FAA's Centers of Excellence (COE), not only fulfills current research needs, but also sets the stage for the workforce of today and the future. He stated that many students graduate from COE programs and go into the aviation industry or are directly hired by the FAA.

Presentation: FAA Urban Air Mobility (UAM)/Advanced Air Mobility (AAM) Update

Presenters: *Mr. Martin Suech, Mr. Chuck Romano, Mr. Thomas Rubino, and Mr. John Bradley,* Federal Aviation Administration

Mr. Martin Suech began his briefing by outlining his presentation titled, "Advanced Air Mobility Integrated Research, Development, Testing, and Evaluation Environment" and introducing his fellow presenters. He began the presentation by showing a graphical depiction of the William J. Hughes Technical Center's (WJHTC) Research, Development, Testing, and Evaluation (RDT&E) Ecosystem. The graphic presented various types UAS aircraft displayed spatially according to their intended operational altitudes. The graphic represented the operations in UAS Traffic Management (UTM), Air Traffic Management (ATM), Upper class E Air Traffic Management (ETM), and Urban Air Mobility (UAM). He then talked about the complexities from a system and safety perspective that are inherent in integrating new and emerging operations such as the UAS, UAM/AAM, supersonic aircraft, rockets, and high altitude long endurance flights. He noted that in order to enable and accelerate industry progress in these areas the FAA must continue to emphasize public and private partnerships.

The second portion of Mr. Suech's presentation detailed the laboratory integration partnership between the FAA's WJHTC and NASA Langley. He outlined the capabilities of both laboratories and spoke about the combined capabilities possessed by integrating the FAA's high fidelity NAS laboratories with NASA's UAM laboratory assets. The combined functionality provides a single thread to look at the entire aviation ecosystem of the future and perform both concept development and test and evaluation work.

The FAA's Mr. Tom Rubino began his portion of the presentation by talking about the AAM (Advanced Air Mobility) NASA/FAA Laboratory Integrated Test Environment (NFLITE) and presenting detailed laboratory capabilities and schematics. Mr. Rubino then reviewed the laboratory accreditation process that the NFLITE capability has achieved. He then showed the different apparatuses that can be used with this capability including NASA's UAM Flyer and Mission Planner, and the FAA's simulation assets that include the Standard Terminal Automation Replacement System (STARS) laboratory, UAS laboratory, Cockpit Simulator Facility, and Out-the-Window Tower Cab Laboratory.

Dr. Hansman stated that it was impressive that accreditation was achieved. Dr. Hansman then asked the presenters to explain the specific tests that the FAA was hoping to achieve, and what the FAA is looking to do with this facility. Mr. Suech explained that the first driver was to develop a system capability of an advanced live virtual environment that expands both the FAA's and NASA's capabilities. The second driver behind the development of this capability was to enable partnerships to tackle specific components of this research within the future of aviation, particularly related to integrating advanced operations like UAS, UAM, and AAM.

Dr. Hansman asked about the rationale behind selecting Atlantic City International Airport (ACY) as a use case and building the functionality there as opposed to areas with higher traffic levels or a known desire for these operations, such as Los Angeles. Mr. Suech indicated that ACY was a cost effective alternative to develop this capability due to this being the home airport of the WJHTC and the ability to access accurate and proven system adaptations that already exist. He then stated that the intention is to develop this capability for ACY and the surrounding areas and then begin to leverage that work into other areas such as the Northeast Corridor or Los Angeles.

Mr. Rubino introduced the FAA's Mr. John Bradley who is the chief use case designer for four separate ACY AAM ecosystem use cases. Mr. Bradley reiterated the benefits of using the ACY airport and emphasized familiarity with airspace (e.g., system adaptations and accessibility), proximity to Atlantic City and the WJHTC's capabilities, and the proximity to the National Aviation Research Technology Park (NARTP).

Mr. Bradley introduced the four AAM use cases that have been developed as part of this capability. Each use case was presented on a slide that contained important points, descriptions, and graphics, as well as the motivations behind each designed scenario. The four use cases presented were an Airport Transfer scenario, a Cross Metro Transfer scenario, a Regional Network scenario, and a UTM scenario. Mr. Bradley concluded the presentation by playing a video that provided an overview of AAM.

Presentation: FAA NextGen Perspectives – Enterprise Human Factors

Presenter: *Ms. Tara Gibson*, Federal Aviation Administration

Ms. Tara Gibson thanked the Committee for the chance to present the critical Human Factors work being accomplished in the FAA program. She began her briefing by providing an overview of the Enterprise Human Factors Program. Ms. Gibson stated that the Enterprise Human Factors Program investigates issues that have effects across all NAS domains, systems, and programs in an effort to provide integrated guidance on human performance considerations. She mentioned that the

primary focus of the research is related to successfully integrating systems developed and deployed to enable NextGen. Ms. Gibson then provided a slide on personnel and facilities used to support the portfolio.

Ms. Gibson proceeded to speak about current Fiscal Year (FY) 2022 accomplishments. She explained the constraints of the last two years caused by the COVID-19 pandemic, most notably facility access, and highlighted two activities that were able to be completed in FY 2022 via remote work. The first of those activities was a final report related to regional Traffic Management Unit (TMU) decision making and coordination, as well as a Human Readiness Levels (HRL) project kickoff.

Ms. Gibson pivoted to discuss anticipated research in FY 2023. These planned research activities included the continued evolution of Trajectory Based Operations (TBO). She presented four planned research activities that included a cognitive modeling effort to examine TBO human factors effects on the TRACON, a laboratory method to evaluate human factors impacts on the Traffic Management Unit (TMU), a regional TMU decision making and coordination exercise, and an effectiveness assessment of TBO training. Ms. Gibson finished discussion of FY 2023 anticipated research by discussing the HRL research that will provide recommendations for applications of HRLs to FAA systems development and acquisition processes.

Ms. Gibson then addressed emerging FY 2024 research areas that are currently being coordinated. The first area focused on the movement towards an Infocentric NAS and the Human Factors questions and issues that FAA must address in this area. She stated that there will be the potential for new actors, more data for all actors, and new traffic management entities. The focus of this research will be the interrelationships and coordination between these existing and new actors. The second focal area for FY 2024 will be concerned with the Air Traffic Control – Vision 2035 document and the impacts of fully shared information. Research questions in this area will address preventing information overload and how the use of intelligent system-driven decision support tools will change air traffic controller tasks.

Ms. Gibson concluded her presentation by presenting a quad chart for the Enterprise Human Factors Portfolio. The quad chart identified research requirements, outputs and outcomes, FY 2024 planned research, and out year funding requirements.

Presentation: Subcommittee Report – Aircraft Safety

Presenter: *Mr. Terry McVenes*, Radio Technical Commission for Aeronautics

Mr. Terry McVenes began his briefing by outlining the recent Aircraft Safety Subcommittee (SAS) meetings and accomplishments. He stated that the Subcommittee reviewed previous Findings and Recommendations and was able to close out a few of those items. He updated the Committee on the SAS Subcommittee's review of the domain portfolio and discussed SAS member presentations given during the last meeting. He also spoke about extended membership on the SAS and their subsequent positive contributions.

Mr. McVenes then spoke about the Subcommittees three major Findings and subsequently reviewed the six related Recommendations. The first Finding related to Artificial Intelligence (AI) and Machine Learning (ML) research and stated that industry has a need for regulatory guidance on the use of these technologies in a safety critical context. He stated that the Subcommittee agreed that research results

pertaining to AI/ML are needed by FY 2025 or sooner and that there is currently no road map for publishing this regulatory guidance. The SAS Subcommittee's first Recommendation was that the FAA publish a phased roadmap for AI/ML. The second Recommendation for this Finding was that the FAA continue to make points of contact to participate in AI/ML standards organizations and continue its strong coordination with the Defense Advanced Research Projects Agency (DARPA) and Air Force programs. The final Recommendation for this Finding was that the FAA should include research on how run-time assurance methodologies can be certified and used in conjunction with AI/ML assurance to ensure safety.

The Subcommittee's second Finding pertained to Aeromedical Research on Fatigue. The Subcommittee acknowledged the research the FAA is conducting on genetic markers of fatigue and stated that the Department of Defense (DOD) and industry is conducting research in the area of wearables and other sensors that have the opportunity to increase safety. The related Recommendation was that the FAA Aeromedical, Human Factors, and Flight Standards researchers and regulators develop a joint RE&D plan with industry and additional U.S. Government agencies to address the addition of pilot monitoring technologies, decision-making algorithms, and automation technologies in the cockpit.

Mr. McVenes then presented the Subcommittee's third Finding related to Digital Systems Safety software development. The Subcommittee noted that there are challenges with balancing the complexity of innovative technology with the ability of traditional software processes. The Subcommittee noted two related Recommendations. The first Recommendation stated that the FAA should more clearly define the focus and applications of this research output in terms of software development, hardware evaluations of performance, validation and verification of complex systems, and platform applicability. The final Recommendation was that this research be conducted before FY 2024 so that results can influence current FAA certification guidance and industry software development standards work that is already in progress.

Mr. McVenes concluded his presentation by providing final comments from the Subcommittee meetings. These comments included the benefit realized through expanding the SAS membership and a note on the positive impact that a newly developed FAA subcommittee input template had on the Subcommittee's process and outputs.

The full Committee discussed the Findings and Recommendations of the SAS and came to a consensus on revisiting the idea of a joint R&D plan. The FAA's Mr. Mike Paglione thanked the Subcommittee for their inputs during the meetings and remarked that the input template and subsequent information received was extremely valuable.

Presentation: Subcommittee Report – Human Factors

Presenter: *Dr. Barbara Holder*, Honeywell

Dr. Barbara Holder began by reviewing the recent Human Factors (HF) Subcommittee meetings and accomplishments. She stated that the Subcommittee reviewed NextGen and Core Flight Deck HF research, as well as NextGen and Core HF Air Traffic Control (ATC) research. She also described the three briefings received by the Subcommittee relating to the topics of UAS integration, enterprise human factors, and an Office of Aviation Safety (AVS) HF research roadmap.

Dr. Holder then presented three Findings and subsequent Recommendations. The first Finding expressed an appreciation for the briefing given by AVS. The corresponding Recommendation was that AVS HF Roadmap development should be continued and sent to AVS-1 for signature. They also added that the FAA should develop a similar roadmap that consolidates the Human Factors (HF) research catalogs across AVS and the Air Traffic Organization (ATO) lines of business.

The second Finding and Recommendation concerned the use of immersive technologies for workforce training. The Finding was that immersive technologies, such as Virtual Reality (VR) and Augmented Reality (AR) have rapidly advanced in recent years and it is not clear if the FAA has the information needed to provide effective guidance and approval for these technologies. The associated Recommendation stated that the FAA should conduct research to explore immersive technologies for training such as VR and AR for developing proficiency, maintaining proficiency, enhancing training, and bringing worker's skills back to standard proficiency levels after periods of skill degradation.

Dr. Holder presented the final Finding and Recommendation of the Subcommittee related to Beyond Visual Line of Sight (BVLOS). She stated that the UAS BVLOS Aviation Rulemaking Committee (ARC) illuminated several potential research gaps. She further stated that industry is driving development in this area but cautioned that input from standards organizations may not be sufficiently incorporated. Dr. Holder added that research is needed to inform the development of standards and policy for operational approval. The corresponding Recommendation was that the FAA should leverage previous Human Factors research on Manned and Unmanned Aircraft and should define specific new research to establish HF guidance and inform operational approval of UAS control stations for BVLOS operations.

Dr. Holder concluded her presentation by outlining actions arising from the Subcommittee meetings. These five actions were the development of an HF research roadmap, a briefing request on reduced crew concepts, a briefing request on Electronic Flight Bag research, a briefing request on conducting naturalistic HF studies where the FAA will be introducing new automation support for controllers, and a briefing request on planned research to update flight deck alerting standards.

Presentation: Subcommittee Report – Airports

Presenter: *Mr. Chris Oswald*, Airports Council International, NA

Mr. Oswald presented the work completed by the Airports Subcommittee in their recent meetings. He described the process of reviewing the Airport Technology Research and Development Portfolio and research progress. He emphasized briefings received by the Airport Cooperative Research Program, Airport Asphalt Pavement Technology Program, and Airport Concrete Pavement Technology Program dealing with a broad range of topics such as Vertiports, Airport Firefighting Research, Sustainable Airfields, and Noise Research.

Mr. Oswald stated that the Subcommittee appreciates the FAA's continuing focus on time-critical research projects such as Alternative Aircraft Fire Fighting agents, assessments of UAS applications at airports, and Vertiport Design Standards. He also stated that the Subcommittee was pleased to see the results of research into new airspace entrants, the impacts of climate change on airport operations and infrastructure, and sustainable pavement research.

Mr. Oswald then presented the Subcommittee's Finding and Recommendation related to construction and material costs. The Subcommittee found that construction cost inflation is affecting planned Pavement Test Facility improvements, including a new pavement materials laboratory. He further added that the costs of pavement materials have increased sharply in recent months as petroleum costs and construction demand have increased. The Subcommittee concluded that these cost increases could adversely affect the rate at which pavement research can be conducted in the near to mid-term future. The subsequent Recommendation by the Subcommittee was that the FAA program assess the impacts of construction and materials cost inflation on ongoing facility construction and pavement research schedules and brief the Subcommittee on these impacts during the fall 2022 meeting. They further added that allowance for inflation should be included in future program funding estimates so they can be taken into account in FAA reauthorization and other budgeting efforts.

Presentation: Committee Closing Discussion, F&Rs, Future Actions

Presenter: *Dr. John Hansman; All Committee Members*

Dr. Hansman addressed the Committee and those in attendance. Dr. Hansman concluded the meeting with a summary of meeting topics. The Committee noted that FAA personnel changes would result in a transition time for the new FAA Administrator. Dr. Hansman recommended that the Committee review its Meta-Recommendations over the past few years to provide a consolidated look back during the next meeting. The Committee concurred that this would be a good exercise to undertake and that it would provide valuable information to the Administrator.

Dr. Hansman thanked everyone for their attendance, and thanked each Subcommittee for their important work. Dr. Hansman noted that he was very pleased at the evolution of the Subcommittee work in the virtual environment.

Mr. Redhead noted that there has been a marked increase in Subcommittee participation since the shift to remote work during the pandemic. Mr. Redhead advocated for keeping a video conferencing option available for meetings, even as the Committee returns to more "in person" activities. He stated that video conferencing allowed many more Subcommittee members to attend the meetings, who would have otherwise, been unable. Dr. Hansman agreed with Mr. Redhead and noted that a hybrid approach for Research, Engineering, and Development Advisory Committee (REDAC) meetings was very likely moving forward.

Research, Engineering and Development Advisory Committee Federal
Aviation Administration (FAA)
VIRTUAL MEETING
April 14, 2022
Agenda

Time	Topic	Presenter(s)
10:00 AM	Welcome Address and Opening Remarks	R. John Hansman
10:15 AM	FAA Welcome Address	Shelley Yak
10:30 AM	Subcommittee Report – NAS Operations	James Kuchar
11:00 AM	Subcommittee Report - Environment and Energy	Ian Redhead
11:30 AM	FAA Urban Air Mobility (UAM) / Advanced Air Mobility (AAM) Update	Martin Suech Chuck Romano Thomas Rubino John Bradley
12:00 PM	FAA NextGen Perspectives - Enterprise Human Factors	Tara Holmes-Gibson
12:30 PM	<i>BREAK</i>	
1:00 PM	Subcommittee Report – Aircraft Safety	Terry McVenes
1:30 PM	Subcommittee Report – Human Factors	Barbara Holder
2:00 PM	Subcommittee Report - Airports	Chris Oswald
2:30 PM	<i>BREAK</i>	
3:00 PM	Committee Closing Discussion - Recommendations - Future Actions	R. John Hansman Committee Members
5:00 PM	Adjournment	

Final

FULL REDAC Winter-Spring 2022 Meeting Attendees:

NAME	AFFILIATION
CA Roundtree-Coleman	FAA
Monique Moore	FAA
Nancy Clarke	JMA
Mark Hale	JMA
John Hansman	MIT
Shelley Yak	FAA
James Kuchar	MIT-LL
Ian Redhead	KCMO
Barbara Holder	Honeywell
Terry McVenes	RTCA
Christopher Oswald	ACI-NA
Martin Suech	FAA
Chuck Romano	FAA
Tom Rubino	FAA
John Bradley	FAA
Tara Holmes-Gibson	FAA
Joseph Bertapelle	JBC
Barbara Esker	NASA
Jason Coon	FAA
Christopher Loring	FAA
Caprice Brown	FAA
Bill Kaliardos	FAA

Dan Herschler	FAA
Di Reimold	FAA
Doug Rodzon	FAA
Jeff Gardlin	FAA/CAMI
James Hileman	FAA
John Dermody	FAA
Jon Schleifer	FAA
Jorge Fernandez	FAA
Karl Kauffman	FAA
Kathy Abbott	FAA
Katie Constant-Coup	FAA
Latasha M. Reddick	FAA
Lee Olson	FAA
Mark Orr	FAA
Michel Hovan	FAA
Mike Paglione	FAA
Patrick N. King	Delta
Phil Yeung	FAA
Rany Azzi	FAA
Rich Golden	CTR/FAA
Robert J. McGuire	FAA
Robert Pearce	NASA
Sabrina Saunders-Hodge	FAA
Steve Kessler	CTR/FAA/ATO
Steve Summer	FAA
Todd Lewis	FAA

Laurence Wildgoose	FAA
Anthony Tvaryanas	FAA/CAMI
Brian Powers	A3 Technology, Inc.
Christine Joseph	House Committee – Science, Space & Technology
Colleen Donovan	FAA
Ferne Friedman-Berg	FAA
Thomas Van Dillen	FAA
Walter Desrosier	GAMA
Alejandra Leija	CSS&T
Joseph Pelletiere	FAA
Hossein Eghbali	FAA
Dave Atwood	FAA
Maria DiPasquantonio	FAA
Lisa C. Thomas	FAA
Jeff Dressel	FAA
Layla Asplen	FAA
Scott LeMay	FAA
Kylie Key	FAA
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