Research, Engineering and Development Advisory Committee (REDAC) MINUTES

Meeting Date and Time: *4/21/2021 – 10:00 AM* **Meeting Location:** *Virtual*

Purpose	REDAC
Facilitator	Dr. John Hansman, *REDAC Chairperson, MIT* ; Ms. Shelley Yak*, FAA WJHTC Director and REDAC Executive Designated Federal Official*
Note Taker	Mark R. Hale

Presentation: Welcome Address and Opening Remarks
Presenter/s: *Dr. John Hansman, Ms. Shelley Yak*

Dr. John Hansman opened the meeting with schedule and administrative notes. Dr. Hansman noted the exceptional nature of the last year dealing with the COVID-19 pandemic and struck an optimistic tone for the future of aviation. Ms. Yak announced the public meeting notice as required, and provided an introduction and updates. Ms. Yak thanked attendees for their virtual presence and commitment to the Research, Engineering, and Development Advisory Committee (REDAC). Ms. Yak remarked that she enjoyed attending the REDAC Subcommittee meetings and benefited greatly from the discussion related to the industry impacts of COVID-19.

Presentation: FAA NextGen Perspectives
Presenter: *Ms. Pamela Whitley,* Assistant Administrator for NextGen

Ms. Pamela Whitley delivered the first presentation on the FAA's NextGen perspectives. Ms. Whitley informed the Committee that the FAA is working to address several of the items in the last FAA reauthorization bill. This includes the establishment of an Assistant Administrator for Research and Development. Conversations are ongoing to determine exactly how this will be handled in conjunction with the new Administration.

Ms. Whitley stated that NextGen is in a transitional space where the Air Traffic Organization (ATO) is taking the lead position to operationalize NextGen including Communications, Navigation, and Surveillance (CNS) capabilities. She added that the FAA continues to work on several significant items such as the EnRoute portion of Data Communications and the Terminal Flight Data Manager. While these programs have been impacted by COVID-19, the FAA is in the process of evaluating schedule impacts and planning these efforts. According to Ms. Whitley, the factors that had the largest impact on these research projects and programs were employee safety and access to facilities for testing and training. Ms. Whitley added that as the country continues to return to a more normal post-pandemic state, the ATO will look for opportunities to continue this work in the most efficient and expeditious manner possible.

Ms. Whitley spoke about an agreement with industry on a minimum capabilities list for aircraft. The

minimum capabilities list refers to equipment on aircraft that will allow them to take advantage of advanced procedures and support the goal of a Performance Based Navigation (PBN) National Airspace System (NAS). Ms. Whitely indicated that this was a great learning opportunity and that the big challenge is the different equipage postures of the various aircraft carriers at the regional level to support different Area Navigation (RNAV) activities. Ms. Whitley stated that there are active and ongoing conversations within the airline communities to understand this mixed equipage problem and how to best address it – with the ultimate goal being increased usage of PBN. Ms. Whitley spoke about conversations with the House Committee on Transportation and Infrastructure (T&I) related to this topic, and upcoming opportunities for a NextGen roundtable hosted by the House T&I Committee. This roundtable would include the FAA and other industry and governmental groups such as Airlines for America (A4A), the Air Line Pilots Association (ALPA), and the NextGen Advisory Committee (NAC) among other participants.

Ms. Whitley stated that as NextGen becomes operationalized the Agency will begin to look at what happens beyond NextGen in what is considered an information-centric NAS. Ms. Whitley stated that the FAA has access to a data rich environment and will look towards leveraging that data to realize gains in safety and efficiency in both Air Traffic Management (ATM) and for NAS users.

Ms. Whitley noted that as the FAA looks into the next 10 to 20 years we expect to see a transition to micro services or third party service providers to provide various capabilities. She stated that this will dovetail nicely into the work that NASA is currently doing on long term research. She noted that the FAA is working closely with NASA on what this long term approach looks like.

Ms. Whitley noted a continuous growth in Commercial Space, the work needed to enable Unmanned Aircraft Systems (UAS), and the management of that associated traffic in a UAS Traffic Management System (UTM) as items of high priority. The UTM will be a cloud capability where various providers can offer a traffic management service through a shared service environment. Ms. Whitley also spoke about the notion of Urban Air Mobility (UAM) and working with industry and the UAS community to approach the integration of traditional air traffic with these newer concepts that are evolving.

Ms. Whitley provided an update on aviation grant programs that the FAA stood up as required in the last FAA reauthorization. These programs focus both on the technician community and the pilot community. These grant programs aim to promote these career paths to ensure a future pool of qualified pilots and aviation technicians. Ms. Whitley offered that proposals are being evaluated currently and it is expected that grants will be awarded by the end of this calendar year.

Dr. Hansman inquired about the maturity of the minimum capabilities list and asked if it was mapped to operational capabilities. Ms. Whitley responded that the minimum capabilities list is public and that while it is fairly mature, it is a living document.

Mr. Terry McVenes asked Ms. Whitley if there was a vision regarding how the data from the information-centric NAS would be used and stored. Ms. Whitley responded that there was a vision document that was under review that will explain the pillars of what the FAA is thinking and inform FAA research. Ms. Whitley explained that the FAA has made investments in a more detailed information architecture that will support the private investment and usage of an information-centric NAS.

Presentation: FAA Center for Emerging Concepts and Innovation (CECI)
Presenter: *Mr. James Wilborn,* Manager, AIR-650 Center for Emerging Concepts & Innovation

Mr. James Wilborn began his presentation speaking about how the FAA facilitates the safe introduction of new technologies such as Advanced Automation, Artificial Intelligence (AI), Autonomous Flight, and Urban Air Mobility (UAM). He stated that while additions of technology may enable certain operations, we must always be mindful of the impact to safety, and leverage these technologies in ways that maintain and increase safety as a whole. For example, Mr. Wilborn spoke about new vehicles and the considerations of how they will integrate safely into the larger airspace system. Mr. Wilborn presented a graphic that summarized the safety continuum as a framework for certification requirements and stated that as new types of aircraft enter the NAS, we must evaluate and understand the acceptable risks associated with them.

After a brief demonstration of the organizational structure of the FAA's Aircraft Certification Service, Mr. Wilborn presented the specific functions accomplished under the Center for Emerging Concepts and Innovation (CECI). Mr. Wilborn stated that the CECI does not replace ATO staff or standards staff, but rather that it compliments them. Mr. Wilborn stated that often, with new vehicles, developed standards cannot be applied or do not exist. The CECI helps to facilitate these innovative products and vehicles through early engagement with stakeholders, understanding certification issues and developing strategies to address them, outreach and education on the certification process, and Research and Development (R&D). This pre-application engagement with stakeholders allows for the development of a path to certification and compliance.

Mr. Ian Redhead stated that the environmental impacts of new entrants must be identified and communicated as early as possible. Mr. Wilborn agreed stating that noise and emissions are both key components and certification requirements.

Mr. Chris Oswald asked about the coordination needed for certification of new entrants with the various industry, governmental, and advisory committee inputs. Mr. Wilborn discussed the relationships that Aircraft Certification Service (AIR) maintains and how they must look at all facets of certification. He further added that AIR keeps appropriate stakeholders apprised of new developments and lines of thinking as they are surfaced.

Mr. Wilborn presented a framework to enable innovation that included: advancing performance based regulations, tailoring certification requirements, identifying emerging technologies and trends, collaborating on cross-discipline approaches to introducing new technology into the airspace, building partnerships, and defining areas of research.

Dr. Hansman read a chat question for Mr. Wilborn that asked if CECI is working to harmonize their rules with other international authorities. Mr. Wilborn responded affirmatively and reiterated the importance of working to harmonize with international authorities wherever possible.

Presentation: COVID-19 Impacts – Industry and FAA
Presenter: *Dr. Eric Neiderman,* Manager – Aviation Research Division (ANG-E2)
Dr. Anthony Tvaryanas, Manager, Aerospace Medicine Research Division (AAM-600)

Dr. Eric Neiderman stated that the purpose of the briefing was to present information on the impact of COVID-19 from the FAA's perspective and from the perspective of industry. Dr. Neiderman presented a list of resources including a repository of knowledge available on the Airport Cooperative Research Program's website. Dr. Neiderman highlighted the work organized by three main areas: airport responsibilities and preparedness, crisis/emergency communications, and continuity of operations.

Dr. Neiderman introduced Dr. Anthony Tvaryanas who spoke about the pandemic from the perspective of the FAA's Civil Aerospace Medical Institute (CAMI). Dr. Tvaryanas described the research program that was stood up in the late spring 2020 related to the pandemic. This program is a 1-2 year effort to inform safety risk management analysis and establish a foundation to inform a cabin safety pandemic playbook for future use.

Dr. Tvaryanas spoke about lessons learned from the approach to the pandemic. He emphasized both the unprecedented volume of research that has been published related to the pandemic, and the uncertainty inherent in some of this research. For example, significant amounts of this research were published through non-traditional means, and in some cases outside of the normal peer-reviewed journal process. Dr. Tvaryanas explained that while this influx of research is valuable, scientists must be cautious when interpreting results as a whole.

Dr. Tvaryanas spoke about the challenge of managing the complexity of the research and the need to scope the problem of the effects of the pandemic. He stated that in order to appropriately scope the problem it must be specific. For example, the focus should be on the aircraft cabin environment and diseases of public health significance as this allows for an appropriate organizing framework for the research. Dr. Tvaryanas then spoke about the risk breakdown structure oriented on the aircraft cabin environment. Finally, Dr. Tvaryanas spoke about the need to focus on the generalizability of the COVID-19 related research results in order to inform a response to the next pandemic. He then indicated that this will take some time to validate.

Dr. Kuchar asked a question about modeling disease propagation and asked if CAMI was close to identifying the R&D investment required to understand the full impact of the pandemic on the aviation industry. Dr. Tvaryanas indicated that CAMI is in the process of developing requirements and understanding the resources needed to model and simulate disease transmission. Dr. Tvaryanas also offered that the focus on the pandemic has been largely tactical and suggested that moving to a more strategic focus is important.

Mr. Redhead offered that the amount of expert opinions that he received regarding his airport and COVID-19 were vast and overwhelming. He stated that it was hard to determine which information was reliable. Mr. Redhead suggested that Dr. Tvaryanas obtain a copy of a presentation given by the Environmental Protection Agency (EPA) as it provided a reliable overview of the methods and technologies to be used in the airport environment to help mitigate COVID-19. Mr. Redhead stated

that the EPA presentation identified numerous unproven and unreliable technologies currently being marketed toward airport operators during the pandemic.

Dr. Neiderman presented a slide related to change in the aviation industry due to the pandemic. Dr. Neiderman stated that passenger demand during the pandemic was down to 1950's levels, while cargo demand had increased significantly. Dr. Neiderman also noted that the pandemic brought into question the U.S.'s funding model as compared to Europe. He added that without segment fees, airport parking, duty free shops, and full-fare first class tickets, the competitive advantage in aviation may shift to Europe. Dr. Neiderman shared a positive note that because the fleet size is down that the average aircraft age is younger and stated that the FAA has done an excellent job of keeping the type certification team engaged. Dr. Neiderman also spoke about the changes in operations including dynamic resectorization and contactless air travel while speaking about the budgetary impacts of COVID-19 on technology and innovation.

Dr. Neiderman spoke about building public confidence in air travel with a "curb-to curb" plan to help people feel safe traveling. This plan would include increased cleaning standards, social distancing, and the establishment of new partnerships that previously did not exist (e.g., CAMI and the Centers for Disease Control and Prevention). Dr. Neiderman concluded that the FAA should learn from COVID-19 and suggested a case study documenting the FAA's response to the pandemic. He further stated that government, industry, and academia need more deliberate modeling of these types of events.

The session concluded with member comments. The Committee emphasized the need to capture lessons learned from the pandemic. Other topics included the suggestion of making Air Traffic Control (ATC) personnel a priority/essential service category for vaccine distribution and the reemphasis of international harmonization of standards.

Presentation: FAA and NASA Collaborative Research
Presenter: *Mr. Akbar Sultan,* Director – NASA Airspace Operations and Safety Program
Mr. Steve Bradford, FAA Chief Architect for NextGen

Mr. Akbar Sultan led a presentation that was co-facilitated by Mr. Steve Bradford on the topic of FAA and NASA collaboration. Mr. Sultan spoke about the vision for the 2045 timeframe, digital mesh technologies, systems wide safety assurance, verification and validation of autonomy, digital twins, and autonomous freighters as "beyond NextGen" research areas. Mr. Sultan spoke at length regarding the Aircraft Technology Demonstration 2 (ATD-2) that is scheduled to be completed in 2021. ATD-2 will have significant environmental and operational benefits for stakeholders including significant reduction in carbon dioxide emissions. Mr. Sultan concluded this portion of the presentation speaking about upcoming work in the areas of Unmanned Aircraft Systems (UAS), Advanced Air Mobility (AAM), Upper E class airspace, and aircraft technologies such as supersonic flight, green aviation, and electrified aircraft propulsion. Mr. Sultan stated that the collaboration between NASA and the FAA has never been stronger, Mr. Bradford concurred.

Mr. Sultan spoke about the Research Transition Team (RTT) administrative framework and five separate RTTs including integrated arrival/departure/surface, digital mesh technologies and applications, Upper Class E Traffic Management (ETM), system wide safety assurance, and Unmanned Traffic Management (UTM). Mr. Sultan concluded this portion of the briefing by

describing the AAM Executive Board which includes several FAA and NASA co-chairs.

Mr. Sultan spoke specifically about expanding FAA-NASA partnerships in the area of aircraft technologies. He added that a collaboration framework was being developed between FAA's Aircraft Certification Service, (AIR-600) and NASA's Advanced Aircraft Vehicles Program (AAVP). He also noted discussions with the FAA William J. Hughes Technical Center (WJHTC) and AAVP exploring advanced composites research and electrified propulsion, and growing engagement with the FAA's Environment and Energy program focused on the Administration's green aviation priorities. Mr. Sultan also spoke about the joint planning between the FAA and NASA on NAS transformation towards a highly data-driven environment with advanced automation – both key enablers to the NAS of the future.

Mr. Sultan then explained the framework for "FAA 2035: Charting Aviation's Future: Operations for an Information-Centric NAS" that is based around safety, security, and resiliency. Mr. Sultan stated that this would include distributed decision making, incorporating performance based standards, building in scalability to expand capabilities, and ensuring systemic adaptability and agility. Key enabling technologies were presented and the committee discussed the topic of delegated separation at length during the question and answer portion of the presentation.

Presentation: Subcommittee Report – Human Factors
Presenter: *Dr. Barbara Holder, Honeywell*

Dr. Barbara Holder began her presentation by providing a summary of the Human Factors Subcommittee meetings. Dr. Holder stated that the Subcommittee meeting was very successful with a very large virtual turnout. The Human Factors Subcommittee meetings included discussion of potential industry changes due to COVID-19, emerging issues, and a review of the Human Factors portfolio. Dr. Holder stated that two new areas were discussed for the Human Factors Subcommittee's emerging issues list. One new emerging area included the increased demand for single pilot operations for cargo missions and the associated needs for increasingly automated vehicles, pilot state monitoring, and simplified flight decks. The second emerging area that Dr. Holder spoke about was a European Union Aviation Safety Agency (EASA) roadmap for use of Artificial Intelligence (AI) in aviation. Dr. Holder informed the full Committee of key briefings presented to the Human Factors Subcommittee including FAA human factors and systems safety activities related to aircraft certification, safety, and accountability legislation; Unmanned Traffic Management (UTM) Human Factors; and a manual on human performance for regulators.

Dr. Holder presented the Findings and Recommendations of the Human Factors Subcommittee for approval by the Full Committee prior to submission to the FAA Administrator. The first finding related to Human Factors for aircraft certification. Dr. Holder stated that the FAA has been responsive to the recent Aircraft Certification, Safety, and Accountability Act and that the Subcommittee was pleased to hear about the FAA's plans for integrating Human Factors into policy and processes for certification of flight standards. The Subcommittee recommended that the FAA pursue the research requirements established in the Aircraft Certification, Safety, and Accountability Act to include identifying and engaging in research areas related to the integration of Human Factors into the certification process.

Dr. Holder presented the second Finding which was related to improving methods used to

determine the individual proficiency of operational personnel. While Dr. Holder noted that the FAA is very engaged in training, there is a need to improve on current methods of determining proficiency. Dr. Holder added that proficiency in cognitive skills is mostly assessed by subjective judgement of instructors and examiners and that those assessments are difficult to standardize. The Subcommittee recommended that the FAA pursue research to address the assessment of cognitive skills and specifically determine the length of time after training that skill proficiency can be expected to be retained.

Dr. Hansman asked if the focus of the Finding and Recommendation was related to air traffic controllers or pilots. Dr. Holder stated that the finding and recommendation were related to all operational personnel to include air traffic controllers, pilots, and maintainers.

Presentation: Subcommittee Report – Airports
Presenter: *Mr. Chris Oswald, Airports Council, NA*

Mr. Oswald briefed the full Committee on the activities of the Airports Subcommittee and outlined topics of discussion from their virtual meeting held in March 2021. Mr. Oswald discussed the Subcommittee's review of the impacts of COVID-19 and the Subcommittee's review of the Airport Technology R&D portfolio. He then informed the Committee of specific briefings that the Airports Subcommittee had received on Unmanned Aircraft Systems (UAS) research, Aircraft Fire fighting Agent testing, Vertiport Design standards, Solar Lighting systems, Airport Environmental research, and Airfield Pavement Management software. Mr. Oswald also noted that NASA briefed the Subcommittee on areas of complementary research that included UAS, supersonic aircraft, and airside surface management.

Mr. Oswald presented observations and commendations from the Airports Subcommittee. He stated that the Subcommittee is pleased to see that the Airport programs on site research has substantially resumed in the last part of the calendar year. He also noted that the Subcommittee appreciates that the FAA continues to focus on time-critical projects such as firefighting agents and UAS detection and mitigation – both of which have legislative research deadlines this year. He commented that the Subcommittee was pleased to learn that the FAA had selected four pilot testing sites for UAS detection and mitigation research exercises. Mr. Oswald also noted the successful conclusion of the FAA's Neighborhood Environmental Survey which culminated in a publication of survey results in January 2021.

Mr. Oswald presented the Subcommittee's proposed Findings and Recommendations for spring 2021. The first Finding acknowledged the disruptions caused by COVID-19 and the fact that critical research activities, including those with provisions in the FAA Reauthorization Act of 2018, may be delayed. The Subcommittee recommended that the FAA assess whether additional time will be needed to complete its alternative firefighting agent research and requested that the FAA coordinate this research with the U.S. Department of Defense (DOD).

Mr. John Dermody commented on the collaborative nature of Aqueous Film Forming Foams (AFFF) work that the DOD and FAA are doing. While the DOD is doing most of the toxicity testing and some compatibility testing, the FAA is focused more on live fire research at the William J. Hughes Technical Center (WJHTC). Mr. Dermody stated that while this is a cooperative effort, the FAA's

congressional requirement on Aqueous Film Forming Foams (AFFF) is more near term (October 2021) than that of the DOD research which has approximately two more years to conclude. This provides a challenge as the government aims for a singular solution that meets both safety and environmental requirements.

Mr. Oswald presented the second Finding of the Subcommittee which related to Unmanned Aircraft Systems (UAS) research. Mr. Oswald stated that UAS research remains a high priority and that the actions the FAA has taken to facilitate UAS operations make these aircraft very attractive for a variety of beneficial uses at airports. The Subcommittee recommended that the FAA continue to prioritize its research into beneficial UAS use cases and implementation challenges at airports. Mr. Oswald concluded with the recommendation that the FAA expedite this research where possible.

Presentation: Subcommittee Report – NAS Operations
Presenter: D*r. James Kuchar, MIT-LL*

Dr. James Kuchar began the NAS Operations Subcommittee briefing by giving an overview of the agenda and topics discussed during the March 2021 meetings. Dr. Kuchar described the Subcommittee's COVID-19 impacts discussion, updates to the FAA's research landscape, and the Subcommittee's typical research program reviews. Dr. Kuchar indicated that the Subcommittee received several deep dive briefings on UAS Traffic Management (UTM), Operations Concept Validation and Infrastructure, NAS Integration of Transitioning Operations (NITRO), and NASA's xTM R&D.

Dr. Kuchar presented general observations from the NAS Operations Subcommittee meetings. The first observation was related to the importance of Machine Learning (ML) and Artificial Intelligence (AI) with an emphasis placed on developing enhancements and extensions to the existing Safety Risk Management process to ensure these risks can be properly identified and mitigated.

Dr. Hansman asked if the concern was that there were emergent risks that would not be identified or if the concern was due to some limitation of the FAA's Safety Risk Management practices as they relate to new technologies. Dr. Kuchar said that there is potential to miss some risks and also the potential to incorrectly flag something as not being able to meet a safety standard, when in reality, it may be acceptable. This uncertainty is directly due to the nature of these new technologies according to Dr. Kuchar.

The Subcommittee also commented that the Air Traffic Control/Technical Operations program is beginning to address job task requirements for personnel at the Air Traffic Control System Command Center. The Subcommittee was pleased to learn about this new work as it is important to strengthen the capabilities and performance of these critical personnel.

Dr. Kuchar presented highlights from the Subcommittee's COVID-19 discussion and started by acknowledging the successful responses of the FAA and aerospace industry to COVID-19. He noted that while there were some disruptions, such as deferred R&D for simulations, and some NextGen Advisory Committee (NAC) milestones slipping, the FAA was able to continue many efforts on pace and even accelerate some. Dr. Kuchar noted additional impacts from COVID-19 in the form of trends and opportunities. These opportunities include interest in purpose-built freighters and increased

autonomy in cargo operations, Advanced Air Mobility (AAM) in suburban/rural locations, and the opportunity to collect lessons learned from the start to the end of the pandemic.

Dr. Kuchar briefed the Committee on the Subcommittee's discussion of the FAA research landscape document. He stated that there is continued interest in topics already included in the research landscape such as mixed equipage operations, certification of new entrants, autonomous ground service equipment at airports, and advanced aircraft energy systems. Dr. Kuchar concluded the research landscape discussion by presenting areas that the Subcommittee feels are not adequately represented in the current FAA landscape document. These areas included risk-based decision making applied to Air Traffic Control (ATC), advanced ground facility energy systems for airports and ATC facilities, and communications technology evolution.

Dr. Kuchar presented the Subcommittee's Finding that fiscal year 2021 enacted R&D budgets show significant funding reductions from prior levels. He noted that weather remains the largest single cause of air traffic delay and that it is likely that weather-related delays will become increasing problematic as the NAS returns to traffic levels similar to those prior to COVID-19. He emphasized that research is needed to ensure that the improvements afforded by NextGen decision support capabilities are effective and robust in weather conditions. Dr. Kuchar stated that Unmanned Aircraft System (UAS) and AAM concepts require consideration with regards to weather impacts, and that the ability to model and forecast winds in upper altitude airspace (Upper E), where sensitive air vehicles will operate, is important. The Subcommittee recommended that the FAA make a directed effort to improve awareness of weather-related research and the impacts that pre-pandemic research had on improving safety and efficiency in the NAS. The Subcommittee also recommended that weather-related research, engineering, and development programs strengthen their connection with FAA programs and strategic thrust areas. The program areas suggested by the Subcommittee were Trajectory Based Operations (TBO), future flow management, UAS Traffic Management, AAM, and NAS Integration of Transiting Operations (NITRO).

Dr. Kuchar concluded the Subcommittee briefing by requesting documentation on the FAA's "Charting Aviation's Future: Operations in an Info-Centric National Airspace System," also known as the NAS 2035 vision, and the "Human Factors Impacts of Highly Automated Vehicles Research Plan." The Subcommittee also requested the following deep dive topics for the spring 2021 meeting: Flight Deck Human Factors, an update from the Environment and Energy program on operational procedures, UAS Traffic Management (UTM) roadmap update, and an update on NITRO.

Presentation: Subcommittee Report – Aircraft Safety
Presenter: *Mr. Terry McVenes, RTCA*

Mr. Terry McVenes briefed the REDAC on the Aircraft Safety Subcommittee meetings held in February 2021. Mr. McVenes mentioned a very useful briefing on a new Memorandum of Agreement between the Aviation Safety organization and the Office of NextGen and stated that it was very well received by industry members. He added that the Subcommittee discussed the impacts of COVID-19 to aviation, including its direction and challenges, and then informed the Committee on specific briefings received by the Subcommittee. The briefings included topics such as: Human Factors certification work; COVID-19 R&D impacts; Fatigue research; UAS research; Air force, Industry, and FAA collaboration; and emerging technologies. He also noted updates on the FAA's budget and fiscal year 2023 research portfolio.

Mr. McVenes presented the Subcommittee's first Finding regarding the visibility of the source of Research, Engineering, and Development (RE&D) funding. He stated that some FAA RE&D activities are being sponsored and managed under Facilities and Equipment (F&E) funding. Mr. McVenes noted that Unmanned Aircraft System (UAS) pilot programs are being managed with F&E funding and that some RE&D being conducted under F&E funding also serves to inform FAA aviation safety, policy, regulation, and rulemaking. He stated that the Subcommittee believes that the lack of visibility into projects sponsored and managed under F&E funding leads to an incomplete research review. He added that the potential exists for regular F&E activities, pressures, and priorities to impact prioritization of resources in the mid-term and long-term research. He then stated that the Subcommittee recommends that the FAA brief the Aircraft Safety Subcommittee on the process by which RE&D and F&E funding is coordinated to ensure prioritization of objectives. He added that the Committee recommends that the FAA include F&E RE&D activities which inform FAA aviation safety policy, regulations, and rulemaking projects in future SAS briefings.

Dr. Hansman interjected describing the historical reasons why some items were moved to the F&E budgetary account in the late 1980s. While this was a necessary move for balancing budgets, Dr. Hansman's opinion was that some F&E items should fall under the development portion of RE&D, and therefore be under the purview of the REDAC. Ms. Yak stated that the National Aviation Research Plan (NARP) includes Airport Improvement Program (AIP), F&E, and RE&D appropriations and that this was an appropriate recommendation to move forward.

Mr. McVenes presented the Subcommittee's second Finding related to ice crystal icing research. Mr. McVenes noted that FAA research on ice crystal icing conditions to address the fundamental knowledge of high-altitude icing on turbine engine damage and power loss is currently unfunded through fiscal year 2023. The Subcommittee recommended that the FAA continue to pursue this important research to ensure it is adequately addressed in certification and rulemaking. The Subcommittee also recommended that additional research be considered to include: aerosol testing to determine the effects on high altitude ice crystal concentrations, continental versus oceanic mesoscale convective systems, and basic physics studies of ice formation within turbine engine flow paths from high altitude ice crystal icing.

The Subcommittee's final recommendation was related to Artificial Intelligence (AI) and Machine Learning (ML). Mr. McVenes stated that future advancement in control system technologies will depend on an artificial learning process that has the potential to impact the basis of system certification. He stated that the Subcommittee believes more research is needed to establish criteria to judge confidence and validation of such systems. He also noted that there is significant standards development work that is being conducted by Radio Technical Commission for Aeronautics (RTCA), Society of Automotive Engineers (SAE), and American Society for Testing Materials (ASTM) on these technologies across the aviation ecosystem, including Unmanned Traffic Management (UTM) solutions. The Subcommittee's recommendation was that the FAA place priority on funding research in ML and AI and that the FAA work in close collaboration with industry to understand the FAA's requirements.

Dr. Hansman commented that it is helpful to specify with more granularity the specific type of research needed and suggested that understanding the certification standards for how well these systems must perform in critical applications, such as aviation, is of major importance. Mr. McVenes concurred and stated that he would follow up on behalf of the Subcommittee.

Presentation: Subcommittee Report – Environment and Energy
Presenter: *Mr. Ian Redhead, KCMO*

Mr. Ian Redhead briefed the REDAC on the Environment and Energy Subcommittee meetings held in March 2021. Mr. Redhead started his presentation by discussing successes that the Office of Environment and Energy R&D Program had made both locally, and on the international front. He stated that the FAA was doing a good job maintaining a balanced portfolio, and maintaining the FAA's global impact in the International Civil Aviation Organization/Committee on Aviation Environmental Protection (ICAO/CAEP). He added that noise is still viewed as a threat and collaboration between FAA, NASA, DOE and other federal agencies is critical for success in this area. Mr. Redhead stated that additional research is needed to adequately address these noise and emissions issues.

Mr. Redhead presented the Subcommittee's first Finding related to ICAO/CAEP. The Subcommittee found that recent commitments by foreign governments to environmental research could challenge the FAA's global leadership and position. He stated that the Subcommittee recommends that the FAA maintain its leadership position at ICAO/CAEP so that it is able influence policy and rulemaking.

Mr. Redhead presented the second Finding by stating that the execution of the Environment and Energy research portfolio has been accomplished working collaboratively with private industry, major universities, and some foreign governments. He added that the benefits of these partnerships have been proven as technologies have matured and directly led to reductions in fuel burn, emissions, and noise reductions. He stated that the Subcommittee continues to endorse public-private partnerships like the Continuous Lower Energy, Emissions and Noise (CLEEN), Commercial Aviation Alternative Fuels Initiative (CAAFI), and Aviation Sustainability Center of Excellence (ASCENT) programs, and suggested continuing the allocation of robust funding in these areas.

The Subcommittee's third Finding was presented by Mr. Redhead. The Finding stated that there have been significant gains in the Sustainable Aviation Fuel (SAF) program and that SAFs are a critical component of the industry's emissions reduction strategy. The Subcommittee recommended that this program be developed further to meet carbon neutral and emission reduction goals.

The fourth and final finding of the Subcommittee acknowledged that despite significant improvements, noise continues to be one of the biggest impacts related to aviation and requires ongoing and increased research. The Subcommittee recommended that the FAA prioritize noise research to address the continued noise concerns of citizens.

The question and answer portion of the Subcommittee briefing focused on discussion of the lack of viability in the near-term for hydrogen fuel cells in commercial aviation and discussion of noise research.

Presentation: Committee Closing Discussion, F&Rs, Future Actions
Presenter: *Dr. John Hansman; All Committee Members*

Dr. Hansman thanked the Committee and those in attendance. The Committee discussed global comments and themes arising from the meeting. This discussion included the topics of Machine

Learning (ML) and Artificial Intelligence (AI), mixed equipage concerns, and learning from the current COVID-19 pandemic. Specifically, the Committee stated that the FAA needs to have an understanding of lessons learned so that it can respond faster to the next pandemic. The Committee noted that the issue of system resiliency and operational and business continuity planning should be considered in preparation for the next pandemic.

Dr. Hansman and the parent Committee will finalize the Findings and Recommendations Report from the Winter-Spring 2021 Research, Engineering, and Development Advisory Committee (REDAC) meeting. The report will be provided for formal submission of advice and guidance to the FAA Administrator for Agency review and future implementation considerations, as appropriate.

Research, Engineering and Development Advisory Committee
Federal Aviation Administration (FAA)
VIRTUAL MEETING
APRIL 21, 2021
Agenda

Time	Topic	Presenter(s)
10:00 AM	Welcome Address and Opening Remarks	R. John Hansman Shelley Yak
10:15 AM	FAA NextGen Perspectives	Pam Whitley
10:45 AM	FAA Center for Emerging Concepts and Innovation	James Wilborn
11:15 AM	COVID - 19 Impacts – Industry and FAA	Eric Neiderman Anthony Tvaryanas Committee Members
12:00 Noon	*BREAK*	
12:30 PM	FAA and NASA Collaborative Research	Steve Bradford Akbar Sultan
1:30 PM	Subcommittee Report – Human Factors	Barbara Holder
2:00 PM	Subcommittee Report – Airports	Chris Oswald
2:30 PM	Subcommittee Report – NAS Operations	James Kuchar
3:00 PM	*BREAK*	
3:30 PM	Subcommittee Report – Aircraft Safety	Terry McVenes
4:00 PM	Subcommittee Report - Environment and Energy	Ian Redhead
4:30 PM	Committee Closing Discussion	R. John Hansman
	– Recommendations – Future Actions	Committee Members
5:00 PM	Adjournment	R. John Hansman

FULL REDAC Winter/Spring 2021 Agenda

FULL REDAC Winter/Spring 2021 Attendees

	ATTENDEES	ORGANIZATIONAL AFFILIATION
1	CA Roundtree-Coleman	FAA
2	Nancy Clarke	JMA
3	Mark Orr	FAA
4	Paul Aussendorf	GAO
5	Matthew Holloman	FAA
6	Monique Moore	FAA
7	Terry McVenes	RTCA
8	Joseph Bertapelle	JetBlue (retiree)
9	Pamela Whitley	FAA
10	Shelley Yak	FAA
11	Colleen Donovan	FAA
12	Brittaini Maul	GAO
13	Christopher Oswald	ACI-NA
14	R John Hansman	MIT
15	Akbar Sultan	NASA
16	Anthony Tvaryanas	FAA-CAMI
17	Antionette Johnson	Concept Solutions, LLC
18	Bill Kaliardos	FAA
19	Robert Pearce	NASA
20	Caprice Brown	FAA
21	Carla Hackworth	FAA
22	Di Reimbold	FAA
23	Diana Liang	FAA
24	Doneliya Deneva	FAA
25	Doug Rodzon	FAA
26	Eddie Austrian	Fort Hill Group
27	Eric Neiderman	FAA
28	Frank Wondolowski	FAA
29	Glenn Morse	United Airlines
30	Greg Schwab	FAA
31	Hossein Eghbali	FAA
32	Jaime Figueroa	FAA
33	Jean Cook	GAO
34	Jim Hileman	FAA
35	Jim Kuchar	MIT-LL
36	John Dermody	FAA
37	John Steventon	FAA
38	Jon Schleifer	FAA
39	Kathy Abbott	FAA
40	Kevin Gildea	FAA

41	**Laura Gomez**	**FAA**
42	**Lauren Hyland**	**CTG, Inc.**
43	**Lee Olson**	**FAA**
44	**Mark Hale**	**JMA**
45	**Marlo E. Allen**	**JMA**
46	**Molly Laster**	**GAO**
47	**Nick Lento**	**FAA**
48	**Paul Strande**	**FAA**
49	**Peter White**	**FAA**
50	**Phil Yeung**	**FAA**
51	**Rany Azzi**	**FAA**
52	**Rich Golden**	**NATSS**
53	**Sabrina Saunders-Hodge**	**FAA**
54	**Sam Magill**	**NASA**
55	**Stafford Duncan**	**FAA**
56	**Tara Holmes**	**FAA**
57	**Terry King**	**FAA**
58	**Thomas Nesthus**	**FAA**
59	**Ahmad Kamyab**	**Veracity Engineering**
60	**James Wilborn**	**FAA**
61	**Dan Brock**	**FAA**
62	**Dan Herschler**	**FAA**
63	**David Sizoo**	**FAA**
64	**Ian Redhead**	**KCMO**
65	**Tomonori Tsuruzono**	**IATA**
66	**Mike Paglione**	**FAA**
67	**Steve Bradford**	**FAA**
68	**Scott LeMay**	**FAA**
69	**Jorge Fernandez**	**FAA**
70	**Barbara Adams**	**FAA**
71	**Mara Jenkins**	**FAA**
72	**Chris Rocheleau**	**FAA**
73	**Carl Berntsen**	**Booz Allen Hamilton**
74	**Evan Harvey**	**HumanProof**
75	**Lauren Thomas**	**FAA**
76	**Laurence Wildgoose**	**FAA**
77	**Warren Randolf**	**FAA**
78	**1 202 770 7440**	**-**
79	**1 202 494 6978**	**-**
80	**1 757 849 8554**	**-**