U.S. Department
of Transportation
**Federal Aviation
Administration**

Office of the Administrator

[redacted]

September 29, 2020

Dr. R. John Hansman, Ph.D.
Chair, Research, Engineering and
Development Advisory Committee
Massachusetts Institute of Technology
[redacted]

Dear Dr. Hansman:

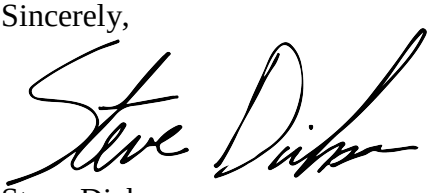
Thank you and the Federal Aviation Administration's (FAA) Research, Engineering, and Development Advisory Committee (REDAC) for your August 25, 2020 letter providing recommendations on the Fiscal Year (FY) 2022 Research and Development (R&D) Portfolio. The important guidance generated during the REDAC Winter-Spring 2020 virtual meeting held on July 9, 2020, is sincerely appreciated.

During this meeting important presentations included a panel discussion that addressed the impact of the COVID - 19 pandemic on the various FAA Research and Development (R&D) programs, FAA NextGen Perspectives, Human Factors, and NASA Updates. Also vitally important to the FAA were the discussions regarding the emergence of new entrants and vehicle classes that include Unmanned Aerial Systems, Advanced Air Mobility, and Supersonics.

I have reviewed the nineteen recommendations submitted by the REDAC. The enclosed FAA Response Report reflects our Agency responses to these recommendations. The FAA Response Report includes our dispositions for the total of nineteen recommendations made by five Subcommittees and authorized by the parent REDAC Committee as follows: Environment and Energy (4); NAS Operations (3); Airports (3); Human Factors Subcommittee (5); and Aircraft Safety (4). The FAA fully concurs with all nineteen recommendations.

I appreciate your assessment and insightful advice as well as the expertise of the REDAC professionals who provided guidance and support of the Agency's R&D programs.

Sincerely,



Steve Dickson
Administrator

Enclosure

FAA Response to Research, Engineering and Development Advisory Committee (REDAC) Recommendations for the Fiscal Year (FY) 2022 Research and Development (R&D) Portfolio

Subcommittee on Airports

Finding: UAS Emerging Vehicle Types - The Subcommittee is extremely interested in the Airport Technology Research Program's involvement in UAS research—both from the perspective of their beneficial use at and in the vicinity of Airports and from the perspective of managing the safety and security risks associated with unauthorized use of these and in the vicinity of airports. We also recognize the growing interest in Advanced Air Mobility systems (AAM)—also known as urban air mobility systems. AAM, like UAS, represent a new class of aircraft that will need to share use of airspace on and in the vicinity of airports.

In both cases, there is a need to ensure ongoing research is effectively coordinated across multiple FAA research portfolios, across federal agencies (e.g., risk mitigation of unauthorized UAS operations), and across a number of external stakeholders.

Recommendation (1): The Subcommittee recommends allocating time during each of its semi-annual meetings for discussion of these emerging vehicle types and the ongoing research associated with them.

FAA Response: **The FAA concurs with the Committee's findings and recommendations and is taking the following actions to address it -** At each of its upcoming semi-annual meetings for 2020 and 2021, time will be allocated to discuss emerging Advanced Air Mobility (AAM) vehicle types and the ongoing research associated with them. For future subsequent meetings, this allocation of time will be maintained, cancelled or postponed upon mutual agreement between FAA and the Subcommittee Chair.

Recommendation (2): We also recommend that the Airport Technologies Research Program look to the Subcommittee to provide airport stakeholder input and insight into its UAS and AAM research activities.

FAA Response: **The FAA concurs with the Committee's findings and recommendations and is taking the following actions to address it -** At appropriate times, the Airport Technology Research's staff (ATR) will reach out to the Subcommittee to gather airport stakeholder input and insight into ATR's UAS and AAM research activities.

Finding: Emerging Pavement Materials and Additives - The Subcommittee remains committed to the FAA's global leadership in airport pavement research and has been highly supportive of the Airport Technology Research Program's efforts to expand its testing and research capabilities with a pavement materials testing lab. The airfield pavement experts on the Subcommittee agree that understanding how new types of pavement materials and additives can enhance both rigid and flexible airfield pavements.

Recommendation (3): The Subcommittee recommends setting aside time during our summer 2020 meeting to discuss how the focus on emerging pavement materials and additives can be increased in airfield pavement research.

FAA Response: **The FAA concurs with the Committee's findings and recommendations and is taking the following actions to address it** - During the Summer 2020 Airports Subcommittee meeting, time was allocated to discuss how the focus on emerging pavement materials and additives can be increased in airfield pavement research. Upon future discussions between FAA and the Subcommittee Chair, time can also be allocated at the Winter 2021 Subcommittee meeting.

Subcommittee on Human Factors

General Observations: Human Factors Research Can Also Reside in Other (non-HF) Portfolios - The Subcommittee was pleased to receive briefings on AVS Core and NextGen, and ATC Core and NextGen research requirements at the Winter/Spring meeting. However, we observe that HF research is happening across the agency in programs that may not be called HF or fall under a HF budget line. It is difficulty for the Subcommittee to advise on research gaps and issues without visibility into all FAA HF research and how the research is prioritized and decided upon. The Subcommittee would like the FAA to consider identifying a way to share all the HF work being done across the agency, even if it is not listed/categorized as such, so that the HF Subcommittee has the big picture view of what HF activities are being done without relying on special presentations. Better insight into the breadth of the FAA's HF work would be of benefit to the FAA by eliminating overlapping work and by increasing coordination of work across the Agency.

Finding: Urban/Advanced Air Mobility (AAM) Research and Definition - The Subcommittee was pleased to receive briefings on the HF research areas and concurs with the inclusion of AAM-related Human Factors (HF) research in the portfolio (research that will inform AAM as well as other aircraft and operations that share AAM automation and HF aspects). The FAA has taken a "watch" stance on AAM while operational concepts are being defined, letting NASA "lead" on AAM research in this rapidly evolving area. The Subcommittee believes the NASA work with its industry partners may be insufficient to address all the HF issues needed to prepare the FAA for efficient AAM approval and safe operation. The Subcommittee understands the FAA is becoming more involved in this area; however, the Subcommittee believes the HF issues should be worked on early. For example, the FAA should be proactive in helping to define the concept of operations, standards, roles of humans, roles of automated systems, pilot/operator training and qualification requirements, and cockpit simplification acceptability. The Subcommittee believes FY22 is too late for the FAA to begin the AAM research because the Original Equipment Manufacturers are targeting Entry-Into-Services (EIS) dates as early as 2023-2025.

Consequences: Because this is a rapidly developing area and there is limited guidance from the FAA on pilot/operator training and qualifications, simplified cockpit design, and operational standards, these definitions will likely be left to the companies developing these vehicles, (such

as UBER, Hyundai, etc.), many of which do not have the expertise to make these decisions, nor can provide a balanced industry-government perspective.

Recommendation (1): The Subcommittee recognizes that AAM and related aircraft/operations is a rapidly evolving domain with a broad range of proposed vehicles and operational concepts. The Subcommittee recommends that the FAA prioritize and accelerate AAM HF Research to ensure HF issues are identified and addressed during concept and use case maturation, and during design and development, rather than waiting until vehicles are entering the system.

FAA Response: **The FAA concurs with the Committee's finding and recommendation and is undertaking the following actions to address its recommendation** - The FAA plans to initiate HF research relevant to Advanced Air Mobility (AAM). The planned near-term research will be managed by the NextGen Enterprise HF portfolio, and will analyze potential HF effects of highly automated aircraft on air traffic controllers and other air traffic personnel. In addition, the FAA has also conducted research and development activities on AAM, including delivery of an initial Concept of Operations, which can serve as a framework for additional HF research planning. The FAA will provide updates on both the near-term and additional HF research at the Winter/Spring 2021 REDAC HF Subcommittee meeting.

Recommendation (2): Timing is critical since FAA and NASA research objectives for AAM are currently in the process of being defined. FAA should coordinate with NASA to identify specific HF research needs and timelines to support near-term EIS targets and NAS integration. The FAA and NASA should jointly determine HF research priorities and gaps as well as define research responsibilities between the two agencies. Areas not being covered by FAA or NASA, but critical to the success of AAM, need to be identified because additional investment may be required to address those gaps. Areas of focus should include standards, roles of humans (pilots, air traffic controllers, others), roles of automated systems, pilot/operator training and qualification requirements, and cockpit simplification acceptability.

FAA Response: **The FAA concurs with the Committee's finding and recommendation and is undertaking the following actions to address its recommendation -** The FAA and NASA have initiated formal research coordination meetings dedicated to the topic of Advanced Air Mobility (AAM) HF, with additional meetings planned. The FAA-NASA HF research coordination effort is part of a more general structure known as "Research Transition Team" (RTT). The purpose of the current HF RTT effort is to provide joint recommendations on AAM HF research, including specific research needs, timelines, priorities, and research responsibilities between FAA and NASA. The FAA will provide updates on the results of the FAA-NASA research coordinating meetings at the Winter/Spring 2021 REDAC HF Subcommittee meeting.

Recommendation (3): The Subcommittee recommends AAM HF research and definition be considered in the budgeting as a high priority emerging issue to get in front of this dynamic area.

FAA Response: **The FAA concurs with the Committee's finding and recommendation and is undertaking the following actions to address its recommendation -** The FAA acknowledges that Advanced Air Mobility (AAM) is a high priority emerging issue, as reflected

in its cross-agency coordination plan that lays out a vision to safely and cost-effectively service the grown in new aircraft and operations, including AAM, expected in the coming years. The FAA will provide an overview of this plan at the Winter/Spring 2021 REDAC HF Subcommittee meeting, and identify any planned AAM HF research.

Finding: Access to FAA Research Artifacts - FAA research generates valuable outputs, i.e., research artifacts including data, reports, and findings. Presently, however, these artifacts are scattered across internal databases, research centers, and universities and are not always accessible via a centralized repository. Currently, there is no means for interested parties to access in an easy and efficient manner the research outputs created from FAA funded research. Practices enabling the sharing of research findings and artifacts with industry and research institutions are enablers to cost effective advancement of the FAA's research objectives and the overall body of aviation knowledge and expertise.

Recommendation (4): The Human Factors (HF) Subcommittee recommends the FAA provide a centralized repository of research artifacts that is easy to access and search, preferably in an online format. All FAA-funded research artifacts should be made available regardless of the resource performing the research. Any research artifacts that are deemed inappropriate for public release should still be made available on-line to trusted parties, such as the REDAC, using appropriate access security measures.

Consequences: Access to FAA-funded Human Factors research outputs will enhance learning, reduce rework/duplication, and enable partners and interested parties to enhance and accelerate the advancement of FAA research objectives.

FAA Response: **The FAA concurs with the Committee's finding and recommendation and is undertaking the following actions to address its recommendation** - The FAA acknowledges that published HF research is not centralized, even when available to the public. Many of the research products that are available to the public reside local to the research-performing organizations, and are therefore distributed versus centralized. Furthermore, the FAA acknowledges that not all of its funded HF research is available to the public online. Although these issues are not specific to HF research, the NextGen HF Division is addressing this in the short term by providing many of its research products on its public web site. Towards a longer-term and broader improvement, the FAA is currently working within the broader U.S. Department of Transportation policy to increase public access to the results of federally-funded scientific research results.

Finding: The Proposed Prioritization Process - The HF Subcommittee was pleased to receive a briefing on the proposed AVS research prioritization process. It was noted, however, that the research proposed and conducted by the FAA generally considers perspectives of each Service/Office separately. The Subcommittee understands the need to fund work within BLIs but is concerned that the proposed process does not require collaboration and coordination across BLIs in the agency to meet system objectives. The introduction of emerging technologies requires a more coordinated approach; for example, in approving new Electric Vertical Takeoff and Landing (eVTOL) aircraft, one must also consider the implications for pilot licensing and how the operator may interact with air traffic control. This finding and recommendation is not

intended to address how projects are funded but rather how needs are identified, and how projects are proposed, prioritized, and executed by the Services/Offices requesting the work.

Recommendation (5)): The FAA's AVS research prioritization process should take a more strategic and coordinated approach, so the Services/Offices may collaborate on projects to achieve common goals. The Subcommittee understands projects are funded and worked within BLIs but it is evident that the current process does not require effective collaboration/coordination across the Agency to meet system objectives. FAA needs an effective process to identify and prioritize HF research that has cross-domain impact, and not just HF issues that reside in one or a few domains or limited to only programs labeled as "human factors". The proposed prioritization process should include identifying and addressing overarching HF issues across air/ground domains throughout the NAS in order to measure and achieve desired system performance with roles and responsibilities defined for each of the Services/Offices involved.

Consequences: The FAA's AVS organization currently proposed research process might result in inappropriate allocation of funding, duplication of effort, and potentially conflicting and/or uncoordinated activities. It will also focus on individual domains and omit HF issues that are overarching and cut across BLIs and domains.

FAA Response: **The FAA concurs with the Committee's recommendation(s) and with the noted exceptions and clarifications intends to undertake the following actions to address its recommendation(s)** - The AVS research prioritization process is currently under revision to be more collaborative, effective, responsive, and flexible. The FAA described a proposed process at the Summer/Fall 2020 HF Subcommittee meeting, which encourages the offices to work together to meet AVS objectives. The FAA recognizes the importance of effective coordination across the Agency, and that HF research should be driven by a cross-agency view. As we continue to strive for improved research prioritization, there remain practical challenges to process improvements associated with the cross-cutting nature of HF. We will present an update on the AVS Prioritization Process, specifically addressing these considerations and challenges, at the Winter/Spring 2021 REDAC HF Subcommittee meeting.

Subcommittee on Aircraft Safety

Finding: Fatigue Management Working Group - The REDAC Subcommittee on Aircraft Safety (SAS) received a briefing on the FAA's new Fatigue Management Working Group (FMWG), which was formed after a recommendation from the SAS in 2017. The Subcommittee was impressed with the progress made to bring together fatigue-related research from different policyholders, funding programs, and research organizations within the FAA. The formation of this Working Group and its continued support from FAA leadership partially satisfies the SAS recommendation for "an expanded fatigue research program" and the "…sharing of results across aviation domains within the FAA," but insufficient information was provided to discern whether other important aspects of the SAS recommendations have been incorporated.

The SAS recommended a) a fatigue research program that provides a method of surveillance for early indicators of fatigue hazards across aviation operations in U.S., and b) a structured research program to assess the effectiveness of Fatigue Risk Management Program/Fatigue Risk Management System (FRMP/FRMS) in Part 121 passenger-carrying operations. While Dr. Avers briefed several studies into the fatigue issue, not enough detail was provided to determine whether these research programs have been proposed, funded, or initiated.

Further, despite the FAA's evident support for the FMWG and for increased fatigue research, the SAS received budgetary information showing that several fatigue research requirements are unfunded in FY22 (Fatigue Mitigation in Flight Operations; CAMI Aerospace Medical Accident Investigation and Prevention), as were other relevant research requirements (Reducing Human Error), suggesting that the briefed fatigue studies may not be funded to completion. The Subcommittee was pleased to note that funding is projected for some fatigue research in the air medical transport environment (Human Factors Considerations and Emerging Trends Associated with Helicopter Air Ambulance Operations), but was concerned about the FAA's long-term commitment to fatigue research across aviation platforms.

Recommendation (1): The Subcommittee requests additional information on the FAA's fatigue-related projects to enable a better understanding of funded research objectives and deliverables. This information could be provided via supplemental material, SAS participation in the FMWG, annual updates to the SAS, or a scheduled deep-dive.

FAA Response: **The FAA concurs with the Committee's recommendation and is undertaking the following actions to address its recommendation** – During the August 11-12, 2020, SAS REDAC Subcommittee meeting, the FAA provided an update on the FAA's fatigue research portfolio. In addition, the FAA provided a supplement on funding of fatigue research projects. Some SAS members have been involved in the Fatigue Management Working Group's annual meetings.

Recommendation (2): The Subcommittee also requests further clarification of the funding profiles and prioritization of fatigue-related research in the FAA.

FAA Response: **The FAA concurs with the Committee's recommendation and is undertaking the following actions to address its recommendation** – During the SAS REDAC meeting on August 12th, the FAA presented a slide representing the status of funding for pilot fatigue research including Fatigue Risk Management System (FRMS) and short haul multi-segment operations.

Recommendation (3): Additionally, the Subcommittee recommends for the FAA to restore full funding for the research which follows up on the effectiveness and utility of the FRMS/FRMP and allows the FAA to identify shortfalls and potential enhancements to the current flight time/duty time regulations. Also, options for the airline industry to provide joint funding should be explored.

FAA Response: **The FAA concurs with the Committee's recommendation and with the noted exceptions and clarifications intends to undertake the following actions to address its**

recommendation(s) – The FAA is exploring options for funding for the subject research in consideration of overall research priorities, and will provide an update in the next SAS meeting scheduled for February 2021.

Finding: Genetic Bio-Markers and Aircrew Performance - FAA's Civil Aerospace Medical Institute (CAMI) has conducted significant research on finding objective genetic markers for degraded aircrew performance and health. These genetic markers are urgently needed to replace current subjective reporting methods that fail to reliably aid accident investigators in assessing human factors in accident causation. The ground-breaking research into gene expression and genetic-based biological indicators at CAMI is unique in the federal government and aims to deliver tools that can identify pre-accident aircrew stress states (e.g., fatigue, hypoxia, disorientation) that will revolutionize aircraft accident investigation. Additionally, these techniques, when validated, can serve as fitness-for-work assessments, giving safety and management personnel tools for real-time risk assessment decision-making. In the review of the 2022 Aviation Safety Research Portfolio Budget Programming plan, the SAS REDAC was concerned about the planned elimination of this important aircrew stress biomarker research at CAMI.

Recommendation (4): The Subcommittee requests that the FAA consider the potential short- and long-term benefits of objective genetic-based biomarkers for aircrew stress and impaired performance and evaluate possible funding strategies to support this important and unique forward-looking research program.

FAA Response: **The FAA concurs with the Committee's recommendation and is undertaking the following actions to address its recommendation** – The FAA will consider the potential short- and long-term benefits of objective genetic-based biomarkers for aircrew stress and impaired performance as well as will explore potential funding avenues to support the subject research program. The FAA will provide an update in the next SAS meeting scheduled for February 2021.

Subcommittee on Environment and Energy

General Observations: The Subcommittee focused on reviewing the R&D portfolio in Environment and Energy that was developed based on the FY20 budget that was enacted on December 20, 2019. There was a good turnout of participants on the call. During the meeting, the Office of Environment and Energy (AEE) provided updates on all of the major research components of the portfolio. Work on programs such as the Aviation Sustainability Center of Excellence (ASCENT); Continuous Lower Energy, Emissions and Noise (CLEEN); Commercial Aviation Alternative Fuels Initiative (CAAFI); Carbon Offsetting and Reduction System for International Aviation (CORSIA) and the Aviation Environmental Design Tool (AEDT) have been progressing. The updates also outlined successes that have been realized both locally and on the international front directly linked to the research that has been completed.

The Subcommittee believes that AEE is doing a good job and has maintained a balanced portfolio and we believe that the research priorities do not need to be adjusted. We are happy to hear about the additions to the staff and plans to address vacancies. This being said, the

Subcommittee members realize that there is still additional research required to address ongoing areas of concern, especially noise, and to facilitate the development of policies to facilitate the overall growth of aviation.

The Subcommittee is concerned about the potential impact that the COVID-19 pandemic could have and the adjustment that will have to be made within AEE and by their partners in order to continue these research efforts. This outbreak is having a major impact on the citizens of the world and the aviation industry, among others. Despite this uncertain outlook, the Subcommittee has proceeded with the following "Findings and Recommendations". The recommendations offered are all for inclusion in the REDAC report.

Finding: Public Private Partnerships - The Office of Environment and Energy (AEE) have proven over decades to be very good stewards of taxpayer money. They have used their budgeted amounts to conduct and coordinate the research necessary to produce informed, data driven policies, facilitate technological advances in the aviation industry, and produced models and data that have positioned the U.S. as both a State leader at ICAO CAEP and on the global aviation stage. The execution of this research portfolio has been accomplished by working collaboratively with private industry, major universities through the ASCENT Center of Excellence, other Federal Departments and Foreign Governments. Three quarters of Environment and Energy research funds generate 100% plus cost matching from non-federal partners (CLEEN, CAAFI, and ASCENT). This leverages scarce FAA R&D funds to accomplish significant advances and improvements. In addition, we believe that government funding has been used and executed effectively to lower the risk of new and emerging technologies such that they can be adopted by industry. This maturation of environmental technologies will deliver improved environmental performance and I bound to enable aviation system growth and associated positive economic impacts.

Recommendation (1): The Subcommittee continues to endorse Public Private Partnerships like the CLEEN, CAAFI and ASCENT programs to leverage resources and recommends that FAA should continue to allocate robust funding for these programs.

FAA Response: **The FAA concurs with the Committee's finding and recommendation and is undertaking the following actions to address it -** The FAA supports the Administration's vision to maximize the impact of taxpayer dollars by improving the efficiency of Federal programs through partnerships with industry and creating benefit for the American public. The vast majority of the Environment and Energy R&D program has been leveraging resources from the private sector via public-private partnerships. CLEEN, CAAFI and ASCENT have all been successful because of their strong engagement with industry. Each of these programs, CLEEN, CAAFI, and ASCENT, have had strong partnerships with, and support from, industry for over a decade. We also appreciate the recognition of our close partnership with NASA and its value. We are also working in close collaboration with a number of Federal Agencies in topics related to jet fuel. We have worked diligently to develop these partnerships over many years. We are very happy to share that we have executed over $34 million of funding to the ASCENT COE over the last year. These funds will ensure that the ASCENT COE continues to have a robust research program that is helping industry to develop innovative solutions to reduce the impacts of aviation on the environment. We are also working very diligently to stand up the third five

year phase of the CLEEN Program, planned to run from 2020 through 2025. CLEEN Phase III will continue the model of partnership with industry to mature technologies that will reduce noise, emissions, and fuel burn for decades to come.

Finding: - Sustainable Aviation Fuels (SAFs) - The elimination of funding for the Alternative Jet Fuel (AJF) Program (including efforts in the Commercial Aviation Alternative Fuels Initiative (CAAFI), CLEEN and ASCENT) in previous years has slowed down significantly the maturation of this industry sector. Sustainable Aviation fuels (SAFs) are a critical component of the industry's emissions reduction strategy and must be developed if industry is to get to their carbon neutral growth goals after 2020 and their emissions reduction goals in 2050. This research in the past has helped with the creation of a number of companies that have the potential to benefit the rural economies of several states and the U.S. Aviation industry. The Subcommittee members were very pleased to see that funding in this area has been restored in the FAA AEE budget and they applaud the FAA leadership for their foresight on this matter as they are making it once again a vital part of their overall investment portfolio

Recommendation (2): It is the position of this Subcommittee that the work on Sustainable Aviation Fuels is critical to the U.S. industry and the FAA should maintain a leadership role in the development of SAFs to ensure that the rules to be considered will be beneficial to the U.S. industry. Since the maturation of the Alternative Jet Fuel program will be a major environmental benefit for the public, will create a new industry within the U.S. that benefits rural America, and will benefit the U.S. aviation industry, we strongly recommend that the FAA AEE continues to allocate funds for the continuation of research on SAFs.

FAA Response: **The FAA concurs with the Committee's finding and recommendation and is undertaking the following actions to address it -** The FAA appreciates the Committee's inputs on the importance of sustainable aviation fuels to industry. This industry pull is driving our continued efforts on jet fuel research. We are pleased to see the increasing uptake of sustainable aviation fuels by industry with more than 3 million gallons being uplifted in the first half of 2020. This is especially impressive when one considers the impacts of COVID-19 on the aviation industry. Our efforts ensure that these fuels are safe for use and the results of our efforts are reducing the time and costs to get new fuels approved. Continued approvals for new fuels ensure that the aviation industry has access to a broad range of fuel options, and having more fuel options should reduce the cost of fuel production, enable greater environmental benefits, and allow for greater blend levels. We are very pleased that eight different fuel types have been approved for use in civil aviation by ASTM International. Our research efforts also ensure that a wide range of aviation fuels can receive credit under the ICAO Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). This is critical to not only allowing airlines additional means to meet their international commitments under CORSIA, but also to gain international agreement on what is meant by sustainability. Our research efforts are also supporting techno-economic analysis to understand how to reduce fuel costs and producing scenarios of future production to inform decision making and planning by both governments and industry. The research program is also providing substantial support to CAAFI, which is essential for coordinating efforts across the aviation industry. AEE continues to coordinate with other federal agencies to make sustainable aviation fuels a focus area of the overall federal effort to stimulate the development of the Bioeconomy and support rural development. This has

resulted in the formation of a new interagency working group focused on SAF under the auspices of the multi-agency Biomass Research and Development Board.

Finding: Noise Research - The Subcommittee realizes that there is much research that is still necessary to address the ongoing topic of aviation noise. There are increased noise complaints from individuals outside of the day-night noise level (DNL) of 65dB. The increase in complaints is paired with an increase in public opposition which is resulting in growing political pressure on the FAA as well as litigation in many areas, which is delaying NextGen Deployment. AEE has a number of research projects that are looking at the impacts of noise on children's learning, sleep impacts, community annoyance and cardiovascular health. AEE is looking at the certification requirements for supersonic aircraft as well as UAS that are larger than 55 pounds. AEE is also examining how to reduce the noise from commercial aircraft and helicopters through changes in operational procedures. Finally, AEE is working with industry to accelerate the development of technologies that reduce noise through the CLEEN Program.

Recommendation (3): The Subcommittee strongly supports the prioritization of the noise research that will support informed decision-making, the introduction of new entrants to the National Air Space, and enable NextGen Deployment.

FAA Response: **The FAA concurs with the Committee's finding and recommendation and is undertaking the following actions to address it -** Noise continues to pose a challenge to the growth of aviation and could impact the introduction of new vehicle types to the National Airspace System (NAS). We have been working for many years to better understand the issues associated with noise from subsonic airplanes and helicopters and to identify solutions that could help address noise concerns. For example, we are continuing to explore operational procedure concepts and engagement approaches that could help identify ways to mitigate noise issues while also improving the Aviation Environmental Design Tool (AEDT) to ensure it can quantify aircraft noise at further distances from airports, where some communities are expressing concerns. Noise reduction from gas turbine powered fixed wing aircraft will also be an area of emphasis for the third phase of the CLEEN Program, which will start in 2020 and is included in the FY 2021 President budget request. We are also working in close collaboration with NASA to address noise from subsonic and supersonic aircraft, helicopters, UAS, and UAM. Finally, we have stood up several new ASCENT Center of Excellence (COE) projects in the last year to address noise. These will help us better understand noise generation from a wide range of vehicle types and should help the FAA and aviation industry develop cost-effective solutions to reduce the impacts of noise on communities.

Finding: Global Leadership - It is evident that the FAA AEE has maintained a role of great leadership in ICAO CAEP and has been the driving force behind the push for enabled analysis/data driven rule making. Examples include the FAA influence/leadership in establishing the particulate matter standard and the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). The Subcommittee has reached the conclusion that maintaining the U.S. global leadership position at ICAO CAEP is advantageous to U.S. industry. Decreased funding will undoubtedly reduce the FAA's ability to respond to domestic needs, such as those regarding noise, and seriously jeopardize the U.S. global leadership position at ICAO CAEP and therefore such actions must be avoided.

Recommendation (4): The Subcommittee recommends the continuing strong support of all research efforts/programs that will allow the FAA and the U.S. to maintain its current global leadership position at ICAO CAEP. It is the belief of the Subcommittee that if the FAA/U.S. does not maintain its leadership position at ICAO CAEP it will not be able to influence policy/rulemaking and this could have a significant negative impact on the U.S. aviation industry.

FAA Response: **The FAA concurs with the Committee's recommendation and is undertaking the following actions to address it** -The FAA appreciates the support of the Subcommittee for our ICAO CAEP activities and the importance of continued U.S. leadership therein. We concur that it is critical for FAA to have robust participation in the ICAO CAEP process, and we have allocated resources such that we can provide leadership in many of the working groups of CAEP, as FAA leadership is critical to securing overall U.S. objectives at ICAO. FAA prioritized research efforts include developing the modeling capabilities and generating the data to support the decision-making process within ICAO CAEP. Much of this work is being done by ASCENT COE universities and the Volpe Center, in close collaboration with NASA and industry. We are currently working with U.S. stakeholders and the international community to develop noise standards for supersonic aircraft with a focus on landing and takeoff noise. These aircraft will need the operational flexibility to be able to take off and land in other countries, which will require international agreement at ICAO on noise standards. As AEDT is the primary tool for supporting decision making related to noise at ICAO CAEP, we are working with the Volpe Center to enhance its capabilities to include supersonic aircraft. In addition to these efforts, we are also standing up a new project in ASCENT, which will be done in close collaboration with NASA, the Department of Defense, and industry, to develop improved models to enable the development of supersonic aircraft that will have reduced jet noise on takeoff. In addition to this broad effort related to supersonic aircraft, FAA is also working to ensure that the evaluation of any long-term aspirational goal is based on robust scientific analyses that quantify the economic costs and potential benefits of any specific goal.

Subcommittee on NAS Operations

Finding: NAS 2035 Vision - In 2015, the FAA and NASA led an analysis to characterize a range of potential future environments, the findings of which were summarized in the report titled, "NAS Horizons." This effort included interviews with more than 80 leaders and strategic thinkers from government, research organizations, and industry.

Building on what was learned from that activity, the FAA NextGen Organization is currently in the process of developing a NAS 2035 Vision document that lays out a view of future NAS operations beyond the current implementation phase of NextGen. Topics will span a range of areas including a transition to performance-based operations, managing new entrants, and leveraging advances in vehicle performance, Datacomm, analytics, and information system technologies. This vision represents a transformation of the current NAS that will lead to a significantly different future system that will impact a growing set of aerospace system stakeholders. This vision will also enable the more rapid introduction of industry-provided services and technologies to the NAS. A preliminary 2035 vision is currently being drafted by MITRE CAASD and was scheduled for completion in March 2020. Following refinement and

an FAA-internal review, the final NAS 2035 Vision is anticipated to be delivered as an FAA product at the end of CY2020.

Recommendation (1): Given the broad implications of a transition of the NAS toward 2035, involving an increasingly complex web of vehicle types, operational models, and industry involvement and provision of services, the NAS Ops Subcommittee recommends that the FAA continue to engage with the wider aerospace community while shaping their 2035 vision. A failure to engage stakeholders early in the process may lead to a vision that does not align with user needs or which may not take advantage of external trends and opportunities.

Recommendation (2): The Subcommittee recommends that the community engagement process described in the 2011 REDAC Culture Change study be adopted. The study stated that "NextGen operational transformation involves diverse stakeholder communities, all of which must be fully engaged and have a shared vision of NextGen. The common vision must be shared by the stakeholder communities, and critically, it must be a vision of shared interest and shared responsibility among the stakeholders... Successful transformation requires stakeholders to synchronize their implementation activities with those of other stakeholders. This synchronization is key to success and can only result from a shared vision of NextGen implementation. An environment that encourages and avidly supports community engagement to determine a collaborative shared vision of and a collaborative plan for NextGen will result in a trusted partnership with industry for NextGen implementation."

FAA Response: **The FAA concurs with the recommendation to continue its engagement with the stakeholder community as** FAA develops its NAS Vision for 2035 with the support of MITRE's Center for Advanced Aviation System Development (CAASD). In fact, the FAA has already engaged and continues to engage with the broader community in a variety of focused forums. For example, the FAA has continually requested the REDAC and its subcommittees to provide their views on the important changes coming in industry that the FAA should take into consideration. It has more specifically engaged with individual initiatives such as Unmanned Aircraft Systems (UAS) Traffic Management (UTM), Upper Class E Airspace Traffic Management (ETM), and Urban Air Mobility (UAM). FAA has partnered with NASA, through the Space Act, to help those communities articulate their needs over the next 15 years. The FAA is also actively engaging with the industry and international partners through efforts with the International Civil Aviation Organization (ICAO) to support major conceptual changes for the global community in areas such as the role of connected aircraft, the evolution of security through a trust framework, and modern Air Traffic Control (ATC) services through the implementation of Flight & Flow Information for a Collaborative Environment (FF-ICE). In addition, the FAA has engaged ICAO on the development of a Global Air Navigation Plan through 2040 including its 2040 Conceptual Roadmap, which is consistent with the major themes of the NAS Vison for 2035. The FAA played a major role in all these developments. Furthermore, the FAA has also expanded its engagement on new segments of the commercial environment with membership in the Global UTM Association (GUTMA) and is seeking new opportunities in communications through collaboration with the Global System for Mobile Communications Association (GSMA). Currently, the results of these efforts are to not only continue to engage, but also expand the scope of previous collaboration activities, as part of the Vision of the NAS in 2035.

Finding: UAS Data Access - At our spring 2020 meeting, the NAS Ops Subcommittee received an update on UAS Integration and Research being performed as part of the ASSURE COE. This plan included an effort focused on developing a schema for data collection across a wide range of UAS operations and test activities, including defining metadata and other structures to aid in organizing and applying the collected information in an effective manner. It is anticipated that this will lead to a very rich set of UAS-specific data including vehicle performance, traffic encounter characteristics, weather and environmental impacts, surveillance and navigation, and command and control system performance. Given the rapid pace of UAS development and the wide variety of open research issues that need to be resolved to enable their safe and efficient operation, providing access to the datasets generated through the ASSURE activity would have great value to the larger research community. During the discussion, the presenter agreed with the Subcommittee that enabling open access to UAS data would benefit the FAA and the external community in pursuing research and development.

Recommendation (3): The FAA should expand the ASSURE effort to provide a means for storing and accessing the growing sets of UAS-related data and make those data, whenever possible (i.e., not restricted due to proprietary or other concerns) openly available to the outside research community. As part of this effort, a data access clearinghouse capability (including associated schemas, data storage, and data exchange interfaces) should be developed that would enable researchers to identify and access data and then share results. The NAS Ops Subcommittee believes that providing these data in this way would enable the FAA to leverage the significantly-larger external UAS community beyond ASSURE, resulting in more rapid innovation and resolution of research issues than would otherwise be possible.

FAA Response: **The FAA concurs with the Committee's finding and recommendation and is undertaking the following actions to address its recommendation(s) -** The FAA has assigned ASSURE to conduct research to inform the development of viable safety cases needed to safely integrate UAS into the NAS. UAS flight tests conducted by UAS operators, UAS waiver applicants, UAS Test Sites, UAS pilot programs, etc. provide the FAA with UAS data to facilitate the development of standards, regulations, procedures, and policy for safe UAS operations in the NAS. The research and development (R&D) effort underway is aiming to define a framework and methodology for UAS flight data collection and analysis that will yield sufficient data on a repeatable basis to enable FAA decision-makers to assess risk and ensure safe UAS operations. This framework is expected to provide enhanced categorization and classification methods to enable FAA analysts to conduct more effective searches on flight data to determine what operations have previously been performed and whether/how the associated data will support critical UAS integration activities. This will increase FAA operational knowledge and understanding of UAS and how UAS operations, such as flying beyond visual line of sight, could impact the NAS. The framework's categorizations and classifications will be tested and analyzed using UAS flight data currently collected by the FAA.

With regard to the REDAC's recommendation for the development of a data access clearinghouse capability that extends beyond ASSURE, the FAA concurs as it has a well-established Aviation Safety Information Analysis and Sharing (ASIAS) program which currently

connects approximately 185 data and information sources across government and industry, 14 including voluntarily provided safety data. The FAA is increasing the quantity and types of participants as part of a phased expansion plan. The FAA intends to expand to unmanned aircraft systems communities in the future. While expansion planning is still underway, the outcomes of the ASSURE research will undoubtedly inform the inclusion of UAS data in ASIAS.