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October 30, 2024

The Honorable Michael Whitaker
Administrator
Federal Aviation Administration
[redacted]

Dear Administrator Whitaker:

Attached below please find the Findings and Recommendations from the Aircraft Safety, Airports, Environment and Energy, Human Factors, and NAS Operations Subcommittees from the Winter-Spring 2024 meetings which have been reviewed and supported by the full REDAC on October 16, 2024.

In addition, the full REDAC discussed a number of more general observations for your consideration.

Aviation Sustainability as an Emerging Driver for NAS Modernization – There increasing public concern that climate change will create an existential threat to aviation as other greenhouse gas emitters transition to alternate anergy energy sources and the relative contribution from aviation increases. In addition to Sustainable Aviation Fuels, the most rapid and direct way to reduce aviation emissions is by reducing the fuel burn through improved operations which are currently restricted by current ATC routing, altitude and flow restrictions. While maintaining safety is paramount, the REDAC expects that improving aviation sustainability will be a driver for NAS modernization much like capacity and delays were a driver for NextGen. The REDAC recommends that sustainability be a more prominent driver as the FAA considers its post-NextGen modernization strategy.

Remote Supervision of Autonomy and Autonomous Aircraft – The REDAC notes the number of emerging applicants and proposals for autonomous vehicles overseen by a remote human supervisor to operate in the NAS. This trend crosses multiple vehicle types and sizes ranging from small UAS to larger AAM and more traditional airframes. While the vehicles are different, the fundamental issues are similar including; human factors, communication, command and control architectures, failure modes and safety analysis and many others. The REDAC identifies this as an important area of emerging research need.

Research Grant Approval Processes – The REDAC is pleased to see the recent improvement in the speed of review and approval of aviation research grants. We hope the current efficiencies can be maintained to make the research more timely and responsive and minimize the stress and disruption to students which had been previously experienced.

We appreciate the opportunity to support the FAA in promoting the safety, efficiency and sustainability of aviation. I would be happy to meet at your convenience to discuss how the REDAC could be of assistance.

Sincerely,

R. John Hansman
Chair, FAA Research, Engineering and Development Advisory Committee

Enclosure

Research, Engineering, and Development Advisory Committee (REDAC)
Guidance on the FY 2027 Research and Development Portfolio

Subcommittee on Human Factors

General Observations: FAA Roadmap for AI Safety Assurance - The REDAC Human Factors (HF) Subcommittee was delighted to see the release of the FAA Roadmap for Artificial Intelligence (AI) Safety Assurance (version I), especially the seven guiding principles outlined on Page 7. The Subcommittee concurs with the principle "Avoid Personification" – Treat AI as an algorithm or computer, not as a human. At the same time, the verbiage used on Page 9 describing this principle needs some clarification. AI is a tool/system; however, it is different from traditional automation and may possess some similarity to humans (e.g., AI potentially can dynamically generate novel solutions to certain problems). Consequently, it is possible that AI, in the future, has the potential to reason or negotiate with human pilots.

Since the roadmap is intended to focus on the characteristics truly unique to AI, the Subcommittee suggests the FAA examine the key differences between AI and traditional automation, as well as the unique characteristics of AI. Since the roadmap guides the aviation industry to treat AI as a system/tool, the Subcommittee argues that a Human-centered Design (HCD) approach is suitable and recommended to ensure the AI is designed and developed to best support human pilots' performance. The verbiage "…this roadmap avoids the use of human-centric language when referring to AI" can cause confusion.

The HF Subcommittee asks the FAA to please consider updating the roadmap with the following wording adjustment:

> Original statement: "For these reasons, this roadmap avoids the use of human-centric language when referring to AI. For example, AI cannot be a part of crew-resource management (CRM) but can affect crew responsibilities. AI cannot be a copilot but can perform autopilot functions and affect how a pilot performs their duties."

The sentence: *"This roadmap avoids the use of human-centric language when referring to AI"* is problematic due to the following reasons:

(1) Human-center design (HCD) is a foundational approach for HF and is also an ISO standard (ISO 9241-210:2019).
(2) "Human-centric" means design/development for the human end users. It doesn't mean "personification of an object/thing." If the intent of the roadmap is to say "avoid personification or avoid anthropomorphizing" – which is a point the Subcommittee supports -- the roadmap should just clearly state that point "avoid personification or anthropomorphizing."
(3) The current wording may cause unintended misinterpretation by practitioners at the operators/MROs who have no or not much HF knowledge.

Suggested Revision: For these reasons, this roadmap avoids personification when referring to AI. For example, AI cannot be a (human) copilot but can perform autopilot functions and affect how a pilot performs their duties. As a system/tool, AI can affect crew responsibilities, and consequently is part of resources to be managed via Crew Resource Management (CRM). A Human-centered Design (HCD) approach is suitable and recommended to ensure the AI is

designed and developed to best support human pilots' performance and to optimize overall system performance.

Finding: New Uses for Heads-Up-Displays – Heads-Up Displays (HUDs) have become a common user interface in the operational environment since their initial introduction in the 70's. The purpose of HUD is to make it as easy as possible for pilots to see and absorb necessary flight or mission details while allowing them to remain "head-up and eyes-out" instead of looking down or away from what is occurring before them. The evolution of HUD technologies is enabling even more complex information to be displayed on the HUD (Enhanced Vision, Synthetic Vision, flight path guidance, navigation data, visual alerts). The management of information displayed on the HUD is often addressed by allowing the user to swap between view modes, or by certain decluttering functions. There is a need for clear guidance on how to evaluate the information that is proposed to be presented on the HUD to ensure it does not negatively impact flight crew performance.

Recommendation: The FAA should conduct research to systematically review the increase in the amount, types, access, and complexity of information being added to the HUD. The research should result in evaluation guidance for new information proposed for presented on the HUD and define appropriate evaluation and approval processes to ensure flight crew performance is not negatively impacted by this information and associated functionality. The outputs of this research should be used to update FAA guidance for the display and management of information on HUDs that has not be updated since 2017.

Consequences: Without understanding the impact on human performance of the emerging trend to increase the amount, types, access, and complexity of information provided through the HUD, the industry may continue adding functionality and data that could adversely impact operational safety.

Finding: Information Management Strategy - The Subcommittee was pleased to see several research projects planned to investigate ways to differentiate information in the flight deck that originates from certified avionics sources versus operationally approved sources. The subcommittee recognizes this distinction is important for understanding the reliability of the presented information. However, this is only part of the current information management challenge faced by flight crews today. Guidance is needed on how flight deck information should be organized across flightdeck displays (including Heads-Up Displays) to support the cognitive work of pilots. For example, the new Boeing 777, Airbus A350, and Gulfstream 700 are all investigating ways to integrate information from non-approved avionics sources (e.g., software applications contained in portable electronic devices) with operationally approved sources and display them on various flight deck displays as an integrated resource. How will that information be effectively managed, trained, etc.?

Recommendation: Research is needed to develop information management guidance for Original Equipment Manufacturers (OEMs) and FAA personnel to effectively assess the impact of advanced information integration strategies on pilot performance. This research could also be used to inform a broader information management strategy for flight deck design and operation. Research should also investigate degradation of information resources and ways for flight crew to be alerted or informed of an information issue.

Consequences: Lack of information management guidance will result in (1) inconsistency across different OEMs and aircraft models, and (2) potentially failure to consider Human Factors in integrating, managing, and training the use of information from different sources. Consequently, there might be negative impact on the performance of flight crew (e.g., cognitive overload) and ultimately operational safety.

Finding: Advanced Flight Deck Alerting Systems – The Subcommittee was pleased to see a new project is planned to develop Design Standards for New and Advanced Alerting Systems. However, this project is still awaiting confirmation for funding. Due to the complexity of this challenging research, it is anticipated the project may take several years to complete. As the number of alerts in the flight deck increases, improved capabilities such as integration of alerts within a category (e.g., into "umbrella" messages) are being implemented. Complexity increases with the integration of the alerting capabilities with other systems and technologies such as Head Up Displays, Head Worn Displays, Artificial Intelligence, etc. Complexity also increases as new technologies and new aircraft are developed. There is an urgent need to define empirically how to design alerting systems to best direct appropriate flight crew attention and guide their response to system failures and flight path deviations. With new aircraft on the horizon, there is an urgent and timely need for updated guidance that accounts for new forms of information integration, combinations of systems, and utilization of advanced technologies.

Recommendation: Due to the criticality and urgency for guidance and design standards for new and advanced crew alerting systems, the Human Factors Subcommittee reiterates that this project should be assigned high priority to ensure research begins as soon as possible to meet industry and FAA needs. The project should also include a mechanism for obtaining input from industry experts (e.g., Original Equipment Manufacturers, Suppliers, Academia, Airline operators, Pilots, etc.) to ensure the needed industry expertise is utilized in the research. The outputs of this research should be used to support FAA guidance but also could inform industry standards groups.

Consequences: The current guidance for flight deck alerting systems is woefully out of date. Without new guidance to develop effective advanced alerting systems, the FAA and industry will have to work the issues simultaneously as they develop these systems. This could potentially result in divergent standards and designs that could negatively impact safety and certification standards.

Subcommittee on Aircraft Safety

Finding: Continued Research in Detection of Bleed Air Contaminants - In a previous finding on the detection of bleed air contaminants, the Committee stated that further research is needed to determine whether there is a direct correlation between exposure to cabin air, beyond engine bleed air, and reported illnesses in well-maintained passenger aircraft. Specifically, scientific studies should establish which substances are hazardous and present in concerning concentrations. This research should support the development of standards for in-situ measurement techniques, which could identify required maintenance and confirm safe environments. Following the Spring 2024 meeting, the SAS Committee provided a narrowed, actionable scope for this research. At the fall 2024 Committee meeting, the FAA presented

research that addressed the FAA 2018 Reauthorization Section 326(c) on cabin air quality, indicating that this phase of the research was complete. While the Committee considers this a positive step toward a comprehensive solution, it believes the research must continue.

Recommendation: The Committee recommends that the FAA continue this research to determine if there is a direct correlation between exposure to cabin air, beyond engine bleed air, and reported illnesses in well maintained passenger aircraft. Specifically, we recommend the FAA conduct scientific studies to establish if a direct correlation exists between illness complaints and nanoparticulate of engine oil, de-icing fluid, hydraulic fluid, or jet fuel chemical components that could be both hazardous and present in concentrations of concern for sufficient duration to cause illness. This research would focus on routine operations and seek to establish if such chemical presences originate solely from aircraft systems or are also drawn in from outside (i.e., ramp or taxiing) to provide useful information to original equipment manufacturers (OEMs) in designing their systems.

Recommendation: The Committee also recommends that future research includes foundational principles for sensor design and operation, as requested by sensor OEMs, to help establish a much-needed baseline for how these nanoparticles will be detected in flight on board an aircraft. This should include both type and quantity of nanoparticles, to facilitate detection and identification of identified compounds to facilitate future iterations of the technology to include a form of proactive mitigation of an ongoing cabin air quality event onboard an aircraft.

Subcommittee on NAS Operations

Finding: Strategic Outlook for Aviation Research (SOAR) – The NAS Operations Subcommittee appreciates the view into the FAA's Strategic Outlook for Aviation Research (SOAR) framework that was presented by the FAA WJHTC Deputy. The Subcommittee believes that the SOAR charts provide a valuable high-level means for communicating accomplishments, current research, near- and far-term expected research activities, and the expected outcomes of those activities in a single consolidated view.

Recommendation: The NAS Operations Subcommittee recommends that the FAA continue to refine and update the SOAR charts to reflect the current state and goals of FAA RE&D activities. The activities represented in the SOAR charts should be closely coordinated with other research frameworks including the National Aviation Research Plan (NARP) and the AVS Safety Research Strategy. We request that the FAA provide an annual update to the REDAC to highlight changes to the SOAR charts and progress against research outcomes over time.

Finding: Guidance for Third Party Service Provider NAS Integration – The Subcommittee commends the FAA for development of early strategic concepts and notional architectures for commercial Third Party Service Providers (TPSPs) across the Extensible Traffic Management (xTM) airspace management domains. These TPSP concepts and their domains include Uncrewed Aircraft System (UAS) Service Suppliers (USS) for UAS Traffic Management (UTM) for small UAS; Upper Class E Service Suppliers (ESS); Provider of Services for Urban Air Mobility (PSU) for Advanced Air Mobility (AAM) and Regional Air Mobility; and Command and Control Communication Service Providers (C2CSP) for all of these new entrants. Anticipated non-Federal services include weather information provision; flight planning and

management including smart routing and strategic and tactical separation; Command and Control; Navigation; Surveillance; multi-path communications. TPSPs will also ingest data from FAA systems including requests for National Airspace System (NAS) data regarding airspace availability or similar information. Though provided by non-Federal entities, the capabilities enabled must ensure the safety with which new entrants will interact with traditional users of the NAS. These UTM, ESS, and PSU commercial operators will be authorized by the FAA for assurance of safety, equitable access, and quality. Some, not all, of these concepts were addressed in the New ATM Requirements (BLI 1A07C) and Enterprise Concept Development (BLI 1A11A) briefings.

We expect that FAA responsibilities for TPSP qualification will include some combination of rule-making, standards development (e.g., involving RTCA, SAE, IEEE, or ASTM), and defining related means of compliance for licensing and operational approvals.

The Subcommittee asserts that the lack of a unified, consolidated description of how the FAA will set standards and authorize these TPSPs delays the ability of industry to establish business plans; financing; systems, technical, and operational requirements; Safety Management System (SMS) assessment; and related client service level agreements and contracts.

Recommendation: The Subcommittee recommends that the FAA accelerate the development of draft guidance for Third Party Service Providers (i.e., USS, ESS, PSU, and C2SCP entities), to include initial considerations for proposed regulatory requirements, anticipated systems standards, and related licensing processes for qualification and authorization of these new entities. This action should necessarily engage industry to assure alignment and relevance between government and industry actors.

Finding: Delegation of NAS Operations to Third Party Service Providers – As introduced under Finding 2, Third Party Service Providers (TPSPs) are envisioned to play a central role in future architectures supporting UAS and AAM operations. These architectures will likely include provision for exchange of selected data into and out of certain FAA systems. FAA air traffic personnel may interact with TPSP-supplied data when operations require integration between airspace users.

It has yet to be determined specifically under what conditions air traffic control services can be safely and efficiently delegated to TPSPs, and when services for a given flight might need to transition between TPSP and FAA control. Example ATC responsibilities listed in the Urban Air Mobility Concept of Operations v2.0 are to "issue traffic advisories regarding known UAM operations (e.g., active UAM corridors) to aircraft receiving ATC services", "set UAM corridor availability", and "respond to UAM off-nominal operations". These data exchange requirements need to be clarified as a function of the type of AAM operation and potential for integration with conventional ATC services.

Recommendation: The NAS Operations Subcommittee recommends that the FAA conduct research to determine specifically under what conditions it is appropriate to delegate operations from conventional FAA traffic services to a Third Party Service Provider. This will likely require consideration of a range of factors including the types of operation, types and densities of

vehicles, and proximity of those operations to conventional air traffic and conventional controlled airspace.

This research would lead to derivative issues relating to those functions that would require FAA ATC interaction with TPSP information and how that usage would be integrated into (or modify) existing ATC procedures and processes. This effort would then ultimately lead to the definition of a human factors research portfolio to address the use of TPSP information by FAA air traffic personnel to explore issues related to human interface design, training, and procedures.

These research thrusts should be an explicit component of the UAS/AAM Integration Research plan. Close collaboration with industry should continue in order to ensure that TPSP concepts are appropriately understood and reflected in determining what operations would be appropriate for TPSP delegation and what functions would be delegated.

Finding: Research Supporting Generative AI for Aviation Applications – The Subcommittee applauds the FAA for acting (in response to REDAC recommendations) in developing the FAA Roadmap on AI Safety and the AI/ML Certification Framework, each of which were briefed to the subcommittee in our summer/fall 2024 meeting. These briefings included the explanation that "the FAA only has authority to regulate safety," and thus the roadmap and the related certification framework activities have confined their initial work to the applications of AI/ML in which deterministic outcomes are ensured.

Deterministic AI ensures that the same inputs will lead to the same outputs using tools such as In-Context Learning (ICL) or closed or learned language models that are created by exposing the model development to only contextual data and information (versus collecting out-of-context information and data from the internet or other sources). This initial approach to ensuring safety in AI/ML tool development and related certification processes by limiting the scope to deterministic AI is appropriate.

While the FAA is only authorized to regulate in the domain of safety, the FAA charter extends to NAS efficiency, security, environmental stewardship and sustainability, innovation and technology advancement, and international leadership and collaboration. These elements of the FAA's charter hold promise for applicability of Generative AI (GAI) tools leveraging large language models based on open or learning information and data sources. GAI tools offer the promise of creative contributions to problem solving and concept development, while also producing non-deterministic outcomes, meaning that the same input will not always produce the same output. The rapid pace of GAI development suggests that opportunities will soon be appearing to leverage GAI to improve NAS operations.

There are many domains for application of GAI tools that may be of significant value in NAS operations, including interpreting weather forecasts, informing aviation dispatch services, facilitating collaborative decision making for air traffic management, flight deck problem-solving and decision support, and airport operations.

The distinction between closed AI models and open GAI models is of vital relevance to FAA strategies for applications development. Progress in AI research is rapid, and the FAA will soon

risk being unprepared for new tools and concepts that may be appearing in the aviation industry. The subcommittee suggests that while the FAA's initial focus on deterministic AI/ML tools for safety management is warranted, the current exclusion of Generative AI (GAI) tool exploration is not in the best interests of the agency and to its broader responsibilities across NAS operations. At the very least, the inclusion of GAI research in the portfolio of AI application development would create value for the agency internally and in matters of importance to external relationships and responsibilities beyond safety.

Recommendation: The NAS Operations Subcommittee recommends that the FAA accelerate and raise the level of strategic leadership and management related to GAI research to include matters related to the broader non-safety-critical domains of the FAA charter. This may mean establishing a position in the Agency's leadership to oversee the development, approval, and application of GAI across multiple domains of value to the Agency.

Subcommittee on Environment and Energy

General Observations: The FAA new reauthorization was approved in March 2024. The Subcommittee focused on reviewing the R&D portfolio for Office of Environment and Energy that was developed based on the RE&D budget for FY23 that was enacted on March 15, 2022 (RE&D received $248.5M). The Inflation Reduction Act has $297M to be spent over five years. The use of these funds within the Section 40007 Program has been programmed into the research efforts. The new SAF Tax Credit and Grant Programs are significant: this includes $297M for FAST-SAF and FAST-Tech grant programs. There are concerns about the impact on SAF production when the Tax Credits expire! During the meeting, the staff from the Office of Environment and Energy (AEE) provided updates and highlighted accomplishments on all the major research projects within the portfolio since our last meeting. 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) and the Aviation Environmental Design Tool (AEDT) have been improved and updated. NASA also provided elaborate updates on two of the four primary areas of focus within its program, updates on the other two will be presented in the Spring 25 meeting. The primary focus of the briefing was on ultra-efficient transport, high speed commercial flight and advanced air mobility. The partnership between NASA and the FAA is invaluable! The EPA presented a detailed and very informative briefing during this meeting. The Subcommittee was happy to learn about how the EPA has been working with the FAA and intends to support the Grand Challenge effort.

As has been the case in previous reports from this Subcommittee, listing the individual accomplishments and their impacts on many of the different facets of aviation is not realistic during this presentation, but these accomplishments further validate the benefits and the need for sound research when developing regulations, policies, and procedures. These updates highlighted some of the new projects that have been started and are being proposed based on the funding that the agency receives. The benefits already seen and anticipated because of the research within the CLEEN program is quite significant.

The presentations outlined a high level of communication between AEE staff and their partners to continue these necessary research efforts. The Subcommittee is pleased to see the improved

working relationship between the FAA and the EPA on multiple fronts. One example of this corporation will result in the improvement in the AERMOD model, which is a key tool for airports to model community exposure to aircraft emissions. The latest FAA initiative to Eliminate Aviation Gasoline Lead Emissions (EAGLE) to lead the transition to unleaded piston general aviation fuel is very important. The Subcommittee believes that the new leadership provided by the FAA Office of Environment & Energy (AEE-1) and the various teams are doing a very good job and have once again presented a balanced portfolio. We believe that the priorities that we had previously identified have not changed and that AEE has added research projects that address these priorities as well as those necessary to address the goals outlined by the current administration. Many of these new projects have been added to the CLEEN and ASCENT portfolios. The was some concern expressed over the methodology currently being used in the research being done on contrails and their effects on cirrus cloudiness. The Subcommittee members realize that there is still additional research required to address other ongoing areas of concern especially as it related to new entrants.

The results that have been accomplished by the projects in CLEEN Phase 1 and CLEEN Phase 2 as well as ASCENT highlight the value of the Public/Private Partnerships that AEE has made an integral part of its research portfolio. The additional funding to CLEEN has enabled the FAA to expand CLEEN Phase 3 while also accelerating the start of CLEEN Phase 4. Another advantage of these partnerships is that universities and hundreds of students have benefited from these advanced research projects. The partnerships with the FAA have allowed universities to improve their facilities and capabilities and thus recruit better students that help improve the quality of the research being done in the USA. The timely awarding of these grants is still a challenge that needs to be addressed. As was noted before, the delay in approving and awarding of these projects has resulted in missed research opportunities and will create challenges in being able to address the priorities ahead and the ability to accomplish our goals.

Finding: Sustainable Aviation Fuels (SAFs) - We know that the Sustainable Aviation Fuel (SAF) Program (including efforts in the Commercial Aviation Alternative Fuels Initiative (CAAFI), CLEEN and ASCENT) is a critical component of the industry's global emission reduction strategy. To meet the federal goals of increasing the production of SAFs to at least 3 billion gallons per year by 2030, there will need to be an increase in the research projects within the ASCENT portfolio. We are happy to see the increased number of companies that are now approved to produce SAF and the increase in the amount of SAF that is being produced every year. The establishment of the Sustainable Aviation Fuel Grand Challenge will ensure that the U.S. Government and the private sector are working together to address aviation sector emissions. There is significant concern that there will be a negative impact on the SAF industry with the expiration of the TAX Credits. The continued financial support of the US Government and the support from ICAO is significant to the success of the SAF program. It is good to see the extent of global involvement towards the production of SAF.

Recommendation: The Subcommittee agrees with the mandate proposed by the current administration that the work on Sustainable Aviation Fuels (SAF) is a critical component for the reduction of aviation sector emissions and supports the SAF Grand Challenge. Since the maturation of the Sustainable Aviation 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. We endorse what has been started but strongly

recommend that AEE needs to accelerate this program in order to accomplish the goal of being able to supply 100% of the aviation fuel needed in 2050. The continued funding of FAST-SAF and FAST-TECH grants is significant for the success of the SAF program. The FAA must also maintain a leadership role in the development of SAFs to ensure that the rules to be considered at a global level (ICAO) will be beneficial to the U.S. industry.

Finding: Public Private Partnerships - The Subcommittee continues to acknowledge and support the fact that the Office of Environment and Energy (AEE) has proven over decades to be very good stewards of taxpayer money. The leadership team at AEE has 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). The success of the CLEEN 2 projects as well as those in the ASCENT Center of Excellence is proof that these partnerships clearly work. These partnerships leverage 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. The research benefits of these partnerships have clearly been proven over time and is very apparent in the current projects. The maturation of new technologies has delivered improved environmental performance and has enabled aviation system growth and associated positive economic impacts. In order to comply with Executive Order 14008 on Tackling the Climate Crisis, there will be an increased reliance on these Public Private Partnerships.

Another benefit of these partnerships is that universities involved in these programs are able to provide STEM support to 100's of students, improve their facilities, capabilities and recruit better students and have created new industry and new jobs in aviation. In addition, private industry, universities, and hundreds of students have benefited from the partnerships. Getting the timely award of these grants is critical to the COE's ability to start vital projects.

Recommendation: Whereas the Subcommittee continues to endorse Public Private Partnerships like the CLEEN, CAAFI and ASCENT programs to leverage resources, we believe that the FAA will not be able to accomplish any of the priorities set forth by the current administration without allocating robust funding for these programs. The Subcommittee endorses the establishment of new partnerships with other federal agencies similar to the one that exist with NASA as a key to success. We acknowledge the improved working relationship with the EPA.

Finding: Global Leadership - Despite the fact that the FAA AEE currently maintains a leadership role in ICAO CAEP and has been the driving force behind the push for data driven rule making, based on the commitments made by the current administration on Climate Change, the Subcommittee firmly believes that maintaining the U.S. global leadership position at ICAO CAEP is essential and advantageous to U.S. aviation industry and will allow the U.S. government to defend its positions based on scientific research. Previous work that has been done with ASCENT and the Volpe Center has clearly allowed the FAA to maintain a scientifically supported position at ICAO CAEP. The close collaboration with NASA and

individuals that have been involved in research projects under the E&E portfolio have played significant roles at ICAO CAEP and that is also clearly supporting U.S. global leadership. The work done within the CAEP Task Group to reach an agreement on a Long-Term Aspirational Goal for international CO_2 emissions (LTAG TG) is a major accomplishment and one example of this collaboration and support setting the stage for U.S. leadership. Establishing international standards for SAF is also important. The FAA AEE's involvement in CAEP work on stringency and other packages is very challenging and demanding and anything that jeopardizes ongoing research at AEE will impact the FAA/U.S. global leadership position at ICAO CAEP. The FAA's ability to attend in person meeting and represent the U.S position regarding international policy making at the international level is essential.

Recommendation: 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. The FAA needs the data/results gathered from its research projects to support their positions at ICAO!

Finding: Noise Research - Aviation noise is and will continue to be one of the biggest environmental impacts related to the aviation industry and it requires ongoing research in order to address the concerns of the citizens. Even though we have learned a lot based on the results of many of the projects in the "Noise Portfolio", the Subcommittee's position on noise has not changed in that there is much research that is still necessary to address the ongoing topic of aviation noise. Whether there are new technologies or new procedures that can be implemented to help reduce the impacts of noise as the aviation industry rebuilds need to be evaluated. Historically, advances in aircraft technology have been the major factor in reducing aviation's environmental impacts. The Subcommittee recognizes that there is about a seven (7) year lag between flight testing a technology and it's appearing in the fleet. Therefore, if we want to consider any new technology being introduced into the fleet in early 2030, we need to invest in the research now. The use of government resources during the initial research stages helps mitigate technology risk and incentivize private companies to invest in and develop cleaner, quieter technology. AEE has conducted several research projects that have contributed to more fuel efficient and quieter aircraft. They have also developed new operational procedures that have reduced the noise impacts in communities in and around airports. There are a few new research projects that have been added to address issues related to new entrants, such as unmanned aerial systems (UAS) and advanced air mobility (AAM) into the aviation system. Many of these new entrants will be active participants in our airspace in the not-too-distant future. There is a need to identify which new entrants are the furthest along in their development and thus will be most likely to impact our airspace soonest. There is strong collaboration with NASA on the noise front. AEE continues to make significant upgrades to the Aviation Environmental Design Tool (AEDT), which is a vital tool for airports. AEE has established an AEDT User Review Group for ideas and feedback to ensure that the tool is beneficial to the actual users. FAA has also launched an initiative to partner with airports to gather more noise data resulting from noise complaints. Finally, AEE is working with industry to accelerate the development of technologies that reduce noise through the CLEEN Program.

Recommendation: The Subcommittee once again recommends the continued prioritization of noise research and the prioritization of projects that will support informed decision-making as it relates to the introduction of new entrants to the national air space. Focus should also be given on the new entrants that are furthest along in development and most likely to impact our airspace.

Finding: Grants - Challenges still exist in getting grants awarded in a timely manner. Research projects are the key to making smart, informed regulations in an ever-changing aviation environment and to accomplishing our goals.

Recommendation: The FAA needs to streamline the process and remove any obstacles that are delaying the approval and awarding of these projects that are necessary to the success of its mission.

Subcommittee on Airports

General Observations: The Subcommittee on Airports remains supportive of the Program's ongoing work and future research directions, which continue to emphasize foundational research to support (1) advisory circulars and design guidance promulgated by the FAA Office of Airports; (2) airport capital improvements currently eligible or prospectively eligible for federal grant funding under the Airport Improvement Program; and (3) U.S leadership in areas of airport safety, planning, and airport infrastructure, and airfield pavements.

The Subcommittee also wanted to recognize the efforts Program staff have made to align the strategic priorities summarized in the Program's Strategic Outlook for Aviation Research (SOAR) chart with actual research efforts. These efforts have expedited research of importance to the airport community--such as sustainable pavement technologies and automated ground vehicles.

The Subcommittee made the following additional observations.

1. We continue to recognize that additional subject matter expertise is needed on the Subcommittee to address unrepresented stakeholders and provide subject matter expertise regarding key emerging technologies. Subcommittee members concurred that representation from emerging entrants—AAM, UAS, and possibly commercial space—would be helpful. In addition, representation from airlines, general aviation, and construction stakeholders would help to round out Subcommittee expertise. The Subcommittee awaits guidance from the FAA regarding when we will be able to seek additional representatives.

2. Related to Observation 1, we appreciate the increased emphasis the Program is placing on new entrant research activities and support the ongoing development of a new entrants section within the Program's organizational structure.

3. We appreciate the productivity and collaborative engagement of researchers working under the Airport Asphalt Pavement Technology Program (AAPTP) and Airport Concrete Pavement Technology Program (ACPTP), which have supplemented the Program's other pavement research efforts.

4. The Subcommittee wants to the need for continuing sustainment of aging pavement testing facilities and equipment associated with the National Airport Pavement Testing Facility and appreciates Program staff's attention to these needs in both budgeting and resource allocation.

5. Subcommittee representatives were impressed and intrigued by interim findings emerging from recently completed pavement testing. These findings provide insight into factors that affect pavement performance and useful life. We encourage to Program staff to continue its focus on factors that impact long-term pavement performance.

6. Subcommittee members would like to receive a briefing at our March 2025 meeting regarding airport and aircraft emissions research, with a particular emphasis on ongoing research into alternatively fueled aircraft—including sustainable aviation, electric, and hydrogen-powered aircraft.

Finding: The Subcommittee appreciated briefings from Program staff regarding autonomous and automated ground vehicle research and encouraged the FAA to continue focusing on this research. However, Subcommittee members also noted that a number of airports have expressed interest in testing various types of automated, remotely operated, or autonomous ground vehicles at their facilities. Remotely operated vehicles for airport perimeter surveillance, autonomous mowing equipment, and remotely operated/autonomous ground service vehicles were examples cited in this discussion. Subcommittee members would like to see "laboratory" research into safe operation of these vehicles coupled with field testing at willing airports.

Recommendation: We recommend that program staff evaluate how a field-testing program for automated/autonomous ground vehicles could be integrated into the Program's ongoing automated ground vehicle research projects.

We note that all of the Subcommittee's prior findings and recommendations have been addressed satisfactorily by Program staff.