Research, Engineering, and Development Advisory Committee (REDAC)
Recommendations for Fiscal Year 2026 Research and Development Portfolio

Subcommittee on Environment and Energy

General Observations: The Environment and Energy (E&E) Subcommittee of the FAA Research, Engineering and Development Advisory Committee (REDAC) conducted its hybrid meeting hosted at the DOT Headquarters in DC. There was a decent mix of in-person and remote participants from those who could not travel. The AEE 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 is a major concern about the lack of an FAA authorization for FY-24 and possible government shutdown. 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 progressing.

NASA also provided a comprehensive update on its programs. The primary focus of the briefing was on ultra-efficient transport, the future airspace, high speed commercial flight and advanced air mobility. The DOE presented a very informative briefing. The Subcommittee would like to see more collaboration between the FAA and the DOD so that everyone is aware of the work that each agency is doing. 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.

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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.

As was noted before, the current administration has made a commitment on climate change and issued an Executive Order 14008 that outlines its goals. It has commitment towards "reducing the aviation sector's emissions in a manner consistent with the goal of net-zero emissions for our economy by 2050". This was further captured in the U.S. Aviation Climate Action Plan. Through this document, the government announced its intention to advance the development and deployment of sustainable aviation fuels, and to maintain a leadership position at the world level with organizations such as the International Civil Aviation Organization (ICAO). Recently ICAO reached agreement on Long Term Aspirational Goal (LTAG) with some adjustments to CORSIA. So now U.S. Aviation Climate Action Plan's net zero 2050 goal is now matched by ICAO LTAG and industry goals. We firmly believe that partnerships with other governments, other federal agencies, the Centers of Excellence and Private Corporations who are involved in the research portfolios that AEE has in place are key to completing this mission and are the most effective vehicle to conduct and coordinate future research and maximize limited resources.

The Subcommittee believes that AEE is doing a very good job and has 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 Continuous Lower Energy, Emissions and Noise (CLEEN) and Aviation Sustainability Center of Excellence (ASCENT) portfolios. The Subcommittee members realize that there is still additional research required to address ongoing areas of concern. We are happy with the selection of the new Chief Scientific and Technical Advisor and with the recent addition of staff to AEE. We also believe that acting senior executive management has been doing a good job managing the Office of Environment & Energy since the various senior level management departures. We also believe that the creation of a separate Energy Division was a smart decision. Understanding that the need to maintain a leadership position at ICAO CAEP is still vital to the U.S. aviation.

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 U.S. 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. In order 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 that some of these research projects have already been added to the portfolio. The same can be said if we hope to develop fuels that can be blended above 50% in today's fleet of aircraft. The current research 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. 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. 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. The signatories of the SAF MOU, the DOE, DOT and USDA are all working very hard and have made progress and have developed goals and made commitments to this program. The new SAF Credit and Grant Programs are vehicles geared towards implementation of the SAF Program. The EPA is also heavily engaged as well. There are ongoing efforts to ensure that alternative jet fuels are in CORSIA through ICAO CAEP. It is good to see the global approach towards the production of SAF.

Recommendation: The AEE 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 awarding 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.

FAA Response: The FAA concurs with the Committee's findings and recommendations and is undertaking the following actions to address its recommendations – The U.S. Government and industry are both committed to achieving 3 billion gallons of domestic SAF production by 2030. This will be critical to enabling the aviation industry to get onto a path to decarbonize by 2050. We in the FAA worked with the DOE, USDA, EPA, and stakeholders from across government, academia, and industry, to develop the SAF Grand Challenge roadmap, which shows how we can all work together to achieve these goals. We continue to engage with other Federal Agencies to document ongoing and planned activities aligned with the roadmap and identify gaps in research, development, deployment, and associated funding needs. Progress will be shared with stakeholders to obtain input, identify relevant industry efforts, and find

opportunities for public-private partnerships. In May 2024 the DOE Bioenergy Technologies Office (BETO) released a Summary Report from a September 2023 Request for Information (RFI) seeking public feedback on building supply chains to meet SAF Grand Challenge goals. The respondents provided significant feedback to all questions and put forth valuable recommendations that could be implemented to support the development and demonstration of a mature, integrated SAF supply chain. We are also continuing our long-standing efforts in ASCENT, CAAFI, and CLEEN to support SAF development through testing, analysis, coordination, and deployment activities. To date, using FY23 and FY22 funding, we have funded 21 ASCENT projects on SAF supply chains analysis and fuel testing, for a total of about $11.3 million. These projects support the cost-effective expansion of domestic and international supply chains, streamlining of the process to qualify novel fuels as being safe for use, and include a new project to establish a facility to acquire, distribute, test, and document SAF and other reference conventional fuel samples. This latter project will ensure a timely distribution of potential SAF products from producers to evaluators and support the average 1.6x annual production growth rate necessary to achieve the planned production goals. AEE is also continuing to work on awarding the funds provided under Section 40007 of the Inflation Reduction Act (IRA) of 2022 through the new Fueling Aviation's Sustainable Transition (FAST) grant program. Selection is under way for projects to accelerate production and use of sustainable aviation fuels and the development of low-emission aviation technologies through projects located in the United States.

Finding: Public Private Partnerships - The AEE Subcommittee continues to acknowledge and support the fact that the Office of Environment and Energy (AEE) have 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 Aviation Sustainability Center of Excellence (ASCENT), other Federal Departments and Foreign Governments. Three quarters of Environment and Energy research funds generate 100% plus cost matching from non-federal partners Continuous Lower Energy, Emissions and Noise (CLEEN), Commercial Aviation Alternative Fuels Initiative (CAAFI), and ASCENT. The results that we have seen in the CLEEN Phase 1 and CLEEN Phase 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.

One of the benefits that has not been highlighted before is that these partnerships have created new industry and new jobs in aviation. In addition, private industry, universities, and hundreds of students have benefited from the partnership with the FAA. It should be noted that Dr. Oldani

graduated from one of our partner universities. 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 recommends that AEE utilize the additional funding that it has received in FY22 and any additional funding it receives in FY23 and FY24 on new and existing projects that will enhance and accelerate research to best address the current federal mandates. 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.

FAA Response: The FAA concurs with the Committee's finding and recommendation and is undertaking the following actions to address its recommendation - The FAA understands the importance of maximizing the impact of taxpayer dollars. By partnering with industry, academia, federal agencies, and foreign governments, we are making our research investments go further by leveraging our collective resources. By having universities in ASCENT work directly with industry partners, it increases the likelihood that industry will use the research product to mature their technologies ahead of implementation schedule to reduce noise, emissions and fuel consumption. In addition to providing world-class research products that are helping address the environmental challenges being faced by the aviation industry, the ASCENT is also creating the workforce of the future. Since 2004, the PARTNER and ASCENT have supported over 674 students. The FY24 funded ASCENT portfolio will include over $18 million dedicated to SAF research, $7.8 million for advancing technological innovation within the industry, and an additional $7.5 million to expand our understanding of aviation noise and emissions, reduce operational noise, develop and improve modeling tools, and support domestic and international standards. By requiring cost share within CLEEN, we increase the likelihood that the industry partner will use the new technology to reduce noise, emissions, and fuel consumption. The FY24 enacted budget will provide an additional $12 million to the final set of options for the CLEEN III program and over $23 million for the first year of the CLEEN IV Program. CLEEN, CAAFI, and ASCENT have all been successful because of their strong engagement with the industry. Each of these programs has had strong partnerships with, and support from, the industry for over a decade. In addition, the establishment of the new FAST grant program will allow AEE to further collaborate with industry, academia, local governments, and potentially others in accelerating the introduction of SAF in the supply system and accelerate the development of low-emissions aviation technology. As with the ASCENT and CLEEN programs, the cost-sharing provisions of these new FAST grants will also allow AEE to further extend the impact and reach of the provided federal funding.

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 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. 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.

FAA Response: The FAA concurs with the Committee's recommendation and is undertaking the following actions to address its recommendation - The FAA appreciates the support of the Subcommittee for our ICAO CAEP activities and the importance of continued U.S. leadership therein. We have made considerable investments over the years to support the work of ICAO CAEP, and that continues today, as FAA leadership is critical to securing U.S. objectives at ICAO. The commitments that FAA has made to ICAO international leadership span a range of integrated efforts that include funding ASCENT research projects in support of ICAO CAEP's work program, supporting technical and system level modeling assistance from DOT/Volpe, hiring subject matter experts to play key technical roles with ICAO CAEP's technical working groups, collaborating with other government agencies such as NASA and EPA, and assigning DOT and FAA personnel to fulfill critical leadership roles across ICAO CAEP's working groups. ICAO relies on FAA-funded research and analyses to inform its environmental work, much of which is done by ASCENT universities and the Volpe Center, under the direction of the FAA and in close collaboration with NASA and industry. In addition, FAA AEE's efforts have also been critical to defining how SAF is credited under CORSIA, and we expect our SAF research to take on additional importance within ICAO.

Our ongoing ASCENT projects to support CAEP standard-setting efforts have been critical in developing the understanding and information needed in the development and execution of the new integrated noise and carbon dioxide emissions standard, the first dual standard ever undertaken by ICAO. These projects will also support exploring metric systems that could be used to control full-flight nitrogen oxide emissions and interdependencies with non-volatile particulate matter emissions. Existing ASCENT projects are also supporting CAEP's technical development for supersonic engine emissions certification standards and recommended practices (SARPs), as well as en-route noise SARPs. In addition, AEE is continuing to fund research to support the development of noise standards that would enable the introduction of drones, AAM vehicles, and supersonic aircraft.

Finding: Aviation Noise - Aviation noise is and will continues 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. Despite the fact that 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 needs 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 and develop cleaner, quieter technology. AEE has seen a number of 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 number of 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 may be 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. There also have been significant upgrades made to the Aviation Environmental Design Tool (AEDT). AEE has established an AEDT User Review Group for ideas and feedback in order 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.

FAA Response: The FAA concurs with the Committee's finding and recommendation and is undertaking the following actions to address its recommendation - The FAA is committed to developing meaningful and equitable solutions to address the complex and nuanced issue of aviation noise. We are continuing to execute the research program that was captured on January 13, 2021, the Federal Register notice (Overview of FAA Aviation Noise Policy and Research Efforts). This includes research not only on the fleet of existing fixed-wing aircraft and helicopters but also on unmanned aircraft, AAM, and supersonic aircraft. The FAA is continuing to strengthen coordination with NASA by exploring collaboration opportunities offered by large scale ground or flight demonstrations, increasing engagement in the development of relevant aspects of the respective research programs, expanding participation to ongoing research and development activities, and by proactively seeking other venues for technical interchange. We are continuing several research projects within ASCENT to further analyze UAS field measurements data to improve our modeling methods and tools, expand our understanding to allow for quieter designs and operation, and to support development of appropriate standards and policies. In addition to the ASCENT projects to improve noise modeling of AEDT near the airport and further afield, we also continue the development of a tool for the rapid computation of noise levels and uncertainty distributions resulting from UAS operations, an approach much better suited to the

expected nature of UAS and AAM vehicles operation. We are also continuing to support research at Boston University, Massachusetts Institute of technology, and the University of Pennsylvania on the health, economic, and sleep disturbance impacts of aircraft noise. Lastly, we have a number of projects in support of the development of technological mitigation solutions to noise. These projects range from efforts to improve physics modeling and analysis and design tools to looking at specific technologies and complement the work being done by ASCENT on assessing the system level improvements expected as a result of the introduction into the fleet of the CLEEN II technologies.

Finding: Grants - There has been additional funding for new grant programs. The need to address the research required for additional SAF production and other projects requires that we remove the delays that we have seen in approving and awarding these grants. These projects are the key to making smart, informed regulations and 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.

FAA Response: The FAA concurs with the Committee's finding and recommendation and is undertaking the following actions to address its recommendation – The FAA understands the need and importance of ensuring the timely awarding of ASCENT grants. AEE, with the active support of APL, is currently maintaining close coordination with both the FAA Office of NextGen and DOT the help with the smooth processing of grants. Review and approval times by OST have seen significant improvements and the FAA is now reviewing its internal processes and working to identify how to best reduce the time required to move COE grants to final approval and award. A change has already been made and packages will now be submitted more often and containing fewer projects. The change will allow projects to move into approval more quickly after the initial legal evaluation as they will not have to wait for all other projects to be successfully evaluated as well. The IRA FAST Grants program continues to be identified as a high visibility program and, therefore, requires a more detailed review and approval process. Extensive coordination with APL and DOT has proven effective thus far and is expected to help ensure that FAST will move according to the expected schedule.

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