Subcommittee on Environment and Energy | MINUTES

Meeting date & time *March 22-23, 2022*
Meeting location *Virtual Meeting*

Purpose	Review Strategic Guidance for the FY2024 R&D portfolio
Facilitator	Jim Hileman, DFO
Note taker	Jim Hileman
Timekeeper	Jim Hileman

Minutes from Meeting

Presentation Welcome | **Presenter** *Jim Hileman*

Jim Hileman provided details on the meeting and went over the agenda.

Presentation Chair Opening Statements and Introductions | **Presenter** *Ian Redhead*

Ian Redhead welcomed everyone, and he did roll call of the members of the Subcommittee.

Presentation FAA AEE Update | **Presenter** *Jim Hileman (on behalf of Kevin Welsh)*

Jim Hileman provided updates on the Office of Environment and Energy (AEE) efforts as a whole on behalf of Kevin Welsh who was on travel. Jim started by noting that AEE have been very busy over the past year.

Jim provided an update on the U.S. Aviation Climate Action Plan, which was announced by the Secretary of Transportation on November 9, 2021 during the COP meeting in Glasgow. The revised United States (U.S.) Aviation Climate Action Plan has also been submitted to the International Civil Aviation Environmental Protection (ICAO) and is publically available on the ICAO website. He noted the considerable work done leading up to this including the September 2021 White House Sustainable aviation event and that he would provide more on the plan in his afternoon briefing. He continued by stating that the office have been working diligently on the roadmap for the Sustainable Aviation Fuels (SAF) Grand Challenge, which will be presented in the afternoon briefing on SAF.

With respect to aviation noise, Jim informed the Subcommittee that three FAA personnel, including Kevin Welsh, appeared before the House T&I Committee on March 17 to provide testimony and field questions from House members on matters related to aviation noise. Jim noted that the FAA thought it went very well. He also reminded the Subcommittee that considerable efforts are underway with respect to drones and advanced air mobility (AAM) and that there will be more on these topics during the noise briefing tomorrow. Jim additionally mentioned that AEE also have considerable work ongoing with air tour development for national parks and with the noise policy review. Based on a question from a member, the FAA shared the link for the

noise hearing (https://transportation.house.gov/committee-activity/hearings/aviation-noise-measuring-progress-in-addressing-community-concerns).

Jim also informed the Subcommittee that AEE have efforts ongoing on broader issues of sustainability for the FAA. These are not necessarily R&D, but they do take AEE staff time. He noted that federal agency sustainability and resiliency are key priorities for the Biden-Harris administration, Secretary Buttigieg, and Administrator Dickson. Executive Order 14057, Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability, makes these priorities clear, placing new, aggressive targets on agencies with an overarching goal of net zero emissions by 2050. Jim noted that these goals are achieved, in part, by eliminating carbon-pollution from electricity usage, increasing reliance on zero-emission vehicles, and constructing sustainable, energy-efficient, and resilient federal facilities. AEE supports the FAA's Chief Sustainability Officer and leads Sustainability coordination for FAA. He concluded by noting that we in AEE are leveraging an existing FAA decision-making body to coordinate across FAA on efforts to increase facility energy efficiency & reduce FAA's carbon footprint.

Jim continued by noting that AEE have filled nearly all of the Office's vacancies and are looking to expand the overall head count. At present, AEE are looking to bring on three additional staff to work on SAF. Additional staff could be then brought on board in the coming year.

Finally, Jim noted that in-person meetings are now taking place and that we have some limited attendance from FAA AEE staff in these meetings. Along these lines, the ASCENT Center of Excellence meeting on April 5-7 will be a hybrid meeting with an in-person component.

Presentation Update on ICAO and CORSIA Implementation | **Presenter** *Jim Hileman (for Dan Williams)*

Jim Hileman provided updates on behalf of Dan Williams as he was on travel.

Jim started by noting that we have been busy with the ICAO, both with the ICAO Council and in the Committee on Aviation Environmental Protection (CAEP). Jim also clarified that the ICAO Council is the body that does the day-to-day governing of ICAO and directs and approves CAEP's work.

With respect to the Council, Jim noted that Ambassador Sullenberger arrived at ICAO in February. While it can be a challenge to bring a new Ambassador up to speed, it is beneficial to have someone who can truly "speak for the administration" in place. This will be even more important as we get to the 41st Assembly. Jim informed the group that the Council wrapped up its 225th Session last week and there will be one final session before the ICAO General Assembly later this year. In the just concluded session, on environment topics, the Council considered the on-going CORSIA periodic review and the results of CAEP's analysis of the feasibility of a Long Term Aspirational Goal (LTAG) for international aviation CO2 emissions.

He continued by remarking that discussions on the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) continue to be challenging. He explained that the U.S. would like to maintain the status quo and if possible increase the overall climate ambition of CORSIA, but a number of vocal states--Brazil, China, and India--would like to renegotiate CORSIA in its entirety. Jim continued by noting that we are hopeful that by the 226th Council Session, we will be able to do more travel to Montreal and better support and host these key discussions in person.

Jim then reported on the CAEP/12 meeting that was held virtually in February. He noted that the U.S. had achieved our desired outcomes on key issues, and that the meeting was relatively productive given the virtual setting. As usual, the U.S. government team played a major role leading up to and during the meeting to make it a success. He outlined a number of key outcomes:

1. Agreement to pursue new/updated CO2 and noise standards for subsonic airplanes - an "integrated, dual stringency."
2. Agreement to review the NOx metric for engine emissions.
3. Unanimous approval of CAEP's Long-Term Goal analysis and report, which provides three emissions scenarios, and a number of sensitivity studies, for the international aviation sector through 2050. This report is already available online - https://www.icao.int/environmental-protection/LTAG/Pages/LTAGreport.aspx
4. Agreement for continued work on both emissions and noise standards for supersonic aircraft and engines, including towards a noise standard that would be at the same level as current subsonic stage 5 / Chapter 14. This outcome reflects a constructive way forward and was fully supported by a number of Members and Observers.
5. Avoided taking on problematic proposals regarding the CORSIA review process.
6. Inclusion of a number of revisions to expand the number of fuel pathways that can receive credit under CORSIA, but do so in a rigorous manner that ensures the environmental credibility of CORSIA.

Jim further noted that CAEP will be continuing to work in a virtual environment in the coming month. However, he also noted that we hope to be able to support Council in person soon as well as supporting CAEP working groups in person.

He then provided an update on the LTAG effort and what is coming next. In the coming weeks, ICAO will be hosting LTAG Global Aviation Dialogues, which will share the results and facilitate discussion of an LTAG. As part of the work on the LTAG, ICAO is expecting to hold a high-level meeting in 2022 to discuss the results and further coordinate with member status. Finally, the next ICAO assembly will take place at the end of September 2022, where we expect LTAG, CORSIA, and other environmental issues to again be a focus of discussion. He concluded with an update of FAA's CORSIA Program, which is currently being implemented through voluntary agreement.

Presentation Industry Perspective | **Presenter** *Steve Alterman*

Steve Alterman provided an industry perspective on environmental matters. He started by noting the major thing from industry is its commitment to be carbon neutral and the need for SAF to make this happen. There is a broad coalition that is working the SAF issue and the industry fully supports the Blenders Tax Credit (BTC). He noted that price continues to be the challenge with SAF, but the high price of oil is currently mitigating this. Regardless, SAF provide the biggest bang for the buck.

Steve also noted that he watched the noise hearing and he thought the FAA did a very good job. He noted that noise is one part of a complex situation as more direct routing makes operations more efficient, but this also leads to people being flown over. He continued by noting that in the past, people at the end of the runway complained about noise. That is no longer the issue – now the issue is that new routes lead to noise in places where they did not fly before and this is

causing problems 10-20 miles out with aircraft 10,000 feet in the air. He noted that the Management Advisory Council provided a report on noise, which found that COVID has led to FAA reaching more people via virtual meetings and there is less contention in the meetings. These meetings seem to be more productive. He continued by noting that noise is the biggest constraint on growth, and it continues to be a major issue. With that being said, he thinks that FAA is moving in the right direction on noise.

In his remarks, Steve also noted that the Environmental Protection Agency (EPA) has a rule out on particulate matter and comments are due in April. He also mentioned that he recently met with a number of participants in the AAM market and he thinks that these initiatives are coming quickly. For example, Joby wants to be flying in 2024. All of these new entrants could redefine how the airspace is being used and this will require additional thought.

The Chair asked if others from industry wanted to provide inputs, and everyone declined.

Presentation FAA R&D Update | **Presenter** *Shelley Yak*

Shelley Yak thanked everyone for joining the meeting. She began by covering how the FAA is handling the pandemic with a focus on when we will be returning to work. She provided some additional details on the situation at the FAA Technical Center in Atlantic City. She discussed the new bipartisan infrastructure law and how it is affecting things at the FAA. She also provided information on recent changes at the FAA including the Administrator, the head of the Air Traffic Organization, the head of NextGen, and the head of Commercial Space. She then talked about the lessons learned from budget uncertainties of the past, and how this has led to improved messaging for the work we do in R&D. She continued with a discussion on the new budget line item to support innovation. She let the subcommittee know the importance of getting feedback from the Subcommittee to be strategic. She noted that we are looking to expand the full REDAC membership, and that we would welcome members' inputs on whom should be on the expanded REDAC.

The Chair noted that the Centers of Excellence have opened up aviation to new students and a larger potential market for people going into the aviation industry. Because of the research efforts on SAF, we now have a new market developing and aviation is expanding.

Presentation NASA Update | **Presenter** *Barbara Esker (NASA)*

Barbara Esker gave an update on NASA Aeronautics efforts. She started by covering the strategic thrusts that guide the work of NASA Aeronautics. She focused on ultra-efficient transport, the future airspace, high-speed commercial flight, and AAM. In terms of supersonics, she provided an update on the Low Boom Flight demonstration mission with details on the manufacture of the X-59 aircraft and the community testing of the low sonic booms. She also discussed the efforts ongoing in NASA to examine landing and takeoff noise from supersonic aircraft. In terms of AAM, she started with an overview of the work being done by NASA. She provided additional information on vehicle propulsion reliability, fleet noise assessments, tradeoffs between noise and performance, and additional safety needs. In terms of ultra-efficient transport, she provided details on four key technical areas; namely, the transonic truss braced wing, small core gas turbines, electrified propulsion, and high-rate composite manufacturing. She noted that there is a comprehensive update on the

work on the transonic truss braced wing efforts in Aviation Week - https://aviationweek.com/aerospace/emerging-technologies/nasa-boeing-buffet-tests-take-ttbw-step-closer-reality. She concluded by noting that the FAA and NASA are working in close collaboration with accolades to the FAA for the 2021 Aviation Climate Action Plan.

The Chair asked for a clarification on the landing and takeoff noise efforts on supersonic aircraft.

A member asked whether the AAM information had been shared with the FAA Drone Advisory Committee (DAC). Barbara noted that it has been shared with the industry and the NASA Advisory Committee. The member offered to share more information with Barbara on the DAC.

Another member asked if NASA is working on cargo drones that could carry multiple packages. This is an interesting aspect that could be considered as it has a multitude of issues that could be examined.

The Chair noted that NASA is making great progress and has good momentum.

A member asked if first flight of the Low Boom Flight demonstrator will happen this year and Barbara confirmed that it is the current plan.

Presentation ATR Environmental Research - Update | **Presenter** *Michel Hovan and Lauren Vitagliano*

Michel Hovan began with an introduction to the Airport Technology Research Program (ATRP) program and its $41 million program and continued with a list of on-going projects being supported by the program. He then provided information on efforts to make airports more resilient. He quickly touched on projects associated with the melting permafrost affecting runways in Alaska, electric tugs, and AAM infrastructure needs. He gave additional details on the full-scale accelerated pavement tests being done at the FAA Tech Center including efforts to consider new materials for runways. He discussed the development of an FAA web-based LCA tool to evaluate the life cycle costs and emissions associated with runways as well as the use of recycled plastics in infrastructure. He continued with a discussion on efforts to examine the embodied carbon in infrastructure and solar powered lighting incorporation at airports.

Lauren Vitagliano continued with a discussion on airport environmental efforts. She provided updates on the future climate scenarios for runway length, the FAA AppMap tool, and resilience evaluations at airports. She discussed how the FAA is working with MIT and MITRE to develop tools to predict runway lengths that will be needed in a future warmer world. She continued with an update on the airport environmental planning tool that is being developed in close collaboration with AEE. She concluded with details on the airport resilience framework that is being developed.

A member asked about coordination efforts on low carbon pavement development efforts, which Michel agreed to discuss further with her. The member additionally noted the challenges associated with meeting the growing low carbon electricity needs at airports. Michel responded that they are working with NREL on this specific question. The member also asked about ATR efforts related to water issues and Michel offered a briefing on water issues and fire-fighting foam development efforts, in particular, should the E&E Subcommittee want it. She lastly

discussed risk assessment efforts in the Airport Cooperative Research Program (ACRP) and Michel offered to share a briefing on these efforts.

The Chair discussed electric ground support equipment with Michel.

Presentation Responses to REDAC Recommendations & Actions | **Presenter** *Jim Hileman*

Jim Hileman walked through the existing findings and recommendations from the Fall 2021 meeting. All of the recommendations were closed. Jim then walked through the action items from previous meetings and the open action items are listed below.

During the discussions, a Chair noted that the DFO provided a briefing to the full REDAC and that it was very well received and led to recommendations being sent to the Administrator. Another Member reported that the NASA representative to the full REDAC was also highly complimentary of the work presented by the DFO at the meeting.

The Subcommittee agreed to close all of the recommendations from the autumn 2021 meeting.

Action items	Person responsible	Deadline
Share ASCENT NFO with REDAC E&E Subcommittee (on an annual basis)	J. Hileman	Ongoing
Leverage "right-to-left" thinking in developing roadmaps wherein AEE start by thinking about the endpoint (goal) that is desired and decide how to get there	J. Hileman	Ongoing
Develop a means to communicate successes from E&E Portfolio summary slide	J. Hileman	Ongoing
Provide a summary of the comments received on the FAA Noise Research Federal Register Notice (FRN) and any potential new research direction/ projects on noise that came from these comments	D. Scata and S. Doyle	Closed

Presentation Budget | **Presenter** *Beth Delarosby*

Beth Delarosby began by giving an update on the RE&D budget. The FY22 budget was enacted on March 15, 2022 and the FAA received $248.5M in RE&D funds. She provided a detailed comparison of the Operations, F&E, Grant-in-Aid, and RE&D accounts between the enacted budget and the final conference language. She also provided the language and funding levels from the FY22 House and Senate reports. She noted the Office of Management and Budget (OMB) provided $260.5M in RE&D funds in FY2023 and that the FY2023 President's budget will be released on March 28, 2022. She concluded by reporting that the FY2024 target for RE&D is $267M and by providing the out year targets for RE&D funding and noting that the FAA reauthorization expires in 2023.

The Chair asked about the out-year targets, and Beth clarified that the targets are set by OMB.

Presentation E&E Research Update | **Presenter** *Jim Hileman*

Jim Hileman started his briefing with background information on the AEE and the overarching E&E Strategy that is guiding the E&E R&D Portfolio. He provided a number of highlights from the R&D program across all of the areas that will be presented during the meeting.

Jim continued by providing the overarching direction of the E&E Portfolio. This included a summary of the environmental impacts of aviation and how these are driving the need for continued innovation by the aviation industry. He gave an overview of the noise R&D program with links to materials that provide more information including on the noise situation today, the results of the noise survey released in January 2021, and the online resources available on noise that have been developed by the FAA, such as the FRN on noise research. He provided a short discussion on the work of the E&E Portfolio on helicopters, drones, AAM vehicles, supersonic aircraft, and hypersonic / commercial space. He then summarized efforts related to aviation emissions, including increasing focus on lead emissions, which are produced by aviation gasoline. He noted that considerable detail would be provided on the new effort to eliminate aviation gasoline lead emissions in the emissions briefing tomorrow.

He then provided an overview of the U.S. Aviation Climate Action Plan. This portion of the briefing started with background on ICAO's ask for climate action plans, contained information from the September 2021 White House Sustainable Aviation event, and provided links to the report and a press release on it. Jim noted that he has given many briefings on the plan and the slides here are representative of the report contents. He provided several charts with data that were at the core of the Climate Action Plan. This was followed by a summary of the full report contents and then charts that give summaries of the various chapters in the report. Jim reminded the Subcommittee that he had provided much of the analytical work to the Subcommittee in their last meeting and that this analysis was also leveraged for the White House Sustainable Aviation event and the SAF Grand Challenge.

Jim continued with updates on international efforts with an emphasis on the key role that the E&E Portfolio has had in enabling the work of the CAEP LTAG and future standard setting efforts. He then followed with a discussion on the budget profile of the E&E Portfolio, including a discussion on the FY2022 enacted budget and how these funds would be used.

A member asked if it would be useful to do relatively simple measurements of nvPM to understand the impacts of changing fuel composition on these emissions. The FAA noted that we are looking at this but it could be challenging to ensure that relatively simple experiments are representative of actual engine conditions.

A member asked how much flexibility there is to switch funds and Jim noted that the FY22 budget provides considerable flexibility to use money within ASCENT and CLEEN.

Presentation Sustainable Aviation Fuels Research | **Presenter** *Nate Brown and Anna Oldani*

Anna Oldani started the briefing covering the benefits of SAF use by industry as well as the challenges to SAF that need to be addressed. She continued with a reminder that the FAA does work on testing, analysis, and coordination.

Anna provided an overview of the ASTM International fuel qualification process, the work the FAA is doing to support it, and where different fuel producers are within the process of gaining fuel approval. She continued with updates on the efforts of ASTM task forces that are supporting fuel approvals and updates on the work of specific ASCENT and CLEEN Projects that are supporting fuel approvals.

Based on a question from a member, Anna discussed the potential for producing SAF with a minimum of aromatic compounds and how ASCENT is supporting these efforts, which include UDRI's work under ASCENT Project 31 looking at seal swell. She noted that seal swell issues are actually more complicated than it appears as there are multiple types of seals and not all aromatics work the same with them. Further, some cyclo-paraffinic compounds also help seal swell. She then added that the FAA are looking to set up additional work on this subject.

The DFO also remarked that aromatic reduction could have a positive impact on reducing climate impacts of aviation through contrail mitigation and that we are looking to do research on this with the FY22 funding.

Anna continued the briefing by discussing analysis efforts to support novel SAF production, including an assessment of new concepts in both green hydrogen for SAF production and power-to-liquid (PtL) technologies for aviation. She continued with a summary of the contributions from ASCENT researchers to a special issue of Frontiers in Energy. She also discussed ongoing efforts on SAF in ICAO within the Fuels Task Group.

Nate Brown followed with information on the SAF Grand Challenge including an update on the development of the SAF Grand Challenge roadmap. He started with an overview of the Grand Challenge, the participants, and its goals. He continued by outlining the role of DOE, DOT/FAA and USDA. He described how the SAF Grand Challenge roadmap provides a multi-agency plan for reaching the goals of SAF production in 2030 and 2050. He went into details on the action areas that will be in the roadmap as well as the outline for the overall roadmap document. He concluded the discussion on the SAF Grand Challenge by capturing the next steps in the development of the roadmap.

A member asked why DOE is issuing FOAs with a 70% reduction in life cycle GHG emissions when the SAF Grand Challenge references 50%. Nate noted the SAF Grand Challenge states at least a 50% reduction and he is guessing that they are being more ambitious. The DFO noted that DOE have long been seeking a 70% reduction in life cycle emissions from ethanol.

The Chair noted that it is important to also capture the jobs benefits of SAF production and the FAA agreed.

Based on a question from the Chair, Nate reported that DOD is engaged with the work on SAF along with many other agencies. There was also additional discussion on how current and potential policies could facilitate the SAF Grand Challenge.

Nate proceeded with information on CAAFI, its 2022 work plan, and the CAAFI General Meeting, which will be in person from June 1-3, 2022. He also provided data on SAF commercialization to date, current and expected renewable fuel production, and the total available biomass for renewable fuels.

A member noted that roughly half of the SAF production in 2021 is likely from Neste who is importing it into the U.S. As such, there is more than one facility producing. Based on the

question, Nate also remarked that the February 2022 data shows 2.5 million gallons of SAF use in the U.S., which is a sizeable increase.

A member congratulated the FAA on the work with SAF stating that the amount of work getting done is very impressive and to please keep up the fantastic job. He continued by remarking that regenerative agriculture is very important and should not be underestimated. Nate added that regenerative agriculture and increased soil organic carbon is indeed important. The DFO agreed and noted that the knowledge gained on this front will be taken to the work in ICAO and CORSIA.

Discussion | Lead *Ian Redhead*

The Chair asked for input from the Subcommittee on the work program and recommendations. He noted that committee has had four recommendations over time related to SAF, public private partnerships, noise, and international leadership.

A member stated that it is important that the FAA does not take on too much and stays focused.

Another member noted that in the past, the Subcommittee had to help prioritize finite resource use. However that is not the case now and perhaps the members are now cheerleaders for SAF as it is a big priority. He concluded that the Subcommittee needs to get better at the four things that the Chair listed.

The Chair remarked that the budget is appropriate to support the SAF work and he is happy to see increased staffing to oversee it. A member noted the staff in AEE are being pulled in many directions and they need to stay full staffed to be able to do their work.

A member asked if there is enough information to conclude that SAF is not just the near term solution but also the longer term solution and followed by stating he is not sure given the potential production limitations. Another member added that there are other means to decarbonize other modes but not so for aviation and we can look at the number of years we can envision. A third member noted that to answer aviation long term future there is the need of a whole of government activity and that the FAA is addressing one piece of this puzzle. She then added that the other member is right to look at staffing and FAA needs to be diligent in ensuring that AEE has the staff to work on this.

The DFO continued the discussion on hydrogen by noting the challenge in using cryogenic hydrogen and how this issue was captured in the climate action plan. A member stated that SAF is what is needed to decarbonize aviation.

A member remarked that AEE have done a phenomenal job in balancing the portfolio. He further noted that he has not seen anyone create a plan and stick to it so well. Another member added that he appreciated the mapping of the climate action plan and the mapping of this effort. The DFO remarked that over the past year AEE have been in the right place and time to coordinate efforts across the USG on the common goal of aviation decarbonization. A member added that the level of coordination of this group with other agencies has been superb and while the Subcommittee takes it for granted it is key and should be captured in the F&R for the FAA.

The Chair closed out day 1 at 5:00 pm.

END OF DAY 1

The Chair started Day 2 by thanking the Members for joining and the FAA for the terrific job with the program.

Presentation Emissions Research | **Presenter** *Ralph Iovinelli, Daniel Jacob*

Ralph Iovinelli started the briefing with a summary of the work FAA has started on eliminating aviation gasoline lead emissions, also known as the Eliminate Aviation Gasoline Lead Emissions (EAGLE) initiative. This effort started with a report to Congress that was requested by Section 177 of the 2018 reauthorization and was released by the National Academies. He continued by noting the collaboration between the FAA, EPA, and industry on this effort. He provided the overarching goal of the EAGLE initiative to remove the use of leaded aviation fuels for piston-engine aircraft in the United States by the end of 2030 without adversely impacting the existing General Aviation (GA) fleet. He concluded this portion of the presentation with the four pillars to a lead-free aviation system, activities that are being led by industry and the FAA under EAGLE.

Based on a question from the Chair, Ralph and the DFO both noted that the FAA has some additional funding coming to the aviation gasoline program in FY2022, but it was not tied to the EAGLE program. Further, the DFO noted that this funding is only for aviation gasoline efforts, which does not cover the full extent of the EAGLE program. Based on a question from a member (Charles), Ralph clarified that reauthorization Section 565 is the one related to lead emissions. Based on a question from another member (Steve), Ralph clarified what is expected by the 2030 date.

Ralph continued the briefing with a summary of the overall efforts on emissions within AEE and was followed by Daniel Jacob that continued the briefing highlighting the key aspect of the work that would be briefed during the meeting.

Daniel began his portion of the briefing by summarizing our work to measure non-volatile Particulate Matter (nvPM) emissions at the engine tailpipe. He provided details on ongoing emissions measurements, which will lead to improvements in the nvPM standard, and details on the volatile PM modeling effort. He gave details on the work being done by MS&T with Honeywell to understand the impact of ambient conditions on nvPM emissions and discussed further work being done by the team with MIT under ASCENT Projects 48 and 83, as well as efforts to measure SAF blends with varied aromatic contents. A member (Jayant) noted that the work is excellent as the measurements are matching up with the modeling results in slides 15. As a part of the discussion, Daniel noted that there is additional work to be done to further improve the correlation.

He continued his briefing with an overview of new work to develop a methodology to model volatile particulate matter in the vicinity of airports. He also provided an update of the research related to air quality monitoring and modeling. This included a summary of work done by Boston University (BU) under ASCENT Project 18 to measure air quality in and around airports to understand the relative impacts of aviation emissions to other sources. Based on a question from the Chair, Daniel clarified when the data was acquired by BU. The DFO also noted that it would be difficult to relate the BU measurements to changes in operational procedures, such as those being moved forward by MIT under the E&E portfolio.

Daniel then provided information on the efforts to develop a new aviation-specific dispersion model for demonstrating compliance to regulations. This included a detailed timeline for the tool development and our coordination efforts with EPA on it. He noted that the effective coordination among the researchers, EPA, and FAA could result in a much faster implementation of the plume rise algorithm in AERMOD, perhaps with a release in 2023.

Daniel continued with information on research being done to evaluate the impacts of various sources of emissions in the upper atmosphere including supersonic transport, high altitude long endurance UAVs, and rocket emissions. He additionally covered the new work being done by MIT under Project 78 to develop a contrail decision support tool.

Based on a question from a Member, Daniel and the DFO noted that the FAA does not intend to make APMT public and the tools have been used for cost-benefit analyses in a number of settings including standard setting and evaluation of fuel composition.

Based on a question from a Member, Daniel noted the work of Project 78 is just starting but is building on long-standing work supported by the FAA and NASA. He noted that he hopes the team could have a prototype in 2023 for evaluation. Based on an additional question the DFO noted the team is considering not just operations but also technology and fuel composition to reduce the climate impacts of aviation via contrails and aviation induced cloudiness.

Presentation Noise Research | **Presenter** *Don Scata, Sean Doyle, Muni Majjigi*

Sean Doyle provided a briefing to summarize the responses from the FRN on FAA noise research that was released in January 2021. The briefing included a statistical analysis of the responses by type and geographical location. The analysis considered the distribution of responses by additional research, noise metrics/thresholds, and policy. Sean concluded the briefing by noting that all of the comments are publically available through the Federal docket. The DFO remarked that the FAA intends to continuing to do research on noise as outlined in the FRN. A member (Melinda) noted that it would be useful to share this information public and the Chair stated that it would be useful to present the information at a coming noise meeting in April.

Another member asked if there were letter writing campaigns to send in common responses to the notice and Sean reported that it did happen where a roundtable provided input and that input was also sent in by individuals. Sean also noted that there is no formal requirement to respond to comments and that the FAA is also looking at individual responses and not just the aggregated statistics.

The Subcommittee discussed potential reasons why some communities had more responses than others.

A member asked if this exercise has resulted in new topics for research, and Sean responded that nothing stood out as things that we are not already doing. Sean also noted that we have a noise policy review that addresses much of what is covered by the responses that we received.

Another member commended the FAA for reaching out to the public on this and asked if there were correlations among the twenty airports including in the community noise survey and the FRN responses. Sean responded that no strong correlation was seen.

The Chair thanked the FAA for listening to communities.

Don Scata set up a second briefing to provide a more traditional update on noise research efforts. Muni Majjigi started with an update on recent efforts related to noise technology. This included the status of the NASA-FAA interagency cooperative agreements, information on FAA participation in the 2022 AIAA SciTech meeting, and FAA work with NASA working groups considering noise. Don continued with discussion on efforts to support noise work in ICAO and Sean followed with a summary of active ASCENT projects that are working on noise.

The Chair noted it would be useful to include dates for key deliverables for projects, and Sean agreed.

The Chair asked whether additional staff is needed to support the work on noise and the DFO noted that the staff are being pushed very hard, but we are initially focusing on increasing staff to oversee the increase of funding to technology development and SAF.

Based on a question from a member Sean noted that the work on white noise would focus on white noise generation in a home, as opposed to an air vehicle. The DFO noted that we are considering a variety of solutions for noise, and he provided details on how the FAA are working to leverage work being done in Louisville to examine how trees could help mitigate environmental impacts in communities. In this instance, AEE is supporting noise measurements and providing insights to the research team on air quality monitoring.

Sean continued his briefing by talking about AEE efforts on UAS noise modeling and concluded with a summary of the ongoing work on health impacts.

A member asked how the FAA is considering environmental justice and equity, and Sean noted that the researchers are examining in the impacts are disproportionately affecting communities and have recently published on this topic.

Based on a question from a member, Muni clarified that the agreements between the FAA and NASA will ease sharing of information. A guest from NASA agreed that these agreements will make it easier for NASA to freely share information with the FAA.

Presentation Aircraft Technology Update | **Presenter** *Levent Ileri and Arthur Orton*

Levent Ileri began by providing a summary of the first two phases of the CLEEN program as well as information on the third phase of CLEEN. This included a summary of all of the technologies that have been matured by CLEEN and the status of those technologies that are currently being matured. He highlighted a number of accomplishments that the CLEEN program has achieved in terms of technology maturation. He also provided the overall benefits of the CLEEN program, which have been evaluated by Georgia Tech under ASCENT. The Chair suggested that the economic benefit of fuel savings should be provided in addition to the other metrics.

Arthur Orton continued the briefing with a summary of the goals of CLEEN Phase III and the technologies that are being supported by the Program. He also gave an update on progress in the technology maturation efforts in the third phase, and expected progress in the next six months. He concluded the CLEEN portion of the briefing with timelines for all of the CLEEN technologies.

Arthur continued the briefing with a summary of the work being done within ASCENT on technology innovation, which included highlights on ASCENT projects 37, 51, 52, 55, 63, and 64. He concluded the overarching briefing with key facts about the technology development efforts being conducted by CLEEN and ASCENT.

The Chair asked how the OEMs interact with the CLEEN Program. This led to a considerable discussion with the Subcommittee on the interaction of industry with the work of CLEEN and ASCENT, and how direct and in-kind cost-share requirements reinforce it.

The Subcommittee also discussed the importance of ASCENT to developing the work force of tomorrow. One member specifically thanked the FAA for their COE efforts as all, including NASA, are benefiting from the students who have entered the industry. Another member noted that it has been useful for the FAA to group the ASCENT work in the way the way it is being done as this is helping universities to recruit students for aeronautics. The DFO noted that several speakers from the FAA side are in fact products of PARTNER and ASCENT including the DFO himself, Anna Oldani, and Chris Dorbian. He also reported that in its first 6 years, ASCENT has supported over 900 student-years of research. A member commented that the FAA could do a better job of sharing this important human story of the research.

The Chair summarized the importance of effectively standing up public private partnerships as it leads to both research products but also the workforce.

Presentation Operations for Reduced Noise | **Presenter** *Chris Dorbian*

Chris Dorbian provided an overview of the research FAA is doing to develop operational procedure concepts to reduce noise. He started with an overview of FAA efforts relating to aircraft operations and then continued with the work being done in the Boston area through the FAA-Massport Memorandum of Understanding (MOU) through ASCENT Project 23. He noted that the research resulted in changes to two procedures that have been published (33L arrival and 15R departure). Additionally, a second set of procedures that were examined by MIT were voted on by the Massport Community Advisory Committee (MCAC) and Massport submitted them to FAA in January 2022. He provided information on four separate procedures that were considered by the MCAC. He reported that the FAA will follow normal process to evaluate and implement proposals and that he thinks that the goals of the MOU in conducting case studies were achieved. He also added that FAA-Massport-MCAC coordination will continue and that he is planning a FAA-MIT-Massport workshop to discuss the overall outcomes and lessons learned from the effort. Further, he shared lesson learned from the standpoint of data visualization and procedure constraints.

Chris continued with an update on the work of ASCENT Project 44 to improve our noise modeling capabilities to enable improved procedure design. The primary objectives of this work are (1) to collect aircraft state and noise measurement data to support validation of noise modeling methodology and identification of low-noise behaviors and (2) to gain stakeholder perspectives on flyability and implementation barriers to low-noise procedures. He noted that an arrival analysis at BOS and SEA indicated noise reduction potential for delayed deceleration approach procedures. He also commented that the team are analyzing aggregate departure noise and flight procedures so statistically significant factors that correlate with measured noise can be identified.

The Chair asked Chris about opportunities to distribute procedures to fan out the noise. Chris responded that individual airports will have different requirements. There was also discussion on the utility of having virtual meetings to communicate air space redesign efforts. A member commented on the importance of conducting procedure design with a communities.

The DFO noted that the MIT efforts have shown the challenge in getting communities to agree on how to share noise as any distribution of flight paths requires communities to agree to increased noise exposure to enable other communities to have a noise reduction. This led to additional discussion with the FAA and the Subcommittee.

Presentation Analysis and Tool Development | **Presenters** *Fabio Grandi, Joe DiPardo, and Sean Doyle*

Fabio Grandi gave an update on analysis and tool development. This covered data and tools infrastructure development implementation, Tools Development (the Aviation Environmental Design Tool (AEDT), Noise Screening, and the Environmental Visualization Tool (EVT)), and the ASCENT Projects that are supporting these efforts.

He started by noting that FAA polices and infrastructure for data have been shifting to support sharing, availability, and capitalization of resources. This well aligned with the long-standing AEE vision for analysis and tool development. He continued by covering how the efforts are providing consistency across the FAA by using common data and methods. He also discussed continued efforts on the plan for Technology Welding and Deployment (TWD) with respect to data and tool development efforts. He concluded this portion of the briefing with an update of progress toward achieving TWD and the benefits we are already realizing from the overarching effort.

A member asked about the timeline for getting everything into the EIM and Fabio noted that the limiting factor if the data cleanup and we hope to have it done this year. The member noted it is great to see the frictions in the data handoffs being eliminated.

Mohammed Majeed continued the briefing by giving information on AEDT3e, which is scheduled for release on April 24, 2022. The new version of AEDT includes a number of usability improvements and updates to the emissions computation. The usability improvements will enable users to select tracks to be edited, CSV import of aircraft operations and tracks data, and improved speed of generating AERMOD input files. The emissions updates include an update to latest AERMOD/AERMET versions, AERMOD source characterization, aircraft lead emissions and dispersion modeling, and revised stationary source modeling.

Joe DiPardo continued the discussion on AEDT by covering how the AEDT development process is taking external feedback from the AEDT User Review Group. The URG will have its third annual meeting in April 2022 and it continues to provide valuable inputs. Joe proceeded by providing information on the AEDT3f development plan which is scheduled for public release in 2023. The new version will have improved aircraft performance, upgrades in emissions and dispersion modeling, and upgrades to some of the underlying software. Joe concluded by covering the plan for the AEDT 4 series, which will be released in 2024, and how it will include a number of noise improvements. As in previous meetings, he showed how our research projects in ASCENT and ACRP are feeding into AEDT development.

Fabio continued the briefing with an update on the development of the Environmental Visualization Tool (EVT). The EVT is a web-mapping application that is currently limited to FAA staff that will enable its user to quickly and easily create customized maps using uploaded or built-in data layers. He then provided an update on the FLeet Evolution, Estimation and evaluaTion Builder (FLEET-Builder) tool. He concluded the briefing with short summaries of several ASCENT projects that are supporting the tool development efforts.

Open Discussion | Lead *Ian Redhead*

The Chair noted that the briefings have considerably improved over time, especially during COVID. These briefings are very good in showing the successes of the program and individuals have not had many questions as AEE is doing a great job in conveying the information.

A member agreed with the quality of the briefings and that it is a result of continuous improvement. She added to please be sure that clear takeaways for all of the charts are included and also think about the human element and stories as these will help with key constituents.

Another member noted that it is important to focus on EAGLE as the full REDAC will not be aware of it. He noted that he is not confident about 2030 date and that it will take considerable effort to get there. He added that there is the need to let senior people know this is important and this aggressive date will require considerable funding.

A third member also added that the presentations were superb and he is looking forward to digging more in the future. He noted that the FAA is doing a great job of focusing on the priorities: domestic, international, CLEEN, ASCENT, new entrants. He was very pleased by the trust shown by DOT and the Congress with budget and stressed that AEE will need to manage that growth carefully and be sure to select projects. Additionally he remarked that, if at all possible, AEE accelerate the work to meet the goals faster and that to manage a larger portfolio more oversight is needed, which will require more staff. He concluded stating that overall the meeting was wonderful and thanking AEE for the briefings.

Another member echoed the remarks noting the quality of the presentations was superb. He stated he was not as optimistic on emissions and in particular had concerns about NOx emissions The DFO noted that a new project is starting in ASCENT on NOx emissions and metric systems.

A member offered his congratulations to the DFO and the FAA AEE team for this fantastic work. He noted that he sees it every day and he sees it in the leadership expressed by the US in ICAO, for which he offered his thanks to the FAA. The member concluded by stating that the portfolio is very strong and investments are being made in key areas.

Another member agreed with what had been said by others. He seconded the previous member's comments on FAA leadership at CAEP, noted it is outstanding, and he concluded saying the portfolio is great and to please keep executing.

One final member noted that the technology maturation is coming along and he saw many benefits, which is key.

The Chair concluded saying that the E&E portfolio has been successful and AEE have addressed previously raised concerns about new entrants. He also added that it was very good to see the human side of this as well with students entering the work force.

Meeting Close-Out | Lead *Ian Redhead*

Ian thanked everyone for their participation. The dates for the coming meetings were shared as was the deadline for findings and recommendations from the meeting (March 31, 2022).

Subcommittee Discussion of Open Recommendations (Discuss status of FAA response and decide to close or remain open)

All of the recommendations from previous meetings were closed.

Next Meetings – Date/Location/Agenda Items to be Included

September 13-14, 2022 (location/format TBD)

March 21-22, 2023 (location/format TBD)

Adjourned at 4:45 pm on Wednesday, September 15, 2021

Attendance

Day 1	Day 2
Adam Scholten	Adam Scholten
Andrew Murphy	Andrew Murphy
Anna Oldani	Anna Oldani
Ashlie Flegel	Ashlie Flegel
Babara Esker	Babara Esker
Bill He	Bill He
Charles Etter	Charles Etter
Chinita Roundtree-Coleman	Chinita Roundtree-Coleman
Chris Dorbian	Chris Dorbian
Christopher Hobbs	Chris Owen (EPA)
Dale Van Zante	Christopher Hobbs
Dan Williams	Dale Van Zante
Daniel Jacob	Daniel Jacob
Dimitri Mavris	Dimitri Mavris
Don Scata	Don Scata
Donald Wuebbles	Durre Cowan
Durre Cowan	Fabio Grandi
Fabio Grandi	Gregg Fleming
Gregg Fleming	Ian Redhead
Ian Redhead	Ira Dassa
Ira Dassa	Jason Coon
Jason Coon	Jayant Sabnis
Jayant Sabnis	Jeetendra Upadhyay
Jeetendra Upadhyay	Jennifer Klettlinger
Jennifer Klettlinger	Jim Hileman
Jim Hileman	Jon Schleifer
Jon Schleifer	Joseph DiPardo
Joseph DiPardo	Juan Alonso
Joseph Zelina	Julie Chang
Juan Alonso	Katherine Preston
Katherine Preston	Kevin Welsh
Kevin Welsh	Krystyna Bednarczyk
Kimberly Brooks	Levent Ileri
Krystyna Bednarczyk	Marc Ehudin
Laszlo Windhoffer	Melinda Pagliarello
Levent Ileri	Melvin Kosanchick
Melinda Pagliarello	Mohammed Majeed
Melvin Kosanchick	Muni Majjigi
Mohammed Majeed	Murphy Flynn
Muni Majjigi	Nate Brown
Nate Brown	Ralph Iovinelli
Ralph Iovinelli	Rick Riley
Sandy Lancster	Roxanna Moores
Sean Doyle	Rudy Dudebout

Shelley Yak Tim Pohle Warren Gillette	Sandy Lancster Sean Doyle Tim Pohle Veronica Bradley Warren Gillette