Subcommittee on Environment and Energy | MINUTES

Meeting date & time *September 14-15, 2021*
Meeting location *Virtual Meeting*

Purpose	Develop 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 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** *Kevin Welsh*

Kevin Welsh started by stating that the Office of Environment and Energy (AEE) are continuing to work in the remote setting. AEE have brought on new staff, including from outside of the DC area, and this has been easier because of the remote work environment. FAA continue to develop plans for re-entering the office and there is an expectation that AEE will continue with a hybrid work setting. As a part of this, we are thinking through how we will manage meetings such as the REDAC.

He continued by noting the White House Sustainable Aviation event that occurred last week. The event highlighted efforts across the United States (U.S.) Government. The event had several Secretaries, Agency Administrators, members of Congress, and corporate Chief Executive Officers (CEOs) speaking. The Designated Federal Official (DFO) will include more information in his briefing later in the day. Kevin highlighted the benefit of everyone working together and the importance of leadership to facilitate our work.

He noted that we are working hard to reduce noise, emissions, and address climate change in the time from now to 2030 as well as through to 2050. He also mentioned that there is considerable activity in Congress that could result in increased resources for the FAA to work on E&E issues. He stated that the REDAC has been very important to us in providing inputs to us, the Agency, and others in the government. We will need your inputs going forward.

The Chair asked about the interest and awareness of the full REDAC on these developments. The DFO and others from the FAA noted that these are important developments and that the full REDAC would almost certainly be interested as well. The FAA also noted that these developments have led to considerable interest from industry and across the U.S. Government and

that direction and clarity from the Subcommittee would be useful in keeping this program going in a productive direction. The DFO noted that we have good cross-REDAC collaboration, in that, we have strong interactions with the Airports REDAC subcommittee and there was a briefing provided by AEE to the NAS Operations (NASOPS) REDAC Subcommittee on the operational procedures work being done in the Environmental and Energy (E&E) Portfolio.

Presentation Industry Perspective | **Presenter** *Tim Pohle*

Tim started by noting how the industry is continuing with the COVID-19 pandemic. There has been more stability in the industry, but there are some issues related to fears with the Delta variant of COVID. The cargo industry continues to do well through the pandemic. The passenger airline recovery is still expected to come but there will be a long time to pay back the debts that they have accumulated during the pandemic. Even with this, the industry has been making investments in sustainability as evidenced by the myriad announcements by airlines on climate change. He noted that the commercial airlines have a goal to be carbon neutral by 2050 and to use 3 billion gallons of cost competitive Sustainable Aviation Fuels (SAF) by 2030. He emphasized the importance of the private sector working with the government to reach the SAF goal – without government support, it simply cannot happen. These are also not just domestic issues, but they are also international issues. This is playing out in ICAO in the form of the effort to develop a long term aspirational goal for international aviation CO2 emissions. He noted that it is amazing we are doing this in a virtual manner. He also noted that there are also important issues surrounding local air quality and noise and these also must be addressed going forward. He noted that climate is very important, but we can only be successful if we also address noise and local air quality. He said that the work of REDAC is very important to ensure appropriate prioritization takes place and to ensure that we put in place the research to ensure success down the road.

A member thanked Tim for his thoughts on SAF and then asked him for his thoughts on the role/ outlook of alternative fuels like hydrogen. Tim noted that the industry will not throw away anything that could help; however, electricity and hydrogen will not provide benefits until further down the way and SAF can make a difference now. We have been working on SAF for decades and we now have a fuel that is certified as being safe for use and can be ramped up. He said that SAF is the priority through to 2050 with the other fuels potentially playing a role in the longer term. The Chair noted that the subcommittee recommended that the FAA work to understand what helps the most in terms of working from a fuels perspective, and that SAF is the best near term option.

The Chair asked Tim about how international airlines are handling the pandemic. He noted that some regions are completely dependent on international travel (e.g., Singapore) and they will be hit harder than those that have a strong domestic market as well.

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

Shelley Yak thanked everyone for joining the meeting as the input is critical to our work as an agency. She provided inputs on how the FAA is handling the pandemic with a focus on the FAA Technical Center in Atlantic City. She discussed how the Tech Center is handling virtual meetings. She then asked the Subcommittee Members how they are handling the return to work. This led to a discussion on how individual organizations are handling the pandemic in their work places.

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

Beth Delarosby began by giving an update on the RE&D budget for FY21. The FY21 budget was enacted on December 27, 2020 and the FAA received $198M for RE&D funds. She provided a detailed comparison of the Operations, Facilities and Equipment (F&E), Grant-in-Aid, and RE&D accounts among the President's budget, subcommittee markups, and the final conference language. Beth continued by noting that FY22 budget was released on May 28, 2021 with a request of $258.5M for RE&D. She noted information from the House but are waiting on the Senate report. She then provided details on the funding levels from the FY22 President Budget and House markup. She also shared key language from the FY2022 House report that relates to the RE&D appropriation. She noted that the FY2023 budget was delivered to OST on June 25, 2021 and we intend to submit it to the Office of Management and Budget (OMB) in mid-September and to Congress by Feb 3, 2022. She also shared the overall RE&D targets for FY23-FY27 that were established in May 2021, but noted that she expects the targets to change. She concluded by noting that current FAA Authorization, which was signed by the President on October 5, 2018, extends the FAA's authorization through 2023.

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

Based on a question from a MembFRNer, Beth noted that the Senate can give different direction from the House in their budget report.

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

Jim walked through the existing findings and recommendations (F&Rs) from the spring 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, one member encouraged the FAA to work closely with other Agencies on potential longer-term solutions (such as hybridization or electrification of aircraft propulsion or hydrogen) for addressing environmental challenges. Several members also noted the importance of ensuring global leadership at ICAO.

The Chair asked about short term, mid-term, and long term impacts on the growth of the industry and what needs to be prioritized to meet those and if that information was being updated. The FAA noted that we have a five year research plan with the FAA National Aviation Research Plan (NARP) and the DOT Annual Modal Research Plan (AMRP). He noted that the landscape document and its process feeds into these processes and that is one way that the FAA takes into account inputs from the REDAC. This led to discussion of the White House Aviation Plan that was developed a decade ago. There was an agreement that this action item could be closed as there is clear coordination occurring among the agencies.

Action items	Person responsible	Deadline
Share ASCENT NFO with REDAC E&E Subcommittee (on an annual basis)	J. Hileman	Ongoing

Action items	Person responsible	Deadline
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

Presentation Update on ICAO and CORSIA Implementation | **Presenter** *Dan Williams*

Dan Williams presented an update on what has transpired since the last Subcommittee meeting with respect to ICAO and the implementation of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). He started by noting that the work of ICAO, including that of Council, continues to be done online in a virtual setting. He provided information on what is happening with the periodic CORSIA review and discussions that are occurring with respect to the ICAO Council. He continued by giving a recap of what took place during the 2021 Committee on Aviation Environmental Protection (CAEP) Steering Group meeting. He also provided a look ahead on other events, including the CORSIA Forum (Oct. 2021), the CAEP/12 meeting (Feb, 2022), a High-Level Meeting (Q1 2022), and the 41st General Assembly (Sep./ Oct. 2022). He concluded with highlights from the United States Emissions Reports from 2019 and 2020.

Presentation E&E Research Update | **Presenter** *Jim Hileman, Muni Majjigi, and Nate Brown*

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 noted that information on ASCENT has been captured in a separate briefing that has been distributed to the Subcommittee members. 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 includes 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. He provided a short discussion on the work of the E&E Portfolio on helicopters, drones, advanced air mobility (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.

Additionally, he provided an overview of the climate change efforts of the FAA. This portion of the briefing started with the commitments made by the Biden Administration and continued with a summary of the September 9, 2021 White House Sustainable Aviation event. Next, he provided a summary of the direction of the E&E portfolio with respect to climate change as well as data

about aviation CO2 emissions. He then spent time discussing analysis that is being conducted to evaluate how aviation could reduce its CO2 emissions.

There was considerable discussion with Subcommittee members about the analysis that has been done with Jim and others from the FAA providing clarifications on the work that that has been done. Based on a question, the DFO noted that the largest source of uncertainty is likely the forecast. He noted that the forecasters do great work, but it is simply not possible to predict what the level of traffic growth 30 years in the future as there are so many unknowns. Based on a question from another member, the DFO noted that FAA is doing much work to improve our modeling of general aviation operations as the fuel burn presented in the 2050 chart differs from other published information. Based on a different question, the DFO noted that the advanced technology wedge assumes a seven year time lag between flight testing a technology and its appearing in the fleet. He further noted that this provides considerable impetus to invest in technology now such that it can be matured in the early 2030s.

Muni Majjigi continued the briefing by providing the Subcommittee with a summary of the Sustainable Flight National Partnership wherein NASA, FAA, and industry will work together to accelerate the development of technologies that could achieve a 30% reduction in fuel burn relative to best in class aircraft today.

Based on a question from a member, Muni clarified that GHG in his charts refers to CO2 and is therefore directly proportional to fuel burn.

A member noted the importance of updating the single aisle aircraft and the fact the 737 was first certified in the 1960s. He noted that gains could be had by simply starting from a clean sheet.

Another member noted that technologies that work on a narrow body may not translate to a wide body and vice versa for a variety of reasons including vehicle size, manufacturing rate, and cost, among others.

Nate Brown then provided highlights of the SAF Grand Challenge, wherein the U.S. Department of Energy (DOE), Department of Transportation (DOT) and Department of Agriculture (USDA) are working together to reduce the cost, enhance the sustainability, and expand the production and use of SAF to meet 100% of aviation fuel demand by 2050.

Jim then continued the briefing with a discussion on the budget profile of the E&E Portfolio. This included a discussion on the new Aviation Climate Research budget line item that was added to the FY2022 President's budget. He provided recent trends in the funding for the E&E Portfolio alongside how the funding has been used between FY2018 and FY2021. He then shared the overarching direction for FY2022 as there is the potential for a considerable increase in funding for this portfolio.

A member noted that while he agrees with the FAA that there is limited direct use of hydrogen in aviation, there is still much discussion about hydrogen occurring within the government and outside of it. The DFO noted that he would be happy to speak to anyone who is interested in knowing more about hydrogen use in aircraft.

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

Barbara Esker gave an update on NASA Aeronautics efforts. She started by noting the four key areas of work in NASA Aeronautics on subsonic aircraft, improved airspace, high speed air

vehicles, and vertical lift technologies. She gave an overview of the Low Boom Flight Demonstrator mission and the three key phases of aircraft development, acoustic validation and community response testing. She noted that this work is being in close collaboration with FAA AEE and is being done to inform standards development in ICAO CAEP. She continued with an overview of the work on AAM. She discussed research areas in the revolutionary vertical high lift project on safety, icing, and noise. She highlighted how these efforts overlap with FAA offices including Aircraft Certification (AIR) and AEE as well as standard setting. She finished with information on research efforts on subsonic transport technologies. These slides overlapped with ones presented earlier by Muni, and she noted this is on purpose as there is a common vision and effort between NASA and FAA. She gave additional details on the hybrid thermally-efficient core (HyTEC), Hi-Rate Composite Aircraft Manufacturing (HiCAM), Electrified Powertrain Flight Demonstration (EPFD), and the sustainable flight demonstrator projects.

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

Levent Ileri provided 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 concluded his portion of the CLEEN Program with an update on Phase III of the Program, which is has been awarded, and where people can find the press release online and the fact there is a comprehensive report on CLEEN now available on the web. Chris Dorbian continued the briefing by describing each of the technologies that will be matured under the six completed agreements in the third phase of CLEEN. He also noted that there are two more agreements pending. Chris concluded with a summary of the innovation portfolio being conducted in ASCENT. Levent noted that the team should be able to provide timelines for each of the technologies at the next REDAC meeting.

A member asked about the goal associated with one of the technologies as it is stated against an OPR of 30, but the engine is unlikely to operate at that OPR. He requested that AEE think carefully about the margin at the design point for the engine. The member also noted that the program does not have items that are aggressive in their goals. The DFO thanked the member and agreed we can think more carefully about how the technologies compare against the CLEEN program goals so individuals see everything on a common manner. The DFO also noted that each phase of CLEEN has had a high risk, high reward aspect and this is also the case for the current CLEEN Phase 3 as there is a project to support the development of a high speed open rotor concept from GE.

The Chair asked that Levent think carefully about how to communicate the cost share that the industry is putting forward in this program. The Chair also complemented AEE on their work with CLEEN Phase 3 and accelerating the work.

Discussion | Lead *Ian Redhead*

The Chair and multiple Members were complimentary of the work being done by the Portfolio. They were also impressed with the fact that the virtual work environment has not slowed down this program.

Based on a question from the chair, the DFO reviewed the FY21 allocation of funding to individual activities from his overview briefing and how the potential increase in funding would be used in FY22. Based on this review, the Chair noted that he does not think that the program is missing anything. A member agreed but noted that the E&E program may need to accelerate activities. The DFO responded by noting the items that the FAA is thinking of pursuing with the FY22 budget and then stated these are the items that he thinks should be accelerated.

The Chair asked if there is anything that should be done considering that increased funding levels may not continue. The DFO explained that the FAA will likely fully fund some multi-year activities, such as those involving the assessment of environmental impacts of aviation, but that he is not sure about all programs as it will depend on both the regular budget process as well as reconciliation. The Chair and a Member both concurred with the approach. The member noted that many grants may benefit from being funded in the manner suggested for impacts research.

The Chair asked about research needs surrounding noise and the DFO noted that the Committee should come back to this question after the noise deck is presented tomorrow.

A Member noted that the overarching list of additional topics for FY22 is good. He followed up by asking about the nature of the work that would be done on new vehicle types. The DFO noted that there is much more than could be done to complement efforts being done by NASA on rotorcraft to address noise issues (e.g., analytical tool development to support environmental evaluations, measurements and analysis to support noise certification, and identifying means to reduce noise). The DFO also noted that there is much work that should be done to understand the impacts of emissions from commercial space vehicles on the ozone layer and climate change. The member agreed that these are areas that need additional research.

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

END OF DAY 1

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

Don Scata presented on the work being done by the FAA on new entrants and noise certification. He covered work that is ongoing with AAM, civil supersonics, and noise certification streamlining. This included work to measure noise from drones and AAM vehicles. He also covered efforts to better model and reduce noise from helicopters. This includes the Fly Neighborly Program wherein the FAA and the Volpe Center are working together to reduce noise from helicopters flying over communities through development of Noise Abatement Procedures (NAPs) for voluntary use by pilots.

Based on a question from a member, Don noted that the ASCENT researchers are doing work on a drone that has the ability to change its configuration easily. This helps to overcome challenges that we have with a lack of different types of vehicles.

Don continued on with a discussion on the work we are doing with respect to supersonic aircraft and noise, both that due to operations near the airport and en-route due to sonic booms. He covered the work being done on several ASCENT Projects, including Projects 57, 59, and 61. The DFO noted that the work of Project 61 by Georgia Tech will be very useful in educating students about noise certification and that will provide broad benefits to the industry. A member also noted that this project is useful in getting industry to share how they do noise certification to make everyone smarter about what could be done to streamline the processes involved.

Sean Doyle continued the briefing by covering the work the FAA are doing on aircraft noise impacts research. He started with an overview of the work the Boston University School of Public Health is doing under ASCENT Project 3 to quantify the impacts of noise on cardiovascular health. He continued with the work of MIT to examine the impacts of aircraft noise on businesses. These were both requested by Section 189 of the 2018 reauthorization.

Sean also provided details on the study being done by the University of Pennsylvania School of Medicine under ASCENT Project 17 with support from the FAA Technical Center to quantify the impacts of aircraft noise on sleep. This will be a national field study sampling around 77 U.S. Airports with a two-year data collection effort. He also provided information on how the FAA and the researchers have developed contingency plans due to the reduced air traffic due to the pandemic. During the briefing he answered several clarifying questions from Members. Sean concluded by noting that we received OMB approval for the study very recently and the study team began issuing the first recruitment letters via mail in early September 2021. Sean stated that we hope to complete the study by September 2024.

There was a discussion on potential research areas on noise impacts and the FAA agreed that it would provide a summary of the information the FAA received in the comments to the Federal Register Notice (FRN) and how we will use this to develop noise impacts projects.

Action items	Person responsible	Deadline
Provide a summary of the comments received on the FAA Noise Research FRN and any potential new research direction/projects on noise that came from these comments	D. Scata and S. Doyle	March 2022

A member asked about non-acoustic factors and the FAA explained that there is much interest in this as a research topic, but it is unclear how this could be used to set policy.

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 discussed how AEE is supporting the FAA vision on sharing resources. 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.

Mohammed Majeed continued the briefing by giving information on AEDT3d, which was released on March 29, 2021. The new version of AEDT includes a number of AEDT maintenance and usability improvements. This includes support for importing aircraft noise spectral data, statistical compression for time-above metrics, multi-pollutant modeling for emissions inventory and dispersion modeling, re-implementation of speciated organic gas emissions (a.k.a., hazardous air pollutants) generation, and an non-volatile Particular Matter (nvPM) computing method update. The new release also contains an updated aircraft fleet database, including recently measured nvPM data.

Joe DiPardo continued the discussion on AEDT by discussing how the AEDT development process is taking external feedback from the AEDT User Review Group. The URG was stood up two years ago and has been meeting annually since. This is ensuring that end users are able to provide direct feedback on the tool before new versions go live. This has enabled us to fix bugs before the tool is released. The URG is also providing the AEDT development team with additional usability improvements and other useful feedback. Joe also discussed how the team has used an external audit to improve the quality, productivity, and predictability of AEDT and the development team.

The Chair complimented the team for their work to get inputs from real-world users as that had been a long-standing request from the Subcommittee.

Mohammed continued with the development plans for AEDT3e, which will incorporate improved modeling for aircraft performance, emissions and dispersion, and noise. The new version, which is planned for public release in Spring 2022 will also include improvements to improve our ability to model aircraft lead emissions and their dispersion.

Joe concluded by covering the plan for the AEDT 4 series, which will be released in 2023, and how FAA are using a broad range of research projects to advance the tool. Joe noted that some AEDT3e features may be pushed to AEDT4 as we will be spending some developer resources on training that was recommended during the audit. He will provide an update on this at the next meeting.

Based on a question from the Chair, Mohammed noted that we have had good interactions with the EPA on how to handle emissions modeling. The Chair complimented the FAA and EPA for working together on this effort.

Sean Doyle walked through the efforts to develop a new noise screening tool. This started with an overview of noise screening and then he continued by highlighting the new capabilities and data that are available to the FAA for this purpose. He also shared the proposed process for noise screening that would rely on the FAA's existing noise inventories for the baseline. Sean noted that we are targeting a FY2023 release but the timing is dependent on working through a number of data security issues.

Based on a question from a Member, Sean noted there is no longer a need to develop a light-weight version of AEDT, but instead we are focusing on figuring out how we can leverage cloud computing better and to utilize or data to answer questions in a more expedited manner.

Fabio continued the briefing with an update on the development of the 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. This will support everyone across the FAA, including FAA Environmental Specialists, can create their information in a common visualization format to communicate environmental impacts. He concluded the briefing with short summaries of several ASCENT projects that are supporting the tool development efforts.

He provided details on ASCENT project 9, which will develop a novel geospatially driven noise estimation module to support computation of noise resulting from the operation of Unmanned Aircraft Systems (UAS) and other upcoming vehicle concepts. He also covered several other projects that will support the development and improvement of AEDT.

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

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

Anna continued by providing an overview of the ASTM International fuel qualification process and the work the FAA is doing to support it, including the ASCENT Clearinghouse. She continued by reporting on the current status of different fuels within the ASTM fuel qualification process and the amounts of fuel and time that have been required to get fuel approvals. She noted that the EU has provided nearly six million euros of in-kind support to the ASTM Clearinghouse that was established by the FAA to ensure that the new efforts are supportive and not duplicative. She provided details on the status of new fuel approvals through the ASTM D4054 process.

Based on a question from a member, Anna noted that we are still in discussions with the UK on their effort to support the ASTM fuel approval process.

Anna provided information on where different fuel producers are in the ASTM approval process and she noted that we are seeing much more interest in fuels that could enable the use of 100% SAF. Anna showed how the efforts of the FAA to streamline the ASTM process have led to reduced fuel volumes and time being required to get fuel approved. She concluded the testing portion of the briefing by discussing efforts that are being planned in ASCENT to help develop fuels that could be blended above 50% in today's fleet of aircraft.

Based on a question from a member, there was a discussion on the importance of ensuring that future SAF fuels, such as those going beyond 50%. The Subcommittee agreed the SAF should continue to be drop-in compatible with the current fleet and the FAA should focus on ensuring future fuels are compatible with today's fleet.

Anna continued with a discussion on hydrogen and the work that is being done by MIT and Washington State (WSU) to examine potential uses of hydrogen in aviation, including as a liquid hydrocarbon fuel.

Nate Brown continued the briefing by discussing the analysis portion of the SAF R&D portfolio. This included an update on the efforts of the ASCENT Project 1 team, including tool development and publications that are planned. He specifically noted that the Volpe Fuels Transportation and Optimization Tool (FTOT) is available on github with software updates being provided on a regular basis. He provided information on how WSU has used their techno-economic tools to examine policies, including some currently being considered by Congress. He also noted that the ASCENT project 1 team are publishing their work in a dedicated issue of Frontiers in Energy Research.

Anna continued the briefing with details on the work being done to support decision making within ICAO CAEP to support efforts related to CORSIA and the long-term aspirational goal development which includes efforts to develop life cycle emissions data, sustainability criteria, and future fuel production volumes.

Based on a question from the chair, Anna noted that Europe is more focused on power-to-liquid fuels, as opposed to hydrogen, and this reflects the fact that advanced northern European countries lack biomass resources and therefore are looking for other means to produce SAF.

Nate updated the Subcommittee on the multi-agency initiative to implement the Federal Bioeconomy Initiative, known as the Biomass R&D Board. Nate continued with details on the SAF Grand Challenge. He captured the efforts of the DOE, USDA, and DOT under the SAF Grand Challenge and he verbally noted that DOE, USDA, and DOT will also work with EPA to facilitate fuel approvals for the RFS. He concluded this portion of the briefing with information on the SAF Grand Challenge roadmapping process.

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

Nate continued with information on the CAAFI Mini-Symposium that was held in June 2021. He also noted that CAAFI are planning a face-to-face meeting in June 2022. He finished his briefing with information on U.S. SAF use and noted that in 2020, 4.6M gallons of SAF were procured in the U.S., which is a 190% increase over 2019, and that 2021 is on pace to exceed 2020 levels. He provided updates on construction of SAF facilities in the U.S. and global announcements of new facilities.

A member asked about the statement that hydrogen is key to unlocking the potential of SAF. The DFO agreed with the member that this is not true for HEFA, but it is in fact true for lignocellulose as these feedstocks are low in hydrogen and will need considerable hydrogen to be upgraded to SAF. The FAA acknowledged that this wording could easily be misunderstood and that the FAA should more carefully consider this wording in future briefings.

The member also asked for information on the life cycle modeling assumed within the SAF Grand Challenge Memorandum of Understanding (MOU) and this led to additional discussion on modeling life cycle emissions.

Afterward, one member thanked the FAA for the very informative briefing while another commended the FAA for the tremendous work.

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

Ralph Iovinelli started the briefing providing an overview of the work being done with respect to emissions research.

Daniel Jacob started his portion of the briefing on work to improve our ability to measure 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 continued with efforts to improve our ability to calibrate equipment to measure nvPM.

He then covered research related to air quality monitoring and modeling. He provided information on the efforts to develop a new aviation-specific dispersion model for demonstrating compliance to regulations. He also summarized the work being done by Boston University under ASCENT Project 18 to measure air quality in and around airports to understand the relative impacts of aviation emissions to other sources. He used preliminary data from the team to show that even though aviation traffic dropped by 50% post pandemic, the ambient particular matter measurements showed a small increase in emissions over the same time period.

Daniel continued with information on research being done related to supersonic aircraft. He started with work being done in ASCENT Project 10 and 47 to model supersonic aircraft technologies and inform the standard setting process. He continued by summarizing efforts in Project 74 at Georgia Tech to develop new combustor technologies for use in supersonic transport. These efforts should lead to knowledge and improve modeling capabilities that will reduce NOx and nvPM emissions from these future vehicles. He continued with the work of ASCENT Projects 22 and 58 to examine the environment impacts of emissions from supersonic civil aircraft.

Daniel also covered the work that will be done by Project 78 to develop a contrail decision support tool at MIT once funding gets to the university. He noted that we are looking at means to potentially expand this work going forward.

He concluded his briefing with information on the project that is helping us examine potential future CO2 emissions trajectories and another project idea to consider AAM and drone emissions from a life cycle perspective.

Based on a question from a member, Ralph noted that the FAA is on schedule with the CO2 Standard Notice of Proposed Rulemaking.

A member asked about the NOx emissions that were captured at air quality monitors, as captured in slide 16 of the presentation, and Ralph clarified that these data were taken at LAX and used to help understand airport contributions to ambient air quality. The member further asked for clarifications on the nature of the plume rise being modeled and how this affects air quality near the airport and further afield. Daniel said that generally speaking the plume rise leads to the emissions being moved further from the airport. The member also asked if there were other studies with similar information on NOx and Daniel noted that the team do have NOx data but are still processing that data. Daniel further clarified that we only have data for Boston Logan.

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.

He continued with the work being done in the Boston area through the FAA-Massport MOU through ASCENT Project 23. He focused on the work being done with the block 2 arrival and departure procedures. The next step is for MIT to present their recommendations to the public in the coming weeks and then they will be considered by the Massport Community Advisory Committee (MCAC). In parallel to this, the team are developing lessons learned and what could be done next.

Chris continued with an update on the work of ASCENT Project 44 to improve our noise modeling capabilities to enable improved procedure design. The current focus of this project is on the potential for delayed deceleration approaches and the use of noise monitor data to improve the concept. He provide an overview of the modeling validation methodology and the locations of the noise monitors at BOS and SEA being used by the team. He showed results from the research team that shows how delayed deceleration leads to a cleaner aircraft configuration with lower noise levels. He noted that the team are also going to use this technique to look for opportunities to reduce noise from the departure phase of flight and examine integration opportunities with ATM merging and spacing tools (speed management).

The Chair congratulated Chris and the MIT team for their great work.

Open Discussion | Lead *Ian Redhead*

The Chair noted that the Members of the Subcommittee think the program has the key areas of work covered and he asked everyone to focus on the F&Rs.

A member said that the FAA are doing a great job in thinking strategically and managing a large portfolio. The portfolio is balanced and covers the water front of what should be done. He agreed with the suggestions from the DFO, as presented in his slide on FY22, as these are good topics for accelerated work. In response to the Chair, the member noted that the

Another member liked the idea to seed longer term work, but she noted that there is a utility in ensuring that we do not box the FAA into a corner – important to ensure that there is flexibility in what exact work is done.

The Member further made an observation based on the White House event, it is obvious that the whole of government to work together. She thinks it would be worthwhile to show how the work of the FAA fits into efforts being done by other agencies. The Chair noted that these are good points and they could be put into the preamble of the F&Rs. The DFO noted that he would fit the idea into his briefings going forward.

The Member further thanked the FAA for the exceptional work and briefings that were provided. She has seen a tremendous improvement in the last four years of briefings. The Chair agreed and appreciated seeing the successes of the work that has been presented. The DFO noted the work of MIT on operational procedures that Chris is overseeing was started in part due to the ask of this Subcommittee to do more work on operational procedures to reduce noise.

A member applauded the work being done and thanked the FAA for continuing work on supersonic civil transport as it is important. He also appreciated the work on SAF and noise.

The Chair noted that he may change the order of the recommendations to have SAF as the first one to match the efforts of the U.S. government. The next would be the partnerships with academia, industry, and other agencies. Also need to have international leadership and noise.

A member said that she really enjoyed the presentations and she appreciates the incredible amount of work being done. She said she agrees with the Chair to keep prioritization as they are with exception of recognition of SAF as there seems to be a significant amount of work left to do to meet the goals of the SAF Grand Challenge. While that workload is not all on AEE, its role is significant in the process.

The chair recommended that the F&Rs include the areas that the DFO had identified in his briefing as being good candidates for additional funding:

- Expand efforts on aircraft technology maturation in CLEEN and ASCENT
- Develop SAF that could be used in jet engines without blending with conventional petroleum-based jet fuel
- Evaluate aviation fuel supply chains to reduce the cost to produce SAF and maximize environmental benefits
- Obtain the data and develop the analytical tools to support evaluation and certification of new vehicle types

The FAA noted to the Chair that the F&Rs are due on October 1 and that the order of recommendations does not affect how they are considered by the Agency. She also noted that the preamble of the F&Rs is not seen as a recommendation by the Agency, but rather as observations of the REDAC.

Two members noted that the bulk of the technical work in ICAO CAEP is done in by FAA AEE through this R&D program. Without this technical work, decisions would likely be political as they would be made without a technical basis. The Chair recommended that this be captured in the recommendations.

The Chair thanked the DFO, Kevin Welsh, and the AEE team as well as the others involved in briefing. The Chair that the Subcommittee really appreciates the work and he thinks AEE are doing a great job.

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 F&Rs from the meeting (September 30, 2020).

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

All of the recommendations from the Spring 2020 meeting were left open.

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

March 22-23, 2022 (location/format TBD)

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

Adjourned at 4:15 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