Subcommittee on Environment and Energy | MINUTES

Meeting date & time *September 13-14, 2022*
Meeting location *Virtual Meeting*

Purpose	Develop strategic guidance for the FY2025 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 attendees of the Subcommittee meeting.

Presentation FAA AEE Update (AEE Update) | **Presenter** *Kevin Welsh*

Kevin Welsh provided updates on the Office of Environment and Energy (AEE) activities. He started by covering how the staff of AEE have been working in a hybrid setting and then noting that there will be much going on in the fall.

Kevin provided insights on the work leading up to the September International Civil Aviation Organization (ICAO) Assembly and said that they are contemplating setting a net zero goal for 2050. He noted that a key part of this work was the technical support by the Long Term Aspirational Goal Task Group of ICAO, which had considerable leadership from the United States (U.S.) government through the FAA Environment and Energy (E&E) Research and Development (R&D) Program. He followed with an update on Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) within ICAO.

He continued with an update on the development of Air Tour Management Plans over the U.S. National Parks. Over the last few years much progress has been made and there have been 3 plans published thus far with another dozen on the way in the next year.

Kevin then discussed the new Eliminate Aviation Gasoline Lead Emissions (EAGLE) initiative to eliminate aviation gasoline emissions. This included the work AEE staff did with the University of North Dakota to eliminate lead emissions from their training operations. If the Subcommittee wants, a briefing on this subject can be scheduled in a future meeting.

Lastly, Kevin updated the group on the progress on developments in other areas of sustainable aviation fuels (SAF), SAF Grand Challenge (GC) Roadmap, increased appropriations, and the Inflation Reduction Act.

The Chair commented that there will also be much discussion on Unmanned Aircraft Systems (UAS) during the day with the request about the R&D Plan. Kevin agreed and noted that there is much work on this topic.

A Member remarked about the interest of communities in the work of EAGLE. Kevin agreed and noted that we need robust plans to ensure that we eliminate lead emissions in a way that ensures the continued safety of general aviation.

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

Steve Alterman provided an industry perspective on environmental matters. He noted that he can only speak on issues facing the cargo and airline industries, but the industry itself is much broader.

He started by highlighting the broad support for SAF and why the passage of the IRA is important. He continued by noting we are going to have a different type of airspace in the future with the introduction of UAS. He stated that noise is very important and needs to be addressed to enable continued operations without unreasonable restrictions as various communities are trying to impose restrictions on aircraft activity based on noise exposure. He finished by noting that the airlines are supportive of the efforts of the FAA at ICAO and of the EAGLE Initiative.

A Member representing airports continued by remarking on the issues facing the nation's airports. These include considerable development of communities near airport runways and the turnover of populations near airports that took place during the pandemic. Many airports are setting net zero goals and are working hard on water quality issues. Another Member representing an airport noted that they have significant growth demand, but they are facing challenges due to air quality degradation. They continue to face challenges with noise and are very concerned about what other airports in Europe are doing. She concluded by remarking that her airport has a net zero goal for the airport by 2030.

The Chair remarked on the challenges in getting people to fill vacancies and the delayed growth. He noted that further challenges that could come with the introduction of UAS due to their noise.

Members representing manufacturers also referred to the concern on PFAS for airports and the importance of SAF / EAGLE.

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

Shelley Yak thanked everyone for joining the meeting. She began by congratulating the E&E Subcommittee on being the first group to have an in-person meeting since the pandemic began. She also remarked that the full REDAC will be meeting face-to-face in October. She gave a brief update on the budget situation, but noted that Beth Delarosby will give more details in her briefing. She then walked through a briefing on the overall FAA R&D Portfolio. This followed the format of how the FAA presents the overall portfolio to the Office of the Secretary of Transportation and Congressional staffers. She presented the mapping of the different aspects of the Portfolio and how the FAA develops its R&D portfolio. This led to a presentation of a new strategic mapping and graphics that will be used in sharing the R&D portfolio to senior decision-makers. Members asked about the bubble chart with the timeline including the purpose of the bubbles.

As for the UAS Advanced Air Mobility (AAM) Integration Roadmap, she asked the Subcommittee consider four questions:

- Are there areas that are not in the plan?
- What is being handled by industry?
- Are there opportunities to leverage industry R&D?
- Are the timelines reasonable?

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.

She provided details on the budget profile of NASA. This includes the FY22 enacted budget as well as the FY23-27 budget profile. With this budget, NASA will have robust funding for the Sustainable Flight Demonstrator Program as well as the X-59 QUESST demonstrator.

In terms of supersonics, she provided an update on the QUESST 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 provided an update on the build of the aircraft with pictures from August as well as the work of the acoustic acquisition and survey team. She thanked the FAA AEE for their support on the survey work and acknowledged the strong collaboration with the FAA AEE. 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 information on vehicle propulsion reliability, fleet noise assessments, trade offs between noise and performance, and additional safety needs. She noted the priorities of NASA are on safety and noise and that there is the close collaboration with the FAA AEE on noise efforts. She provided details on a workshop on AAM designers to share details on their safety work. She also summarized the interactions of NASA with the FAA, ICAO and standards organizations about AAM efforts.

In terms of ultra-efficient transport, Barbara 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 provided details on each of these areas, including timelines.

Barbara provided information on NASA's efforts to develop a vision for the work beyond the Sustainable Flight Demonstrators.

She concluded covering work on other important items including the strong collaborations with FAA, DOE, and DOD.

A Member asked for a clarification on the FY22 budget. The DFO noted the Chips Act contains NASA authorization, as it contains direction for NASA on environmental efforts.

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, Facilities and Equipment (F&E), Grant-in-Aid, and RE&D accounts between the enacted budget and the final conference language. She provided the language and funding levels from the FY23 House and Senate reports. 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. She also highlighted Section 40007 of the IRA, which has
$300M to be spent over five years.

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

Jim Hileman walked through the existing findings and recommendations (F&Rs) from the Spring 2022 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.

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

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

Dan Williams started by providing an update on efforts in ICAO. This included the high level meeting on the development of a long term aspirational goal for international aviation CO_2 emissions as well as the ICAO Council Meetings that are taking place leading up to the 41st ICAO Assembly. He also noted that the Committee on Aviation Environmental Protection (CAEP) Working Groups have returned to having meetings face-to-face and that the coming CAEP/13 Steering Group 1 meeting with be taking place in Brazil. He also provided a look-ahead to the 41st ICAO General Assembly.

A Member noted that it was concerning that information is not being shared within ICAO due to Russia Sanctions. The FAA agreed.

Dan continued with an update on the FAA's implementation of CORSIA. He remarked that FAA still does not have the legislative authority to fully implement CORSIA and we are examining possible solutions. He noted that we are seeing signs of recovery for international travel in 2021 and that FAA are looking forward to updating our voluntary program should Assembly adjust

CORSIA. He concluded his presentation with a summary of the CORSIA United States Emissions Reports for 2019, 2020, and 2021.

A Member asked for clarification on the new baseline being proposed for CORSIA. The FAA explained the proposal as well as the rationale for it. The Member also asked about the authority the FAA has to execute CORSIA. Dan noted that we have data and the ability to get data to run the program, but there are questions around the FAA's authority to oversee a program for airlines to offset their emissions.

Based on a question from another Member, there was additional discussion on the views of different countries about a long term aspirational goal for international aviation CO_2 emissions.

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

Jim Hileman started his briefing with background information on the Office of Environment and Energy (AEE) and the overarching Environment and Energy (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.

He continued by providing key collaborations and outreach efforts that have taken place over the last year. He started with the White House Sustainable Aviation event of September 2021. He continued with an overview of the U.S. Aviation Climate Action Plan, which was briefed in detail at the March 2022 Subcommittee meeting. He reminded the Subcommittee of the Sustainable Flight National Partnership, the SAF GC, and EAGLE Initiative, all of which involve multiple agencies and industry partners. He concluded this portion of his briefing with examples of outreach that have been above and beyond the normal efforts of AEE.

Jim then described the overarching growth that is occurring within the E&E Portfolio. He described how the annual appropriations to the portfolio have doubled, which has enabled a doubling of the CLEEN and ASCENT Programs. He noted that the increased funding to CLEEN will enable the FAA to expand the third phase of CLEEN while also accelerating the start of the fourth phase. It has also ensured that ASCENT can continue to pursue technology projects while expanding the existing SAF portfolio of work and continuing the myriad other projects in the Center of Excellence (COE). Jim provided information on the recently passed Inflation Reduction Act, but noted that since it was only enacted a month ago there is still much to be decided on the use of funds within the Section 40007 Program. He concluded this portion of the briefing by describing how AEE will be increasing its staffing in the next year to match the expansion of the Portfolio.

A member asked for clarification on the status of grants and Jim noted that there are still delays in executing ASCENT grants. For the first memo that was awarded in FY2022, Tech Center legal concurrence occurred in February for some grants, but the package was not awarded until May. The 3 month delay coincided with the FAA and U.S. Department of Transportation, Office of the Secretary (OST) review processes. However, nothing about the grants changed during this time. Jim noted that the current process still adds months of delays to awarding projects. He also noted that there are discussions with OST and the FAA about improving the process further.

The next section of the briefing provided direction in the areas of noise, emissions, energy and international.

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 Federal Register Notice (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 next summarized efforts related to aviation emissions, including increasing focus on lead emissions, which are produced by aviation gasoline. He provided the overall plan for advancing knowledge on contrails and aviation induced cloudiness. He noted that considerable detail would be provided on the new effort to eliminate aviation gasoline lead emissions in the emissions briefing tomorrow.

Several Members discussed the need for work on contrails and aviation induced cloudiness. Jim noted that we have had work in this area for many years, but it was significantly slow for several years. The work picked up again in this portfolio with the work of ASCENT Project 78, and now there is considerable interest from other agencies in helping in this area.

Jim also provided insight into the work being taken on aircraft energy and how there has been substantial work to consider a wide range of energy sources for aircraft.

Several Members complimented the presentation on aircraft energy, and this led to discussion on the rationale for the use of cryogenic hydrogen as a fuel in commercial aircraft. There was also discussion on the importance of SAF for aviation decarbonization.

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 Long Term Aspirational Goal (LTAG) and future standard setting efforts.

A Member asked Jim about the leadership role the FAA played in the work of the LTAG. Jim noted that every group within the LTAG, and all of the subgroups as well, had leadership from FAA AEE, NASA, or individuals who are conducting research under the E&E Portfolio. Jim also commented that the work of the LTAG was possible because of investments made over many years in work such as ASCENT Project 1, 10, 52, and 64. Those projects laid the ground work for the LTAG. The Member told the Chair that this was exemplary work that could be elevated in the F&Rs.

Jim continued the briefing with an update on the ASCENT COE. This included information on number of students that have been supported by PARTNER and ASCENT (674 and counting) as well as the soon to be awarded grants (over $35M). He noted that the grant approval process is still resulting in delays in executing projects. At present, there are 59 projects worth $32.9M awaiting approval through the grant approval process. He then provided details on new projects.

Jim concluded the briefing with an update on the accomplishments of the E&E Portfolio, and key questions that could be considered by the Subcommittee as they make their F&Rs:

- Are there R&D areas within the E&E Portfolio that should be lower / higher priority?
- Are there R&D areas that AEE is not examining that should be added to the E&E Portfolio?

- What do you see coming on the horizon regarding E&E that may require future R&D efforts?

Based on a question from the Chair, Jim also provided a budget breakout of funding by research area. This was in the backup slides. Jim noted this was the same information as was provided at the March 2022 meeting.

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

Don Scata gave an overview of noise research. He started with the RFN, issued in January 2021, which outlines FAA's noise research program. This comprises efforts to understand the effects of aircraft noise on individuals and communities, including research on the heath and economic impacts from aviation noise. It also includes efforts relating to noise modeling, noise metrics and environmental data visualization. Finally, the overarching efforts also covers reduction, abatement and mitigation of aviation noise.

Don provided extensive details on multiple projects that are assessing the health and economic impacts of aircraft noise. This includes work at Boston University to understand cardiovascular health impacts, work at MIT to understand economic impacts, and at University of Pennsylvania to understand the impacts of noise sleep. He also presented a new effort at University of Pennsylvania to examine the use of broadband sounds to mitigate sleep disruption due to aircraft noise. He concluded this portion of his presentation with a reminder of work being done to quantify the impact of trees as cost-effective means of noise and pollution mitigation.

Muni Majjigi continued the briefing with an update on the work with NASA on noise from AAM and subsonic aircraft, including multiple workshops and interagency agreements. He also provided an update on efforts at ICAO CAEP on items related to noise and covered the noise-CO_2 dual stringency and the development of noise standards for supersonic aircraft. He concluded with information on technology projects being done by ASCENT.

Presentation UAS/AAM Research in AEE | **Presenter** *Don Scata and Bill He*

Don presented a summary of the ongoing AEE research efforts related to the noise from unmanned aerial systems and AAM. He noted a number of questions related to these air vehicles:

- Which vehicles should require noise certification?
- What procedures should be used? (i.e. operating profiles, altitude and speed, microphone types and placement, etc.)
- What noise metrics and limits are appropriate?
- How should FAA approach the noise analysis for Environmental Review?
- What data are to be collected and what modeling tool(s) need to be updated/developed to support modeling for environmental review?

He presented additional information on field measurements and data collection efforts of UAS noise that are underway in Oklahoma, North Carolina, and Massachusetts. These measurements are supporting the development of databases, improve our understanding, and to support modeling.

Bill He presented an overview of the Fly Neighborly Program, which is reducing noise from helicopters flying over communities through development of Noise Abatement Procedures (NAPs) and their voluntary use by pilots. He continued with information on ASCENT Project 38 which is developing rotorcraft noise abatement procedures. He noted how these efforts are helping with UAS/AAM. He then transitioned and provided updates for ASCENT Project 49, which is developing AAM noise models to aid in the development of noise reduction opportunities, and ASCENT Project 77, which is conducting noise measurements of UAS/AAM vehicles.

Don wrapped up the deck with information on various ongoing collaborations.

A Member asked about any connections between the community noise survey and the ongoing work of UAS to understand community annoyance. Don noted that we don't have direct connections of the survey with UAS noise, but we are working to better understand the relative annoyance of UAS/AAM relative to traditional air vehicles.

Based on a question from a member, NASA and the FAA clarified that NASA is leading efforts on auralizing the noise of air vehicles. This is one aspect of strong collaboration between the two groups.

The Chair asked if any work is being done to consider how UAS/AAM noise could differ in the day versus at night. Don noted that the sleep study will be helpful in letting us know of differences in how aircraft noise levels affect sleep. However, FAA might need to do more as there are important differences in the noise content of UAS/AAM versus traditional aircraft noise. He then provided the extensive lists of collaborations and partnerships working with FAA on UAS/AAM.

Presentation UAS/AAM Integration Research Framework and Planning| **Presenter** *Sabrina Saunders-Hodge*

Sabrina introduced herself to the group as the Director of the UAS Research at FAA. She provided background on the FAA UAS/AAM research plan and the request to the REDAC Subcommittees. She then provided background on the UAS integration plan and how it feeds into the FAA's UAS/AAM operational capabilities. Sabrina reminded that the document is for official use only and should only be discussed internally. The review needs to be completed by October 5 and be reported to the full REDAC meeting.

Multiple members remarked that the report contains much information. The Chair noted that there was a lack of discussion on noise complaints and how they would be considered. He also asked about the operating lanes for the UAS within the airspace.

Don noted that the noise complaint issue is interesting. Airports and FAA both get complaints today. As the airport will be neither the origin nor the destination for UAS, then there is little reason for the airport to get the complaint. However, noise complaints often go to the airport and this will need to be dealt with.

A Member asked about the emissions aspects of UAS/AAM. The DFO noted that UAS emissions are unlikely to have a material impact on climate and are not included in the aviation climate action plan. He also indicated that the FAA has plans to examine the life cycle emissions aspects of AAM.

The Chair observed that the plan needs to consider the unique aspects of individual airports as they are all unique. This includes techniques to bring down rogue drones, should it be needed, but also includes other aspects of airport.

The Chair also noted it was great to see the international collaborations on this front. Sabrina thanked him for this and said the collaborations would most certainly continue.

A Member asked if the African nations who have implemented UAS are a part of the efforts covered in the Plan. Sabrina confirmed that the FAA have learned much from Rawanda in their implementation of UAS and the FAA are very heavily engaged with them.

Discussion | Lead *Ian Redhead*

The Chair asked Members for their inputs on the UAS report by the end of the month such that he can share it with the full REDAC on October 5. Based on inputs from Members that the document is long, the DFO said input could include suggestions for how the document could be made more accessible.

A Member remarked that it will be difficult to know where UAS are flying. The FAA replied that we are standing up research to be able to model noise from a stochastic prospective. This is going to be done under the new ASCENT Project 94.

The Chair asked the Subcommittee consider the three questions that Jim had raised in Slide 62, copied below.

- Are there R&D areas within the E&E Portfolio that should be lower / higher priority?
- Are there R&D areas that AEE is not examining that should be added to the E&E Portfolio?
- What do you see coming on the horizon regarding E&E that may require future R&D efforts?

The Chair observed that Jim presented several new areas of research, including work on aviation induced cloudiness and energy. He said that staffing is still of concern. He noted the importance of the existing international work in ICAO CAEP as well as the importance of getting international SAF production, following the international standards being developed by the FAA via ASTM Intl and CORSIA. The Chair also remarked on the close collaboration of NASA and FAA, and the close collaborations of other government agencies.

The Chair welcomed inputs from others via email as well as during the meeting. He noted that he has a little over a week to get the report together.

A Member asked about work on emissions that affect air quality. The DFO responded that FAA have much effort ongoing on that subject.

The Chair asked about the process for approving grants. The DFO provided an update on how the grant approval process is currently working. He further noted that a project to measure the combustion emissions from the use of SAF had to be cancelled as the funds could not be sent in time. An observer commented that the grant approval process is delaying the Secretary's priorities on sustainability.

The Chair closed out day 1 at 4:55 pm.

END OF DAY 1

The Chair started Day 2 with a quick overview of the agenda.

Presentation Emissions Research | **Presenter** *Ralph Iovinelli*

Ralph Iovinelli started the briefing with a summary of the work being done on emissions. He provided information on new projects to examine the environmental impacts of commercial space emissions. Based on a question from the Chair and a Member, Ralph and the DFO clarified that the work would consider the range of fuels being considered for use in commercial space and would work on all of the layers of the atmosphere through to outer space. Ralph further clarified that the project has just started and we have not had engagement with the commercial space industry as yet.

Ralph then provided an update on the work being done on emissions measurements. He reported that the work on emissions measurements was delayed due to the pandemic. He gave details on a new ASCENT project 81 that will provide greater information on nvPM emissions. Based on a question from the Chair, Ralph clarified that part of the work of Project 81 will be to understand how small details can change the nvPM emissions. This includes things such as how small amounts of contaminants could affect nvPM emissions.

Ralph continued with information on the new ASCENT Project 83 to look at cruise emissions of NOx and Project 87 to measure how fuel composition impacts nvPM size and number. The Subcommittee talked about how the delay in the grant memo process has led to a significant delay in Project 87 as there was an emissions measurement opportunity in September 2022 that was lost.

Based on a question from the Chair about historically black colleges and universities, the DFO noted that ASCENT includes two minority serving institutions as well as the ability to make subawards to any school. However, FAA is not in a position to expand the universities within ASCENT.

Ralph continued his briefing with additional information on work being done to measure emissions. This includes work of Project 69 that should ultimately reduce the costs of calibrating nvPM measurement equipment.

He then transitioned to work that is taking place to improve modeling of emissions exposure in communities. This is work being done through ASCENT Projects 18 and 19 and the project teams are directly engaging with EPA to improve the algorithms that predict the behavior of aircraft engine plumes and how they rise, a key aspect of modeling community exposure to aircraft emissions. He noted that there has been great cooperation between FAA and EPA on this that will result in an improved AERMOD model.

The Chair observed that this is a problem that was identified by the Subcommittee in the past and that it is very good to see it being addressed. Based on question from a Member, Ralph noted that EPA have been very helpful in improving AERMOD. The DFO further clarified that FAA AEE have a very good working relationship with EPA on multiple fronts: community emissions,

SAF, and the work of CAEP. Another Member asked if there was a means to share that EPA leadership has been working effectively with the FAA. The Chair indicated he would capture this in his report.

Ralph continued his briefing by providing an update on the emissions monitoring efforts in the Boston metro area. He showed preliminary nvPM number results from two monitors to give a sense of the direction of the work. He also showed how the measurement and modeling projects are complimentary.

He finished his deck with details on the work AEE are doing on contrails and aviation induced cloudiness. This includes ASCENT Project 78 which is set to develop an open-source contrail support tool, and how this is the start of a growing area of work.

He concluded by noting the portfolio on emissions is comprehensive and has been responsive to the direction of the Subcommittee. He also remarked that anyone who wants to know more is invited to join the AEC Roadmap, which occurs every May.

A Member asked about the timeline for the AERMOD work. Ralph reported that the beta version of the tool should be available in the Spring of 2023. He mentioned he would have much more information at our next Subcommittee meeting. He further noted that there would need to be rulemaking for the new version of AERMOD and that timeline is longer. The beta version would be available for use during the rulemaking process.

Another Member stated that altitude studies should consider both business aviation and commercial aviation as they travel at different higher altitudes. A Member commented that there are high level discussions taking place between NASA and Gulfstream along these lines.

Based on the previous discussion, the DFO noted that at present there is a gap in the U.S. government's ability to measure emissions at altitude as the NASA DC-8 is not currently available. This lack of an aircraft that is fitted with emissions measurement equipment is a critical gap in our ability to do needed research. Until it is addressed, the U.S. will need to rely on researchers from the German DLR to do emissions measurements.

Based on discussion on unleaded aviation gasoline within the Subcommittee, the DFO said that we would have a dedicated briefing on leaded aviation gasoline and the efforts in EAGLE at the Spring Subcommittee meeting.

Action items	Person responsible	Deadline
Provide a briefing on efforts related to aviation gasoline and EAGLE during Spring REDAC Meeting	J. Hileman	March 2023

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

Anna Oldani started the briefing covering the opportunities presented by SAF and provided an anecdote on the importance of using a drop-in fuel as a Navy helicopter was recently fueled with seawater from a ballast tank as the liquid passed the visual inspection test (it is clear like jet fuel). The helicopter obviously crashed shortly after takeoff. She also presented the challenges to the use of SAF that need to be addressed. She continued with a reminder that the FAA does work

on testing, analysis, and coordination. She finished the introduction section with a short presentation on the new grant program that was established with Section 40007 of the IRA.

She continued by providing 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. This included details on the new projects being stood up in ASCENT to support the approval of a 100% SAF.

Anna started the discussion on analysis projects with a description of ASCENT Project 93 to evaluate opportunities for the development of a global SAF supply chain. She also provided further details on the new SAF GC Lifecycle Working Group, which was stood up in August.

Nate Brown continued the presentation by noting that the life cycle working group is the first one wherein we have engaged with the Internal Revenue Service (IRS), which will be important for the SAF Blenders Tax Credit. It is also the first working group to be stood up under the auspices of the SAF GC. He then talked about the ongoing work of the Fuels Task Group of ICAO. This includes how the ASCENT Projects are providing data to the FTG.

Based on a question from the Chair, Nate clarified that the ASCENT researchers are looking at future fuel production potential with a focus on the next decade. The Chair asked for a chart showing what is happening around the globe in terms of SAF production. Nate noted that both CAAFI and ICAO are tracking information on SAF. The Chair and a Member both stated that a slide summarizing what is happening would be immensely useful as we work to get to net zero by 2050, and to consider this on a global basis.

Action items	Person responsible	Deadline
Develop a high level slide summarizing global SAF efforts	N. Brown	March 2023

Nate continued the briefing with a focus on the SAF GC. He started by reminding the meeting that the signatories to the SAF GC MOU were DOE, USDA, and DOT, but EPA is also heavily engaged in the work. He provided the commitments and goals of the SAF GC as well as the relative roles of the different entities engaged in the SAF GC. He also provided an update on the SAF GC Roadmap, including its structure.

A Member asked how the DOD is engaged with the SAF GC. Nate noted that DOD have been engaged with the Roadmap development and have been providing details on the various aspects therein. This includes DLA-Energy who have been providing considerable input on activities. He further reported that there will be implementation teams to work on the various elements of the Plan.

He continued with an update on the CAAFI General Meeting that took place on June 1-3. He noted the first day was the SAF Summit, which was requested by the Administrator's Management Advisory Committee, with presentations from the FAA Administrator, DOT Assistant Secretary, among other senior executives from government and industry. He continued with an update on fuel production in the U.S.

Nate concluded the deck by revisiting the challenges slide that Anna had at the outset by capturing the efforts of the FAA to address these challenges.

A Member commented that he is excited to get the Roadmap later this month. Based on the Members follow-up question, Nate and the DFO noted that the government procurement between 2007 and 2013 were critical to stand up the SAF industry. Nate added that any future procurements by the government for its use, e.g. by DLA-Energy, would also be captured in this chart.

The Member followed up with a question on the regional variations in support for SAF and how that is effecting the market for SAF. Nate clarified the SAF Blenders Tax Credit and other incentives stack on one another and it is this stacking that is making the fuels profitable. This led to a discussion on differential crediting of SAF.

Another Member asked about the lead time on SAF production. Nate noted that 2030 is very close and we need facilities to enter into production in the next 2-3 years if they are going to contribute to the goal. This led to further discussion on the challenges that need to be overcome to rapidly ramp up production of SAF. This included how the DOE and USDA are both heavily engaged in the SAF effort.

Presentation Aircraft Technology Update | **Presenter** *Chris Dorbian and Arthur Orton*

Chris Dorbian began by providing a summary of the work of the CLEEN Program over its three phases. He then gave specific updates on work being done in the second phase of the CLEEN Program. This includes work that has been completed on a compact engine nacelle and a compact combustor as well as planned work on additional technologies in the next six months. He also provided an update on the benefits assessment of the CLEEN Program. This includes new information on the cumulative NOx emissions benefit of over 1.3 metric tons of reduction by 2050. Based on a question from the Chair, Chris clarified that we still have work on CLEEN Phase II that should wrap up by the end of the calendar year, 2022.

Chris continued with a summary of the goals for the third phase of the CLEEN Program and the technologies being supported in the effort. He provided updates on recent accomplishments and plans for the next six months.

Arthur Orton continued the briefing by providing detailed timelines for all of the CLEEN Phase III technologies with their specific TRL milestones, which reflect specific ground or flight tests. He also provided details on the work to expand the work of CLEEN Phase III and to stand up CLEEN Phase IV.

He then shifted the briefing to discussing the development of a new technology strategy. This new strategy will improve the alignment possible between ASCENT and CLEEN and will balance work on new discrete technologies, improved design and analysis models, and fundamental physics. It will also address near term and longer term opportunities towards our fuel burn, emissions, and noise goals. A Member asked that this strategy should be developed in coordination with NASA projects on HyTec, AAVP, and analytical tools development.

Arthur continued the briefing with a summary of the work being done within ASCENT on technology innovation. He highlighted the new work of ASCENT Project 92 which will see the

expansion of the Penn State turbine facility, thus enabling more research to be conducted in the future. He concluded the ASCENT portion of the briefing with highlights from the ASCENT technology development projects. He finished his briefing with a summary slide on the overall CLEEN program.

The Chair asked about the timing of CLEEN Phase IV. Arthur responded that we should have completed the market survey by the next Subcommittee meeting, and will report on it.

A Member asked if the tasks of CLEEN Phase III are behind and Arthur reported that everything is on time, but the coloring of the markers needed to be updated.

A Member asked about the fuel burn reduction benefit and Arthur noted that the fuel burn benefit is based on domestic flights as well as international departures from the U.S.

Another Member asked for clarity on NOx emissions within the CLEEN Technology benefit assessment. The FAA explained that NOx emissions will increase, but because of CLEEN Technologies, the increase is less than it would have been without CLEEN. This led to a discussion on the metric system used for regulating NOx and the importance of ASCENT Project 83 in its work to re-examine the metric system.

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 the types of things that could be done to reduce noise through operational procedures. He then continued with an overview of the work that has been done under the MOU between FAA and Massport. He walked through the lessons-learned from the MOU and how they are being disseminated.

The Chair asked about the duration of the Massport MOU and Chris said that the work started in 2015. The DFO noted that the work was actually started at the request of the Subcommittee.

Chris continued with updates on the ongoing work of ASCENT Projects 23 and 44. This included details on recent work of Project 44 to understand opportunities to reduce noise by looking at actual measurements.

The DFO remarked that it is important to look at multiple monitors as one can do things to reduce noise at one location that results in greater noise elsewhere. Chris agreed and indicated this is something that will be considered.

Presentation Analysis and Tool Development | **Presenters** *Mohammed Majeed, Joe DiPardo, and Adam Scholten*

Mohammed Majeed started the briefing by covering the status of the Aviation Environmental Design Tool (AEDT). He went through the AEDT 3f development, and noted the public release is planned for 2023, in line with the plan to release a new version of AEDT every year. He went through the details on the development plan including elements such as the improvements in emissions and dispersion modeling, aircraft performance, and nvPM modeling. He also talked about how AEDT3f will include modeling capabilities for supersonic aircraft to support the needs of CAEP. He concluded covering a number of performance improvements in the next version of the tool.

Joe DiPardo continued the briefing with an overview of the feedback the AEDT development team has received from the AEDT User Review Group. He also provided information on improvements to the processes that are used for AEDT software development.

He continued the AEDT update by providing information on AEDT4a which is planned for a 2024 release. The new version of the tool should include updated aircraft noise characterization; enhanced ground impedance and terrain modeling; replace delay and sequencing module; and flight performance harmonization. He also provided the timeline of AEDT development and how research efforts in ASCENT are feeding the development.

Based on a question from a Member, Joe clarified that the AEDT User Review Group includes a wide range of power users of AEDT.

Adam Scholten presented on the U.S. inventory of fuel burn, noise and emissions that are developed on an annual basis by the FAA. He provided information on the input data sources that are used to calculate the inventory as well as how the data are processed for use by AEDT. He continued with improvements that are planned for the inventory, both in the coming year and in the longer term. After Adam concluded the briefing, the DFO explained that FAA AEE is working to increase the availability of the inventory data to help with a wide range of applications such as environmental assessments.

A Member reminisced about the missed opportunities for bundling of flight tracks. She would like to brief this to the ACI Noise Working Group. The DFO noted that Don Scata and Fabio Grandi would be the appropriate people to reach out to.

Open Discussion | Lead *Ian Redhead*

The Chair remarked that the briefings were great and understandable by a wide audience. He gave kudos to the DFO, Kevin Welsh, and the staff of AEE for this.

The Chair stated that the portfolio is moving in the right direction and that the F&Rs should be similar to the last set. These include recommendations related to SAF, international leadership, public-private partnerships, noise, staffing concerns, kudos to the EPA for their work with the FAA, and a need to expedite awards of grants as there are many projects being affected and one project that was missed due to delays in the current process. The Chair also noted two new actions that were captured in the minutes.

A Member remarked that she appreciates the coordination across agencies as well as the need for continued coordination on technology efforts with NASA as captured in the technology briefing that was given by the FAA.

Another Member said that the team did a great job. He noted that there is a clear strategy to invest the new funds that are coming in via IRA and the increased appropriation. He said that he looked at the whole deck and thinks it is complete. He thinks it is important to fund things with careful consideration as these funds are only coming once. The work of CAEP is instrumental and critical. The U.S. does the vast majority of the work in CAEP, and it is important to support this team.

Another Member noted that continued leadership at CAEP is critical and it is important to capitalize on IRA as these funds may only come once.

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 25, 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

March 21-22, 2023 (Washington DC Metro Area – Hybrid Meeting)

September 12-13, 2023 (Washington DC Metro Area – Hybrid Meeting)

Adjourned at 3:30 pm on Wednesday, September 14, 2022

Attendance

Day 1	Day 2
Steve Alterman	Steve Alterman
Kimberly Brooks	Kimberly Brooks
Nate Brown	Nate Brown
Nancy Clarke	Jason Coon
Jason Coon	Nicole Didyk Wells
Beth Delarosby	Chris Dorbian
Nicole Didyk Wells	Marc Ehudin
Joe DiPardo	Barb Esker
Rudy Dudebout	Charles Etter
David Dunning	Warren Gilette
Marc Ehudin	Josh Glottman
Barb Esker	Bill He
Josh Glottman	Trisin Hearn
Bill He	Jim Hileman
Trisin Hearn	Ralph Iovinelli
Jim Hileman	Sandy Lancaster
Chris Hobbs	Prem Lobo
Ralph Iovinelli	Dora Lopez
Sandy Lancaster	Mohammed Majeed
Prem Lobo	Dimitri Mavris
Dora Lopez	Anna Oldani
Muni Majjigi	Arthur Orton
Julie Marks	Melinda Pagliarello
Dimitri Mavris	Katherine Preston
Andrew Murphy	Ian Redhead
Kerin Olson	Chinita Roundtree Coleman
Arthur Orton	Jayant Sabnis
Melinda Pagliarello	Jon Schliefer
Katherine Preston	Adam Scholten
Ian Redhead	Susumu Shirayama
Chinita Roundtree Coleman	Demi Tigue
Jayant Sabnis	Jeet Upadhyay
Sabrina Saunders-Hodge	Kevin Welsh
Don Scata	Jason Welstead
Jon Schliefer	Joe Zelina
Adam Scholten	
Susumu Shirayama	
Mark Sudol	
Erin Sunshine	
Jeet Upadhyay	
Lauren Vitagliano	
Kevin Welsh	
Jason Welstead	
Dan Williams	

Shelley Yak	