Subcommittee on Environment and Energy | MINUTES

Meeting date & time *September 11-12, 2018*
Meeting location *GAMA, Washington D.C.*

Purpose	Develop strategic guidance for the FY2021 R&D portfolio
Facilitator	Jim Hileman, DFO
Note taker	Jim Hileman
Timekeepe	Jim Hileman

Minutes from Meeting

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

Ian Redhead welcomed everyone and those in the room introduced themselves.

Presentation FAA Update (AEE and International Efforts) **| Presenter** *Kevin Welsh*

Kevin Welsh briefly introduced himself and then gave an update on what is happening at the FAA and AEE. He noted accomplishments over the past six months as well as areas of continued focus. He also remarked that we are having some challenges.

Kevin reported that the ICAO Council hit a big milestone and introduced a standard for the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). The U.S. Government has supported this effort and expects other governments to also support this scheme. The CO2 standard continues to be promulgated domestically. This is an effort being done with EPA. The triennial CAEP meeting is coming in February and we expect there will be much discussion on the nvPM standard. The CAEP meeting will also have considerable discussion on future work, including what will be needed to support the reintroduction of supersonic aircraft.

Noise continues to be an active area for the FAA. Much of our work has been on public engagement and outreach. We at FAA are working to improve our engagement on noise with airports. The current FAA reauthorization has a number of noise provisions.

We also are continuing to make progress on CLEEN and a third five-year phase of the program.

A member asked about the promulgation of the EPA CO2 Standard. Kevin noted that a proposed rulemaking would come out next year.

A member asked if Kevin would discuss the challenges. Kevin said that we are having challenges redefining our program to enable the continued reduction of noise and emissions in the face of a lack of strategic direction.

In response to a question from a member, Kevin noted that we have many standards in place and we have been working new work items in ICAO in an ad-hoc way as they come up. Europe has proposed a more routine checking of standards. We are not really sure of the direction though. A

good question to ask is, how do we look at noise and fuel burn (CO2) together and how do we look at nvPM and NOx together. The DFO said this is a good question and we are working on SST in the immediate CAEP cycles but we also need to have an R&D program that positions the USG to handle future standards to ensure we have appropriate tools in place to work on these integrated standards (e.g., noise and fuel burn or nvPM and NOx).

Several members discussed the changes that are taking place in noise and aviation expansion. The Chair noted that we need to think about all of the infrastructure work that is being planned for airports over the next 5-10 years. He remarked that we should ensure that Environmental Assessment and Environmental Impact Statements do not lead to unwarranted delays.

A member asked if we should take a more holistic approach to R&D. Are the tools in place sufficiently robust and/or work on new tools. These tools need to be used both domestically and internationally. The FAA noted that we use analytical tools for many uses domestically and internationally; however, the question could refer to analytical tools or it could be a broader question. Another member asked if the tools (broad meaning of wording) sufficiently address the needs of a changing world? Do we have the right skill sets and tools to deal with our changing world? Another member said that we need to continue to work on both domestic and international issues. He also noted that noise has been and will continue to be an issue. He remarked that it would be good to take a step back to look at the methods used to develop standards and also know if the standards have been effective. He stated that it is important to lay the ground work for what is needed 5 years out and the E&E program is essential to making this happen.

The Subcommittee discussed how social media has led to an increase in the number of noise complaints and how those complaints are being lodged. They noted that is a challenge for airports now. A member asked if the FAA has a plan for this. Becky answered that FAA needs to work with airports and airlines to provide responses to the community about noise. This is important from the perspective of hearing from pilots as well as regulators. AEE is working on this with regards to noise.

The Chair noted that we have a lot of methods and tools that are enabling solution development. An important question is to ask is what else we need to do with these tools and what else needs to be developed.

A member stated that it would also be useful to leverage the noise communication tools that are being developed to enable improved communications on air quality.

Presentation R&D Budget Status | Presenter *Mike Gallivan*

Mike Gallivan presented details on the budget process for FY18, FY19, FY20, and the out-years.

The FY18 budget was signed on March 23, 2018.

The FY19 budget is in development. Both the House and Senate Appropriations Committees provided $180M and $191M RE&D funds to the FAA, respectively. This is relative to the President's budget request of $74M. The full Senate has also approved the FAA budget and they are in discussions with the House. Mike provided details on the funding levels within the RE&D appropriation for both the House and Senate budget markups.

Mike walked through the language in the House and Senate FY19 budget reports. This included language in both the House and Senate directed toward the budget line items that support the E&E Program (namely A13.a Environment and Energy and A13.b NextGen, Environmental Research-Aircraft Technologies, Fuels, and Metrics).

The FY20 Target is set at $74M. This was delivered to OST in June 2018 and then to OMB in mid-September. The President Budget would then be released in February 2019. The out-year targets for FY21-FY24 that were established in January 2018 are all $74M. He expects the targets to be updated.

Mike said that the current FAA Authorization runs through the end of FY 2018 (September 30, 2018). The FAA is awaiting congressional action.

Mike concluded by stating that the future direction of the budget is foggy.

Presentation FAA R&D Landscape and Direction | Presenter *Shelley Yak*

Shelley Yak joined remotely. She started by explaining that FAA R&D is tied to US Code Titles 42 and 49. FAA conducts applied research to "analyze information and identify, develop, establish, improve, accelerate and/or enhance practicable methods, procedures and new technologies." This research leads to the expected outcomes that "provide scientific results that support the setting and enforcement of standards and regulations (for safety, efficiency and environment) that enable the aviation industry's ability to predict and prevent defects, failures and malfunctions."

She provided an overview of the overall FAA R&D program including an explanation of the six FAA research domains: aircraft safety assurance, digital systems and technology, environment and weather impact mitigation, human factors and aeromedical factors, aviation performance and planning, and airport technology.

Shelley described the effort to understand the FAA R&D Landscape such that we understand the enabling technologies and that we see what is being done and what needs to be done. FAA needs to consider what R&D we should "watch, follow and lead."

She discussed the alignment of the FAA NARP goals and the DOT goals; as a result of this alignment, the FAA does not see a need to change the NARP goals. She did say though that FAA would like the REDAC to help FAA better manage and improve the research portfolio through the following: Balance Strategy/Plan, Plan Short/Long term research needs, Prioritize investments, and Communicate Results.

As written in the US code, the REDAC *"provide(s) advice and recommendations regarding needs, objectives, plans, approaches, content, and accomplishments with respect to the aviation research program. AND Assist(s) in assuring that such research is coordinated with similar research being conducted outside of the FAA"*

She started a discussion with the REDAC based on the following question, *how may we use the upcoming 2019 REDAC meetings to develop Aviation Community R&D Landscapes?*

FAA will draft the initial landscape for discussion with the REDAC as covered in slide 18. This will be a continuing conversation with the REDAC.

A member commented that there is a lack of inclusion of civil society organizations within the partnerships and that the addition is much needed alongside industry and academia. Shelley agreed with the member and noted how this is a potential issue with UAS.

The Chair said that we do need to do a very good job of communicating results and we need to do more on this front to educate the public on the good work of the FAA.

The Chair asked about what are the "drivers" for the work and referenced the need for more infrastructures and the fact we will be getting more EIS and EA to process.

Shelley asked for the thoughts from the Subcommittee on this effort and a member noted that the wording of landscape makes sense. A member asked, in relation to slides 14-15, if Shelley is asking for the R&D efforts in industry and if so why, as it has been communicated before. Shelley noted that we may have gotten some of this information but it has not been well communicated. The member also asked if our tools are sufficient and Shelly noted we need to get ahead of the needs. Shelley and the DFO discussed the need to understand what is happening in industry to ensure that the research being done by FAA is not duplicative of efforts by others and to know whether or not industry would do the work should the FAA stop supporting it.

A member noted that in addition to partnerships with industry, the FAA needs to include the public good within the briefing. The FAA is a regulatory agency after all. What about the education of the next generation of aviation professionals? Can this also be captured? Shelley responded that this is a very good point and that on slide 9 we have STEM captured but it is not highlighted. She said she would work that into the landscape structure.

Shelley said that she would develop a draft plan and landscape for discussion for the Oct 3 meeting of the full REDAC. She would like to use the calendar year 2019 REDAC meetings to work through this.

Based on a question from a member, Shelley said that she is interested in identifying research and whether the FAA should be watching, following, or leading.

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

Jim Hileman walked through the existing findings and recommendations from the last two meetings. All of the recommendations from the August 2017 meeting were closed and all of the recommendations from the March 2018 meeting were left open. He also walked through the action items from previous meetings. 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 we start by thinking about the endpoint (goal) that is desired and decide how to get there	J. Hileman	Ongoing

Action items	Person responsible	Deadline
Monetize the air quality and climate benefits of having an alternative jet fuel with reduced sulfur and naphthalene content	J. Hileman	March 2019
Leverage the road mapping efforts at NASA and FAA to update the White House National R&D Plan	J. Hileman	On hold until NARP revisions completed
Update the E&E trifold to include information on how the E&E Portfolio is leveraging private sector funding	F. Grandi	March 2019

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

Jim Hileman gave an overview of the Environment and Energy Research beginning by broadly covering the economic benefits provided by the industry and highlighting the resulting environmental noise and emissions challenges. He then highlighted the ongoing efforts in the E&E portfolio, the program's outlook based on the enacted FY18 and FY19 President budgets, and the efforts towards ensuring that the work being done by E&E is properly captured and communicated for the benefit of the public. In the briefing, he also provided details on both the ASCENT Center of Excellence (CoE) and the Continuous Lower Energy, Emissions and Noise (CLEEN) programs. He also gave a brief update on the E&E outputs that are in the FAA NARP.

The update on the ASCENT COE program led to considerable discussion among the Subcommittee members. After a comment from a Member, Jim clarified that the FAA would continue to seek two paths forward for funding work in ASCENT. The existing path where the FAA identifies problems as well as a new, additional path that uses an open solicitation that would go out to a wide range of ASCENT researchers. The Subcommittee members were supportive of this approach.

Jim reported on the E&E Portfolio Financial summary through FY2020 and the out-year financial projections from FY2020 to FY2024. He then presented bar charts illustrating various aspect of the E&E Portfolio funding profile: the 20 years view from FY05 to FY24, the 5-year view showing the in-house and contracts funding for FY15 through 20, and the complete funding breakdown by E&E program from FY15 through FY20. He also provided information of what would change with the E&E Portfolio under the FY19 President budget (noting that this information was originally presented in the March 2018 meeting).

Action items	Person responsible	Deadline
Examine how aviation economic benefits are conveyed in E&E outreach materials (to ensure that importance of aviation exports are captured)	F. Grandi	March 2019
Provide feedback on NARP objectives and outcomes	Subcommittee	Sept 2018

Presentation Analysis & Tools Efforts | **Presenter** *Fabio Grandi*

Fabio Grandi presented the overall roadmap of tool development and analysis efforts through 2022. This included tool development for AEDT, Environmental Screening Tools, FLEET-Builder, APMT-Impacts, and a new GIS-based Noise Estimation Tool. It also covered analysis to support technology evaluations, forward evaluations of noise and fuels burn, and the annual inventories. He provided details on Fleet-Builder, Environmental Visualization Tool (EVT), screening tools, and the proposed work to develop a new GIS-based Noise Estimation Tool.

The Subcommittee had a long discussion on screening tools. This included a discussion about who would use the new screening tools. The FAA noted that the existing tools are available outside the agency, and that we need to examine whether or not these tools would be available and what the cost structure would be for its use. The Subcommittee also discussed how the public grows accustomed to getting new information and could expect this in all situations going forward.

Fabio concluded with some information on the FAA Pathways Program, which was an action item from the Subcommittee at a prior meeting.

Presentation Noise Research | **Presenter** *Rebecca Cointin*

Becky started her briefing with an overview of the challenge that the FAA is facing in terms of noise and some of the work FAA is doing to respond to this challenge. She provided a list of the projects that are currently being conducted by the FAA to examine the impacts of noise on the public. This included annoyance, sleep disturbance, cardiovascular health, and children's learning. She presented a summary of research on new entrants including unmanned aerial systems, urban air transport, commercial space and supersonic aircraft.

Based on a question from a member, there was a discussion about how AEE uses ACRP products. The FAA said that we are planning on using a number of ACRP outputs in our analytical tool development efforts. Prior to using any products from ACRP, the FAA conducts a review of the work alongside our contractors. A number of outputs are currently in the pipeline for use in future versions of AEDT.

There was a discussion on the noise from commercial space. The FAA noted that re-entry noise is a concern as there is a strong sonic boom generated. This might be a larger issue than launch noise as many more people could be exposed. The FAA also clarified that the current work on commercial space noise is geared toward improving the NEPA process. The FAA also stated that the emissions briefing on day 2 would cover emissions issues associated with commercial space.

Becky provided a summary of the certification challenges associated with new vehicles being introduced. She continued by outlining noise research goals for 2025.

There was a discussion on organizational delegation authority with the FAA clarifying that we are seeking more flexibility with manufacturers and to develop a framework that works for both industry and FAA. A member noted that FAA would retain full authority over the process but increase industry involvement.

There was also a discussion on who is responsible for the noise from UAT. The FAA noted the situation with UAT could be similar to helicopters today where little if any helicopter traffic is associated with the airport, but yet the airport receives the complaints.

A member asked about the cardiovascular health research and whether or not eliminating aircraft noise would actually affect public health given the large number of factors that impact it. The FAA said that we want to quantify the actual contribution of noise to health such that we can have an informed discussion. He suggested that we need to be careful in how research efforts like this are used to set policy. Another member noted that there are well developed methods within the scientific literature that can be used to link exposure (to things like pollutants) to outcomes (like heath). The FAA explained that we have been using the research program to develop scientific data to inform decision making and that we have been working to develop this information from a variety of perspectives. The health impacts work provides a top-down view on the potential impacts of noise while the sleep and annoyance work provides a bottoms-up understanding of why those impacts could be occurring. The end result should be more comprehensive than what we have today with an evaluation of whether or not there are health impacts of noise, and if there are, to provide a quantification of the impacts, with uncertainty bars, as well as an improved understanding for how these impacts are occurring.

Becky provided information of the work being done in the next two years to meet the 2025 goals.

She concluded with a short summary.

Presentation UAS R&D Plan **| Presenter** *Jim Hileman*

Jim shared that the full REDAC Chair, Dr. John Hansman, had asked for feedback on the UAS R&D Plan. He stated that the plan is For Official Use Only and should not be shared outside of the FAA REDAC. The report and the tasking memo to do the work were shared with the attendees.

Jim noted that feedback will not be part of the Findings and Recommendations for this "season." Instead, it would be separate and dedicated to the task. He additionally remarked that some of the other subcommittees discussed the plan at the meeting and then agreed to review further (homework) and have a teleconference after the meeting to finalize their findings. This was suggested as the best method for handling this request. The report will be discussed at a high level at the next full meeting (Oct. 3) and John will probably give some additional direction there. Jim shared that if the Subcommittee wants some flexibility, Shelley said that she could provide it.

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

Chris Dorbian provided an update on research FAA is doing to develop operational procedure concepts to reduce noise. This included an update on the work by MIT through the FAA-Massport MOU, ASCENT research, and Airport Technology Research (ATR) projects.

Chris presented an in-depth update of the work done by MIT on the Block 1 procedures. This included a description of the ideas as well as the processes being used by FAA to evaluate these procedures.

He discussed the concept of reducing speed on takeoff to reduce noise and the uncertainty in the potential benefit from its use. He continued with an explanation of the proposed work to measure aircraft noise of actual aircraft operations. He then provided information on the work being done by MIT on dispersions and how the information is communicated.

Chris gave short summaries of several ATR funded projects at MITRE that are examining concepts to reduce noise. This included projects on noise abatement procedure usage and effectiveness, and operational feasibility of steeper approaches for noise abatement.

He closed his briefing with a few observations and questions FAA are considering as we move forward.

Presentation AEDT Update **| Presenter** *Mohammed Majeed and Joe DiPardo*

Mohammed Majeed and Joe DiPardo provided an update on AEDT tool development. The briefing covered the current status of AEDT and the plans to incorporate BADA4 as well as reduced thrust takeoff and alternative weight modeling. They also covered AEDT Near-Term Development (FY19 – FY21) and AEDT Future Development (FY22+).

Mohammed presented the update on the status of AEDT3a. This included an aircraft performance update, new nvPM methods for use in ICAO CAEP, updates to the fleet database, and compatibility with Windows 10. He followed with additional details on the improved performance model as well as airport level results using the new model. He also discussed the modeling improvements to better capture what is actually happening with takeoff thrust and weights.

Joe provided information about plans for AEDT going forward. This included plans for AEDT3X to further improve the tool's efficiency and user workflow, expand and refine ground operations modeling capabilities, improve terminal area noise modeling for airports near water, improve helicopter noise modeling, and enhance air quality modeling. He also covered the plans for AEDT4 that will improve aircraft noise modeling significantly. AEDT4 would also incorporate an improved version of EPA's AERMOD for local-scale airport air quality modeling as well as capabilities to model supersonic aircraft performance in cruise. He showed how ASCENT research is directly feeding AEDT development.

He concluded with the long term AEDT development timeline that covers both AEDT3X and AEDT4 with updates being released every 6 months. He finished with a summary of the briefing

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Presentation Alternative Jet Fuels (including fuels aspects of CORSIA) **| Presenter** *Nathan Brown and Dan Williams*

Nate Brown started his briefing with a reminder to the Subcommittee that FAA does work on coordination, testing and analysis on alternative jet fuels. He noted that he would cover efforts on CAAFI, ASTM, supply chain analysis, tool development, and CORSIA.

The primary coordination effort is the Commercial Aviation Alternative Fuels Initiative (CAAFI), founded by FAA, A4A, AIA, and ACI-NA. He provided an update on actions of CAAFI in the recent past.

Nate covered an overview of FAA testing activities that are supporting ASTM International evaluation of alternative jet fuels and improving the evaluation process. He showed a spaghetti chart of the various means of producing alternative jet fuels from a wide range of feedstocks and the status of the ASTM approval process for each pathway. Nate then showed the ASTM approval process and the current status of fuels that are working through it. He noted that over a dozen companies have had discussions with CAAFI about entering the ASTM approval process.

He stated that a number of fuels have entered the process. He also said that ARA is likely the next fuel to be approved and this could happen as soon as June 2019.

He provided an overview of the work of ASCENT in Project 1, as well as the Volpe Center, to conduct alternative jet fuel supply chain analyses. This included details on work being done by the University of Hawaii and the Volpe Center. Nate also discussed how the work of ASCENT and Volpe is being done in collaboration with USDA funded efforts. Nate concluded his slides with a slide on how the Farm-to-Fly effort is leading to coordination across the federal government.

Dan presented several slides on CORSIA and how fuels fit within it. He provided details on how CORSIA Eligible Fuels will be credited under CORSIA to reduce offsetting requirements. He related information on the two components of the life cycle, core life cycle and induced land use change (ILUC), as well as how ASCENT researchers are providing this information to the ICAO CAEP Alternative Fuels Task Force, which is collecting it for inclusion in the standard for CORSIA.

There was a question from a member on the progress being made on life cycle emissions modeling within ICAO and the FAA noted that the researchers who are looking at core life cycle emissions are working together very well. However, it took many years of work to get the Argonne National Labs, ASCENT, the European researchers, and other researchers to be working closely together. The current challenge is with the ILUC modeling.

There was also a brief discussion as well on recent progress in commercialization efforts.

Discussion on Findings and Recommendations | Lead *Ian Redhead*

Ian asked everyone to think about the questions posed by Jim Hileman in his briefing and provide answers tomorrow. He also asked everyone to look at Shelley's briefing (slides 17 and 18) and provide their views. As part of the task to examine landscapes, the FAA also asked the Subcommittee to think about the work that is being done by industry and evaluate whether or not industry would do this research if the FAA was to stop its efforts.

End of Day 1

Presentation Supersonics **| Presenter** *Jim Skalecky*

Jim gave a briefing on the efforts of FAA on supersonic aircraft and research needs going forward. He covered the following topics with his briefing: Supersonic Noise Regulations, ICAO Standards Development Schedule, Supersonics Interest within the U.S., Research Activities, and 2025 Research Goals for Supersonic aircraft.

He provided details on recent developments in noise regulations on supersonic aircraft. Based on a question from a member, Jim clarified that the current noise regulations for supersonic aircraft are limited to the Concorde. He continued his briefing by discussing the progress and plans in ICAO CAEP regarding supersonic aircraft as well as describing the interest of U.S. industry in supersonic travel.

The briefing covered the work being done currently by the FAA to advance supersonic aircraft – both now and planned for FY19. This included details on a number of ASCENT projects that are related to supersonic aircraft. Based on a question from some members, the FAA clarified that the work of ASCENT examining supersonic aircraft and engine design is just starting. The FAA has over a decade of working with universities on subsonic aircraft design but is just starting on supersonic aircraft and engine design with the work under ASCENT Project 10 and 47. The FAA also noted that the work of ASCENT on supersonics could soon be put on hold due to delays in processing grants. Based on a question, it was clarified that Project 47 would work on a variety of engine cycles and look at multiple flow streams to the engine.

Jim informed the meeting about the CLEEN Phase III market survey and the fact it included a question on whether or not it should encompass technology maturation for supersonic aircraft. He also provided high level information on efforts being done by NASA with quiet supersonic flight testing, low boom flight demonstration, and studies of supersonic transport concept airplanes. He also presented a summary of the work being done in the RUMBLE research program with European funding and noted that this work is being done in collaboration with US funded efforts.

A member asked how the international researchers are collaborating and if there are researcher-to-researcher collaborations. Another member stated that there are indeed collaborations taking place in this manner. The FAA also noted that there is a lot of collaboration coming via ICAO CAEP.

Jim concluded with three slides on the 2025 research goals for supersonics. These goals included items relating to LTO noise and emissions, engine emissions certification support, aircraft design / operations, review of the ban of overland flight, sonic boom certification, emissions source characterization, emissions impacts, as well as some other considerations.

A member asked about health impacts of noise and whether or not supersonic aircraft could fit into this. The FAA clarified that we would consider the subsonic noise data that we have, but it is impossible to do similar work with supersonic vehicles as there is a lack of exposure data. This led to a discussion of the magnitude of sonic booms and the noise from shaped booms. The FAA noted that a key reason for having the NASA demonstrators is that it will provide us information on how people respond to the boom levels from an aircraft that is designed to have a relatively quiet sonic boom.

There was a question about how loud these aircraft would be during landing and takeoff. The FAA stated they could not answer as there is ongoing rulemaking. The FAA also clarified that supersonic operations would be covered under CORSIA, but not under the current CO2 standard.

Presentation Emissions Research | **Presenter** *Daniel Jacob*

Daniel provided a briefing highlighting emissions research efforts by the office. The briefing included an update of the emissions research roadmap, an update on the development of a non-volatile particulate matter (nvPM) standard, information on commercial space emissions, and research needs out to 2025.

He covered the interconnectivity of emissions research and a summary of how engine emissions affect air quality. Daniel then provided details and status of the nvPM standard being examined by ICAO CAEP. He also discussed efforts to improve the standard including a need for

corrections to account for ambient conditions, fuel composition, and to understand engine-to-engine variability.

The briefing led to a discussion within the Subcommittee on how engine manufacturers could reduce nvPM and NOx. A member asked about replacing seals with those that do not need aromatics to swell and the opportunity with alternative fuels to reduce nvPM. The DFO noted that the work of ASCENT Project 39 is examining how one could remove naphthalene and other specific types of aromatic compounds to reduce nvPM without changing any of the seals in aircraft. The Subcommittee also discussed tradeoffs of fuel and nvPM and another member noted that there has not been any tradeoffs between the two as improvements in reducing smoke number have resulted as a consequence of improvements in efficiency.

Daniel continued with a presentation on commercial space and the range of fuels and emissions that result from their operation. He also provided a summary of knowledge on the impacts from their operations and the gaps that exist regarding their impact. The FAA clarified that we have only put very limited E&E portfolio funds into commercial space. There is however a project ongoing under ACRP funding to look at emissions from commercial space operations. A member remarked that there is a researcher at Stanford University that is examining green propellants and that he would connect him to the FAA.

Daniel finished his briefing by talking about research needs through to 2025.

A member asked if the National Institutes of Health (NIH) was doing health impacts work on ultra-fine particulate matter and the FAA stated that we do not know of any work. FAA is trying to do some work on this front to understand exposure.

Presentation NASA Update | **Presenter** *Rich Wahls (NASA)*

Rich gave an update on NASA Aeronautics efforts. He started by providing an overview of drivers moving NASA aeronautics and then gave on update on the strategic thrusts. He presented the budget for FY2017 through FY2023. He provided an update on the work to develop the low boom flight demonstrator and other efforts on supersonics.

He presented a short summary of NASA's work to develop vertical lift concepts to support emerging aviation markets and the challenges these vehicles will need to overcome in terms of developing electrified aircraft propulsion and integration, noise, weather tolerance, assured autonomy, human integration, and integration of these vehicles with the NAS.

There was a discussion around who controls airspace immediately over someone's property. The FAA said that these and other questions are being addressed through the FAA pilot programs.

There was also considerable discussion about the range of designs that are being considered for vertical lift. Rich noted that NASA has seen over a 100 designs. However, a member noted that only 10 of these are likely viable based on his experience working with the industry. Another member asked about the electricity requirements for these vehicles at airports. The FAA said that there is a coming ACRP project. The member noted that the electric vehicles are only a part of this issue as ground equipment at the airport are becoming electrified and there are more cars that need to be recharged. This led to additional discussion on increased electrification at airports.

Rich continued with a discussion on the work at NASA to advance subsonic aircraft technologies. He presented ongoing flight testing efforts on the adaptive aeroelastic wing,

adaptive compliant trailing edge wing, landing gear noise treatments, and the all-electric X-57 Maxwell aircraft. Two of the tests will help noise.

A member asked how well NASA and FAA are working together. Rich said that there have been great interactions on CLEEN in both phases I and II. FAA is using NASA facilities for CLEEN testing with Honeywell, GE, UTC, and Aurora Flight Sciences. There was also discussion on interactions to reduce noise from helicopters and UAM. The FAA noted that we are also working closely on supersonics and have plans to work much closer together on noise modeling.

Based on a question, Rich stated that noise is gaining more prominence within NASA. A question was also posed by the FAA on how we can better work with NASA going forward.

A member asked if FAA has all of the information that is required to inform decision making on NEPA, cost-benefit analysis, etc. with respect to new entrants. The FAA responded that this is a good question and we need to determine the needs. The Chair observed that the FAA does not want to impede progress by industry, but if you don't have the research to enable these technologies to enter service then industry will in fact be hindered. Without effective regulation to enable these operations, industry will advance overseas as opposed to here in the U.S. There was a discussion about the challenges with certificating new entrants, including for noise.

Based on a question Rich explained that with the current budget, the low boom demonstrator will fly by 2021 and after that there are opportunities to do a demonstrator for subsonic technologies. As such, much of the vision from previous year budgets for demonstrators still exists but it has been stretched in time to match the current budget.

Discussion Industry Perspective | **Presenter** *Steve Alterman (CAA) and Tim Pohle (A4A)*

Steve Alterman provided some thoughts on reauthorization. He noted that it is going back and forth between the House and Senate. He remarked that there are a number of amendments on noise that would inhibit the ability of the FAA to modernize the air space. He stated that industry has always been supportive of CLEEN and ASCENT and that the programs need to continue. However, that is a challenge with the current Administration.

Tim Pohle noted that noise has been and continues to be a major issue and potential constraint on the industry. It needs to be addressed in a rational way. The airlines are also concerned about mandates as proposed in reauthorization. Tim also reported concerns regarding air quality, which like noise is locally driven. He does not think this issue will ever go away; however, the political interest is not there at present. Carbon emissions are also important and the implementation of CORSIA and the CO2 standard are priorities for the airlines. He said that there has been an education process with the Administration to let them know the CORSIA and CO2 standard are in fact good things. Tim agreed that resources need to be available to continue CLEEN and ASCENT to be able to continue to inform policy makers and develop the technology base that is needed.

Steve stated that no one would benefit from CLEEN and ASCENT being stopped.

Tim remarked that we need to think about what policy makers actually need for decision makers and this should drive what is being developed. There could be an opening at the international level to use the next few years to have the opportunity to understand what is needed.

A member endorsed what was said by Tim. He noted that data does not necessarily lead to action and he strongly endorsed the view that what is required is thinking through what data is actually needed to inform action. Tim stated that we need to have those using models to understand their limitations and communicate them to policy makers.

The FAA noted that we want to ensure that industry can thrive. Are the risks to industry larger if we have gaps in the research? Tim remarked that FAA could point to the fact it took two decades to get a new runway in Seattle due to environmental concerns. Industry has had real constraints and it will be able to thrive only if we have real information.

A member asked if key individuals know where we are and what is needed in the future. Does everyone know what is important about the E&E program and why it is critical? How do we explain this to a larger audience?

A member said that a briefing could be put together based on the last slide of Jim Hileman's presentation from day 1. Many in the private sector would benefit from seeing this slide and having an explanation for each of these points.

There was a discussion on how the FAA could manage the Administration's priority on deregulation and the fact that research could lead to a push for more regulation. The FAA noted it would be good for the Subcommittee to provide feedback on if and how the knowledge being developed by the E&E portfolio is ensuring that the aviation industry can thrive.

Priorities Discussion and Development of Findings and Recommendations | Lead *Ian Redhead*

The Subcommittee Chair led a discussion on the three questions that were raised by Jim Hileman on day 1.

- 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 opened the floor to members responding to the questions and initiate discussion on the findings and recommendations.

A member noted that the E&E portfolio has a focus on the direct impacts of aviation. He asked if it was possible to examine how aviation is driving efficiencies in other parts of the economy that results in reduced emissions. For example, if aviation improves connectivity and this reduces the number of warehouses, is there a benefit? What is the environmental progress enabled by this? Aviation enables just in time delivery and reduces need for inventories thus resulting in more efficient supply chains. Another member said that multi-modal modeling could help facilitate this. Another member concurred with this being of interest, but the effort would also need to consider instances where aviation leads to inefficiencies.

A member remarked that AEE has provided a comprehensive list of research areas that could be covered in the near and longer term and therefore is indeed asking the right questions for the near and longer terms. The member also stated that there is a question of where to devote the

resources of the E&E Portfolio. He noted that UAM noise could be a big issue and that FAA could increase its efforts there in a collaborative manner with NASA. He also recommended that AEE not work on things that are not of immediate concern such as commercial space. His thinking is that the focus should be on subsonic, UAM/UAS, supersonics, and then commercial space in that order. Other Subcommittee members concurred with this ordering.

A member noted that the FAA should continue to work on alternative jet fuels. The other Subcommittee members also agreed.

The Subcommittee chair noted that he intends to have findings and recommendations on the following topics. Alternative jet fuels are a priority. The Subcommittee would continue to endorse the work in CLEEN, CAAFI and ASCENT. It would also continue to endorse the need for U.S. leadership at ICAO CAEP and to do work on environmental standards and CORSIA. There is also a need for long term funding certainty for the E&E Portfolio such that it can achieve long term goals. There could also be a recommendation about the need to resolve the bottleneck in getting grants approved and to reduce interruptions to ongoing research

A member noted that the delays in grant approvals are causing hardship for graduate students and these people would face the brunt of these delays

A member asked the FAA how they would handle the two very different potential funding levels for FY2019. The DFO reiterated information from his briefing from day 1 using slides from that slide deck. A member noted that the Subcommittee is concerned with the impact of budget cuts on U.S. industry. Another member stated that if not addressed, environmental issues will become constraints on the growth of the U.S. aviation industry and this would have economic consequences across the country as aviation has a large impact on the national economy. Based on a question from a member, the FAA said that the briefings had presented the range of work that could be done out to 2025 for noise, emissions, supersonics and tool development. However, it is the budget levels that will determine when the work would actually get done. The Subcommittee chair remarked that funding levels within the 2019 President's budget and out years are not viable and would ensure that environment becomes a constraint on aviation growth. Another member noted that without research, regulations will be poorly informed and that is not good for either the industry or the public. Another member stated that the continued growth of aviation is critical for the economy. If the industry doesn't come up with technological solutions to environmental issues that are informed by research, then the only solution to deal with the environment is to curtail growth by cutting operations.

A member stated that subsonic aircraft will be the priority for many decades, but FAA will also need to regulate supersonic aircraft and other new entrants to enable the industry. Another member said that industry will not be able to support a supersonics industry unless FAA addresses concerns related to the environment. This led the Subcommittee members to the conclusion that more resources are needed to deal with the challenges posed by new entrants and not a cut to the budget. Further, staff will also be required to handle this work. The FAA noted that we will have to do rulemaking with whatever information we have on hand at the time, and that a robust research program would help this process.

A member remarked that it is important for FAA to do quality control on research products being created by other entities in the U.S. and internationally to ensure that regulations are well informed. Other institutions the world over are also looking at these issues and FAA needs to do research as a check on their results and findings.

There was also a suggestion for the FAA to see what other modes are doing and if there is similar work to the E&E Portfolio being done elsewhere in DOT. The FAA said this was a good idea, but it also noted that aviation noise is different from that created by other modes.

The Subcommittee had a long discussion about the relationship between the noise work of the E&E Portfolio and the sound insulation program of the FAA, which has spent nearly $11 billion over the last three decades. This discussion included whether industry could take over the research work of the FAA and there was a consensus in the Subcommittee that it would not. The FAA said that some of the R&D efforts have led to the sound insulation program being more efficient. The Chair also noted that research done by the FAA has reduced DNL contours and is therefore helping to reduce the need for sound insulation.

The Subcommittee Chair observed that for new entrants to survive, we need research and science. The only way to get that work done is to continue the existing research partnerships and ensure the E&E Portfolio is well staffed.

A member noted that some people in airport communities do not trust AEDT and they would prefer to use microphones to get noise data. She suggested that the FAA provide better communications tools about AEDT. Another member stated that AEE is very sophisticated but the community who is concerned about noise generally only cares about a single number. Based on this discussion, an action was added to develop outreach materials on AEDT.

The FAA asked if there are other materials that should be developed. A member reiterated her suggestion that the FAA could take slide 48 from the briefing by Jim Hileman and expand this into a larger set of materials to show people the importance of each bullet point.

The Subcommittee then continued their discussion on how analytical tools are being used to inform the community about noise and NextGen.

The Chair and many Subcommittee members expressed their gratitude to AEE for the great job of preparing materials for the meeting and the hard work that is being done. They asked FAA to please keep up the very good work.

The Chair remarked that he is looking for feedback on the UAS R&D Plan and that he will reach out to everyone with more information on the landscapes request from Shelley Yak.

Action items	**Person responsible**	**Deadline**
Develop a means to communicate information on AEDT to the layperson. This could include its noise and emissions modeling capabilities and how it reduces the need for noise and emissions monitoring	F. Grandi	March 2019
Develop a means to communicate successes from E&E Portfolio summary slide	J. Hileman	March 2019
Examine indirect environmental impacts from aviation that result from modifications to supply chains	J. Hileman	March 2019

Meeting Close-Out | Lead *Ian Redhead*

Ian agreed to develop findings and recommendations based on the discussions for further development by the group.

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

All of the recommendations from the August 2017 meeting were closed. All of the recommendations from the March 2018 meeting were left open.

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

March 19-20, 2019 in Washington DC

September 10-11, 2019 in Washington DC

Adjourned at 2:30 pm on Wednesday, September 12, 2018

FAA REDAC Subcommittee on Environment & Energy
Summer 2018 Meeting Agenda
GAMA 1400 K St NW #801 Washington, DC 20005

Purpose:

- Develop strategic guidance for the FY2021 R&D portfolio
- FAA provides deep-dive briefings on topics of interest to develop strategic guidance
- E&E REDAC to provide recommendations on R&D portfolio and direction

TELECONFERENCE: 888-251-2909 Passcode: 8330491

Read Ahead Materials: https://redacdb.faa.gov/browse.cfm

Tuesday, September 11, 2018

Time	Duration	Title	Presenter
8:00	0:30	Check-In	
8:30	0:05	Welcome	E. Smith
8:35	0:10	Chair opening statement & Introductions	I. Redhead
8:45	0:15	FAA Update (AEE and International Efforts)	K. Welsh
9:00	0:30	FAA R&D Landscape and Direction	S. Yak
9:30	0:15	Budget Update	M. Gallivan
9:45	0:15	Discussion	
10:00	0:15	Break	
10:15	0:15	Responses to REDAC Recommendations & Actions	J. Hileman
10:30	0:45	E&E Research Update	J. Hileman
11:15	0:15	Discussion	
11:30	0:30	Analysis & Tools Efforts w/Discussion	F. Grandi
12:00	1:00	Lunch	
13:00	1:00	Briefing on Noise w/ Discussion	R. Cointin
14:00	0:30	UAS - Discussion on Research Plan	I. Redhead (lead) / S. Saunders-Hodge et al. (SME)
14:30	0:30	Briefing on Ops for Low Noise w/ Discussion	C. Dorbian
15:00	0:15	Break	
15:15	0:30	Briefing on AEDT w/ Discussion	J. DiPardo & M. Majeed
15:45	0:30	Briefing on Fuels (including fuels aspects of CORSIA) w/ Discussion	N. Brown & D. Williams
16:15	0:45	Subcommittee Discussion on F&R Ideas	
17:00		End of Day-1	

Wednesday, September 12, 2018

Time	Duration	Title	Presenter
8:00	0:30	Check-in	
8:30	0:45	Briefing on SST w/ Discussion	J. Skalecky
9:15	0:45	Briefing on Emissions w/ Discussion	D. Jacob
10:00	0:15	Break	
10:15	0:45	Briefing from NASA w/ Discussion	R. Wahls
11:00	0:15	Industry Perspective	S. Alterman
11:15	1:00	Priorities discussion	I. Redhead
12:15	0:45	Lunch	
13:00	1:00	Priorities discussion	I. Redhead
14:00	0:45	Subcommittee Discussion on F&R Ideas	
14:45	0:30	Agree on Draft Action Items and Findings & Recommendations for the E&E Meeting	I. Redhead
15:15		End of Day-2	

Attendance List:

First name	Last name	Affiliation	10-Sept	11-Sept
Juan	Alonso	Stanford U.	X	X
Steve	Alterman	CAA		X
Gonca	Birkan	FAA	X	
Ralph	Cavalieri	WSU	X	X
Rebecca	Cointin	FAA	X	X
Joe	DiPardo	FAA		X
Chris	Dorbian	FAA	X	X
Eric	Elmore	FAA	X	X
Charles	Etter	Gulfstream	X	X
Gregg	Fleming	Volpe	X	X
Mike	Gallivan	FAA	X	
Fabio	Grandi	FAA	X	X
Steve	Hamburg	EDF	X	X
Kathy	Hurst	ALPA	X	X
Jim	Hileman	FAA	X	X
David	Hyde	AIA	X	X
Levent	Ileri	FAA	X	X
Ralph	Iovinelli	FAA	X	X
Daniel	Jacob	FAA	X	X
Melvin	Kasanchick	Boeing	X	X
Sandy	Lancaster	DFW Airport	X	X
Mohammed	Majeed	FAA		X
Monique	Moore	FAA	X	X
Maureen	Molz	FAA	X	X
Melinda	Pagliarello	ACI-NA	X	X
Tim	Pohle	A4A	X	X
Ian	Redhead	Kansas City Intl Airport	X	X
Chinita	Roundtree Coleman	FAA	X	X
Jayant	Sabnis	MIT	X	X
Don	Scata	FAA	X	X
Jason	Schwartz	Port of Portland	X	
Jim	Skalecky	FAA		X
Ed	Smith	GAMA	X	X
Rich	Wahls	NASA	X	X
Kevin	Welsh	FAA	X	X
Jerry	Wright	ALPA	X	
Shelley	Yak	FAA	X	
Darcy	Zarubiak	Airport Consultants Council (ACC)	X	X
Joe	Zelina	GE		X