Research, Engineering and Development Advisory Committee (REDAC) MINUTES

Meeting date, time *10/11/2017, 9:00am* **Meeting location** *FAA – Conference Rooms 8A, 8B, and 8C, 800 Independence Avenue SW, Washington DC*

Purpose	Strategic Guidance on FY 2020 Research and Development Portfolio and Special Assignment Discussions on the UAS Integration Research Plan and FAA Cybersecurity R&D Plan
Facilitators	Dr. John Hansman; REDAC Chair, Massachusetts Institute of Technology (MIT) and Shelley Yak; FAA Research and Development Executive Director, FAA William J. Hughes Technical Center (WJHTC)
Note Taker	Mervette Saadia Abdu

Ms. Shelley Yak opened the meeting by welcoming everyone and reading the public meeting announcement. She noted that meeting notice was published in the Federal Register.

Presentation Welcome Address and Chairman's Overview **Presenter/s** *Dr. John Hansman, Shelley Yak*

Ms. Yak commented on a memo from the White House's Science and Technology Office, which outlined research and development (R&D) priorities regarding American Security, American Energy dominance, American Prosperity, and American Health. She noted that under the American Health priority, there was an area under R&D practices focused on efficiency and maximizing agency coordination. M. Yak stated that those were all issues that have been discussed during the National Aviation Research Plan (NARP) redesign efforts, and she similarly briefed the Research Executive Board (REB) members at a recent meeting.

Dr. John Hansman asked Ms. Yak about the NARP redesign efforts, and if what the subcommittee reviewed, was now obsolete. M Yak responded that the content was the same, and that recommendations would be taken into consideration from the REDAC and the five subcommittees. She further stated that the reviews were "not a moot cause". Dr. Hansman reiterated that he was asking for clarification and trying to understand the process moving forward. He also asked if a process was in alignment, and if there were substantial changes, would the REDAC be briefed again.

Ms. Yak responded that the timeframe for the next round of R&D Executive Board (REB) meetings would be in January and February 2018. She stated that reviews could be discussed at the next round of REDAC subcommittee meetings during Spring 2018.

Dr. Hansman suggested that the REDAC members could do a teleconference. M Yak asked Ms. Chinita Roundtree-Coleman to take an action to asset up a teleconference for the review and discussion, to which Ms. Roundtree-Coleman confirmed as an affirmative.

Mr. Kenneth Hylander, *Chair, Flight Safety Foundations*, then asked, if there was a possibility that some actions could be disregarded due to low priority. Ms. Yak responded, "A reevaluation is possible, but it's early to say". Dr. Hansman remarked that, "Because at the end of the day, we're an advisory committee and this is the reason for suggesting circling back to the issue."

Presentation FAA NextGen Perspectives **Presenter/s** *Jim Eck*

Discussion: Mr. Jim Eck, *Assistant Administrator for NextGen*, began his presentation by introducing himself. Mr. Eck welcomed the deputy administrator on his behalf, who was unable to attend the REDAC meeting. He noted that he was sure that if the deputy administrator were in attendance, that he would discuss the research priorities.

Mr. Eck began his presentation by addressing the attendees about the direction of NextGen. He stated that, this industry and the FAA itself was impervious in the structure of air traffic control services. He asked, "What are the things that are happening in technology that could have a significant impact on where aviation is going in the future?. He mentioned, "Our task as the FAA is not to make a better remote tower, or a better rocket, or better UAS, Our task is to focus on safety within the NAS." Mr. Eck mentioned some fundamental things that have been done in looking at the safety operations. He pointed out that the forward thinking about some of the priorities of the mission was to promote or provide safety and provide technologies, particularly the research priorities of 'American Prosperity' and 'American Health'. Mr. Eck stated that this was already happening to a great extent and reiterated that the priority was to get the FAA's mission done. He noted that there would be opportunities to cross-pollinate, and stated, "So for me, that is what's going to change. That's where we need to change our perspective in the future, in the next 5-7 years; we know what the challenges are". There are many tools in the laboratory now, to use new tools for integration with airlines, with Initial Operating Capabilities (IOCs), how to deal with the human centered aspect of and a high-level strategic plan. Mr. Eck affirmed that separation assurance would still be done as was used, but with more.

Mr. Eck noted that the cultural change was not going to be air traffic control, but with general aviation, and then to synchronize the whole thing. He said, "We have a document that will look into why we're going into what we are going into. In addition, not only the technology, but this technical evolution. And finally, beyond that, is the ability to react more quickly and how to use information effectively".

On looking away from design assurance and looking at performance assurance, Mr. Eck said, "I'm not sure what that means exactly. When we look in the future at how we will deal with a high level of autonomy, a high level of an interconnected world and agency. Therefore, now the challenge would be that the performance assurance is there. How do we also then, assure that the system cannot be tricked into learning the wrong things, while learning from big data and analytics?" Mr. Eck stated that "those are the things I see as the challenges in the near term and future", as far as how the future looks.

Questions and Comments:

Dr. John Hansman asked as a follow up to Mr. Eck comments about learning big data, if his vision was on real time big data learning. Alternatively, off time or offline learning about big data?

Mr. Eck replied that this was a logical first step, so before people start putting code down, he stated, "We figure out design principles and design assurance". He further stated that he thought there was going to be a great cross-pollination with what the Department of Defense (DoD) was doing with systems that need to protect troops, keeping them out of harm's way. He further noted, "We need to understand how to make explainable artificial intelligence (AI).

Dr. Hansman replied, "So you alluded to industry coming in and taking on some of the research. I hear a lot about Air Traffic Control (ATC) and that it's going to go to private industry". He further stated that it could work if someone was in charge. If Uber and Amazon can control their own vehicle, Dr. Hansman asked how all of that would be integrated. "How do you think about that sort of future?" he added. Mr. Eck replied that there has to be information sharing and some sort of adjudication process.

Dr. Hansman remarked that it seemed that the FAA has some sort of governmental role and that there has to be rules of the road. Mr. Eck answered, that he did not envision that the FAA would come up with all of the rules. Mr. Eck said to Dr. Hansman that if this were about autonomous vehicles, then that would be another discussion.

Dr. Hansman noted that there was this tension between the innovation/investment community and the government and the need for the government to regulate. Mr. Eck stated that it did not require a single government entity

Another attendee commented there were people trying to make solutions about problems that did not yet exist.

Ken Hylander asked, concerning the philosophical move away from design assurance", "How are you working on addressing emergent risks? Is there research going on about that?" and noted that it seemed like a rich research topic.

Mr. Eck replied that they were coming, and so the issue was to take a more traditional approach to fly based on how information was provided, and stated, "Either the industry will move away from us or stay with the FAA if we have something that isn't offered elsewhere. Our challenge, our intention, moving forward, has to be bolstered by how to certify things. What are the methods and tools that can be utilized in our current efforts?" Mr. Hylander noted, he wasn't sure about the way the FAA considered things in REDAC (named all 5 subcommittees) seems to have a gap

Ms. Yak replied, "We are trying to get away from those specific domain areas, in the discussion about the NARP redesign. We want to have a deeper conversation with how to move the NARP and the REDAC."

Dr. Hansman noted that there had to be a way to monitor for emergent risks, and, said "I do think that there is a structural issue with the FAA and research, and our structure in the REDAC with, for example, human factors, that goes across different lines of business. Shelley has done a good job of trying to bring those together, to make it cross cutting."

Jim Dermody, *DFO for Airports* remarked, "Under Shelley's leadership, there has been more efforts on how to integrate issues and that there is more cohesiveness." Mr. Dermody went onto elaborate how Airports (ARPT) is working with Environment and Energy (E&E) on noise issues, which they have been slowly migrating. Whereas, there used to be more stove piping, they are now working more on seeing similar issues, especially with some of the newer technologies like UAS and cybersecurity.

Ian Redhead, *E&E Subcommittee Chair*, introduced himself by stating that he was new to the REDAC. Mr. Redhead stated that unless the FAA fundamentally changed how they did things; they would always be behind private industry. In further explaining his point, Mr. Redhead described an example of how airports dealt with changes when Uber, then Lyft ride sharing services came in. He noted that the FAA had to come up with rules and guidelines that were flexible enough for industry and changes that would be coming.

Presentation Office of UAS Integration/UAS Integration Plan **Presenters** *Earl Lawrence, Sabrina Saunders-Hodge*

Ear Lawrence: FAA Unmanned Aircraft Systems (UAS) Update

Discussion:

Earl Lawrence, *Executive Director, FAA's UAS Integration Office,* introduced himself to the REDAC attendees and noted that he would be providing an update on the UAS Integration Plan. He noted that aviation as a whole was joining the internet of things, but with UAS, that was happening faster. Mr. Lawrence noted that the FAA and UAS Office were struggling to keep up as this development was happening in Silicon Valley at a fast pace.

Slide 2 went over setting the stage for UAS Integration. Mr. Lawrence noted that they were seeing developments in weeks that they used to see in years. The airport plays a central role, and is "in the palm of the hand." They have more partners than ever before. UAS has been certifying pilots and aircraft, which is nothing new; however, they are just being pushed with more volume now and moving towards trusted systems. The consumer products and operators need to understand that their way of doing business was evolving.

Slide 3 reviewed "Volume Indicators". Over 2000 have been registered per day as of early October 2017. There are over 900,000 registrants; these are per person, not per aircraft. If one looked at those for commercial use, they were approaching almost 9,000 that were registered. Mr. Lawrence went over the other waiver requests, which includes Night Operations, Operations

over People, Beyond Vision Line of Sight (BVLOS) Operations, Operational Limitation: Altitude, and Operations from a Moving Vehicle.

Dr. Hansman asked if the 7,000 registrants were technical certificates. He followed up with asking, "So, 7,000 are experimental? Mr. Lawrence replied that, yes they were, and many of those were the beyond line of sight. Dr. Hansman followed up with asking for some examples. Mr. Lawrence replied with a few examples, such as border patrol, as well as, a lot of unmanned firefighting equipment, and several delivery services.

Dr. Hansman asked what percentage of the certificates were non-governmental. Mr. Lawrence said that he believed the majority were private use, but could not give the exact number, and pointed out that there was many experimental aircraft out there.

Mr. Lawrence noted that the number of pilot certificates on the slide were already outdated, meaning that the numbers were about 3 weeks old (as of October 11, 2017). He stated that he was expecting to get a new count that day, and that the number of pilot certificates will probably go from 63,917 to over 70,000. Mr. Lawrence noted that there were a lot of the class, D and E waivers. There are many people doing night operations, many people doing operations over people. Mr. Lawrence noted that the slide charts did not include hurricane operations. Mr. Lawrence noted that he was going off the top of by head in recalling these statistics, however over 400 waivers have been issued. Mr. Lawrence noted that they have seen a lot of partnership with UAS operators, such as insurance, emergency personnel, media, and that the operations are in coordination with the incident commander.

On Slide 4, 'The Path to Full Integration', Mr. Lawrence stated that all of the information was familiar to the REDAC attendees. They made a few changes since the last time it was presented.

Slide 5 went over FAA UAS Priorities. Mr. Lawrence discussed the specific priorities, which were to automate systems, address security concerns, and continue expanding operations. There was a perception among the developers that the FAA controlled every single aircraft all the time, however, that was not the case.. Mr. Lawrence stated that, "We don't need that for safety, however, they have to set that general rule for the game, and this is a good start. As we say, it's 1.0 in Jan/Feb timeframe and we will continue to modify and build from there." Mr. Lawrence also noted that they were automating certification and building everything from an IT standpoint from the ground up. They have been looking at a system to be fully integrated from day one and across the different functions in the FAA. Beyond Visual Line of Sight (BVLOS) operations also include, extended Visual Line of Sight (EVLOS). The agricultural commercial operations are over 55 lbs. and is growing rapidly. They are getting away from manned operations, but they see the way the industry is going and are adjusting towards that.

Slide 6 provided the FAA UAS Research Plan Status. Mr. Lawrence noted the following points:

- The UAS Integration Research Plan is undergoing final executive review and

coordination within the FAA.

- The Research Plan will be available for review when internal deliberations are concluded.
- This plan aligns with the Administrator's Strategic Priorities, the FAA's UAS integration priorities, and reflects a unified vision of the FAA's position.

Dr. Hansman noted that the last time the REDAC met, they were expecting to get the UAS plan. He asked, "So, why haven't we got it and when will be getting it?" Dr. Hansman noted that the REDAC needed the plan so they can advise on the research.

Mr. Lawrence said that they are not hiding it, but it was still in executive review. He wanted his boss to see it first, and that some of what will be presented by Sabrina Saunders-Hodge will address that in her presentation next.. Ms. Yak noted that she and Ms. Saunders-Hodge have been in discussion regarding the research plan. Dr. Hansman remarked that the process for the plan should also be made public.

Slide 7 highlighted the 'FAA UAS Standards Development Efforts'. Mr. Lawrence reviewed the organization chart of everyone who worked on managing this effort. He noted that it was the one-year anniversary of this office (as of 10/11/2017), and they have been working very hard. He remarked that everyone knew Sabrina (Saunders-Hodge), and it was great to get her over from ANG. Mr. Lawrence also noted that the standards division just had their kick-off last month (September 2017). On the international side, Tricia Stacey is leading that, there has been a lot of work with Israel and other partners.

Slide 8 went over 'Stakeholder Collaboration'. Mr. Lawrence asked "How do we accelerate our research efforts, what are some better efforts we can use?" and followed up with, "How do we do a better job with the playing field?" Some test sites go over fire rescue. "What can we do to set those goals and with our limited resources?", Mr. Lawrence added.

Mr. Lawrence concluded by saying that he appreciated the opportunity to present and meet with everyone.

Mr. Redhead asked a question about privacy concerns and rule making. Mr. Lawrence replied that they put forth a rule making effort and it went all the way to the White House, however, they stopped it due to security concerns. This year they worked on ID tracking. Mr. Redhead raised a concern that there was no mention of noise pollution and noise impacts. Hopefully, the impact of noise will be addressed, as this was a big concern in the Midwest. Mr. Lawrence replied that all of the regulations with noise also applied to UAS. The noise regulations were designed for larger aircrafts. He pointed out an example of the delivery companies who are tuning their propellers to address decibel levels in response to reducing noise impacts.

Sabrina Saunders-Hodge: FAA UAS Integration Plan

Discussion

Ms. Saunders-Hodge, *Director, UAS Integration Office Research Division*, began her presentation by reviewing Slide #2 Section 2211: Unmanned Aircraft Systems Research and Development Roadmap, the statute that goes over the 2016 Reauthorization Requirement. She stated that this will give some background, and led to the development of the office and Earl Lawrence setting up the staff.

Slide #3 went over the 'FAA UAS Integration Research Plan'. Ms. Saunders-Hodge noted that it took a little while for stakeholders to get on board and to see themselves as part of the research process. They have structured the plan to the cadence concerning the rule making that Mr. Lawrence presented to the Committee.. The slide included the major sections of the plan:

- Alignment to FAA's Strategic Priorities
- FAA's Applied Research Approach
- UAS Integration Landscape
- UAS Research Collaboration and Partnerships
- UAS Research Functional Areas
- UAS Research Domains
- Operational Capabilities Towards Full UAS Integration

Slide 4 reviewed a graphic of detailing the Alignment to FAA's Strategic Priorities. Ms. Saunders-Hodge noted that new entrants were one of those key priorities, so UAS being the sister to Commercial Space, and the office was aligned to the integration plan. In addition, the key to this group is the alignment to the NARP. She noted that she and Ms. Shelley Yak have spoken quite a bit about how to align their research to the NARP.

Slide 5 was titled, 'National Aviation Research Plan: Alignment Research Planning Framework and Terminology' which went over the NARP and alignment of the research planning framework and terminology. Ms. Saunders-Hodge commented that this slide was just a deeper dive, and that it used some different terms.

Slide 6 went over the 'FAA's Research Approach'. Ms. Saunders-Hodge noted that the FAA had always been aligned with applied research and had been in that realm.

Slide 7 reviewed the 'FAA's Applied Research Methods' and Ms. Saunders-Hodge went over the various aspects of applied research that included empirical analysis, fast time modeling, forecasting, modeling and simulation, logical models, concept validation, flight testing, test and evaluation, and human in the loop.

Slide 8 was a detailed graphic on the UAS Integration Landscape. Ms. Saunders-Hodge noted that she used this slide from NASA.

Slide 9 outlined the 'UAS Research Collaboration and Partnerships'. Ms. Saunders-Hodge read off the various partners on the slide, which included UAS ExCom, NASA, ASSURE, MITRE, and various entities within the FAA. The research tiger team goes over the highest-level priorities, and she went over the priorities. "So we work with our partners. We have open days where we ask industry and researchers for feedback.", stated Ms. Saunders-Hodge. She also noted that they work with NASA all the time and she went over the various partnerships with NASA. There has been a UAS Center of Excellence (COE) since May 2015.

Dr. Hansman asked how their research was prioritized and of the COE. Ms. Saunders-Hodge replied that they have been marching to the implementation plan and that they prioritize based on the research plan. Dr. Hansman asked, "Can we see the plan?" to which Ms. Saunders-Hodge replied, "Probably not." Dr. Hansman followed up his question with noting that the REDAC was tasked with asking for these details. He also asked if the COE was tasked with research. Ms. Saunders-Hodge answered that yes, the COE had about ten research areas to focus on and they each submit a proposal for her office to decide on. This was a detailed proposal and they assign Principal Investigators (PIs) to it and submit a plan for how to carry out the research.
They have had some research conducted in maintenance and repair, some ground collision, etc.

Mr. Lawrence stated that this was quickly evolving, the industry is changing, and what they were tasked with in 2016 has already changed. They went with the best direction they had at the time.

Dr. Hansman noted that people have been coming to him addressing concerns about the COE and not knowing how the research priorities were and how the plans were being determined. Mr. Lawrence noted that Dr. Hansman's comments have been incorporated and a response will be provided.

Ms. Saunders-Hodge noted that they leverage what was out there as a full-time job. They now have seven UAS test sites; they create test flights from ATM, and make sure that they can glean further research from it. She also noted that they have MITRE conducting work, the MIT Lincoln Lab, the Tech Center, and CAMI who all conduct research.

Slide 10 went over "UAS Research Functional Areas". Ms. Saunders-Hodge reviewed the plan as it showed the various functional areas. These areas included policy, standards, security, air traffic management, aerospace, capabilities and systems, aircraft certification, procedures, environment and training. The framework is underscored by UAS regulations and UAS Integration Research.

Slide 11 went over the "UAS Research Domains". Ms. Saunders-Hodge read off some of the domains, such as detect and avoid, command and control, and human factors, among others. The UAS research domains represented key challenge areas for the safe and effective integration of UAS operations in the NAS. Within each domain, there are research initiatives that address these challenges to help solve the technology issues to support UAS integration.

Slide 12 went over the "Operational Capabilities towards Full UAS Integration" Ms. Saunders-Hodge noted that in the timeline, they highlighted research that was in progress, planned, and needed.

Slide 13 went over the "UAS Research Timelines - Overview". Ms. Saunders-Hodge described how the timelines were broken out by operational capability. The research included activities captured from research planning documentation. This included Lines of Business (LOB) discussions, Roundtable Meetings, and Partnerships. Each research activity is mapped to functional areas and research domains. Ms. Saunders-Hodge noted that the research was classified as completed, in progress, planned, or needed.

Slide 14 went over the "Expanded Operations Research Summary"**.** Ms. Saunders-Hodge noted that the slide as boxes going over 'Summary of Ongoing Research Areas for Expanded Operations' and 'Summary of Identified Needs for Expanded Operations'. The slide went over research needs and gaps in order to meet expanded operations and goals.

Slides 15 and 16 went over "Expanded Operations". Ms. Saunders-Hodge commented that they have expanded on the functional operations and areas.

Dr. Hansman asked what the expanded operations were. He noted that the slide is still unclear on what expanded operations are. Ms. Saunders-Hodge said they are working with the roundtable, and there is a plan that is over 200 pages that explains this in more detail. Each Line of Business (LOB) knows their capabilities and bring that to the roundtable. She noted they have worked tirelessly to tease out what to bring forward and how to meet demand in their domains. That is how the initial list came up.

Chris Oswald asked, "You're getting input from so many industry bodies, and what emerges out of the NPRMs, academies work, I think there's a process problem. Who has a voice on the industry?" Dr. Hansman commented affirmatively to Mr. Oswald's comment. Ms. Saunders-Hodge noted that when ASSURE came on the scene, they had about 50 proposals they presented and they had to sift and filter through.

Mr. Oswald remarked that he was not sure how to come up with the appropriate working lanes in these areas. When everything is moving, he looks to is there anything to do to streamline some of this, or is too big of a challenge. The community with UAS is bigger than something we're used to and we're learning to adjust to. How do we channel this input and as rules come out, and we put more structure to it, it gets easier. The more we can get out there and put structure in place it gets easier. Dr. Hansman noted that the session was over time, so they would come back to it.

Slide 17 was the "Conclusion". Ms. Saunders-Hodge noted that once they had things ready to print, it already needed to be updated. She noted that they looked forward to input from everyone; this was a dynamic process. The FAA will continuously re-evaluate its UAS research program to determine the required level of effort and account for unanticipated changes.

Questions and Comments

Mr. Hylander noted that they received a good briefing from Sabrina in the Aircraft Safety (SAS) subcommittee meeting. He stated, "We do feel that progress has been good. I don't think we left the SAS meeting with the same sense as the COE. We just wanted to make sure that the COE was working with the research priorities and not just being a grant-oriented body." Ms. Saunders-Hodge replied that the COE knew coming in that it had to perform on time and within budget and that, there was now a contract element. Mr. Lawrence noted, that they started the COE with a press conference and wanted to emphasize that UAS represented a new phase in aviation in general.

Mr. Hylander stated the second finding had to do with ground collision and the recommendation that there is a tight engagement between the FAA communities, He asked, "What do you do with research once it's been done? What are the next steps?" Ms. Saunders-Hodge replied that this was a great question and point. She outlined how the correlation happens within their research plan. Mr. Hylander noted that the plan identified gaps, which were acceptable, and one of their concerns was whether there were resources to address those gaps, to have a Plan B that addressed minimal standards.

Dr. Hansman noted that the meeting would take a 10-minute break and come back at 11:15am

---

Presentation FAA Cybersecurity R&D Plan **Presenter** *John Lapointe, Chuck Agava*

Discussion:

John Lapointe, *Portfolio Manager, Aviation Research Division, FAA*, opened the session with introducing himself and his colleague Chuck Agava, *Aerospace Engineer, FAA*. He noted that he will go over the first ten slides in their presentation and then Chuck will take over from there to complete the rest of the slides. They began with general overview of the objective to provide an update on the FAA Cybersecurity R&D Plan.

Mr. Lapointe briefly went over the FAA Extension, Safety, and Security Act of 2016 Section 2111. The Act goes over the following areas:

- Comprehensive and Strategic Aviation Framework
- Update on Cybersecurity Implementation Progress
- Cybersecurity Threat Model
- National Institute of Standards and Technology Information Security Standards

Slide 5 was titled, 'Timeline': The timeline begins with July 15, 2016 and ends at July 15^{th,} 2017 which denoted the time period of when PL 114-90 was signed to the deadline of the plan being established. Mr. Lapointe noted that there was an initial draft out around the early weeks of April 2017. Most of the comments they received were editorial. The plan came back in early July 2017 and Mr. Lapointe and his team immediately performed edits and released it on July 14, 2017. Mr. Lapointe went through the rest of the slide and highlighted some of the dates and key events that occurred.

Slide 6 went over the FAA Cybersecurity R&D Plan – Version 1.0 Development. Mr. Lapointe pointed out the process development, which went over assessment, discovery, comments/concurrence and output.

Dr. Hansman asked Mr. Lapointe about who were the cybersecurity R&D experts that were consulted. Mr. Lapointe replied that Isidore Venetos, *Supervisory Electronics Engineer*, and another colleague has been involved. He said they immediately got them on board and involved. Ms. Yak mentioned there was also involvement from the Tech Center. Mr. Lapointe went on to mention additional partners that they have briefed. Dr. Hansman expressed surprise that Department of Defense (DoD), Northrop Grumman, etc. weren't briefed or contacted.

Slide 7 went over the Alignment to the CSC Strategic Plan: 2017-2022. Mr. Lapointe stated that his team briefed them back in June. He stated, "They tried to align our plans to the FAA goals that were in the Cybersecurity Committee (CSC), most of our goals are aligned to those with risk management, resiliency, human factors, and the fourth one is really trying to get more partnerships with outside agencies."

Slide 8 went over the Cybersecurity R&D Plan - Partnerships. Mr. Lapointe noted that they collaborated with other government agencies. The slide categorized partners by those entities within the FAA (NextGen, Air Traffic Organization, etc.), Industry and Academia, International and other Government Agencies, such as Department of Transportation, Department of Homeland Security, etc. Mr. Lapointe noted that the upper right section of the slide lists the FAA organizations that Cybersecurity worked with.

Slide 9 went over the Cybersecurity R&D Plan Definitions. Mr. Lapointe stated they wanted to make sure they were consistent with the language and the goals. The slide identified a list of 'FAA Goals', 'FAA Domains', and 'Research Areas'. Dr. Hansman commented that it was strange that the FAA did not have aviation safety as a goal. Mr. Hylander remarked that the SAS Subcommittee shared the same concern as well. Mr. Lapointe noted that he would brief the CSC on including Aviation Safety as an FAA goal. Mr. Lapointe noted that the 3rd column (Research Areas) had to do with putting the research areas in buckets. The 4th research area, which is the system wide safety assurance, had to do with developing real time, continuous, safety analysis and assurance tools and capabilities to prevent/mitigate the impact of cyber-attacks. Per Dr. Hansman, Threat and Vulnerability Assessment should be a number one goal/top priority.

Slide 10: reviewed the Cybersecurity R&D Plan Framework. Mr. Lapointe noted that the section with white lettering is the FAA Cybersecurity Goals, the ones that are in red, implied that they saw funding in FY 2017, and the other section was work that had been performed. He clarified that R&D did not perform this work; however, Radio Technical Commission for Aeronautics (RTCA) performed the work. Cytec Engineered Materials also completed some work for a service fee. Dr. Hansman commented that under cybersecurity risk (on the slide), it showed no work had been done. "But to my understanding from the SAS subcommittee meeting, there was some firewalling, and asked if those firewalls had been broken down." Dr. Hansman added.

Slide 11 went over the Cybersecurity R&D Plan Research Requirements – Research Area: Security and Resiliency. Chuck Agava discussed the various phases of research on this slide (system threat analysis, safety risk factor identification, and safety risk management). Mr. Agava noted that they have worked on developing standards for control and command. Phase 1 had been completed and Phase 3 would be introduced soon. The slide noted the funding profile with budget numbers from FY18-FY22. Mr. Lapointe said the only number he would put any confidence behind was the FY 18 one. For FY19 there was some uncertainty about the budget. There was some duplication of work and they would need to sit down with the sponsors and performers and reassess the numbers.

Slide 12 went over the Cybersecurity R&D Plan – Research Area – Data Analytics. Mr. Agava stated that the requirement provided a holistic view of the data analytics. He noted that data analytics developed analytical capabilities for aggregating and correlating current data with the intent of understanding, predicting, and responding to cyber-attacks. Dr. Hansman said, " So I'm surprised that this is the first area of priority. I think that, you know, given the vulnerability to the overall system." Mr. Agava replied that the focus was to identify the Internet Protocol (IP) data link between the ground station and the pilot. Dr. Hansman followed up expressing that vulnerabilities may currently exist, and asked what the FAA was doing about if there was a threat in the NAS today. Mr. Lapointe replied that the one that has been funded for now was NextGen Information Security. He further added that, however, it was the responsibility of the CSC to prioritize these areas.

Mr. Agava stated that there needed to be lab-to-lab communication as most of the time, the different labs do not communicate with each other. They were hoping that through this requirement, the labs would interface (MITRE, Lincoln labs), so that there will be a global standard.

Dr. Hansman asked why they did not use the standards the better-established organizations used. He noted that it was an area where the wheel may not need to be reinvented. Mr. Agava replied that some of the agencies like DoD and others had different standards, therefore, they were looking to create a unified one. To which Dr. Hansman suggested, "But why not just take on your favorite and go with that?"

Slide 13 went over the Cybersecurity R&D Plan –Research Area – Human Behavior/Human Factors: Mr. Agava noted that if looking at the first example they talked about, it was critical that a pilot was aware of when a cybersecurity attack happens. The slide addressed the situational awareness visualization research. Dr. Hansman asked for more details on this and Mr. Lapointe responded that the issue was if a pilot would know if a cybersecurity attack happened. Mr. Agava added details about insider threats, and situational awareness as well.

Slide 14 went over Cybersecurity R&D Plan –Research Area – System Wide Safety Assurance. Mr. Agava stated that system wide safety assurance was to develop real time, continuous, safety analysis and assurance tools and capabilities to prevent/mitigate the impact of cyber-attacks. Dr. Hansman asked if they have talked to MITRE and suggested that they really should, since MITRE had been working these issues for the past 10 years. Mr. Agava replied that they spoke

about another requirement that would validate those standards. He said, "And also when you think about NextGen to replace legacy systems, the future of cybersecurity will be to expand on those partnership sand building additional capabilities." Ms. Yak noted that the cybersecurity testing facilities were also validating those systems.

Slide 15 went over Research Needs: UAS Cybersecurity. Mr. Lapointe stated that in their dialogue with Sabrina Saunders-Hodge and Nick Lento, they both agreed that the two plans have to be coordinated (UAS and Cybersecurity). are four UAS-cybersecurity requirements that address a research gap. The initial draft version of requirements was pending additional review and acceptance. The cost estimates need to be vetted.

Slide 16: went over some of the FY17 accomplishments. Mr. Agava noted that these included Aircraft Safety Information Security Protection (ASISP), NextGen Information Security, and CyTF Virtualization. The next phase of research will be the NextGen Information Security; they are doing a lot of work in the area of big data. Mr. Agava noted that with the CyTF Virtualization – this is going to be a big area for them moving forward.

Slide 17 went over Cybersecurity R&D Pan-Funding Summary. Mr. Lapointe reviewed the chart detailing funding for the program from FY18 through FY22. He noted that he did not want to spend a lot of time on this one. He noted that he wanted to spend a couple of minutes talking about some comments they had received. He noted that there was uncertainty with the funding levels from FY2019 and beyond.

Slide 18 was a Summary of REDAC Comments – Example. Mr. Lapointe noted that they received about 95-100 requirements that were categorized and adjudicated. They received comments in the areas of ASISP, Cabin Communications Cybersecurity Risks, Commercial Space, System Design – Human Factors, NextGen Information Security – Artificial Intelligence (AI) and Machine Learning, and the Cybersecurity Test Facility.

Slide 19 went over the Adjudication of REDAC Comments in more detail. Mr. Lapointe stated that he and Chuck had an opportunity to look at every single comment and adjudicate them. Mr. Dermody asked if there was anything on airports and cybersecurity. Mr. Lapointe replied that the airports side did not have any comments.

Slide 20 concluded with Next Steps. Mr. Lapointe briefly highlighted that the next planned steps included:

- Continue discussions internally and externally on collaborative efforts;
- Update the Cybersecurity R&D Plan;
- Develop a framework for continually monitoring and providing updates on ongoing research; and
- Ensure consistency with the FAA LOBs work plans pertinent to cybersecurity.

Questions and Comments

The questions that occurred during the presentation are embedded in the aforementioned text.

Presentation Subcommittee Report: Airports **Presenter** *Chris Oswald*

Discussion:

Mr. Oswald, *Chair, Subcommittee on Airports, ACI*, began the presentation on Slide 2 with an introduction and noted his intention for a brief presentation. He reviewed some of the activities since the Spring 2017 REDAC meeting, namely, that they met from August 14-15th, 2017 and reviewed the FAA's Cybersecurity R&D Plan.

Slide 3 went over the "Airport Technology Research Program at a Glance". Mr. Oswald reviewed a list of topics they were dealing with topics that were categorized under Safety and Planning RPAs, Pavement RPAs, Airport Noise and Environmental RPAs, and New/Enhanced Facilities. He noted that the research program areas affect what goes on at the airport.

Slide 4: "Airport Technology Research Program Review – Overview" –focused on relatively shorter fused advisory circulars (ACs) and design guidance. Mr. Oswald noted that airport infrastructure enhancements were currently eligible or prospectively eligible for federal grant funding under the Airport Improvement Program (AIP).

Slide 5 went over "Recurring Themes". Mr. Oswald noted there were growing areas for need of collaboration. There has been collaboration with Environment & Energy (E&E). There is a need to work more closely with NAS Ops, especially with drones. Surface management was another area of collaboration where there was interest. Mr. Oswald also pointed out that they work closely with John Dermody, *DFO,* and Michel Hovan, *DFO,* on airport research issues.

With side 7, Mr. Oswald began reviewing the subcommittee findings and recommendations.

The first addressed Runway Braking Fiction. This was an area that was discussed a lot over the years. Mr. Oswald cited the example of a project on the effect of snow on the runway. However, snow was minimal at the Atlantic City Airport (ACY) , which presented a challenge in the research There are needs out there and a lot of research within both the FAA and externally, (Airbus and 3rd party vendors). He stated that they were pleased with the redirection of the expert groups. They wanted to see that expert? group address some of the research in the spring or by next week's meeting. The subcommittee would like to recommend that the runway braking working group report back its recommendations at the meeting and possibly to the full REDAC meeting next Spring.

The second finding addressed Heated Pavements. Mr. Oswald noted that the subcommittee was pleased to learn that research and use of heated pavements might be possible at lower costs than originally thought. Discussion also included that since fundability of the research was more likely, it was mentioned that consideration should be given on potential safety and operational issues associated with heating pavements electrically. There was some concern about magnetic materials in the pavement and how that would affect avionics.

The third finding was on Light Emitting Diode (LED) Lighting Research. Mr. Oswald pointed out there was a lot of crossover with human factors. There is a rule that lighting can only be 15 degrees out from an airplane. Dr. Hansman asked for clarity on the standard of lighting used for the LEDs. Mike O'Donnell cited an example in response about the lighting and globe lighting at the runway. The Airports subcommittee recommended that the FAA expand evaluation of LED runway edge lights to include airfield conspicuity considerations.

The fourth finding addressed Improving Awareness of other REDAC Research Programs and Opportunities for Cross-Program Collaboration. Mr. Oswald reviewed that this was based in part on the discussion of research projects that involved other REDAC subcommittees – including noise research that involved the Environment & Energy (E&E) subcommittee, runway braking and runway incursion mitigation research that involved the Human Factors (HF) and Aircraft Safety (SAS) Subcommittees and air traffic automation research that involved the NAS operations. Mr. Oswald noted that they were working with NASA, and certainly would extend an invitation for any subcommittee that would like to meet with Airports in Atlantic City.

The concluding slide addressed the FAA Cybersecurity R&D Plan. Mr. Oswald noted that a few things that they believed were missing had to do with top line safety and shutting down facilities if there was an attack, additional linkages between DHS and others systems. They generally agree with the plan and its focal areas. Mr. Oswald concluded the next subcommittee meeting was scheduled for March 2018.

Questions and Comments:

Michel Hovan introduced himself and said that they agree with all of the recommendations. The one about LED lighting is a new one. The comment about standards was helpful; the rules had to do with incandescent lights. The recommendation about collaboration with the other subcommittees was one that was agreed on.

Presentation Subcommittee Report: Aircraft Safety **Presenter** *Ken Hylander*

Discussion:

Ken Hylander, *Chairman, Flight Safety Foundation*, opened his presentation for the Aircraft Safety (SAS) subcommittee meeting and noted that the subcommittee met in September 2017 in Atlantic City, New Jersey.

The 2nd slide went over the Fall 2017 SAS Meeting Objectives. Mr. Hylander stated that they looked at previous projects and areas, with a focus on the cybersecurity R&D plan. Dr. Hansman noted that was a suggestion to put in their agenda. There are 30-40 airlines that are looking into cybersecurity. To which Mr. Hylander replied, "Yes, hold that thought, by the end of the presentation, it should come full circle."

The 3rd slide went over the SAS Approach. Mr. Hylander stated that the next meeting was in March. He noted they do deep dives in various areas. Other details from the SAS approach included:

- Their approach to continue to build upon the work of prior SAS meetings;
- Meet the advisory needs of the AVS Management Team;
- Continue to improve the research review process.

Slide 4 went over the Agenda Development Guide. Mr. Hylander noted several areas that contributed to the development of the agenda per SAS, REDAC and AVS request as well as emerging issues. These areas included Deep Dive into Cybersecurity, UAS Research Update, General Aviation Safety focus, improving the understanding of the research portfolio big picture, 2017-research portfolio accomplishments review and comments, support AVS requirements, and continue education on Tech Center and Industry capabilities

Slide 5 went over Findings and Recommendations on Fatigue Management. Mr. Hylander noted that they held their meeting at CAMI and had a deep dive. They learned about genomes and biomarkers. Mr. Hylander remarked, "Generally, what we are saying is that the FAA is making good progress in this area, but there are two things that we are concerned with. There are new rules regarding fatigue management but doesn't seem to have a lot of data collected, or if it's being sent, we aren't sure how much work is being done with that research." He said that they did have some concerns about the data collection both electronically and on paper. There is a fatigue management-working group, and the FAA has some concerns with how the research is being studied. Fatigue as a root cause of events is very hard to determine because the data does not lead in that direction. Dr. Hansman observed that it seemed that if there was a rule change, it was effective, and there were precursors, it would show correlation, not necessarily causation, but data could point to outcomes. Mr. Hylander confirmed that was the perspective of the SAS as well. Ms. Yak asked if the fatigue working group already been formed or was it a recommendation? Mr. Hylander answered, "No, it hasn't been formed yet. This is our recommendation – to support the FAA in forming one."

Slide 6 went over Findings and Recommendations on UAS Update. Mr. Hylander provided a brief summary, which included:

- Briefed on status of Integration Research Plan although they have not seen the plan in detail yet;
- Briefed on ASSURE Center of Excellence (COE) and non-COE research activities;
- Understand the plan is beginning to identify gaps in required research and funding;
- Committee sense is progress is being made and looks forward to a more detail review of the plan in the future.

Mr. Hylander noted that lot of these issues were addressed in the UAS presentation this morning.

Slide 7 went over additional Findings and Recommendations on UAS. Mr. Hylander noted that their first discussion was related to the funding and research that goes towards the COE. It is important to the SAS that their research is high level enough and addresses research priorities. There were some concern about disconnects.

Slide 8 was on second finding and recommendation for UAS. Mr. Hylander noted that they discussed UAS Ground Collision Severity Evaluation research and to ensure that there was maximum transfer of information. Most of the recommendations about UAS were programmatic in nature. One of the recommendations was to develop tighter engagement of research performers and the FAA organizations that leverage research results in safety and rulemaking activities.

Slide 9: Finding 3
Mr. Hylander said that this was the important finding. As time goes on, there will be some gaps with funding and it was important that the FAA work on identifying the minimum acceptable, prioritized, research level to achieve each integration step and revise the plan accordingly.

Slide 10 went over the fourth Finding and Recommendation, which addressed UAS. The finding noted the integration plan is identifying a significant amount of research. Funding to achieve research in the required timeline is uncertain. Mr. Hylander noted that they recommend the FAA and stakeholders work together to identify the minimum acceptable research level that will allow UAS integration

Slide 11 addressed the Cybersecurity R&D Plan High level comments – Mr. Hylander referenced the list of comments on the slide and remarked that he did not think it was necessary to go into this one. He stated that John Lapointe discussed this in his presentation earlier today. They received over 100 comments because there were two people; one from MITRE.

Slide 12 addressed General Comments. Mr. Hylander stated that about half of the comments had to do certification, "You've heard me talking about additive manufacturing, propulsion fuel research, etc." He noted they had a briefing about the FAA 2030 and Pegasus, and had a concern that those findings from the briefings will make their way. On the topic of technology status briefings, they have had discussions (five of them) with Pratt & Whitney, Honeywell, etc.).

Questions and Comments:

Dr. Hansman requested that Mr. Hylander (and SAS) to add the electrical question on the list. He noted that they were, "going to get serious applicants in the next year or year and half." Dr. Hansman asked what the dispatch requirements on aircraft operations were as there were significant certification issues.

Ms. Yak commented that she would not mind looking at emerging and surface issues.

Dr. Hansman noted that last time they took a request to look at emerging issue was from Mr. Hylander's predecessor. Mr. Hylander replied, "I actually think we are better positioned to do that now, last time it came as a bit of a shock, but now our customer, AVS, is asking us to advise on what we need to be doing research on."

Ms. Yak commented that it brought her to the next point. She asked, "In looking at your second bullet – what does the safety side look like? Is it GA, is it not? The FAA isn't totally ready yet but we need to start getting our mind around it." Mr. Hylander replied with an example from additive manufacturing.

Presentation Subcommittee Report: Human Factors **Presenter** *Barbara Holder*

Discussion:

Ms.. Holder, *Committee Chair, Honeywell,* began her presentation by stating that she was new to REDAC and will be providing an overview of the Human Factors subcommittee meeting.

Slide 1 Findings and Recommendations - Observations. Ms. Holder mentioned that the recent subcommittee meeting was the first that she chaired and that she learned a lot about how to carry them out. They looked at the 2017 projects with a focus on cybersecurity and emerging issues. At their next meeting, they plan to look at emerging issues. Ms. Holder stated that she would appreciate any guidance on that. Ms. Holder went over the section titled 'Observation'. After reviewing the 2017 portfolio projects, tasks and their status and outcomes, the subcommittee supported the ongoing flight deck research being conducted and scheduled. However, the subcommittee identified several important gaps in the planned Human Factors research, which the subcommittee deemed high priority areas of research that should be reprioritized for FY18 and funded in subsequent years.

Slide 2: Information Management - Finding and Recommendation 1: - Ms. Holder stated that the concern is that the human will need to respond to more information and this created vulnerabilities with how to mitigate and address this. The subcommittee recommended that the FAA should review its Human Factors portfolio for 2018; 2019 to include information management as a research focus areas and ask planned projects as appropriate to address information management issues in their current project tasking. The 2020 research portfolio should include information management as a specific research focus well above the "Mendoza line."

Dr. Hansman asked, "So are you talking about sterile cockpit rules, or limiting information in general? How much information can be in the display?"

Ms. Holder replied that they were addressing information overload, and added, "I think the committee isn't as specific or as narrow." Mr. O'Donnell replied that he could be more specific. They looked at distractions in the cockpit, and in the tower.

Dr. Hansman asked what the distraction thresholds were, and how to make this into actual research projects. Ms. Holder replied that they have identified that there was a gap, and they can go back and narrow it down to a more specific recommendation. Dr. Hansman replied that he thought that they should focus it more on information flow and management.

Ms. Yak suggested to make it a recommendation that information management to be part of research plans. Leo Prusak, *NAS Ops Subcommittee Chair*, *PASSUR*, noted that it was part of the previous findings and was removed.

Slide 4 addressed Pilot Training – Finding and Recommendation. The finding recognized a major gap in the Human Factors portfolio was related to Pilot Training for NextGen that included human factors issues not being investigated nor were they currently planned. This was in reference to new training methodologies and there were concerns from some of the alpha members In how they can assess the training. With the changing demographic of pilots, they wanted to look and see if current training was a mismatch for learning styles.

Mr. O'Donnell commented that he was also a professor and there was a difference with distance learning – the older students hated it and the younger ones loved it, the students in the middle are just trying to figure out if whether or not, it was effective.
Mr. Prusak added that for the training requirement, it was below the Mendoza line for FY 17.
Dr. Hansman stated that, as a rule, "We say what we think is a priority area and hopefully that gets taken back to the FAA."

Slide 5 addressed the third finding and recommendation: Research to Reality. Ms. Holder stated that they need to see the impact of the research on the reality of what we do and if the learning that occurs from the research. They see good results from data communications for example, but they do not see it across all of the research outputs. Ms. Holder reiterated that they needed to come up with some methods to look at lessons learned and effectiveness.

Dr. Hansman asked, "Can you define what you mean by a vehicle?" Ms. Holder replied that it was not a vehicle necessarily but a method that will research effectiveness. Dr. Hansman commented that this has been an ongoing issue with the FAA.

Ms. Yak added, "This has been a problem, well more of a challenge, with how to look at the research that the FAA does, how do those projects get utilized in industry, or in general." Dr. Hansman responded by saying the issue is that there is a delay between identifying research needs and then getting funding and carrying out the work, and by then it might fall behind. The other option was to do the research for 10 years, and discuss it, even though it may be forgotten and possibly outdated.

Slide 7 went over the Finding and Recommendation for UAS in the NAS. Ms. Holder noted that at the last Human Factors subcommittee meeting, there were several presentations related to the FAA research plans for including UAS in the NAS. There was the human factors aspect of latency and what the acceptable amount of lag time for communication between various operations was.

Questions and Discussion:

Dr. Hansman noted that latency was an issue, as is shared situational awareness, latency is an area that is easy to point to but not necessarily the issue itself. Ms. Holder remarked that this was raised in the context of the briefing.

Presentation Subcommittee Report: NAS Operations **Presenter** *Leo Prusak*

Discussion:

Mr. Prusak, *NAS Ops Subcommittee Chair, PASSUR*, noted that this was the first time he chaired the subcommittee meeting.

The first Finding and Recommendation was on Human Factors. Mr. Prusak noted that there was no slide for this one. He discussed human in the loop and that there were segmented studies and not comprehensive so it didn't really provide a lot of insight into the aggregate problem. The recommendation is that they lay these human factors studies flat and look at them together

The first Finding and Recommendation addresses Commercial Space. Mr. Prusak noted that they thought that the implementation plans were based on the FAA. The subcommittee believed the implementation dates needed to come sooner in order to address the significant growth in commercial space operations anticipated by the subcommittee. There were many R&D projects across the 4 pillars. Concerns were addressed where, with the available budget, there may not be enough funding to achieve meaningful results. They felt that there was adequate research on NASA and others for the past 50 yrs. Dr. Hansman asked for clarification on what the four pillars were, since they were not noted in the presentation. Ms. Yak also asked why some research was being stopped.

Dr. Hansman asked about the launcher pad site. Mr. Prusak replied that they thought that the compression would come eventually, especially with the work in UAS. . Land has been purchased already for use to make commercial space launch pads.

The second finding and recommendation addressed the Pathfinder Programs. The general observation noted that the subcommittee received briefings on the FAA's three Pathfinder Programs, namely CNN's Visual Line of Sight operations over people, PrecisionHawk's Extended Visual Line of Sight operations, and BNSF's Beyond Visual Line of Sight operations. Mr. Prusak noted that they thought the recommendations were good and valid. They are focusing specifically on CNN's Visual Line of Sight operations over people. Mr. Prusak further noted that Pathfinder risked falling behind and needed to be integrated into the UAS R&D Plan. Dr. Hansman asked about the Pathfinders, if they were required to document their hours of operations, successes, challenges, etc. Mr. O'Donnell replied that there was one instance that he can recall.

Questions and Discussion:

Francisco Bermudez, *DFO for NAS Ops Subcommittee*, noted that Volpe is conducting related research. Mr. O'Donnell asked, "What do we do with the information?" Dr. Hansman replied, "We have no idea…we are moving away from a risk-based system…we can't tell how many people have flown in the last year. The reasons we do Aviation Safety Information Analysis and Sharing (ASIAS), and where to focus the efforts."

Mr. Prusak remarked, "I can tell you, we had an incident over Brooklyn. We were over a DG 500, but you had to be incredibly close to identify another UAS." To which Dr. Hansman replied, "We ought to be getting data from these Pathfinder activities."

Another attendee asked, "Have you talked about high altitude endurance? Like with Google and Facebook? Some kind of paradigm for operations?" Dr. Hansman remarked, "We have a military presence" and asked "Do we need to have a mid-level standard?"

Mr. Prusak stated, "The good thing is that there are very few encounters at 65K feet. In addition to the eventual re-entry, how are you going to get them in? Ingress and egress into the airspace?"

Presentation Subcommittee Report: Environment and Energy **Presenter** *Ian Redhead*

Ian Redhead introduced himself, and noted that he was the current chair of the E&E subcommittee.

Mr. Redhead noted that they discussed turboelectric and hydroelectric certification; however, the FAA does not currently have it.

Finding 1: Members of the E&E subcommittee are very aware of the budgetary constraints that exist within the Department of Transportation and the FAA. The Continuous Lower Energy, Emissions, and Noise (CLEEN) program, the Commercial Aviation Alternative Fuels Initiative (CAAFI) and the Aviation Sustainability Control (ASCENT) program are successful industry/FAA cost-share programs that leverage scarce FAA R&D funds that have accomplished significant advances and improvements for the industry.

Mr. Redhead noted that the E&E subcommittee were very mindful of the budgetary constraints. Their recommendation was that the FAA continues to prioritize robust funding for the Public Private Partnership programs like CLEEN, CAAFI, and ASCENT.

Dr. Hansman noted, "We cannot advocate for more funding for our specific subcommittee, because it can undercut the REDAC, but rather to make recommendations, that xxx work is important and should be high priority." Mr. Redhead concurred.

Finding 2. Mr. Redhead noted that concerns were raised over the twelve vacancies currently in the in the Office of Environment and Energy (AEE), and the increasing requests for answers..

The subcommittee. In order for the dedicated employees within AEE to be able to manage the current portfolio properly, which is believed to be well balanced and maintain the FAA's global leadership position in the International Civil Aviation Organization (ICAO), address the growth of other areas of commercial transportation and the development of smart policy, there is a need for answers. The answers to the many questions require the ongoing need for research.

Dr. Hansman said, "I think it's perfectly acceptable to state that there are 12 vacancies and that this makes it difficult to fulfill the research needs, there is a shortfall, and we recommend that the FAA address the shortfall. Everyone always says "fund my area", but it's better to point out the problems that this raises."

For Finding 3, Mr. Redhead noted that there had been an increased interest in supersonic aircraft under this administration. The finding also noted that there was potential growth in unmanned aerial systems and commercial space vehicles.

Mr. Redhead stated that the subcommittee recommended the FAA to advance understanding on the environmental impacts supersonic aircraft, UAS, and commercial space vehicles given the interest.

Finding 4 addressed non-volatile particulate matter (PM) emissions standards. Mr. Redhead noted that about 13 years ago, there was a study done in Seattle where they tried to extend the runway and there were concerns about particulate matter (PM). This finding came forth from that issue. It is unknown how much research performed nationally, plays out in the international arena. This has also led to an ICAO rule. The research being done is significant and the standing that the FAA has in the international arena is important.

Mr. Redhead reviewed the recommendation, which read: The subcommittee highly recommended that the FAA continue their commitment for all of the necessary programs to support continued U.S. leadership in International Civil Aviation Organization (ICAO) Committee on Aviation Environmental Protection (CAEP). This includes the non-volatile PM emission standard, Carbon Offsetting and Reduction System for International Aviation (CORSIA), alternative fuels and supersonic aircraft.

Jennifer Solomon, *Eastern Regional Administrator, FAA*, was introduced and she remarked, "I appreciate the recognition of that work. The work we do with ICAO is important and with private industry is key."

Mr. Redhead stated that, "Two years ago we asked for a report as a member of a particulate subcommittee. We've got to figure out how to form some sort of partnership with private industry while they are developing their standards."

Presentation Committee Discussion and Recommendations **Presenter** *Dr. John Hansman*

Discussion:

Dr. Hansman asked, "What are the things, one, two and three, that are recommended to go into the letter to the Administrator?" He noted that there was a question about Dr. Chappell's initial questions about reprioritization of research goals.

Dr. Hansman then noted, "I think we should say that we are disappointed that we haven't seen the UAS R&D plan."

Mr. Hylander agreed with this and added, "Well, we say that we're eagerly awaiting the plan."

Mr. Prusak noted, "The word 'disappointed' is okay with the NAS Ops subcommittee."

Dr. Hansman asked, "Okay, on the cybersecurity, should we say something? Overall, it's good, but should we say something."

Ms. Yak noted, "I think with system view and best practices of seeing vulnerabilities."

Dr. Hansman stated, "The other issue I had written down was about looking at emerging issues, and the last thing I had was about monitoring data from Pathfinders and UAS. I'm not sure if that's all."

Mr. Hylander asked, "That's in someone's report right?"

Dr. Hansman confirmed, "Yea, but we can elevate it as a group for the letter. I'm oaky with leaving it in the NAS Ops report."

Mr. Hylander suggested, "You can highlight in the way of saying, "as we noted in our previous report", this would be a way to elevate it a notch" to which Dr. Hansman and others agreed.

Dr. Hansman concluded the meeting and stated, "Okay thanks everyone, this has been good. Thanks everyone."

Ms. Yak: "Thanks everyone."

Research, Engineering and Development Advisory Committee
Federal Aviation Administration (FAA)
FAA Headquarters, 800 Independence Avenue, SW
Conference Rooms 8A, 8B, and 8C
Washington, DC 20591
October 11, 2017

Agenda

Time	Topic	Speaker(s)
9:00am	Welcome Address and Chairman's Overview	John Hansman Shelley Yak
9:15am	FAA NextGen Perspectives	Jim Eck
9:30am	FAA UAS Update • Office of UAS Integration • UAS Integration Research Plan	Earl Lawrence Sabrina Saunders-Hodge
10:30am	Break	
10:45am	FAA Cybersecurity R&D Plan	John Lapointe Chuck Agava
11:30am	Lunch	
12:30pm	Subcommittee Report – Airports	Chris Oswald
1:00pm	Subcommittee Report – Aircraft Safety	Ken Hylander
1:30pm	Subcommittee Report – Human Factors	Barbara Holder
2:00pm	Subcommittee Report – NAS Operations	Leo Prusak
2:30pm	Break	
2:45pm	Subcommittee Report – Environment and Energy	Ian Redhead
3:15pm	Committee Discussions • Recommendations-Future Actions	ALL
4:15pm	Chairman's Final Thoughts	
4:30pm	Adjourn	