Research, Engineering and Development Advisory Committee (REDAC) | MINUTES

Meeting date | time *4/24/2013 8:30 am* | **Meeting location** *FAA – 800 Independence Avenue, SW. Washington, DC*

Purpose	REDAC Recommendations on the FY 2015 Research and Development Budget
Facilitator	Dennis Filler, REDAC Executive Director
Note taker	Aisha Staples

Presentation *Comments from the Administrator* | **Presenter** *Hon. Michael Huerta*

Discussion - Hon. Michael Huerta greeted the Committee and thanked them for their dedication and commitment to the Agency. He stated that the Research, Engineering and Development Advisory Committee (REDAC) has played an important role in the development of the Agency's research and development (R&D) portfolios over the last few years, and his office is looking forward to the recommendations for FY 2015.

Hon. Huerta welcomed Dennis Filler as new Director of the William J. Hughes Technical Center and the Executive Director of REDAC.

Hon. Huerta stated that research has been an extremely important part of aviation from the beginning and the National Aviation Research Plan carries that legacy forward. He mentioned that he was very impressed with the recent research by the FAA and highlighted important areas of research:

- The Aviation Environmental Design Tool was released to the public in March, and is used to analyze environmental consequences of air traffic procedures.
- The Fire Safety Team at the Tech Center in Atlantic City developed fire safety criteria and guidance for new large transport aircraft, which is extremely important in maintaining safety.
- The FAA has developed a Wake Encounter Screening tool that will help the FAA understand how aircraft wakes could affect other aircraft traveling on NextGen trajectories.

Hon. Huerta stated that the research mentioned is extremely important and funding is required to continue identifying innovative solutions and to maintain global leadership. In order to do that, the Agency needs to make the right investments in research, technology and development.

The Agency is currently operating in an increasingly difficult budgetary environment and the technology continues to advance more rapidly. For that reason, the Agency will need the Committee's recommendations even more to maintain a viable R&D portfolio with an ever-shrinking pool of resources.

He spoke about how the sequester has impacted the RE&D appropriation this year, as well as every other area within the FAA:

- RE&D funded employees are being furloughed along with other employees for up to 11 days (1 day per pay period). There will be some delays in the research for NextGen and other programs, including the future work on wake turbulence.
- The Agency has had to curtail contract funding for NextGen research and other areas.
- Delays in new technologies, applications and procedures.

Hon. Huerta added he will be speaking to Congress on the impacts that the sequestration will have on the FAA, including the R&D programs. The challenge will be maintaining safety and continued technological advances while operating under a budget that is $351 million lower than it was in FY 2012. Key points mentioned included:

- Despite the budget cuts, the Agency expects to continue critical research in NextGen.
- The budget includes $7.5 million to meet the nation's growing need for unmanned aircraft systems (UAS).
- $5.6 million was identified for the Alternative Fuels for General Aviation research program; this has generated a great deal of interest and the research will be focused on evaluating fuels developed by industry.

Hon. Huerta stated that the FAA will continue to work with the Joint Planning and Development Office (JPDO) and partners at the National aeronautics and space Administration (NASA) centers. He thanked NASA and the FAA for their collaborative efforts on a recent joint research initiative.

The Administrator reiterated that the Agency needs the REDAC's help now more than ever due to shrinking budgets and other financial challenges that are looming. He urged the REDAC to focus on what is far-reaching research and what the Agency needs to do to address future needs in aviation, far beyond FY 2020. In conclusion, Hon. Huerta stated that his hope was for the nation to rally together to support the needs of the aviation system that all agreed was important.

Hon. Huerta thanked the REDAC members again for their hard work and diligence, reiterating that their work is extremely important and the Agency takes the Committee's recommendations very seriously.

Presentation *Welcome* | **Presenters** *Dr. John Hansman and Ms. Pam Whitley*

Discussion: Dr. John Hansman (REDAC Chair) introduced Ms. Pam Whitley to the Committee and welcomed her to her first REDAC meeting.

Ms. Whitley stated that the Agency is still working through FY 2013 fiscal challenges as well; because while the CR has passed, the Agency still has a lot of implementation activities to execute. Pam stated that it is important that the Agency work closely with the Technical Center to ensure they are connecting the work to the goals that the Agency wants to achieve over the long term to support the advancement of NextGen. Ms. Whitley introduced Mr. Dennis Filler to the Committee and provided a brief overview of Mr. Filler's experience and expertise.

Presentation *Comments* **| Presenter** *Dennis Filler*

Discussion: Dennis Filler stated that the Agency is faced with challenges as well as opportunities. He added that Safety is the priority concern; there is an opportunity to exert global leadership in efficiency and access through the Agency's operations of the National Airspace System. Mr. Filler stated that the FAA is viewed as the world's leader in aviation; and there are new technologies and methods to explore such as alternative fuels and UAS.

Mr. Filler stated that the FAA has to operate with a progressive mindset while ensuring that we are focusing on the right problems and the effectiveness of the research. The current aviation system's infrastructure enables the Agency to have control of the electro-magnetic spectrums operations in cooperative airspaces, etc. He warned that the FAA may not enjoy that luxury in the future; the Agency needs to be proactive in preparing for potential threats. In closing, Mr. Filler stated that he looked forward to the opportunity to work with the Committee.

Dr. Hansman thanked Mr. Filler for his comments and stated that in considering the pressure of the fiscal challenges that the FAA faces, it is important that the REDAC help the Agency identify and articulate the value of the research in the short and long term to aide in decision making.

Ms. Whitley then asked the REDAC members to introduce themselves.

Presentation *Panel Discussion* **| Presenters** *FAA Senior Management Panel*

Discussion: Ms. Whitley explained how the panel was established and introduced each of the panel members to the Committee. After the introductions, she explained that the Panel session would start with a series of questions, and then segue into a discussion with the REDAC members.

Question: What is the most critical challenge for the FAA and how can R&D help address it?

Mr. Carl Burleson: The most critical component in moving aviation goals forward is developing solutions outside the set standards to adapt to an ever-changing environment; technological, economical, and physical.

Question: How do solutions drive industry and impact the larger aviation community?

Mr. Burleson: There are benefits in leveraging public and private funding together. He referenced the Continuous Lower Energy, Emission, and Noise (CLEEN) Program and the Committee on Aviation Environmental Protection (CAEP) Initiative as successful examples; there is strength in collaboration.

The FAA and NASA's programs are well linked and the FAA has worked very hard to identify synergies and create relationships within the Agency. Work done on continuances approaches and collaboration with the Air Traffic Organization (ATO) was cited.

Question: Is pavement research still a high priority for the FAA?

Ms. Lang: Within the Airports Research Technology Plan, pavement research is still a priority; one of their highest priorities is keeping things in a state of good repair and fixing it forward. Preservation of the current infrastructure is very high on their list as well. Ms. Lang cited the following challenges:

- Funding
- Predicting the impact that new advances and technologies being used in aircraft, such as high-pressured tires, will have on pavements.
- Increasing the longevity of runways and making better uses of the rehabilitations when they do them.

Question: How can human factors work help the FAA move the air traffic tools forward as the Agency continues to operate under a down-sized budget?

Ms. Ray: The human factors research is critical for how her organization moves forward. Through observation of past programs, it is apparent that stumbling blocks could have been avoided if more work were performed on the front end. There is an onus on ATO to be more disciplined with the implementation of projects and programs. In acquisitions, Human Factors has put good products in place with good results. She mentioned the successes of the Program Management Organization.

Advice for the Agency included:

- Removing what is not needed to retain resources; people and money.
- Deciding how to communicate to the public the reasoning behind making certain decisions; in terms of research and rigor.
- Developing a suitable timeframe for planning, developing and implementing strategies as it relates to NAS Ops.

Mr. Joseph Bertapelle asked if Ms. Ray felt that her organization was getting enough support from the REDAC for the research.

Ms. Ray: There are encouraging things happening however, the level of detail and focus is unknown. There is concern as to whether the data is being captured in a way that helps to make the best informed decisions moving forward.

There was a brief discussion among the panel members on the challenges facing NAS Ops. The following points were mentioned:

- The REDAC is looking at proposed research that doesn't start for five years and NAS Ops has a three to five year window.
- The fundamental gap and disconnect with what the REDAC proposes and what NAS Ops implements
- The focus on research outside of Human Factors.
- The Agency is a short-term focused organization.
- The Agency needs to look at the NextGen under the current financial environment.

- The REDAC can help the FAA understand what items are mature enough in the research portfolio to really bring to closure and move into acquisitions.
- The Committee should consider how the Agency/REDAC can shorten the 3 to 5 year planning cycle.

Question: Are there any studies that the REDAC could take on that would help them understand how some of the changes in the environment may impact safety?

The REDAC should focus on how the research can be more time critical to address new challenges. Major Challenges:

- Advanced Flight Technologies – this is mainly an issue for general aviation (GA). There is an increased use of advanced technologies in GA aircraft; however, pilots' skillsets are not keeping pace, as they don't fly the airplane as much due to increased automation.
- Software – there is not a single person who knows all of the software code on any particular system that Boeing has, for example.
- Cyber Security on an Aircraft – research is needed in this area; hackers are a true threat and the threat grows as more aircrafts begin adopting the use of Wi-Fi systems.
- Human Factors – The aviation community needs to find better solutions for real term practical applications.

Other critical issues facing the FAA:

- System of systems integration.
- Maintaining the workforce we have today (i.e., the pool of talent).
- Having the ability to understand the impacts and trade-offs, and the availability of tools to help translate them into cost-benefits.
- Quantifying or even identifying risk in a system that is extremely safe. So the issue becomes how to look at predictive risks, utilizing tools such as ASIAS.
- Focusing the future on how data mining is done and making it a standard procedure across the board; including operations.
- Identifying ways to conduct research and to find patterns in data that the Agency has not yet learned to discern.
- Bridging the gap between the existing issues and those in the future. The following key points were made:
    - The Committee's help is needed in setting priorities and defining consequences of various levels of budget cuts.
    - Input from entities outside the Agency would be helpful.
    - The REDAC could help the FAA identify synergies within the subcommittees: "What are common areas that could be better connected, and how does one portfolio impact another?"

Dr. Jaiwon Shin stated that data mining is one example that demonstrates that the FAA is making progress. NASA is looking forward to collaborating with FAA and helping support ASIAS.

It was suggested that the Subcommittees can assist the Agency in driving research priorities by:

- Helping articulate the benefits of research.
- Having a more holistic view across the Agency in terms of research.
- Developing a more comprehensive view of all the research that is going on; one of the challenges being that research is not easy to track due to the REDAC's limited purview of the scope of research currently underway.
- Deciding what research is most critical, what the consequences are of not doing it, and provide that information to the REDAC to help impact decision making and giving the REDAC credibility, because the justification for additional funding is provided.

A discussion among the members yielded a similar theme: that transparency to the REDAC and objectivity in analysis of what is being reported from the portfolios will help the Agency make better decisions in the long term. Final thoughts and input from the REDAC members included:

- The FAA should focus on the investments that have already been made rather than pursuing other acquisitions.
- The FAA needs to focus on data mining; data integration to help users maximize performance and make better decisions, focusing on efficiency.
- The REDAC can help match the FAA's budget with the priorities of each functional area.
- There's no flexibility within the budget to support the Subcommittee's efforts in prioritizing needs and making recommendations.
- From NASA's perspective, collaboration between the FAA and NASA has improved. One thing government agencies (NASA and FAA) can do better is to think about how to speed things up to be able to compete globally. Those improvements may involve research, infrastructure upgrades, or the development of new and existing systems.
- The connectivity could improve if they looked at things more strategically; applicable to the real world.
- The FAA needs to get better at defining requirements so that NASA knows what to do; rather than guessing.
- From a NAS Operations perspective, the concern is defining just how automated the system will be in the long term and focus on the realities of what could be implemented, what could be certified, etc. The biggest challenge will be getting certifications for the systems.
- From a safety perspective, data mining, done correctly, allows the Agency to do more outside of the scope of the regulatory process.
- There is some voluntary reporting from the Airports side (wildlife). However, they haven't really looked at the long-term strategy for gathering the data being produced by a broader array of stakeholders.
- Integration is a key factor in human factors research.
- The FAA is currently paying a lot of attention to human factors research, examining it from end to end.
- The FAA can do a better job of taking the research that is being done, and making sure the results of the research are integrated early enough to help frame a decision at the appropriate time in the acquisition.
- The challenge is shifting funds to a line item where there is no strategy or plan to support implementation.

Dr. Hansman concluded that the discussion was very informative and Ms. Whitley thanked everyone for their input.

Presentation *NAS Operations Subcommittee Report* | **Presenter** *Dr. Steve Bussolari*

Dr. Steve Bussolari (Subcommittee Chair) stated that they had three findings and two recommendations.

- The Weather Program pointed their research to the NextGen Segment Implementation Plan (NSIP) as the justification for needing more improvement in their weather forecast tools.
    - The Subcommittee had a hard time determining what level of functionality was needed or desired (enhancements) for the forecasting tools based on that justification (Finding 1).
    - The recommendation was to define the relationship between operational benefits and necessary forecast skill (where you are and what is the target objective).
- Weather Technology in the Cockpit
    - Referencing Finding #2, the Subcommittee felt neither program provided enough evidence to prove that better forecasting tools or cockpit display of weather would reduce weather-related accidents in general aviation.
    - The recommendation was that the connection between improvements and reduction of accidents be clearly defined and justified.

Dr. Hansman asked for clarification on what the recommendation was; to have them go back and make a small parallel study to examine the accidents and to see if advancements in technology could have helped prevent them. Dr. Bussolari agreed and there was further discussion on this topic; citing the lack of research and parallel case studies available.

- Referencing Finding #3, there are many pieces of research going on in different programs, but the Subcommittee had a hard time looking across the research portfolios in attempting to prioritize.
- The recommendation was for the FAA to seriously consider implementing a portfolio management process to look across the research portfolios because it would be useful for the REDAC to be able to look at the information and make comments with respect to priority. Although they do not have a mechanism to suggest, they are willing to work with the FAA to come up with a mutually beneficial solution.

Action items	**Person responsible**	**Deadline**
1. Define the relationship between operational benefits and necessary forecast skill	S. Bussolari	[TBD]

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

Since the meeting was ahead of schedule, Mr. Chris Oswald's presentation was moved up on the agenda.

Airports – Mr. Chris Oswald (Subcommittee Chair) referenced the budget slide and cited several line items for FY 2013. He went on to highlight a select few findings and recommendations:

- He commented on Hon. Michael Huerta's mention of Fire Safety; adding that they have made progress with that initiative over the last several months. Mr. Oswald also talked about the testing that has been occurring on the cargo fire side (liner panels, nozzles, etc.) and there are a number of reports published on that effort.
- Mr. Oswald highlighted a few tools and capabilities that are in the process of testing and due to be released in the future, some as early as summer 2013. They have received feedback from the Technical Center, identifying several go/no-go decision points.
- Dr. Hansman added that the aircrafts don't have a representative breaking system and asked if there is any indication that the research being done adds value. Mr. Oswald stated that there is significant reward if they are able to clarify the relationship between tire and pavement (Aircraft Breaking Friction).
- There was discussion about concerns not being addressed and money being spent with little or no data being produced. In addition, there was mention of issuing a shut down decision, which Mr. Oswald felt would be inappropriate at this point since they need to see if data (on wet pavements) can be produced first.
- **RPD155 –** Mr. Oswald referenced Finding #4, stating that there has been an increased interest by northern countries in Europe for installing thermal systems. Recommendation #3 was referenced; the Subcommittee asked FAA to make a stronger business case justification for the heated pavement and concept of use. Dr. Hansman suggested that the verbiage be changed in Recommendation #3, because the Subcommittee does not have the authorization to approve and the language needs to be sharpened to be more comprehensive.
- **Noise Study (RPD149) –** Although this topic was not originally covered in the presentation, Mr. Alterman asked if he could comment. Referencing Finding #2, Mr. Oswald stated that surveying surrounding communities about airport noise can prove to be problematic without proper coordination. Mr. Alterman stated that he appreciated the fact that Airports was not impacted by the sequestration. He added that the Subcommittee agrees with Recommendation #2; that better coordination needs to be done when surveying efforts are occurring. The consensus was that it demonstrates the need for cross cutting across Subcommittees to enhance program goals.

Mr. Oswald concluded that the Noise Study has vast political ramifications, so this research is not set to start anytime in the near future.

Presentation *UAS Update* **| Presenter** *Jim Williams*

Mr. Williams began his presentation by stating that his key role in the FAA is to help bring the FAA research portfolio together and align it with NASA, Department of Defense (DoD), etc.

- Referencing Slide #3 of his presentation, Mr. Williams reminded the group that the FAA has a dual role; as a provider of services and a regulator. His goal was to establish a single integration office that focuses on one mission and not multiple ones. The bottom line is that to accomplish the goal, the UAS needs data.
- Slide #7 identified the UAS issues that need to be addressed. Mr. Williams added that the list reflects what his office felt were the highest priorities. He went on to provide detailed examples for each issue category. Dr. Hansman added that it would be nice to have a list that maps the UAS issues to a more detailed set of issues then to the requirements and to the actual research activity that is ongoing.
- Referencing Slide #8, Mr. Williams stated that every program office that has a manned aircraft program also has an unmanned one, with the exception of the EPA. The listing divided aircraft by public use and civil use. There was a discussion on whether companies that receive certificates to do experimental work could use it for commercial purposes; the answer was no. Mr. Williams provided examples of UAS that are operating in different areas today.
- Referencing Slide #10, he provided examples of efforts for the UAS Research program; collecting and analyzing data examining the ATC Safety issues, trying to gather DoD experience in both training and maintenance information in an attempt to understand the criteria needed to certify personnel in certain functional areas.
- Speaking on collaborative activities (Slides #11 - #12), Mr. Williams highlighted that FAA UAS Program Office (UASPO) is not only responsible for facilitating cooperation across aviation but in the industry as well. This is one area where NASA, FAA, and DoD missions are aligned.
- Referencing Slide #13, Mr. Williams stated that the UAS Roadmap Integration Plan is a complete set of work break-down structure with objectives, strategies, timelines, and points of contact. RTCA's charter was too ambitious for the maturity of the system so they were not able to complete anything that was actionable. Therefore, Special Committee 238 (SC-228) was established to focus on standards for 1) Detect and Avoid, and 2) systems for Command and Control.

Legislative Updates for UAS

- Working with MITRE and former White House experts, UASPO was able to come up with a strategic approach. Mr. Williams reiterated that there is a lot of interest in the program.
- They originally planned to complete the evaluations and make the awards during FY 2013, but the sequestration caused them to lose 10% of the staffing hours. So, they are revising the planning schedule.
- Citing Slide #17, Mr. Williams stated that the Artic provision of the law presented a challenge for UAS, specifically with commercial usage. He went on to pinpoint specific territories on the map for representative Artic areas; seen on Slide #18.
- On Slide #19, the Small UAS Rulemaking is important to opening up the market in the U.S.; they have been working with DOT to develop this and it is very complex.

FY 2013 UAS Budget Outlook

Mr. Williams stated that the budget has been a challenge this year for obvious reasons. They have been increasing the funds being requested for UAS research and they were successful the first two years, as referenced on Slide #22. Due to the sequestration, the UASPO had to start making cuts so they stretched out three objectives and cancelled one.

There was discussion about the decision by UASPO to cut certain programs and what the decision-making process looked like. The REDAC asked for clarification. Mr. Williams stated that the budget issues impacted the program a lot and there were several initiatives being addressed in other agencies, therefore, they would leverage other funds for the initiatives that they chose to drop. Although all the issues listed on the slides are not being addressed by UASPO, they are being addressed by the larger community (DoD, NASA, FAA, or MITRE).

Dr. Hansman stated that they need a mapping of the requirements (milestones, resources needed, implementation, etc.) in the UAS program. There was further discussion on providing clarity on how to design a strategic approach.

Action items	Person responsible	Deadline
1. Provide a list of requirements	Jim Williams	[TBD]
2. Clearly define issues that research will address.	Jim Williams	[TBD]
3. Provide a comprehensive mapping of current research activities.	Jim Williams	[TBD]

Presentation *Environment and Energy Subcommittee Report* | **Presenter** *Steve Alterman*

Environment and Energy – Mr. Steve Alterman (Subcommittee Chair) stated that the Subcommittee continues to be extremely pleased with the work. All the recommendations had been followed through by the Agency and all future recommendations have been closed out; nothing outstanding.

- There are no new recommendations that they would like to send to the Administrator; however, they have several existing ones that they would like to move forward with. Finding #1 referred to the impact of the Sequestration. In light of the budget cuts, it is important that the FAA monitors the portfolios to ensure that proper funding is allocated.
- One recommendation was that there should not be any across the board cuts to all the programs, rather ensure the level of funding that permits the program's operation continue.
- Finding #2 indicated that the Tools Research is absolutely necessary to sustain the implementation of NextGen initiatives and should be a high priority. The recommendation was that funding of AEE tools development and maintenance continue to be a priority.
- Referencing Finding #3, which highlights the importance of the Continuous Lower Energy, Emission, and Noise (CLEEN)/Alternative Fuels program. The recommendation was that the funding for the CLEEN/Alternative Fuels program continues because it is a major initiative and has had success.

- Finding #4 reiterated the importance of the U.S. to continue to be a leader in the International Civil Aviation Organization (ICAO) Committee on Aviation Environmental Protection (CAEP) process. The recommendation was that funding should continue to be a priority for this initiative.
- Finding #5 deals with the cooperation between the FAA and other domestic agencies in the area of environmental research. The collaboration efforts have improved drastically and they want that to continue. For this reason, the recommendation was for the cooperative efforts to continue and international partnerships be explored.
- In referencing Finding #6, Mr. Alterman stated that the FAA Reauthorization Act required the establishment of a Center of Excellence (COE) for alternative fuels. The recommendation was that the FAA review the existing problems and those lessons learned should be incorporated into the formation of the Advisory Board for the new COE.
- Finding #7, the Subcommittee found that a lot of the advancements and successes in environmental research were not fully communicated to everyone. The recommendation was that a process be developed to ensure that research successes are communicated to a broader audience.
- The final finding of the Subcommittee referenced Aviation Climate Change Remove Initiative (ACCRI) program. A recommendation was not put forth because it would have been premature; they would like to wait until the final report is released. In the interim, the Subcommittee urged the FAA to create awareness for the ACCRI program.

Dr. Hansman asked if they reviewed the Alternative Fuels for General Aviation research program. Mr. Alterman stated that they have had briefings on that topic but have yet to make any recommendations.

Mr. Burleson announced that the Secretary of Transportation and the Secretary of Agriculture recently signed Phase 2 of Farm to Fly; USDA has committed publicly to donating one million gallons of alternative fuels to commercial aviation by 2018. This really has to be a multi-agency approach.

Presentation: *Human Factors Subcommittee Report* **| Presenter:** *Dr. Amy Pritchett*

Human Factors – Dr. Amy Pritchett (Subcommittee Chair) stated that they reviewed the portfolios that were ongoing pending upcoming budget cuts. Part of the discussions surrounded how to implement the budget cuts, if they were to be approved.

- Human Factors downsized from a $4M budget to a $400K budget over a two year period (90%).
- All research into Air Traffic Controller personnel selection has been ended; huge concern for a number of reasons, including legal liability and efficiency in hiring controllers.
- Dr. Pritchett reiterated the importance of integration and provided an example of it in aviation (pilot and systems).
- They looked at ways to use existing research to identify integration points for the various software and systems that are used in aviation today.

- One of the differences they noticed was in the reporting of research requirements from AVS and ATO.

Dr. Hansman opened the floor for questions and commented that there seems to be a consensus to avoid across the board budget cuts, and that it should be mentioned in the letter to the Administrator. The potential downside is that certain portfolios may lose functionality in areas that are deemed critical.

Presentation: *Aircraft Safety Subcommittee Report* | **Presenter:** *Joe Del Balzo*

Aircraft Safety – Mr. Joe Del Balzo (Subcommittee Chair) highlighted two main points. The first one has already been covered during the meeting but is reiterated: the AVS funding level falls short of supporting all of the AVS requirements. The Subcommittee recommended that Recommendation #1 be rewritten to state: "The FAA must incorporate within its planning process flexibility to respond to unforeseen requirements and the near term impacts of changing resources and at the same time, address how best to deal with the timeliness of completing long-term research related to long-term industry requirements."

Rob Pappas stated that the process does provide for flexibility and making adjustments, citing the recent revision of the existing process. He stated that he would be happy to provide the updated process document to the committee. The update was a fine-tuning of the document, rather than a major re-write. Mr. Del Balzo cited the 747 battery issue as an example of a pop-up requirement and asked Rob Pappas to walk the REDAC members through the process for handling it. Rob provided a step-by-step analysis of the issue.

There was discussion about what happens if a budget line item is cut; it was concluded that the FAA is not allowed to hold reserve budgets for pop-ups.

Dr. Hansman asked if that was a legal issue or an operational issue; Rob Pappas deferred the question to a later time when he can provide an accurate answer. The discussion continued on what can be put in place as a proactive measure, since the FAA knows that there will be pop-ups; how does the Agency get ahead of the curve? It was suggested that Aircraft Safety implement better management of the portfolios, as safety is very important to the longevity of the Agency.

It was stated that there is some flexibility within the program to deal with pop-ups. Dr. Pritchett suggested that rather than eliminating a budget line item, they lower the levels of effort for a particular line item.

Mr. Del Balzo asked if the Administrator has Agency level priorities (UAS integration, cockpit systems, etc.). Dr. Hansman stated that there does not appear to be a holistic research and development strategy for the Agency that will allow developing one priority list to work from. Destination 2025 was mentioned in the discussion as a baseline strategy for identifying long-term agency goals to improve various areas of research and moving toward them. The reality is that the Agency does not have a process to set priorities for research goals and the hardwired initiatives are sustaining existing capabilities and the acquisition of baseline programs to maintain operability. The consensus was that there needs to be an agency-wide strategy that

identifies research priorities to sustain and improve overall operations (meta-level decisions). Dr. Hansman stated that a starting point would be to identify ways to address the need for a more holistic approach.

Action items	Person responsible	Deadline
1. Send AVS's new process document to REDAC Subcommittee on Aircraft Safety.	Rob Pappas	[TBD]

Committee Discussion

Dr. Hansman stated that the reports were fine but most of the portfolios would be required to do minor modifications. He asked if there were any meta-issues. The REDAC letter to the Administrator is provided in Attachment 2.

Recommendations

- It was agreed that there is a need for a high-level view of research priorities across the Agency. With that, Dr. Hansman stated that there were two key concerns that echoed in the meeting from every portfolio and should be put in the letter to the Administrator:
    - How to show the value in defining a high level strategy.
    - How to communicate to the Administrator the importance of not making budget cuts across the board and developing a strategy to maintain critical path functionality (projects and capabilities).

Future Committee Activity

There were three areas of concern that were worth mentioning in the discussion but did not rise to the level of meta-issues:

- The discussion about better dissemination of results on the research accomplishments and impacts.
- In looking critically at the UAS program, the need to have a mapping of the issues to the requirements, to the research, etc. There is a hesitancy to present it because the details were not communicated as clearly as they could have been. This was noted as an action item; develop a stronger business case.
- The concern about the workforce capability in the midst of prospective budget cuts (pressure).

Dr. Hansman stated that he would include three issues: needed a high-level, cross-Agency view, not implementing across the board funding cuts, and the concern about maintaining the workforce if there were funding cuts. He opened the floor for other suggestions.

- Dr. Pritchett added to the request for a high level view, stating there is a need to maintain balance with short and long-term research goals because currently for AVS the area of consideration is always based on outcomes, not longevity.
- Dr. Shin recommended that the FAA Administrator be more proactive in working with NASA's Administrator and DoD to come up with a few highly visible needs in aviation and collaborate on achieving a common goal. He added that FAA and DoD are really active in the UAS program, demonstrating its importance. He suggested that the top level

executives may be more effective at communicating the successes and value of programs such as UAS.

Dr. Hansman stated that they do feel the need to communicate the national importance of aviation research, but this will need to be done at the FAA Administrator's level, as it may be outside of the REDAC's scope but they will try to formulate the comment in the letter. There was further discussion on ways to do this.

The members agreed that the Agency needs to get better at demonstrating the value of the research programs and the work being done.

The meeting was adjourned at 3:00 pm.

Attendance

Members:

John Hansman (Chair)	Steve Bussolari	Jack Blackhurst
Steve Alterman	Joe Bertapelle	Amy Pritchett
Jaiwon Shin	Chris Oswald	Joe Del Balzo
Dennis Filler (FAA, REDAC Executive Director		

Other Attendees:

Michael Huerta, FAA	John Wiley, FAA	Jean Watson, FAA
Karlin Toner, FAA	Andrea Schmidt, FAA	Daniel Brock, FAA
Jim Hileman, FAA	Lee Olson, FAA	Andy Mur, FAA
Dale Hawkins, FAA	Eric Neiderman, FAA	Lynda Bottos, FAA
Cathy Bigelow, FAA	Pamela Whitley, FAA	Mohan Gupta, FAA
Jim White, FAA	Katherine Lemos, FAA	Tony Fazio, FAA
Jim Williams, FAA	John Hickey, FAA	Kate Lang, FAA
Carl Burleson, FAA	Lynn Ray, FAA	Gloria Dunderman, FAA
Aisha Staples, JMA	Al Pollard, Martin State Airport	

Attachment 1

Research, Engineering and Development Advisory Committee
Federal Aviation Administration (FAA)
FAA Headquarters, 800 Independence Avenue, SW
Washington, DC – 10th Floor Round Room
April 24, 2013

Agenda

	(Public Meeting Announcement)	(Dennis Filler)
8:30 am	Comments	Hon. Michael Huerta
8:45 am	Welcome	John Hansman Pam Whitley
9:00 am	Comments	Dennis Filler
9:15 am	Discussion – Senior Management	John Hickey, Kate Lang, Carl Burleson, Lynn Ray, Karlin Toner
11:15 am	Break	
11:30 am	Subcommittee Report – NAS Operations	Steve Bussolari
12:00 noon	Lunch	
1:00 pm	Update - UAS	Jim Williams
2:00 pm	Subcommittee Report – Environment & Energy	Steve Alterman
2:30 pm	Subcommittee Report – Airports	Chris Oswald
3:00 pm	Subcommittee Report – Human Factors	Amy Pritchett
3:30 pm	Subcommittee Report – Aircraft Safety	Joe Del Balzo
4:00 pm	Committee Discussion - Recommendations - Future Committee Activity	John Hansman Dennis Filler
4:30 pm	Adjourn	

May 14, 2013

The Honorable Michael P. Huerta
Administrator
Federal Aviation Administration
800 Independence Avenue, SW
Washington, DC 20591

Dear Administrator Huerta:

Thank you for taking the time to meet with the Research, Engineering and Development Advisory Committee (REDAC) at the spring meeting. Your presence, under difficult circumstances highlights your understanding of the importance of research, engineering and development are to the needs of the agency.

As you indicated in your comments, the FAA will be under financial pressure for the foreseeable future. As a consequence it will be critical to define, articulate and prioritize clear R&D objectives to focus resources and justify investment. The REDAC and its subcommittees are committed to help and we hope you will use us as a resource in this process.

In reflecting on the expected financial stress and your request to also consider the longer strategic view, the REDAC makes a number of recommendations:

1. It is important for the FAA in coordination with other related government agencies (NASA and DOD) to identify and articulate the importance of Aviation Research and Development to the nation. This includes: meeting critical needs for infrastructure and safety while improving environmental performance, supporting national defense, and creating opportunity and economic development.

2. It is be important to develop a holistic agency view of the R&D priorities to integrate and improve coordination of research and development across the agency. The REDAC observes that current research priorities are defined within the FAA lines of business. There does not appear to be an integrated agency wide view of the research and development priorities which will be important if financial pressures dictate a reduction of the R&D effort.

3. If cuts must occur, the REDAC recommends that there should not be an across-the-board cut in all programs. Rather the agency should use the recommended holistic view of R&D priorities to insure that “critical mass” is maintained in the most important programs and that the agency maintains technical capability in essential areas.

4. Under financial pressure, the FAA must continue to develop and maintain the technical workforce which will allow the agency to meet operational requirements; to respond to and to capitalize on emerging technologies.

I am also enclosing the summary findings and recommendations from the spring 2013 meetings of the standing REDAC Subcommittees (Aircraft Safety, NAS Operations, Environment and Energy, Airports, and Human Factors).

Thank you for the opportunity to engage and contribute to the safety, efficiency and sustainability of aviation in the United States. Please let us know if there is anything further we can do to help.

Sincerely,

R. John Hansman
Chair, FAA Research, Engineering and Development Advisory Committee

Enclosure

Research, Engineering and Development Advisory Committee
Recommendations on the Fiscal Year 2015 Research and Development Portfolio

Subcommittee on Airports

Finding: The Subcommittee is pleased to see that the turn-around time for research reports has been reduced from 9-12 months to 2-3 months as a result of reorganized editorial procedures.

Finding: The Subcommittee reiterated the need for continuing coordination between noise and sleep disturbance projects within the FAA Office of Energy and Environment's research and development program (e.g., PARTNER Projects #24: Noise Exposure Response: Annoyance and #25: Noise Exposure Response: Sleep Disturbance) and the noise study currently underway within the Airport Technologies Program (Airport Sleep and Annoyance/Aircraft Noise (RPD149)).

Recommendation: The Subcommittee recommends that the Subcommittee on Energy and Environment and the Subcommittee on Airports receive regular briefings regarding each subcommittee's noise projects to ensure that redundancy among these projects is minimized.

Finding: Regarding RPD149, The Subcommittee would like to ensure that airport operators are informed about planned noise survey efforts well in advance of administration of these surveys.

Recommendation: The Subcommittee recommends that the RPD149 project team meet with airport noise and environmental specialists at the airports where noise perception surveys will be administered to review the survey contents, research objectives, and survey plan (e.g., communities that will be surveyed and survey sample sizes) in advance of administration of the surveys.

Finding: The Subcommittee appreciates the work to evaluate existing heated pavement installations in Heated Pavements (RPD155), but had concerns about whether advanced materials research should take place before more convincing evidence can be provided regarding the circumstances under which heated pavement systems are cost effective.

Recommendation: The Subcommittee has reviewed the 2013 and 2014 work plans for the RPD155, but would like to continue to receive detailed briefings concerning project progress. We strongly recommend that the FAA describe the circumstances under which heated pavements are likely to be cost beneficial (high-speed exits, critical turn locations, aprons) as well as the rationale behind this assessment. We also recommend that additional efforts be put forward to estimate the life-cycle costs of these systems. The Subcommittee recommends that this work take place before additional work is performed on advanced heated pavement materials.

Finding: FAA has provided improved explanations of the objectives, research plan, and progress associated with RPD147, Aircraft Braking Friction. They have also included "go/no go" decision points in the project schedule as requested by the Subcommittee. However, the

Subcommittee continues to have concerns about the project's complexity and challenges associated with producing meaningful research results.

Recommendation: The Subcommittee will continue to closely monitor this project. We recommend that the FAA present results of dry/wet braking tests at our September 2013 meeting to assess project progress. In addition, if data from winter condition tests that will be performed during the Winter 2013-2014 season isn't available for reporting by the Subcommittee's Spring 2014 meeting, the Subcommittee recommends holding a special coordination call with FAA staff to discuss these results in May or June 2014 to assess progress.

Finding: The Subcommittee is pleased to see that many of the FAA's aircraft and rescue and firefighting projects are concluding successfully.

Recommendation: As Airport Rescue and Fire Fighting (ARFF) project technical reports—particularly those associated with cargo aircraft—become available, we encourage the FAA to distribute widely to key stakeholders, including airport ARFF representatives and cargo airline representatives.

Finding: The Subcommittee believes that the FAA is making good progress on several research projects that deal with advanced sensor technologies (i.e., foreign object debris (FOD) detection in Airport Design (RPD133), avian radar in Wildlife Hazards Research and Development (RPD150), and low cost surface surveillance in RPD151), but would like to see additional focus on the operational integration of these systems in the field environment. There is also a desire to utilize identified operational needs as the basis for technology specifications, rather than starting from current vendor system capabilities, which may exceed these operational needs.

Recommendation: The Subcommittee recommends explicit consideration of operational integration of the aforementioned airport sensor technologies into the airport environment and the development of operational justifications for the specifications developed under the research program.

Finding: Regarding Pavement Design and Evaluation (RPD145), the Subcommittee believes that the FAA has addressed our recommendations from our Fall 2012 meeting on a conceptual level. These recommendations included (1) definition of the term "40-year design life" and (2) description of project success criteria. This said the Subcommittee would like to see refinement and embellishment of these definitions as the project proceeds. There was also a desire to have opportunities for more robust industry participation of the project by subject matter experts (SME) in both asphalt and Portland cement concrete design.

Recommendation: The Subcommittee recommends forming a SME advisory panel with selected members of the Subcommittee and the Airfield Pavement Working Group that can collaborate with the FAA project team directly in its refinement and execution of the RPD145 work plan, leaving the subcommittee free to focus on the higher level aspects of the pavement research program.

Finding: The Subcommittee believes that research conducted by the FAA demonstrates that trapezoidal transverse pavement grooves improve runway drainage and reduce groove wear in comparison to conventional rectangular transverse grooves.

Recommendation: The Subcommittee encourages the FAA to make necessary modifications to its advisory guidance—particularly Advisory Circular 150/5320-12C, *Measurement, Construction, and Maintenance of Skid-Resistant Airport Pavement Surfaces*—so that airport operators can utilize trapezoidal grooves to improve runway drainage and friction under wet conditions should they desire.

Finding: The Subcommittee would like to emphasize the need for and value of the Airport Pavement Test Vehicle (RPD135), construction of the high temperature pavement test facility. This facility will enable the testing of asphalt concrete (AC) pavements under "real-world" environmental conditions, including innovative AC paving techniques (e.g., warm mix asphalt) and new AC materials (e.g., advanced polymers binders, stone matrix asphalt, recycled asphalt).

Finding: The Subcommittee encourages the National Airport Pavement Test Facility (RPD138) project to continue investigating high strength concrete effects on pavement fatigue life. The current research results indicate that high strength (e.g., flexural strength of approximately 1000 psi) Page Control Chart (PCC) surface layers perform as well or better than medium strength PCC surface layers (e.g., flexural strength of 750 psi) assuming that the PCC layers are of the same thickness. While these results provide evidence that the FAA's flexural strength design limits can be relaxed provided pavement section thicknesses are held constant, they do not address the important relationship between pavement strength and pavement thickness. The Subcommittee believes that the significant benefit of using higher strength materials lies in being able to reduce construction costs through the use of thinner PCC surface layers. Many local areas are able to achieve higher strength concrete with normal construction practices. Making use of this phenomenon is logical and can help reduce construction cost.

Recommendation: The Subcommittee recommends the FAA continue research on the effects of higher strength concrete on concrete pavement fatigue life by investigating the pavement life when reducing pavement thickness proportionally to the increase pavement strength. Until such research is completed, relaxation in maximum flexural strength limits for PCC surface layers should be conditioned on the retention of "conventional" PCC surface layer thicknesses.

Subcommittee on Environment and Energy

Finding: In view of the current budget crisis, including the effects of sequestration, it is crucial that Office of Environment and Energy (AEE) continue to review its portfolio to ensure that available funding is spent most effectively.

Recommendation: With declining resources, it is imperative that AEE prioritize its activities, funding those projects that promise the greatest environmental benefits. In practical terms, this means that there should **not** be an across-the-board cut in all programs. Rather, AEE should ensure that the most important projects are funded at a level that permits these projects to continue with the least possible disruption.

Finding: Continued Tools Research is necessary to support the implementation of domestic NextGen initiatives and the development of environmental standards through the International Civil Aviation Organization (ICAO) process.

Recommendation: Continued funding of AEE tools development and maintenance is a priority and is required to permit assessment of the environmental and economic impacts of, and trade-offs among, different possible mitigation strategies. These tools enable the analysis of the environmental consequences of aviation operations, as well as the potential impact of NextGen implementation and standards under consideration at ICAO.

Finding: Another area of AEE activity that demands prioritization is the ongoing Continuous Low Energy, Emission and Noise (CLEEN)/Alternative Fuels programs. These activities have demonstrated success in maturing technologies which will facilitate integration into future products and in developing fuels that can be used as a substitute for traditional petroleum-based jet fuels.

Recommendation: The Subcommittee strongly recommends that funding necessary to support the CLEEN/Alternative Fuels programs continue. Indeed, the Subcommittee strongly endorses the AEE above-target funding request for the continuation of these programs at the highest possible level. The first phase of the CLEEN program, a cost-sharing program between industry and government, has resulted in the accelerated development of a number of environmentally beneficial products that are likely to be incorporated in aircraft and engine designs in the relatively near future. This program should continue into its next phase with the level of funding necessary to encourage future success.

Finding: United States leadership in the ICAO Committee on Aviation Environmental Protection (CAEP) process continues to be an important priority.

Recommendation: Sufficient funding should be available to AEE to permit continued U.S. leadership in the ICAO arena. For example, the current ICAO initiative to develop a worldwide CO2 standard is moving forward, with specific deadlines that must be met. It is important that the United States remain engaged in a leadership position to focus the CAEP work on the most important efforts. In addition, it is important that other CAEP members provide resources so that the United States does not have to carry the entire burden. Perhaps most critically, U.S. resources should not be used for CAEP projects that are not supported by, or of significant priority to, the United States

Finding: The cooperation between the FAA and other domestic agencies in the area of environmental research has been effective and has permitted the leveraging of diminishing resources.

Recommendation: In order to ensure the most efficient use of resources in environment and energy research, the Subcommittee recommends that existing partnerships between AEE and other agencies in the United States continue. In addition, the Subcommittee recommends that international partnerships be explored in an attempt to further leverage available funding. For

example, the Subcommittee supports and encourages continued collaboration with the Swiss government which has funds available to expand research in the area of Particulate Matter.

Finding: As a new Center of Excellence for research into environmental and alternative fuels issues is established, the FAA has an excellent opportunity to ensure that stakeholders play a meaningful role in the selection of projects selected for inclusion in the research. Experience from the existing PARTNER Center of Excellence suggests that its Advisory Board may have become too large and, in more recent years, has often not been consulted soon enough to weigh in on the merits of particular projects under consideration.

Recommendation: In view of some perceived shortcomings in the existing PARTNER Center of Excellence Advisory Board, the Subcommittee recommends that the FAA review such problems and identify problems that need to be corrected. These "lessons learned" should then be incorporated in the formation of the Advisory Board for the new Center of Excellence.

Finding: The Subcommittee has found that advancements in environmental research, and their implications for aviation, are often not fully communicated to government decision-makers and to stakeholders, including the general public. This lack of communication with the "larger world" has complicated requests for funds to continue the research and deploy the insights gained.

Recommendation: The Subcommittee recommends that the FAA establish a process to ensure that research project successes are effectively communicated to a broader audience. In addition to typical outreach activities such as the publication of Fact Sheets; placing information prominently on the FAA website; and placing articles in trade journals and the mainstream media, the FAA should seek creative methods to ensure the most effective and efficient dissemination of information. For example, publication of the successes in the first phase of the CLEEN program would make the argument for continued funding of the program into a second phase more attractive.

Finding: One of the existing environmental research programs is the Aviation Climate Change Research Initiative (ACCRI). This program concentrates on research involving non-CO2 atmospheric pollutants. Phase 2 of ACCRI is nearing its completion, with a final report expected in the near future. When this report is issued, the subcommittee urges the FAA, consistent with available funding, to determine what future research and policy steps are necessary to address the findings. U.S. research involvement in this area is important to expand understanding beyond the more limited findings from past European initiatives. (Since the report is not yet completed, and the Subcommittee does not know what conclusions will be reached, no formal recommendation on what future steps are necessary can be made at this time).

NAS Operations Subcommittee

Finding: The Subcommittee observed that the Weather Program Planning Team (PPT) Portfolio research requirements, while directly linked to NextGen Segment Implementation Plan (NSIP) Alpha and Bravo, were too broadly stated and open-ended. Examples included: enhanced turbulence forecasts and graphical guidance information, enhanced ceiling and visibility analysis

and forecasts, and enhanced aviation specific weather hazard diagnosis and forecast information. While there may be an operational need in NextGen for enhancement to these forecast tools, it was difficult for the subcommittee to ascertain just how much enhancement was needed and what NextGen operational benefits would be achieved with each incremental enhancement. Moreover, the research prioritization process employed by the FAA for the Weather PPT Portfolio appears to be internally focused within the weather research organization. Individual components of the weather research portfolio are prioritized within the A.11k Budget Line Item (BLI) rather than prioritized relative to what is needed to achieve NextGen Operational Improvements. The subcommittee recognizes that this BLI is not controlled by the NextGen Program. However, if the principal justification for this investment of RE&D funds is the NextGen Segment Implementation Plan, then this research should be driven by NextGen operational requirements. If the operational requirements are not sufficiently defined, then the research should focus on defining them. The users of the products of the weather research should be included in this activity.

Finding: One of the principal justifications for both the Weather PPT Portfolio and the Weather Technology in the Cockpit programs is that they would provide a safety benefit to general aviation (GA). Both programs cite the 75% average fatality rate in GA weather-related accidents and the fact that GA accounts for 88% of weather-related aviation accidents. However, the subcommittee was presented with no evidence of any systematic study of the causality of these accidents that leads to the conclusion that better forecast tools or cockpit display of weather will substantially reduce the GA weather-related accident rate.

Recommendation: In future Subcommittee reviews of the Weather PPT portfolio and Weather Technology in the Cockpit Programs, the FAA should present a clear justification for the research investment. The FAA should provide quantitative (e.g., monetized) estimates of the NextGen safety and operational benefits achievable with the research results when applied to operations. Where the justification for the research requirement comes from NSIP, the FAA should define specific requirements for weather technology improvement, based upon the safety and operational requirements of NextGen. If these requirements have not been defined and quantified, the FAA should orient the Weather PPT research portfolio to define these requirements. The FAA should also provide specific quantitative estimates of the safety benefit for those research investments targeted for GA safety.

Finding: The NASOPs Subcommittee has previously recommended that the FAA undertake a broader management framework for its research and development. This would enable FAA to manage its research portfolio across funding lines to focus on achieving specific operational benefits to the National Airspace System (NAS). At its summer 2012 meeting, Paul Fontaine agreed to develop a portfolio view of FAA activities related to NAS surface operations. The Subcommittee found this portfolio view to be excellent. The graphical depiction of related efforts highlighted the interplay between requirements sources, funding sources and projects within the portfolio and could easily be expanded to include more detail on FAA R&D and related research projects from other government agencies (e.g., DoD and NASA).

A true portfolio view and management of research priorities across the portfolio will require the right level of aggregation and oversight by an executive-level governance body such as the

Research and Development Executive Board (REB), the NextGen Management Board (NMB), or the Strategic and Budget Planning (SBC). The Subcommittee realizes that asking for this information places workload on already highly loaded managers; however, we believe that there is high value to the FAA being able to see the integrated view to identify research gaps and synergies. The NextGen portfolios are a good start to taking a portfolio perspective; expanding these portfolios beyond projects with NextGen funding is a critical next step.

Recommendation: The FAA should build upon the work that Paul Fontaine presented to the Subcommittee and present a similar portfolio view of FAA research for one or more additional NAS domains during the next subcommittee meeting. This portfolio view should include a first-order, quantified description of the benefits pool(s) that drive the decision for the projects (e.g., safety case, security case, efficiency case, reliability case, etc.). In addition, the portfolio views should include more detail of FAA R&D activities and the research activities of inter-agency and non-governmental organizations. The subcommittee will work with the FAA to define which domain(s) will be presented and how to maintain them as the research activities evolve.

Subcommittee on Aircraft Safety

Finding: For the most part, the FAA's RE&D program and the research components of F&E are 'applied research', that is research involved with addressing practical and identified problems. The anticipated impact of each project in the FAA's research program should be able to be articulated. Research's impact might be to inform an FAA investment decision or help guide a rule-making effort. Research might lead to the development of technical standards or guidelines for industry. Research might develop a technical capability that fills an operational requirement. While most of the projects in the FAA's current research portfolio could be tied to a desired outcome (e.g., reduce the accidents due to weather), the means for the research to effect that outcome is not always clearly articulated. In some instances when the impact can be clearly articulated, it seems that the FAA research investment is late to the need. As an example, the human factors research that would help inform certification of new technology such as angle of attack indicators for general aviation will not be complete until years after the first products begin the certification process. There appears to be an almost three year lag between when a requirement for research is identified before the research can be initiated.

The Subcommittee commends the FAA on the methodical planning process that has been put in place to prioritize its portfolio of projects in a way to meet growing requirements. This process requires that all requirements be clearly articulated in order to receive proper consideration. During a time of a shrinking and unstable federal budget it becomes even more important to be able to clearly justify requirements. In this ongoing environment of budget instability, which the SAS believes will continue into the foreseeable future, the FAA must incorporate within its planning process a means to respond to near term impacts of changing resources, and address the timeliness of completing longer term research in order to be relevant to industry requirements.

It is important for FAA research managers to have the flexibility to reprioritize research to address practical problems in a timely fashion.

Recommendation: To best deal with the current environment of budget instability, the Subcommittee on Aircraft Safety (SAS) recommends that FAA consider establishing a process for establishing and reassessing research priorities across all Lines of Business. There needs to be a single focal point responsible for the agency's research strategy (including priorities) guided by executive oversight from within the FAA. Advisory committees (such as the REDAC) might be used as a sounding board.

Action: The Subcommittee requests a briefing on the AVS planning process that has been put in place to prioritize its portfolio of projects in a way to meet growing requirements. Examples of how the process has been used to accommodate a pop up and changing priorities will be helpful.

Finding: (Strategic Plan) The subcommittee is very pleased to hear FAA is nearing completion of a 10-year strategic plan for research within the subcommittee's purview. Communication of the strategic direction for FAA research is improving, but many elements seem either overlapping or simply disconnected. Having a 10-year strategic plan is expected to add significant clarity to how numerous FAA research activities are connected and the sum benefit of the anticipated outcomes.

Finding: (Aeromedical Research) The SAS observes that the funding at CAMI is stable as befits a national resource and appreciates the clear linkage to AVS goals in continued operational safety, standards/policy, and certification. The SAS notes the value of knowledge of effects of various drugs on pilot performance, but requests explanation of the specific requirements in Accident Prevention and Investigation.

Action: In Accident Prevention and Investigation, please explain why certain diseases are relevant, why some drugs are more relevant than others, and how particular drugs or diseases (e.g. diabetes) are chosen over others for studying their effects on human performance?

Action: Please provide accurate budget numbers for the Fire and Cabin Safety Aeromedical requirements.

Finding: (Fire Safety Research) The SAS finds that the Fire Research and Safety Program continues to be responsive to clear AVS needs producing timely results with stable funding and portfolio. At the same time the program is flexible to respond proactively to current and emerging needs. Examples were highlighted where the FAA is performing R&D that seeks to understand why fire-related events are happening and thus provide knowledge to be able to prevent them.

Finding: The Weather Program has many facets and addresses a large range of issues from GA weather accidents to improving capacity in the NextGen environment with better environment modeling and forecasting.

Of the $15.1M budget for AVS weather, $3.5M of this budget is driven directly by AVS needs and the remainder by the Air Traffic Organization (ATO) organization. This funding within the REDAC SAS portfolio is unique but seems to be appropriate due to the nature of the products needed in the ATO community.

The Weather Program involves a large number of interagency partners including National Oceanic and Atmospheric Administration (NOAA), National Weather Service (NWS), National Aeronautics and Space Administration (NASA), etc. Despite the diversity of needs and programs, the weather programs result in meaningful and contemporary products. There is no shortage of needs to better understand weather and new research needs appear as technology to better understand weather is created.

Finding: (Advanced Materials Structural) The Subcommittee was pleased with the overall direction in this area. The subcommittee noted there have been many years of research in the area of composite structures and asked what was distinctively different about the current research plan. The FAA noted prior research focused on small aircraft and the future activity was aimed primarily at transport category aircraft. The subcommittee appreciated the clarification but also requested FAA be conscious of overlapping areas, such as occupant survivability research, or worse yet conflicting goals of areas so closely related. The subcommittee also noted the value of research aiming to validate prior 'ditching' assumptions is not seen as high value in light of other opportunities.

Finding: (Flight Deck/Maintenance/System Integration Human Factors and NextGen Human Factors) As in the last two REDAC SAS meetings, the Subcommittee once again expresses the importance of what has been traditionally known as human factors research in all aspects of aviation safety. The Subcommittee also recognizes the importance of most of the human factors issues that AVS has identified for funding and further research. It is obvious to those in FAA AVS, AFS, and in the aviation industry that human factors research covers a broad spectrum of accident prevention, interventions and supporting information for the development or updating of regulations and guidance. Unfortunately, this significance and importance is not obvious to those who aren't directly involved with the industry on a daily basis. This is evident by the drastic reduction of much of the FY 2014 human factors research funding. The Subcommittee understands the difficult environment that FAA currently is experiencing, however no other area of research received this drastic amount of funding reduction.

The Subcommittee senses that much of this situation might be caused by a lack of emphasis of the following items:

- the importance of the human factors issues to the overall safety of the system
- how those issues fit in with, and are important to the other areas of research being conducted
- specific details on the projected outcome and benefits of the research

Additionally, FAA responses given to the Subcommittee about specific human factors areas tend to be supportive of the issues identified as important by the Subcommittee, then are sometimes given a low priority and receive limited or no funding. The direct result of this is sponsors of the requested research are forced to develop and implement significant regulation, certify systems and components or write guidance material without the information needed to make data driven, results oriented, scientifically-based decisions. Examples of this discussed in the meeting were

UAS control stations, Facility Roster Management System (FRMS), and guidance material for loss of control training.

Recommendation: The Subcommittee recommends that, for funding and functional purposes, AFS and AVS explore the possibility of closely aligning human factors research requirements with the other research areas they support, even though those issues fall outside of the traditional human factors portfolio. For instance, research on artificial vision and the complexity of instrument approaches both support increasing airspace capacity, which is a NextGen issue. Additionally, the Subcommittee recommends that more support and priority be given to human factors research that supports significant new or revised regulation.

Action: Also, the Subcommittee suggests that when projected outcomes are developed, they are linked directly with the specific benefit, metric, regulation, or document that they support and given a target completion date. An example of this is the Weather Program briefing, Outcome section, presented on 12 March. This section ties the research requirement to a specific AC and a target completion date.

Finding: (Continued Airworthiness Flight Control Mechanical Systems) The Subcommittee was pleased with the briefing provided, which focused on FY15 and beyond research. The subcommittee asked FAA to verify that planned future work (FY15 and beyond) would be limited to Part 23 aircraft. The FAA confirmed that current efforts, inclusive of transport category aircraft, would shift to Part 23 only by FY15. The subcommittee strongly encouraged FAA to ensure future focus on "developing methods to incorporate derived and sensed angle of attack (AOA) into displays, existing autopilots, and emerging fly-by-wire systems for small aircraft" was coordinated with human factors activity in HF-15-06.

Finding: (Continued Airworthiness Structural Integrity Metallic) The subcommittee greatly appreciates the tour of the Tech Center's facility that directly supports this area of research. The ongoing research into repaired structure, flutter suppression, and exploring new metallic structures is seen as high value by the subcommittee. Likewise, efforts aimed to improve detection of and mitigations for fatigue damage are important for both small and large aircraft.

Finding: The subcommittee finds that the Terminal Area Safety program is appropriately addressing and prioritizing research needs in this area. As they plan for new projects focused on helicopter safety improvements beginning in FY15, the subcommittee notes the importance of close coordination with DoD to leverage prior work performed on synthetic and enhanced vision systems for helicopter applications.

Finding: The FAA aircraft icing research program is well focused and responsive to identified safety needs. Using resources available, the leadership of this activity is effectively using collaborative partnerships to identify and pursue relevant activities that support the efficiency of current and future icing certification processes.

Finding: (NextGen Alternative Fuels for GA) Over the last year the efforts on finding a viable, lead-free replacement fuel for the piston general aviation fleet has taken a critical turn as a result of environmental and supply side pressures. In the recent FAA Reauthorization Bill the FAA

was directed to qualify a replacement fuel through the use of FAA Technical Center resources and to create an FAA Fuels Office (AIR-20). The FAA Administrator has included the determination of an unleaded aviation fuel in the Destination 2025 plan for completion by 2018.

With over 187,000 piston airplanes in the U.S. fleet, the size and scale of the unleaded avgas transition is a significant one. The FAA Technical Center's Aviation Fuel and Engine Test Facility (AFETF) is the only independent lab in the world capable of doing the necessary research to assure the continued safe operation of the this general aviation fleet.

Action: The current plan is level funded at $5.571M per year while the program activity is projected to experience a ramp in effort in the coming years followed by a decline in work. Further, the effort is only partially funded raising questions about whether the program can achieve its goals under the current funding circumstances. The FAA Fuels Office should assure that the funding plan for research aligns with the expected needs for successful completion considering the critical nature of the program. The subcommittee would like an update at the next meeting on the funding levels.

Finding: (Software Digital Systems) In the area of software digital systems, the Subcommittee is pleased with the progress made by FAA in terms of establishing the appropriate internal expertise; organizing the work program; connecting the work program to specific outcomes and impacts within the agency; and in reaching out to potential partners and collaborators. At present, the committee feels that the work being undertaken seems reasonable and that there are no glaring gaps. However, the Subcommittee notes that this is an extremely complex area with rapidly changing research drivers as well as progress being made in various domains that may have relevance for aviation. The subcommittee is apprehensive that the FAA is appropriately resourced to keep-up with the pace of change in this research area and remain a head of the curve.

Finding: The Subcommittee finds that the Continued Airworthiness of Composite Structures requirement continues to develop important information for FAA personnel to evaluate and understand the challenges related to composite structures in use in the field. The SAS also commends the FAA for using the flexibility of the pop-up process to reprioritize some funding to deal with standardization and a risk-based approach in MRO Oversight Support, a very important topic to the industry.

Finding: The Subcommittee finds that research programs around Continued Airworthiness-Engine NDE and Propulsions and Fuel Systems are effectively addressing the research needs in these areas. These efforts have produced tangible results in the form of regulation and guidance material that is regularly used in industry, with more on the way in the near future. Particularly noteworthy is leveraging the relationship with industry and evolving the research effort to where industry responsibility and contributions continue to increase.

Finding: (Aircraft Catastrophic Failure Prevention) This research activity is focused on enabling the use of analytical methods to show regulatory compliance of engine containment designs against rotor burst or fan blade failures. Although a narrow focus, the research goals align with the much broader trend by industry to make use of analytical tools wherever possible.

Observation: The analytical tools being developed to support certification are important to industry and could be a pacing item for the certification cost and efficiency of new engine designs currently being developed. The FAA should continue to support this activity as intended and also provide an implementation plan as to when these tools will be available for use by industry.

Finding: (Continued Airworthiness; Rotorcraft Systems) The subcommittee found the briefing on rotorcraft systems to be very thorough and areas of future research well placed. When asked, the FAA adequately explained the lack of FY14 funding for the Advanced Control Systems research but the subcommittee voiced interest as to whether a funding change could be made at a later date. Further, the subcommittee looked favorably on the progress of HUMS activity and the proactive research aimed at better understanding the risk of bird strikes.

Action: Report on FY 2014 funding picture at next SAS meeting in August.

Subcommittee on Human Factors

Finding: Human centric design is key to achieving safe, effective, and efficient systems and a human factors research program must be scaled commensurately. Over the past few years, many strides have been made in creating a human factors program of sufficient scale to address the needs for human centric design in the areas of flight deck and air traffic control (ATC). In looking at FY2012 – FY2015, the Subcommittee is concerned that these strides will be erased with a down-scaling of the human factors research program. Human factors research needs to be supported at a level commensurate with the overall mission of the Agency to ensure human centric design can be implemented in the flight deck and ATC systems. As the FAA evaluates the appropriate sizing of programs, consideration must be given to the fact that human factors research has a large role in safety and efficiency and any down-sizing of broader research portfolios should recognize that equally-proportional down-sizing of key human factors research components may adversely impact the ability of the Agency to conduct its mission.

Recommendation: Ensure that the scale of the human factors research programs is commensurate with meeting the mission of the Agency through an adequate understanding of the risks associated with any down-sizing. These risks need to be understood in terms of integrating human factors research in system design and acquisitions as well as needed regulatory and guidance material. Critical human factors staffing and key capabilities should be maintained during prioritization of flight deck and ATC research programs.

Finding: Overall, the projects defined for 2015 in the Flightdeck/ Maintenance/ Systems Integration Human Factors portfolio adequately address the requirements that are set-out by Aviation Safety (AVS) and the Subcommittee agrees with the portfolio.

Recommendation A: Office of Aviation Safety (AVS) should ensure that the 2015 plan as defined gets executed. Prior to execution of each research requirement, survey the field of research and modify the detailed plans as appropriate.

Recommendation B: Several important projects, i.e., UAS HF Considerations, Avionics and New Technologies: Certification and Operational Approval Criteria, and Advanced Vision Systems are significant areas and the 2015 plan needs to ensure that key resources are available.

Finding: One of the primary goals of the REDAC is to review and provide guidance on the FY+2 portfolio. The winter meeting is presented with the research requirements as coalesced by the AVS process. This data is not sufficient to adequately assess the overall portfolio for the Flightdeck/ Maintenance/ Systems Integration Human Factors program. Additional information regarding rankings would allow the REDAC Subcommittee to perform its task.

Recommendation: At the winter/spring meeting, the REDAC Subcommittee requests visibility into the rankings of the AVS requirements for the FY+2 year as of the date of the meeting, even if the rankings are preliminary.

Finding: The Subcommittee reviewed the Air Traffic / Technical Operations Human Factors Strategic Research Plan and found it to be an excellent document to guide the core research efforts in this area, particularly in cross-cutting research areas that may not be addressed by isolated technology programs. This strategic plan clearly identifies the most important areas for continued research and development investment and the Subcommittee agrees with the importance of these areas. In looking at the 2015 portfolio there appear to be significant gaps between areas of important research defined by the plan and the projects that are currently in the portfolio. While there are many criteria to consider in prioritizing research projects, the Subcommittee sees that the current strategic plan represents important areas of need and hence should represent a significant input to research funding criteria. Where gaps exist between the strategy and plans, the Subcommittee is concerned that important areas of research will not be addressed. Several specific gaps in the 2015 plan were identified by the Subcommittee and are noted in the following findings and recommendations.

Recommendation: Ensure that the Air Traffic / Technical Operations Human Factors Strategic Research Plan is used as a significant input to the prioritization of research efforts in the human factors ATC Core program. Where parts of the strategic plans are not being implemented, define the impact and create a plan for how it will be addressed in future years. Provide this information as a briefing at the next meeting.

Finding: All Air Traffic / Technical Operations human factors research that supports personnel selection has been eliminated. Testing as part of personnel selection based on prior human factors research has been demonstrated to significantly reduce the cost of training in the past. As the demographics of incoming personnel change, and as new systems are implemented, such data-driven methods for effective personnel selection will require further research. Thus, this research needs to continue and expand for placement purposes and to support NextGen implementation. The elimination of this area also puts the agency at potential risk in terms of its ability to successfully defend against future lawsuits that target hiring and selection processes. Finally, ongoing human factors research into personnel selection preserves the specialized skills and knowledge to further improve the Agency's efficiency in this area.

Recommendation: Ensure the Human Factors research that supports Personnel Selection is retained to enable the agency to realize the efficiency, cost savings, and scientific defensibility associated, and to mitigate the potential loss of competency in this area that could result from elimination of this work.

Finding: The Air Traffic / Technical Operations Strategic Plan Objective 5 focuses on maintaining a high level of human performance and safety. It cites a strategy with specific actions to reduce the probability of human error within the ATC system, including:

- Human performance baseline development to assess effectiveness of mitigations to identified challenges or error type
- Development of methods to prevent skill degradation brought on by increased dependence on automation
- Development of ATC best practices

There is a gap between meeting those goals and the portfolio presented, prompting the concern that the loss of focus in these areas would be detrimental to the Agency's mission going forward. This risk needs to be carefully evaluated in determining the final portfolio.

Recommendation: For research relating to the Air Traffic / Technical Operations Human Factors Strategic Plan for Safety, the ATO and the NextGen Organization should complete an assessment to ensure sustainment of plans and activities in this area that are commensurate with the continued pursuit of NAS modernization, for which the research items listed in Objective 5 of the strategic plan are particularly relevant.

Finding: There is a significant gap in designing new tools and systems for the operation of the NAS in terms of maintainability from a human factors perspective. This includes design at the level of individual devices and at the level of collections of devices or subsystems that need to be maintained by the same individual or team of individuals.

Designs need to be developed such that, from a human systems engineering perspective, it is easy to detect, diagnose, and repair faults and to train Technical Operations staff to perform such activities. For some subsystems, this includes the development of a user-centered design for an integrated workstation that allows Technical Operations personnel to monitor the health of several tools or subsystems remotely and, where feasible, diagnose the nature of a system failure and in some cases (such as a software failure) even repair the fault remotely.

Recommendation: Conduct the human factors research necessary to guide the development of such an integrated maintenance workstation, as well as guide the design of individual tools and subsystems to ensure easy maintainability. Insert specific tasks and reviews into the Acquisition Management System (AMS) lifecycle to ensure that this research is used to provide human factors guidance in the implementation of operational systems.

Finding: Advances in airport surface management, trajectory-based operations, dynamic airspace design, traffic flow management and flight operations control will enable both greater flexibility and more precise control of flight operations. To be effective, however, this requires

an integrated system design that supports much greater synchronization across the surface, terminal, en route, and systems operations domains. To effectively support interactions among the relevant operators, cross-domain human factors research is needed.

Recommendation: Conduct human systems integration research focused on the integrated management of airport surface and airspace constraints that considers airport surface, terminal and en route (gate to gate) operations as an integrated, distributed work system. Translate these findings into human factors guidelines and into requirements for the acquisition of the tools and subsystems necessary to support effective individual work, as well as to enable effective teamwork across these domains.

Finding: Although planning tools such as the Human-System Integration Roadmap help to identify interactions among different development programs at key Decision Points, as does the development of specific human factors guidelines, there remains a need to ensure closer integration of FAA human factors research and human factors design decisions for different development and acquisition programs. This applies to the design of new roles, responsibilities, and procedures, as well as the development of supporting tools and technologies. It is especially important in cases where a single operator, such as an air traffic controller, will have to work with tools that are being developed by different programs or where the work supported by these tools has to be coordinated across a distributed team of operators.

Recommendation A: To ensure better coordination among the human factors professionals involved in human factors research and/or the design and acquisition of specific new tools, the AMS lifecycle should include specified points in the design and requirement generation process where the human factors professionals conducting research, design, and requirement definition across related subsystems exchange information. This is needed to ensure compatibility with established human factors guidelines and to maintain consistency across the designs for these related subsystems from a human factors perspective.

Recommendation B: Include a focus on scenarios including off nominal, emergency, and system degradation events, as those are often the most demanding situations confronting operational staff in these cross-program information exchanges.