Research, Engineering & Development Advisory Committee (REDAC)
Federal Aviation Administration
September 26, 2012
Meeting Minutes

On Wednesday, September 26, 2012, the Federal Aviation Administration (FAA) Research, Engineering and Development Advisory Committee (REDAC) held at JMA Solutions Headquarter, 600 Maryland Avenue, SW, Washington, DC. The purpose of the meeting was to receive guidance from the Committee on the FY 2015 Research and Development (R&D) portfolio. Attachment 1 provides the meeting agenda.

Welcome and Introductory Remarks

Dr. Wilson Felder, FAA REDAC Executive Director, read the public meeting announcement and thanked everyone for attending.

Dr. John Hansman, REDAC Chair, welcomed everyone. He also recognized Dr. Agam Sinha who informed the REDAC that he is going to leave the Committee because he is retiring.

Dr. Felder briefly greeted the Committee members and stated that this meeting would be his last, as he will be retiring as of November 30, 2012. He stated that he looks forward to the new initiatives set forth by the Committee.

Update – ANG Organization – I2I – New Chief Scientist

Ms. Vicki Cox followed up by commending the Committee for all the hard work it has performed over the years. Ms. Cox stated that she appreciated the dedication and the time put forth by the Committee members and that Dr. Felder would be greatly missed. She recalled the decision to move the management of FAA research to the leadership of the FAA William J. Hughes Technical Center Director, they had no idea that Dr. Felder would be stepping down so soon. Ms. Cox went on to say that they are taking steps to backfill the vacancy, in the interim. She added that this would be one of the fastest vacancy announcements ever disbursed by the FAA, especially for an executive-level position such as this. They are also planning an announcement for a Technical Director position at the Technical Center. Ms. Cox stated that Dr. Felder has been very versatile in being able to handle the technical scientific research aspect as well as the Base Commander aspects of the position he held. She stated that her reasons for bringing up the vacancy announcements was to assure the Committee that they are being very aggressive in filling both positions and to market the positions to a broader pool of qualified persons in the community represented by the REDAC. Ms. Cox stated that it is her goal to have at least the Technical Center Director position filled by the time that Dr. Felder departs to ensure a smooth transition.

She went on to speak about the NextGen Organization; stating they received approval in September 2011 to reprogram the NextGen organization that was lifted out of the Air Traffic Organization (ATO) and stood up as a separate entity to support the successful delivery of NextGen.

Ms. Cox provided the Committee with an overview of what the NextGen organization does as outlined in a document called the 1100 series. This document details the logistics for setting up the organization and designates roles and responsibilities. A copy of the 1100 document was distributed to the Committee members. She highlighted that the Office for Chief Scientist of Software is a position the Committee has been recommending that they fill it for several years. The FAA has hired Mr. Natesh Manikoth who comes from industry and has great experience putting complex software systems into place around the country. He led the software efforts on the EZPASS system and has recently worked with IBM. Mr. Manikoth will be reporting to duty on November 19, 2012 and may be working on some of the Subcommittees by request.

Ms. Cox stated that NextGen continues to do the planning for the future of the National Airspace System (NAS) and part of that is to ensure that appropriate steps are taken as they plan to include things like developing a new concept of operations and in documenting the requirements.

Ms. Cox mentioned for NextGen that they have put in place a process called Ideas to In-Service (I2I) to help the organization manage responsibilities as a NextGen organization. The process operates as a framework for carrying out responsibilities and is documented in a flowchart indicating who has decision rights at all points from research to in-service operations. She stated that the intent of the I2I process is to put an emphasis on accountability and collaboration. Ms. Cox noted that one of the biggest challenges in the Agency has been having decision-makers change their minds when the organization is going forward with a process they assume has been approved.

The I2I process allows NextGen to document the various projects and milestones to minimize confusion, ensure visibility with key decision-makers, and help streamline workflows. In conclusion, Ms. Cox spoke about the role of the REDAC itself. She stated that there has been some focus on advisory committees; they had a round table with Congress inquiring what process was set in place to allow the Agency to solicit industry inputs and feedback. To this point, she reemphasized the importance of the REDAC operating as a vehicle to solicit industry input. She added that they have a pretty good success story with the Task Force 5 work to adjust some budgets, which is a big challenge for the REDAC. Ms. Cox stated that the REDAC has more personal influence over what the Agency does than the other advisory committees by virtue of the way the REDAC works with the Subcommittees and engages with the sponsors of the research.

Remarks – Honorable Michael Huerta

Dr. Hansman welcomed the FAA Acting Administrator, Honorable Michael Huerta and opened the floor to him for comments. Mr. Huerta welcomed the Committee and thanked them for the work that they continue to do; particularly the efforts on FY 2013 with regard to the Agency's priorities for that year. He added that he admired their due diligence and appreciated the work that the Committee is doing, particularly with anticipated fiscal challenges for 2015.

Mr. Huerta stressed the importance of highlighting what the associated benefits are for the Agency as it continues to make investments in technology and deploying new capabilities . He

added that communicating the benefits outside of the Agency has been a challenge because there is not a good sense in the outside community about NextGen and what it really is. Mr. Huerta said the big focus for the Agency currently is to highlight and put efforts toward creating visibility for points on continuum and to tell a story that represents the steps the Agency is making toward progress. He added that as the Agency continues to deploy capabilities, those success stories would increase; they have a few success stories already, such as DataComm. Mr. Huerta commented that they are making progress across the NAS, but the important thing is to tell the success story in totality to provide a big picture and not piecemeal it

Dr. Hansman stated that based on his reading from the REDAC, things are going pretty well and some of the items that they have been pushing to get more visibility in the REDAC have actually gotten more traction. He added that the relationship between the REDAC and the Agency is a beneficial one. He continued by saying that one thing that has been done in the past is to try to set up some activity on a model of the Defense Science Board. If there are issues which the Committee deems as not being in the normal review for the budget, they can act as a sounding board or engage in a focus study that would be beneficial from a technical standpoint or with future issues. He noted an effective Human Factors Subcommittee study that increased the visibility of an issue to management and highlighted the magnitude of the issue.

Ms. Cox stated that another area she thought was helpful on the focus study was the one on cultural issues. The feedback from that study strongly influenced the establishment of their organization and the I2I process and how the FAA conducts business. She added that a good follow-on to that might be an examination of the transition factors, which are largely cultural. Mr. Huerta stated that they have done a lot with regard to ongoing situations, as mentioned earlier. He added that the feedback about what is being produced in ATO has been relatively positive as it pertains to flight standards. The FAA was making a safety case on development of a procedure; the findings indicated that there was a disconnect between stated policy and what is actually implemented within the Agency. Dr. Hansman stated that we are in an SMS state of technology and culture, however, it turns out that they do not have the data needed to do some of the analysis. He added that part of the problem is they have no means of getting the data because they are all estimates and not stated figures. He went further to state that it is actually relatively easy to make the safety case similar to what is already being done. He added that the analysis will only need to be done on the modification. Therefore, you have to review target levels as opposed to relative risk analysis; which makes the process vulnerable because someone can place an obstacle in that safety. He stated that while it is well intentioned, it is very conservative so it makes it harder to make those changes; which is related to the transition issue. He reiterated that the safety analysis has to be done on new technologies; it is inevitable. In some cases, they found that the criteria were too high. Mr. Huerta asked what could be done to minimize the transition issue, if the safety analysis cannot be avoided. Dr. Hansman answered that the best thing that can be done is to come up with more innovative ways to do the analysis. There are some innovative strategies being explored on early implementation. For example, there is a huge amount of data available in monitoring the system. The question becomes, can they take advantage of that data? He explained a case in point: suppose there is not enough information available that would be needed to make a full safety case because the potential failure mode cannot be determined. Is there a way to do conditional approval with monitoring that would then allow them to get into the field with a waiver, build the data and then build the safety case with

experience so that it starts to come into the system?

Mr. Joe Del Balzo asked if there was something that the Committee could do that would be helpful because it is clear that there is a coherent story to be told about NextGen progress. He stated that it is a story that needs to be told, but if it is only FAA telling the story, then it appears to be self-serving and it will not get the desired visibility. He asked if the Committee could assist with that initiative, highlighting the achievements of NextGen. The efforts would be done independently because the Committee is not paid for the work that it does. Dr. Hansman stated that the idea was an interesting thought and the summary could include a technical impact statement that includes the progress made on NextGen initiatives.

Ms. Deborah Kirkman stated that the error is putting out the idea that "we are not there yet", when it comes to NextGen. She added that NextGen is achieving things every year and if the Agency can tell the story of NextGen's continuous improvement as opposed to telling people that" "we will get there when we're done."

Dr. John Cavolowsky commented that the problem has been going on for a decade and the desired endpoint has been 2025. The consensus was that NextGen is a very difficult story to be able to tell because it will surpass 2025 because its initiatives are progressive in nature. He added that the benefits case has to come most compelling from the user system; the government benefit is critical and needs to be told. However, the most compelling part of that story is from JetBlue and others.

Mr. Chris Oswald referenced the work that has been done by Deborah Kirkman's advisory group on the NextGen Advisory Committee (NAC) regarding the business case and performance metrics she's been leading. He went on to say that they had a long conversation about defining the criteria for success for Deborah's group to try to define those metrics. He added that if the Committee can review that work as well, there's probably a lot of value in that. One of the concerns he mentioned was how does the FAA commit to the levels of improvement that they could see using those metrics when they have a dynamic system that will have change for other reasons. He added that when you move to implementation, you could get demand increase due to the recession being over and the benefits play poorly with the public because they don't understand the impact. He stated that all the public would see is that delays are really increasing.

Dr. Hansman added that when you look at the performance of the system over the past few years, it has been pretty good. For example, at delays, the thing that is an indicator of saturation is volatility abilities, volatility is down; so the problem is how you can indicate these subtle factors as an indication of better performance.

Mr. Joseph Bertapelle asked whether everybody reads the recommendations that have been put forth by the NAC to the FAA. Mr. Huerta stated that the Agency has the ability to share the work and we could take to try to figure out how they can provide that type of sharing with regard to agendas and work products. He went on to say that the recommendations could not be shared as easily until they are made public after the NAC sends them to the FAA. Mr. Huerta stated that he thinks the REDAC's feedback is beneficial to the Agency and that he reads the reports. Dr. Hansman added that what the REDAC typically tries to do is use the subcommittee reports to

synthesize up to higher-level bullets that are normally put into the letter to Mr. Huerta. Mr. Huerta stated that the reporting format works for him because it clearly identifies the "big picture." Dr. Hansman thanked Mr. Huerta for attending the meeting and they moved onto the next agenda item.

ACTION: Explore ways to share materials with the REDAC from the NextGen Advisory Committee (NAC).

ACTION: Provide NAC materials to the NAS Operations Subcommittee prior to their next meeting.

Update - REDAC Operations Working Group & REDAC Input Discussion
Dr. Cathy Bigelow provided a brief summary on the REDAC Operations Working Group. She reiterated that anyone who has not provided responses to the questions to please do so. Dr. Bigelow stated the objective of the Working Group is to enhance the operation of the FAA RE&D Advisory Committee. The Working Group is considering all aspects of the REDAC for possible improvements, including but not limited to the number of meetings per year, tasking associated with meetings, membership of both REDAC and subcommittees, the number of topics of the subcommittees, and any other aspects that the Working Group deems appropriate to enhance the value of the subcommittees and REDAC.

The Working Group is made up of representatives within the FAA, including the Subcommittee Designated Federal Official (DFO) and members of FAA R&D Executive Board (REB). Dr. Bigelow went on to say that the Working Group's approach has been to stay within the boundaries of legislation that established the REDAC. In addition, the Working Group must consider any constraints imposed by the FAA budget formulation process as it affects the scheduling of REDAC meetings. The approach was to collect ideas within the team and members of the team would also go back to the home organization and collect feedback.

A survey was done of the REDAC members, FAA senior managers, and other advisory committees to gather ideas for best practices. At this point, the Working Group is still in the survey phase and awaiting feedback. The survey questions centered around: what is working for the REDAC right now, what is the impact of the REDAC, questions related to subcommittee meetings, and ways to improve the REDAC. She added that some of the collective input that they have received: most people appear to be clear on the role of REDAC and interact appropriately; there is a general consensus on the calendar, however, it was suggested that the calendar include enough time for recommendations to be submitted so that the recommendations could have more impact on the planned research portfolio; some would like subcommittees to meet more frequently and/or have more extended meetings; most are content with the level of commitment shown by the subcommittee but would like the REDAC to be more agency-centric; and there was a request for more insight into the "bigger picture." Dr. Hansman asked Dr. Bigelow to explain what was meant by "more agency-centric." She explained that the statement was suggesting that the REDAC provide more strategic guidance and direction at a cross-Agency level. The consensus was that "it should be more top-down than bottom-up." Dr. Bigelow stated that the next steps for the Working Group are to continue with the survey to get inputs from other REDAC members and FAA management. Once the data has been

collected, they will develop recommendations based on the input and submit for consideration to senior management. She stated that their original target completion date was December 31, 2012, but due to organizational changes, the date has been extended.

Dr. Amy Pritchett had a question regarding the timing of the subcommittee meetings; she stated that the requirements that are supposed to be reviewed prior to the meeting are often not released in time. Dr. Bigelow answered that the current schedule has been in place for quite some time, but that, over time, some of the organizations have developed a schedule for the requirements development processes that doesn't match with the overall schedule as well as it once might have. Dr. Felder stated that part of the work of the Working Group is to try to assess scheduling conflicts and consider changing the meeting schedules or the contents of the subcommittee meetings. Dr. Bigelow reiterated that the purpose of the REDAC is to propose recommendations that add value to the organization and improve processes; however, if those recommendations are provided too late and the requirements have already been submitted, the process will need to be modified to work.

Dr. Felder asked what was meant by the suggestion to get more involvement from senior management. Did they want the Administrator to come to the subcommittee meetings? He wanted to understand what that type of engagement would look like and what would be expected. Dr. Bigelow stated that based on the comments received, the expectation is that the recommendations be taken seriously by FAA senior management and implemented wherever possible. In addition, the subcommittees would like to have their requests for information taken seriously and the requested information provided.

Dr. Bigelow mentioned the feedback also indicated that some subcommittee members don't think that the Administrator is taking the recommendations seriously either. Ms. Deborah Kirkman made the observation that there needs to be clarity on the decisions faced; if they are simply commenting on budgets and requirements that have already been set, there's very little flexibility to respond to those comments. She stated that senior management has a window of opportunity to provide information and to help guide decisions; that is where the group would feel much more engaged if they knew what that decision is based on. Dr. Felder commented that the earlier conversation with Mr. Huerta was very good and that next time they would like to have him stay longer.

Mr. Steve Alterman stated that all of the members on the different subcommittees come up with recommendations on those subcommittees and, in an era of declining revenues and declining resources, they've all tried to prioritize within their little buckets. However, the question raised is once they prioritize within those buckets and make recommendations on what can be done, how does the Agency set its priorities ? He asked how the recommendations are prioritized and managed internally. Dr. Hansman stated that the recommendations are managed through the REB process, which is collegial. However, if there is an environment initiative that is compelling then there may be some degree of support from the other communities, but in general, that has been difficult.

ACTION: See if the Administrator's calendar will allocate more time at the next meeting. Coordinate more specific items to be discussed with the REDAC.

Report – NAS Operations Subcommittee

Mr. Deborah Kirkman (filling in for Subcommittee Chair, Dr. Victor Lebacqz) stated that Joint Planning and Development office (JPDO) has done an analysis of what research would be needed and when it would be needed to put NextGen level 4 into place; however, they have not completed the gap analysis. Some of the concerns are whether the FAA understands the gaps in R&D and identifying what can be done to prioritize those research areas to make more progress.

One key concern of the NAS Ops Subcommittee was that the content of the presentations did not address the question of how much equipment is necessary and will there be variations. In addition, would it be possible to get benefits with lower levels of equipment than might be optimal? She added that this is a tough question to answer and there were a lot of tradeoffs in a mixed equipage environment.

Dr. Hansman stated that he felt the sense that there is not a strategy and to get near term benefits, you have to have a strategy for mixed equipage. He added that it might be unrealistic to expect them to have some special controller of decision support tool because by the time the tool gets put into place, they would be at full equipage. Ms. Kirkman said that is the trade-off.

Dr. Hansman went on to say that it has to include procedural separation. There was discussion amongst the group about the challenges controllers face when new capabilities come into play.

Ms. Kirkman reiterated that ConOps does not address the challenge of transitioning new procedures when there is not a preponderance of capabilities. She stated that there are a lot of concerns that the navigational capabilities were not being adequately leveraged in the environment.

She went on to highlight the Weather Technology in the Cockpit Program presentation. NAS Ops requests additional information on 1) research directly aimed at general aviation (GA) safety and 2) major problems driving overall weather in the cockpit research. She stated that, although the FAA has improved GA safety on a major level, the NAS Ops Subcommittee wants to see what problems the FAA anticipates, what risks are being addressed, how big are the risks, and how the risks are being quantified. This will help tell a better story and justify what factors are driving the research and why the research is important.

Ms. Kirkman said the NAS Ops Subcommittee requested an update on FAA's strategy to use Big Data initiatives. Dr. Hansman asked what is being done with Big Data? Ms. Cox stated that the FAA is taking a look at overarching data management; pulling in all the data resources from Airports, Air Traffic, site surveys, etc. Dr. Hansman stated that he was surprised the NAS Ops did not have a stronger recommendation on this topic, because of the significant changes in this area. Ms. Kirkman stated that they didn't want to make the recommendation without knowing what the FAA was implementing already. Mr. Wendell Griffin stated that, from an AVS perspective, they did a deep dive for Subcommittee on Aircraft Safety and they will be happy to do that for NAS Ops as well.

Mr. Chris Oswald stated that Big Data is a research area that is of interest to other subcommittees and that for Airports, data sharing research is a priority as well. He mentioned the collaboration of SMS processes and the concern for how to protect the data that is submitted.

ACTION: Dr. Felder stated that Eric Neiderman will take action on how to respond to the issues mentioned by Mr. Oswald; create several presentations.

Ms. Cox stated that she is still not convinced that they are working on it to the level that the Committee would like. Ms. Kirkman added that they are not requesting that the Committee act on this issue immediately; it is simply a request to start engaging in this area. There was discussion about developing a strategy to align with the presidential initiatives on system-wide information management and data management. There was a discussion on collected data on aircraft positioning, archiving data requirements and tracking requests for information.

Report – Subcommittee on Environment and Energy

Mr. Steve Alterman (Subcommittee Chair) stated that the overall view is that the priority is on NextGen support; however, the subcommittee noted that there seems to be another growing emphasis on growing research. He added that in the current environment, the emphasis should be on the function of better routes, diverse routes, and redesigning airspace. Mr. Alterman stated that it is unclear whether the noise issue is an issue of airplanes flying over different residential areas that are 10-20 miles away from the airport or residential areas within runway space. From a research perspective, the Agency is looking at how to mitigate the complaints of noise and address those concerns; what are the issues, are they health issues, are they airplane issues.

He stated that they are making great progress in aviation fuels, but there are still significant commercial challenges. They have made progress in the certification of new fuel sources, but the question is whether there is refining capacity and what the price point will be to use those fuels in great quantities within the aviation industry; thus the research needs to continue.

In light of the federal budget cuts, there is a grave concern about research priorities because there are too many uncertainties. However, the subcommittee did decide that if budget cuts are to be made, they should not cut below baseline levels rather than cutting ay programs out; especially with the CLEEN program. Mr. Alterman stated that the subcommittee also recognizes that there are two potential areas of environmental concern that have not been dealt with: particulate matter (PM) and unmanned air vehicles (UAVs). Dr. Hansman asked what was the environmental concern with UAVs? Mr. Alterman responded that the concern has not been identified yet but they anticipate one.

Mr. Alterman stated that there is an absolute need for the FAA to engage in cooperative research with other governmental departments; it is especially crucial in the area of limited resources. He added that they are encouraged with what the Agency is doing and they want to ensure that the progress continues. The recommendation is that NASA and the Department of Defense continue to cooperation and update the subcommittee on their environmentally related programs and that this type of briefing be expanded to include other governmental programs, such as the Environmental Protection Agency (EPA) and the Department of Agriculture.

Another recommendation was that the Agency continues to develop and refine environmental tools that will enable the assessment of the environmental consequences of NextGen implementation as well as assist in the establishment of environmental standards at the International Civil Aviation Organization (ICAO). As it relates to the ICAO process, they believe that U.S. leadership and the international community need to be an important priority, especially with CO_2 emissions standard. He stated that the demands on the Office of Environment and Energy are burdensome; with the U.S. playing a disproportionate role, we don't want to have to do everything. He added that the subcommittee thinks that the FAA should exercise discipline over the ICAO project.

The FAA should request clear problem statements to be appropriately vetted and encourage other countries to play a greater role in the research areas because the Agency cannot do it alone. He added that a noise roadmap is being developed and the subcommittee had requested to know how the roadmap was being developed. Mr. Alterman stated that one of the ways to do this would be to conduct a survey to get feedback from the communities: where are the problems. The concern was that validity of the result of any survey in the area of aircraft noise depends on the questions asked; there was a concern that all aspects of the noise issue may not be addressed in the current planning process. Therefore, the suggestion was that the FAA selects a focus panel to review the survey questions ahead of time.

Mr. Alterman then went on to the Center of Excellence (COE). The COE is coming to the end of its life; the plan was to implement a new COE and let the existing one expire. One of the suggestions was to form a new COE that would include Environment and Energy in accordance with the Congressional mandate. The subcommittee strongly supports this approach. The subcommittee thinks that the FAA needs to play a leadership role to ensure that the COE is aligned with Agency research goals. To do this, the FAA should be encouraged to make annual presentations to the COE detailing the goals and making sure the projects are aligned with Agency goals.

The next recommendation was that the process be established to enable stakeholders to have a meaningful input into COE research activities.

Lastly, the subcommittee recommended that a small percentage of COE projects be devoted to "entrepreneurial" activities that might appear to be "out-of-the-box" but which might lead to environmental breakthroughs, if successful.

Mr. Chris Oswald commented on NextGen Advisory Committee (NAC) and REDAC collaboration: defining the "noise" metric to support the Section 213c appropriations bill. He added that there are probably opportunities for cross collaboration. There was a discussion about crossing over defining noise metrics between the REDAC and the NAC.

Report – Subcommittee on Airports

Mr. Chris Oswald (Subcommittee Chair) began with stating that there is a lot of pavement

research, especially in the Atlantic City area, and it is delivering excellent results. The Subcommittee came up with three sets of recommendations. The Sleep and Noise study is a collaborative effort with Energy and Environment; it is a study just initiated and being funded under the Airports Technology program. This study has the potential to be controversial; it will redefine the criteria for noise annoyance and identify what types of political and funding issues exist.

Regarding Airport Rescue and Fire Safety; they have been waiting for results from research to come out; and are acquiring aircrafts to simulate fires as they pertains to cargo aircrafts, etc. Mr. Joseph Del Balzo asked whether the $29M is congressionally fixed or does FAA have the discretion to raise or lower the budget. Mr. Jim White stated that it is a separate line item in the Airport Improvement Program (AIP) appropriations, so they do not have discretion to modify it without going through the congressional budget process. The law prohibits transfers of funds from AIP to other appropriations within the FAA.

Mr. Oswald commented that the Aircraft Breaking Friction is a complex project that uses a real aircraft and simulated snow to measure how wheels slip and how the breaking system reacts. There are a lot of risks involved but they are looking for researchers to develop criteria for "go"/"no go" decisions as they go through the projects.

Regarding the Heated Pavements, they are working on a business case dealing with geothermal, electrically heated, and other systems that will substitute for the use of deicing chemicals. These systems could potentially be easier for airports to implement them but the costs of the systems seemed to be well outside of the budget scope and the safety risks associated with this project have not yet been defined. There are some existing efforts in Scandinavia (Norway, Denmark, and Sweden) where those airports have geo-thermal features available for to heat the pavements. Ms. Cox asked if the evaluation will include weighing the electrical effects on the environment versus chemical, since hydropower-electric is used in Norway and Sweden.

Mr. Oswald said that the electrical systems are not really rising to the level of being supported right now. Dr. Hansman asked what research that is currently being done? Mr. Oswald stated that the research is multi-fold: it started in geothermal insulation in Bington. Dr. Hansman asked what the $1M per year was being spent on. Mr. James White confirmed that the funds are being spent on geothermal test sites, pre-recommendation pavement, and building a business case.

Dr. Felder asked for clarity on both projects; are they asking for the risk associated with research? Mr. Oswald answered that for the braking system, it is more related to a complex research projects. Dr. Hansman stated that the research is geared toward applicability. Mr. Oswald followed up by saying that with heated pavements, the research is geared toward assessing the effectiveness of different approaches to heated pavements. He added that in the end, the question becomes whether these research areas are places where we should spend money.

Mr. Oswald commented on the 40-year Pavement Life program. They need to define pavement life and a list of expected pavement maintenance activities that would enable a 40-year pavement life cycle at or before the next Subcommittee meeting.

Mr. White mentioned another airports research activity, which is a separate line item in the appropriations bill for $15M. It is an oversight committee that selected the topics to fund for FY 2013; there was a broad sense in the oversight committee that quality of the topics submitted to ACRP was not of the caliber that had been seen in the past, particularly in the area of Environment. ACRP asked Congress to increase its budget from $10M to $15M: the additional $5M in funds being allocated to fund Environmental topics. They are looking for more decent topics from the Environmental community. Mr. Holsclaw stated that targeting universities to do research with the objective of near-term deliverables to the current airport environment are not necessarily going to match up. Mr. White stated that he understood, but they are trying to get a broader reach on the types of research topics that come in. He stated that anyone could submit a research topic to ACRP; the board reviews them, scores them, discusses them and awards the money to the topics that are the most promising. Mr. Oswald mentioned the priorities of Airports Subcommittee; adding time to the meetings to discuss research areas emerging from the industry, enhance surface management and data sharing, Advanced Sensing project (big issue), operations changes in surface operations for NextGen, and six inches of pavement. He added that they would be defining those priorities at the next meeting.

Report – Subcommittee on Human Factors

Dr. Amy Pritchett (Subcommittee Chair) began her briefing by stating that one of the specific areas that the Subcommittee recommends focus on is the Electronic Flight Bag (EFB) system; this is a key area that captures a number of other considerations. The Subcommittee sees other issues that may merit some consideration of what research is taking place and the FAA may be able to dovetail much of the research that was presented at the Subcommittee meeting.

Regarding Fatigue Risk Management Systems (FRMS), operators may choose to implement earlier, so the proposed database for tracking carriers' application of FRMS may also need to be moved earlier.

Related to on-going research within "NextGen: DataComm Human Factors R&D," there are concerns emerging in the community, including questions about digital Notices to Airmen (NOTAMs) and proper methods for amending pre-departure clearances (PDCs) such that all relevant parties remain synchronized.

The REDAC recommendation from the Spring 2012 meeting regarding the Airline Operations Center (AOC) remains open. This research was also presented to the NAS Operations Subcommittee. At the Summer meeting it was said that funding for all of the AOC related work was reduced. Ms. Vicki Cox asked if it was just the Ohio State University (OSU) work that was being cut out and suggested the REDAC review integrated work that is going on, because she felt there was other AOC related work. Dr. Felder stated that this was just one thread of the HF work and one thread of the AOC related research therefore, the REDAC needs to take an IOU for a broader view.

ACTION: Obtain more detail information on the work being done with AOC and the specific budget line item.

Report - Subcommittee on Aircraft Safety

Mr. Joe Del Balzo (Subcommittee Chair) began his presentation by stating that the Subcommittee on Aircraft Safety found the FY 2012 portfolio to be substantially correct. In addition, all programs that were under review had expected outcomes directly linked to clearly stated research requirements. He mentioned that no programs or research activities were recommended for elimination.

Mr. Del Balzo stated that the subcommittee was impressed with the major progress made on the research side; upgrading the expertise in technical areas and allowing more focus on critical areas. He stated that a lot of credit goes to Vicki Cox, Wilson Felder, and John Wiley.

He highlighted one recommendation that should be provided to the Administrator in the area of UAS. The Subcommittee got a very good briefing on the different research activities but it is difficult to comment on the actual value of the research activities out of context. He mentioned that they are missing the context of operations and the airspace roadmap to properly assess the impact of the research and identify gaps as it is compared against the ConOps.

Mr. Del Balzo stated that they are pleased to see the organizational changes and the establishment of the UAS program office. However, they question whether or not the program office is able to provide the leadership in management working as a matrix organization. In the past, FAA has not been successful doing anything in matrix format.

Regarding Digital Systems Safety; the Subcommittee sees that the organizational changes that FAA has made will bolster their ability to maintain momentum and they are currently taking steps to upgrade their technical capabilities. Mr. Del Balzo mentioned that a lot of time was spent on ASIAS; the recommendation was that the FAA considers conducting additional research that will connect the human element with the operational events recorded by ASAP/FOQA data. He stated that the other programs that they reviewed have provided proof of good progress and that no significant recommendations were made for those projects.

Committee Discussion

The members engaged in discussion on what recommendations and issues should be raised to the attention of the Administrator. Dr. Hansman opened the discussion by providing a list of items that he felt were important to highlight:

- Something positive should be said about the response to the Digital System Software recommendation.
- REDAC could be encouraging regarding the opportunity with Big Data.
- From discussion earlier with the Administrator two that came up were:
- Review of the progress made with Next Gen.
- Transition barriers, of which two studies have been done in the past.
- AOC-Integration was covered.
- Regarding UAS, the members felt the Administrator is already well aware of the problems

with UAS.
- Suggested that they merge data mining with the human element into the letter.
- Did the members want to say anything regarding the FRMS database; the issue is that the FAA database is not going to be ready until 2013. It was suggested that FRMS not be mentioned in the letter to the Administrator because it is not a research topic.
- Ms. Kirkman reiterated the importance of clearly articulating the benefits in a quantified way and identifying how much something is worth. In addition, she stated that the Agency needs to balance the R&D investment with the resulting benefits.

Homework: Ms. Deborah Kirkman will provide information to help clarify the recommendation.

Dr. Amy Pritchett stated that it is important that the REDAC does not type cast Big Data as just SWIM or just ASIAS; but rather capture what the Agency is coming up with as a whole.

Dr. Cavolowsky stated that a more in-depth briefing on the I2I process would be helpful.

ACTION: Next REDAC meeting schedule an in-depth briefing on the I2I process at the end of the meeting. Include briefing as part of the read-ahead materials.

Dr. Hansman thanked everyone. He will draft the letter to the Administrator and send to the members for review and approval. (The final letter to the Administrator is provided in Attachment 2.)

The meeting was adjourned at 1:41 pm.

Attendance

Members

John Hansman (Chair)	Steve Alterman	Agam Sinha
Deborah Kirkman	Joe Del Balzo	Amy Pritchett
Chris Oswald	John Cavolowsky	

Wilson Felder (REDAC Executive Director)

Other Attendees

Hon. Michael Huerta	James Knight, FAA	Cathy Bigelow, FAA
Paul Krois, FAA	Joe Bertapelle, JetBlue	Gloria Dunderman, FAA
Eric Neiderman, FAA	Mike Gallivan, FAA	James White, FAA
Mohan Gupta, FAA	Andrea Schandler, FAA	Leslie Riegle, FAA
Koichi Minato, FAA	John Hickey, FAA	Curtis Holsclaw, FAA
Vicki Cox, FAA	Wendell Griffin, FAA	Ben Thielen, FAA
John Wiley, FAA	Kevin Carbajal, NASA	Michelle Yeh, FAA
Lee Olson, FAA	Ken, Knopp, FAA	Irma Rodriguez, NASA

Attachment 1

Research, Engineering and Development Advisory Committee
Federal Aviation Administration (FAA)
600 Maryland Avenue, SW Suite 400E Washington, DC 20024
September 26, 2012

Agenda

8:00 am	Welcome	Wilson Felder John Hansman
8:45 am	Update – ANG Organization – I2I – New Chief	Vicki Cox
9:00 am	Remarks	Hon. Michael Huerta
9:15 am	Update – REDAC Operations Working Group & REDAC Input Discussion	Cathy Bigelow
10:00 am	Break	
10:15 am	Subcommittee Report – NAS Operations	Deborah Kirkman
10:45 am	Subcommittee Report – Environment & Energy	Steve Alterman
11:15 am	Subcommittee Report - Airports	Chris Oswald
11:45 am	Lunch	
12:45 pm	Subcommittee Report – Human Factors	Amy Pritchett
1:15 pm	Subcommittee Report – Aircraft Safety	Joe Del Balzo
1:45 pm	Committee Discussion Recommendations Future Committee Activity	John Hansman Wilson Felder
3:00 pm	Adjourn	

Attachment 2

October 3, 2012

The Honorable Michael P. Huerta
Acting 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 our recent meeting. The committee enjoyed the discussion and benefited from your insights. In response to one of your suggestions the REDAC will take the action to cross coordinate with the NextGen Advisory Committee (NAC).

The REDAC is encouraged that the agency is making progress in several areas noted in prior REDAC reviews. In particular the committee noted the progress in developing capability in software and digital systems both in AVS and in the recent appointment of a Chief Scientist for Software in the NextGen organization.

The REDAC noted that the FAA is uniquely positioned to take advantage of the national initiative in "big data". While recognizing the current capabilities in ASIAS and NAS monitoring there appear to be significant opportunities to improve the safety, efficiency and environmental performance of the NAS by applying the current and emerging data mining technologies to the vast set of operational data the agency routinely collects (e.g. ETMS, ASDE-X, PDARS, ASAP, FOQA, …).

The REDAC recommends that the agency develop an aggressive "big data" strategy for both monitoring and operational control of the NAS. One particular area identified by several of REDAC subcommittees is the potential use of "big data" to characterize the human element in operational performance both at the individual flight level and the overall system level.

The REDAC also encourages the FAA to clearly articulate and quantify the range of user benefits and costs of proposed operational concepts and systems. Capturing this range should help to focus and balance needed investments in Research and Development, as well as for eventual implementation. This is especially important if significant costs must be borne by entities such as airports or flight operators before benefits can be realized.

I am enclosing the summary findings and recommendations from the fall 2012 meetings of the standing REDAC Subcommittees (Aircraft Safety, NAS Operations, Environment and Energy, Airports, and Human Factors).

Finally, we would like to reiterate our offer to address specific areas of concern in a focused study if there are issues that you feel the REDAC could provide independent and effective advice.

Sincerely,

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

Enclosure

Research, Engineering and Development Advisory Committee
Guidance on the Fiscal Year (FY) 2015 Research and Development Portfolio

NAS Operations Subcommittee

Finding: The important work in Operations and Concept Validation Program briefed by John Marksteiner was very near term and had no five-year or longer plan or roadmap of needed activities. While understandable in light of the budget situation within the FAA, this work, in particular, which the subcommittee has championed every meeting, needs to have a longer-term outlook and the capability to develop it.

Recommendation: FAA should enable and support a longer-term (e.g., five year) activity in developing a coordinated and understandable plan or roadmap for these activities, particularly those supported by the facilities and equipment (F&E) budget line, which would be informed by assessing and monetizing shortfall areas (see related finding and recommendation) to define needed research areas.

Finding: Given the breadth of advances associated with the implementation of the NextGen Concept of Operations (ConOps), it is very important to address integration requirements. This applies at both the level of workstation software for the operational staff with different roles and responsibilities and at a broader systems level, where collaboration and coordination need to be carefully addressed in terms of direct and computer-mediated human-human communication, coordination and collaboration and human-automation interactions.

Specific examples of the need for workstation integration include the need for integrated workstations for Air Traffic Control (ATC) Tower, Terminal Radar Approach Control (TRACON) and Air Route Traffic Control Center (ARTCC) controllers, supervisors and traffic managers. At the system level, the issue is one broader systems thinking during the design and evaluation of ConOps, procedures and technologies in order to ensure effective integration. Of particular concern is the need to design to support coordination of the many actors within this distributed work system, including controllers, traffic managers, pilots, dispatchers and ATC coordinators, ramp controllers, airport operators, and Airline Operations Centers (AOCs). It appears that some of this required crosscutting human factors research for NextGen was eliminated after the Human Factors Subcommittee review, as was noted in the succeeding NAS Operations Subcommittee review.

Recommendation: More intense cross-cutting human factors research and development efforts are necessary to ensure that the linkages among different ConOps that have been developed are carefully defined and addressed in order to ensure effective integration. In particular, we reiterate our recommendation that all nodes of collaboration, including AOCs, as appropriate, are explicitly identified as components in all areas of NextGen research and implementation where the flight deck, air traffic control and AOCs already collaborate today or will in NextGen, and should be adequately funded.

Finding: The Subcommittee was pleased by Dr. Karlin Toner's Joint Planning and Development Office (JPDO) presentation for its overall thought leadership, depth and maturity.

We were impressed by the completeness of JPDO's recent engagements of the stakeholder communities, and the explicit acknowledgement of the complexities of the issues and willingness to face the difficulties each presents. In particular, the JPDO briefing describing the flow of NextGen capabilities as a function of needed work was considered excellent by the subcommittee, particularly the understanding that, to reach a 2025 Nation Airspace System (NAS) with changed roles and responsibilities (a long-standing concern of the Subcommittee), work beyond the research currently ongoing is required.

Recommendation: The research requirements to move beyond the NextGen Operations Level 3 to the Level 4 implementation capabilities have been initially identified by JPDO. A gap analysis of on-going research against that required to reach these capabilities should be developed as soon as possible and briefed to the NAS Operations Subcommittee.

Finding: A significant portion of the FAA's research agenda involves the definition and validation of operational concepts that build upon NextGen equipage. The NAS Operations Subcommittee was not briefed on any activities that address issues related to transition and mixed equipage or multiple levels of service based on differing levels of aircraft capability. The NAS consists of, and will continue to consist of, a wide range of aircraft capabilities (e.g., equipage, training, performance envelopes) and missions. Regional jets, for example, are unlikely to be delivered with, or retrofit, certain NextGen functionality due to cost-effectiveness considerations.

Recommendation: FAA research activities (e.g., ConOps development, validation, etc.) involving NextGen equipage need to explore the following:

- Critical mass thresholds for delivery of benefits to equipped users
- Potential automation mitigations to enable controllers to handle mixed capabilities
- Trade space of performance requirements, benefits, costs, aircraft equipage levels, and ground capabilities with respect to overall system performance gains, system benefits, and net benefits to equipped operators
- Performance and equipage levels in different timeframes and operational environments (e.g., 2018 timeframe versus the 2025 timeframe and later)
- Methods to ensure that aircraft with NextGen equipage gain differential benefits over non-equipped aircraft

Finding: The FAA presented a plan to complete a Trajectory-Based Operation (TBO) concept of operations by November 2012. While there are several activities in place to develop standards and implement TBO capabilities, the direct benefits for operators equipping with a TBO capability have not been quantified, nor have the mechanisms for delivery of benefit been validated. Current work has not allayed operator concerns that equipped aircraft will not achieve differential benefits.

Recommendation: The FAA research supporting the validation of a TBO concept of operations should include the following activities:

- Differentiation of mid-term (2018) and post-mid-term (2025+) operations and benefits

- Integrate operations associated traffic flow management and collaborative decision-making with those involving digital communications to the aircraft regarding reroutes (both pre-flight and during flight).
- Address mixed capability operations (see previous recommendation)
- Quantify the marginal benefits of differing performance requirements and capabilities from both a system perspective and the perspective of investing operators

Finding: The Weather Technology in the Cockpit research program is addressing a wide range of issues related to the delivery of commercial weather products to pilots while in flight. The subcommittee could not determine, based on the information presented, the magnitude of the problems being addressed or the likely impact that could be achieved with respect to addressing the FAA's strategic goals for general aviation (GA) safety, such as captured in Destination 2025.

Action: The NAS Operations Subcommittee requests that FAA provide an update on the suite of research activities that are addressing major contributors to GA safety problems. In addition, the Subcommittee requests that FAA provide additional rationale that captures major problems to be addressed in the FY 2015 research portfolio for the Weather Technology in the Cockpit program.

Finding: Current capabilities to collect and store data related to NAS operations are expanding at a rapid pace, today there is the potential of collecting, and correlating, literally terabytes of data. Federal use of "big data", however, must be sensitive to concerns related to privacy, labor agreements, non-punitive safety culture initiatives, and several other factors. The FAA has initiated use of big data in initiatives such as the Aviation Safety Information Analysis and Sharing (ASIAS) capability; ATM initiatives may similarly benefit from leveraging a combination of public and private organizations that can provide the FAA intelligent and predictive ATM data analytics to improve planning, awareness and ultimately operational decisions.

Action: The NAS Operations Subcommittee believes this is an emerging area that can provide great benefit to the FAA. We request that FAA share with the Subcommittee an update on the FAA's strategy to utilize big data initiatives to inform research and decision-making.

Subcommittee on Aircraft Safety

Finding: The subcommittee found the Digital System Safety briefing to be thorough and reflected the FAA's acknowledgement of previous concerns of adequate focus and staffing in this area. Further, the subcommittee feels recent organizational changes will bolster the FAA's ability to maintain momentum in this area. Unquestionably, the digital system safety focus must remain agile to match the changing nature of the threat environment and maintain complementary coordination with other digital systems that comprise the aviation system. The subcommittee encourages FAA to review how common-place, commercial-off-the-shelf technology can be integrated into general aviation cockpits, where price sensitivity may otherwise prevent safety gains which could be recognized from using technology that is now available in many consumer products.

Finding: The routine integration of Unmanned Aircraft Systems (UAS) into non segregated civil airspace is clearly a complex challenge, requiring significant research and analysis. The FAA's RE&D budget alone is not likely to be able to fund the necessary research to address this challenge in a timely fashion without close collaboration with other Federal agencies sponsoring similar research. The subcommittee is encouraged by FAA and JPDO efforts to align research among the FAA, DoD, and NASA. The subcommittee is similarly encouraged by efforts internal to the FAA to effectively organize the agency to address the integration challenge. The subcommittee applauds the creation of the new UAS Integration Office, AFS-80, and efforts within the Office of Advanced Concepts & Technology Development, ANG-C, to ensure FAA research and analysis efforts are planned in a coordinated fashion. The subcommittee could not help but note the similarities between the UAS integration challenge and the integration challenge created by commercial space which has an Associate Administrator and a separate line of business devoted to addressing. While the subcommittee notes considerable FAA organizational improvements with the creation of AFS-80 and changes in ANG-C alignments, the subcommittee is concerned that the matrix nature of the organizational structure without clear lines of authority may not be the most effective.

Recommendation: The FAA Administrator should review whether the FAA is appropriately organized to address the UAS integration challenge and whether sufficient FAA RE&D resources are being devoted to the challenge.

Finding: At our August 2012 meeting, as part of our UAS integration "deep dive," the subcommittee received a very comprehensive and well-presented briefing on the FAA research efforts, which in the absence of additional context, seems appropriate. Based upon our recommendations in the Fall of 2010, the subcommittee had been assured that a NAS Integration Roadmap would be available in March 2011. It was not. In August 2011, we were told that the roadmap was again not quite ready. At our meeting in March 2012, we were once again told that the Airspace Integration Roadmap is still not ready and is under review by the UAS Aviation Rulemaking Committee (ARC) that may recommend changes. The subcommittee again requested information for the August 2012 meeting on "the FAA's UAS Airspace Integration Roadmap and Concept of Operations and how this material is being used to inform R&D planning." Again this information was not available because comments from the UAS ARC are being incorporated. The subcommittee recognizes that the FAA is working with the JPDO, the DoD, and NASA, to not only develop and coordinate this material but to develop a Comprehensive UAS Integration Plan based upon Congressional direction. The subcommittee also recognizes that coordination of such material among Federal agencies takes time. The subcommittee feels we are unable to make any recommendations regarding the appropriateness of the existing FAA research plans without appropriate context to include an integration roadmap, operational requirements, concept of operations, and some idea of the research being conducted by DoD, NASA, and others.

At our August 2012 "deep dive," it was explained that for UAS integration there are three competing objectives associated with each of the following: safety, efficiency, and timeliness. The subcommittee agrees. The subcommittee recognizes the political pressure from the UAS stakeholder community to accelerate efforts ensuring more *timely* integration, while at the same time legacy airspace users are unlikely to be willing to accept a less *efficient* National Airspace

System (NAS) to enable UAS integration. The subcommittee believes that the FAA needs to continue to avoid the temptation to compromise safety in an effort to satisfy aggressive integration timeline objectives from the UAS community.

Action: At our March 2013 meeting, the subcommittee requests a briefing on the UAS Airspace Integration Roadmap, the FAA UAS Concept of Operations, and the UAS Comprehensive Integration Plan. The subcommittee also requests that the FAA map planned FY 2013-FY 2015 research efforts to this guidance material.

Finding: The subcommittee received a thorough briefing on the Aviation Safety Information Analysis and Sharing (ASIAS) and finds this program continues to be an exemplary model of how R&D is successfully transitioned into operational use. The FAA in association with the transport community has developed a collaborative process to collect and share data in order to identify potential safety risks. The FAA must continue to build on this success to expand the ASIAS program to other applicable communities such as general aviation (GA) and Rotorcraft.

The subcommittee sees a gap between the Aviation Safety Action Program (ASAP)/Flight Operational Quality Assurance (FOQA) data collected and how it connects to the human element in each situation. The subcommittee understands the challenge with closing this gap but feels that it is a logical next step and that there is great potential value to enhance safety and assist with the development and implementation of future regulation by connecting the human element to ASAP/FOQA data collected as part of this program.

Recommendation: FAA should consider conducting research into connecting the human element with the operational events recorded by ASAP/FOQA data.

Finding: The Subcommittee again expresses the importance of human factors research in all aspects of aviation safety and is pleased to see the coordination both within the FAA and with outside organizations to help establish and set priorities for the focus areas of this activity. It will be important that the human factors research requirements be completed in a timely manner to meet both current and future regulatory needs as well as the needs of the NextGen. In particular there are many research activities ongoing across the aviation community to provide interventions intended to reduce the loss of control category of accidents. The research covers a broad spectrum of interventions to include upset recovery training, enhanced simulator fidelity, and new display systems such as Angle of Attack (AOA) or Synthetic Vision. The FAA will need to make sure the outputs of their human factors research do not stretch out but are completed in time to effectively support the objectives of these interventions. Additionally, there currently is considerable regulatory activity around fatigue management and Fatigue Risk Management Systems (FRMS). With an implementation date of January 2014, the SAS is concerned that the FAA Flight Standards Service (AFS) might have research needs closer in than FY 2015 to support regulatory development and approval efforts.

Recommendation: The Subcommittee recommends that AFS revisit their research needs to support the implementation of FAR 117 as well as approval and development of FRMS. The high level of industry interest and activity in this issue will likely necessitate funding for research and support in FY 2014 as well as FY 2015.

Finding: The Subcommittee finds the work being done in the area of metallic structures to be valuable and relevant to safety community. The collaborative efforts on the materials handbook and crack growth computer codes show good results with wide applicability both within the FAA and across industry and have focused on newer materials and repair processes. The work provides a good foundation for the life and crack growth risk assessments of small aircraft by the small aircraft directorate staff.

Finding: The Subcommittee is pleased to see the GA envelope protection work being successfully completed with proof of concept flight testing of the FAA developed approach. The stall departure and envelope awareness and protection work for transport aircraft appear to be off to a slow start with contract awards for FY 2012 yet to be completed. The list of proposed FY 2015 research topics appears to cover some important areas in flight controls but the Subcommittee wonders why the AF447 lessons are not being worked urgently today. The FY 2015 proposed tire failure research effort seems so basic the Subcommittee suggests a close collaborative approach with tire and airplane manufacturers would be a good means to make rapid progress.

Recommendation: If lessons from the AF447 incident regarding flight controls design and certification warrant new research, the Subcommittee recommends the research be prioritized and accelerated for near-term completion.

Finding: The Subcommittee appreciates the briefing on the FAA's overall plan for R&D addressing rotorcraft safety in response to its March 2012 Finding. The subcommittee has two observations concerning Health and Usage Monitoring System (HUMS) usage credits and the advanced control research.

The HUMS-related research being performed in the Continued Airworthiness of Rotorcraft Systems area is well along and should be continued. Currently 7 years into a 10-year program, the research should support certification of a HUMS for usage credit in response to its users. Subcommittee recognizes the importance of the program and encourages the FAA to meeting the completion date of 2017. Subcommittee requests a progress report at the March 2013 meeting. However, given HUMS equipage requirements for certain airspaces, the SAS suggests that the HUMS research include potential benefits of using this equipment in order to move the collaboration with the European Aviation Safety Agency (EASA) in the direction of a HUMS certification for usage credits.

The Subcommittee also notes that the advanced control systems research is behind schedule. The Subcommittee suggests that the program catch-up by using R&D from the fixed wing effort (e.g., Fly-By-Wire/Fly-By-Light) to the extent possible.

Action: The HUMS-related R&D is of high priority; leverages work from other areas, and should continue. Subcommittee asks to be updated at the March 2013 meeting.

Finding: The Subcommittee finds that Aircraft Icing continues to be focused on important safety areas; especially critical are completion of super-cooled large droplet means of

compliance and High Ice Water Content (HIWC) characterization and threat mitigation. Overall, Aircraft Icing is a strong effort and is producing good results. The Subcommittee is concerned with the HIWC schedule slippage due to the complexity of getting flight data. The FAA has recognized the importance of maintaining in-house icing expertise and has taken appropriate measures to build engineering strength by nurturing and developing technical area co-leads at the Technical Center as well as by leveraging skills from key partnerships.

Finding: The Subcommittee continues to see excellent work being conducted by this team. The work is relevant to both current and future needs of the composites community. The composite airframe crash worthiness work is late to need for the first transport airplane certification but is still very much needed to provide the design and certification guidance to the FAA and industry. The Composite Materials Handbook this team continually updates is very valuable to the composite design community and its continued support by the team is appreciated by the SAS.

Finding: The Subcommittee continues to support the important work this research team has performed in delivering ever improving Nondestructive Evaluation (NDE) techniques to industry applied to high energy critical components. The subcommittee suggests the team poll their industry partners to help identify the next level of safety improvements possible with further inspection technique development.

Finding: The Center for General Aviation Research (CGAR) and the Joint Advanced Materials and Structures (JAMS) Centers of Excellence continue to be examples of how cost sharing arrangements, complemented by competent FAA management and leadership, can be an effective way to conduct relevant research, produce valuable products, provide a source of talent for FAA recruitment and advance the knowledge of FAA staff.

Finding: The Subcommittee again notes that the Fire Research and Safety Program continue to be relevant, well managed, and directly responsive to current and emerging requirements. The international reputation and credibility achieved by the team is noted and is especially important in light of the recent congressional language limiting the ability of FAA to impose fire safety regulations that are no more stringent than the International Civil Aviation Organization (ICAO) standards. The Subcommittee also notes, without passing judgment, the comparatively high level of out-year funding for this program activity relative to other safety areas which are repeatedly shown as leading contributors to fatal accidents.

Finding: The Subcommittee finds that the Maintenance & Inspection (M&I) area is taking an appropriate life-cycle view by balancing performance of the actual research tasks with development of training and guidance materials based on the results of the research. The Original Equipment Manufactures (OEM) is involved on relevant committees and incorporates results into their maintenance manuals. Focus of emerging need areas for FY 2015 and beyond is based on continuation of the trends in materials (particularly composites) being deployed by the industry.

Finding: The Subcommittee finds that the Electrical Systems area is producing results in response to FAA sponsor's requirements. The Subcommittee would find it helpful to better

comment on the focus of emerging need areas if all of the areas considered and the rationale for their inclusion, or non-inclusion, in future prioritization were presented.

Finding: The Subcommittee continues to support the excellent work of the Civil Aerospace Medical Institute (CAMI). They are a unique, internationally-recognized, national asset. The Subcommittee is encouraged by the support provided by the Aerospace Medical Equipment Needs (AMEN) program for modernization and refurbishment of CAMI's facilities so that they may continue their valuable work. Continued, consistent funding of CAMI remains essential.

As some of the CAMI stalwarts retire, the FAA should actively recruit the next generation of researchers.

Finding: The Subcommittee found the briefing on the Aircraft Catastrophic Failure Prevention Program thorough and reflected positive activity in an area considered to be of high value. The Subcommittee was encouraged to see an upcoming transition of focus from metals to composite material in the coming years. The Subcommittee noted the continued refinement of tools created by this activity is considered to be of high importance.

Finding: The Subcommittee finds that the approach and focus of the Weather Technology in the Cockpit (WTIC) research activities align well with the expanded weather information expected to become available to the cockpit via NextGen technologies. We were also please to see that since the last review, WTIC has taken positive steps that show a close coordination with other projects as appropriate, in particular the NextGen - Air Ground Integrations Human Factors Budget Line Item. The WTIC project appears to be adequately funded to support its planned activities; however, it may face a challenge getting these funds obligated and/or costed in a timely manner. The FAA may want to take steps as appropriate to ensure these funds are protected from any end-of-year realignments the agency has to make to meet cost performance metrics.

The Subcommittee observed WTIC has implemented a large portfolio of research activities via contracts to address the identified FY 2012- FY 2014 focal areas. While it could be a potential challenge to effectively comprehend and manage all these activities, the Subcommittee was impressed and reassured by the grasp of knowledge the presenter seem to have across the breath of these activities.

Finding: The Subcommittee is pleased to see the level of effort and investment being made to find a suitable alternative for leaded piston engine fuel. It is well recognized how important, yet challenging, this area of research is. Further, we recognize research may be needed beyond the Destination 2025 goal of transitioning "most" of the piston fleet to an alternative fuel by 2018.

Finding: The Subcommittee received a concise briefing on the progress made toward infusing damage tolerance into design lifting practices, including the current and planned guidance material releases, as well as updates to the Design Assessment of Reliability With INspection (DARWIN) code for desirable new capabilities. Spinoff of other government involvement and support was also highlighted. The Subcommittee finds that this area is a good example of making progress on research requirements in partnership with industry, producing useful

information for both Original Equipment Manufacturers (OEMs) and regulators, and then planning to sunset the work when those results are achieved. The direction of future work toward lifting of composite engine structures in response to applicant designs is encouraged. The Subcommittee suggests that direct FAA interaction with the community to further examine current needs and future trends (considering service difficulty reports, Commercial Aircraft Safety Team (CAST) recommendations, and future engine designs) will enhance the Technical Community Representative Group's (TCRG) identification of future research to enhance turbine engine safety.

Subcommittee on Environment and Energy

Finding: The Office of Environment and Energy announced at the meeting that it would be establishing a new Center of Excellence (CoE) that will include both environmental and energy projects. The existing PARTNER Center of Excellence will continue to exist to enable ongoing projects to be completed, but will then be shut down.

Recommendation: The subcommittee strongly supports the establishment of the new Center of Excellence and urges that the following principles be included in the CoE mandate:

a. The FAA must play a leadership role in ensuring that the CoE projects are aligned with FAA research goals. In order to accomplish this objective, the FAA should be encouraged to make an annual presentation to the CoE detailing these FAA goals.
b. A process to enable stakeholders to have a meaningful input into CoE research activities must be established.
c. A small percentage of CoE projects should be devoted to "entrepreneurial" activities that might appear to be "out-of-the-box" but which might lead to environmental breakthroughs, if successful.

Finding: A continuing theme of the subcommittee is the absolute need for the FAA to engage in cooperative research with various other government departments. These cooperative efforts would be important in any budget scenario, but are particularly important in the current fiscal environment. The subcommittee also commends the continuing internal cooperation within the FAA to ensure that environmental considerations are taken into account in all Agency decision-making activities.

Recommendation: The subcommittee is encouraged by the continuing cooperation among government agencies and among the various lines of business within the FAA and strongly recommends that these efforts continue. In order to continue to assess these efforts, it is recommended that NASA and the Department of Defense continue to brief the subcommittee on their environmentally related programs and that this type of briefing be expanded to include other governmental departments and agencies (Department of Agriculture, Environmental Protection Agency, etc.).

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

Recommendation: The Agency should continue to develop and refine environmental tools that will enable the assessment of the environmental consequences of NextGen implementation as well as assist in the establishment of environmental standards at ICAO. This effort is particularly important now, when several tools are on the verge of being fully operational.

Finding: United States leadership in the international community continues to be an important environmental priority, especially as the ICAO debates the setting of a worldwide aircraft CO_2 emissions standard. At the same time, the subcommittee is concerned that the demands on the Office of Environment and Energy in the ICAO context are burdensome, with the United States playing a disproportionate role in the international research effort. A possible result of such an overemphasis on the ICAO research requirements may limit needed research projects in the domestic NextGen context.

Recommendation: The subcommittee strongly recommends that support for ICAO activities continue. However, the Agency should exercise discipline over the ICAO work projects by requesting a clear problem statement for each request that has been appropriately vetted and encourage other countries to play a greater role in the environmental research area.

Finding: The Noise Roadmap designed to update the Agency's position on the effects of aircraft noise is moving forward with the development of a community survey to track public concerns. The validity of the results of any survey such as the one underway in the area of aircraft noise depends on the robustness of the questions asked. The subcommittee is concerned that all aspects of the noise issue may not be addressed in the current survey planning process.

Recommendation: The FAA should consider empanelling an expert review board to assess the survey questions before the survey is actually conducted to ensure that all aspects of aircraft noise issues are considered.

Subcommittee on Airports

Finding: Regarding Research Project Description (RPD) 155, Heated Airfield Pavements, the Subcommittee felt that additional information was needed regarding the business case justification for heated pavement installations, which would include defining the conditions under which these pavements can be used beneficially. Because the concept of use, benefits and life-cycle costs associated with heated pavements are not fully understood, the Subcommittee also felt that the project schedule should incorporate explicit decision points together with "go/no go" criteria to manage the risks associated with the research project.

Recommendation: The Subcommittee recommends that the FAA complete its review and assessment of existing heated pavement installations (e.g., Oslo, Helsinki, Stockholm) and the prototype heated pavement sections at Binghamton Airport. The assessment of existing heated pavements should include a review of what drove the business case for the heated pavement installation and what proven benefits these existing systems can provide. The Subcommittee also suggests that the project schedule include explicit decision points together with "go/no go"

criteria to its project schedule so research funds can be conserved in the event this research does not prove fruitful.

Finding: Regarding RPD147, Aircraft Braking Friction, the Subcommittee believes that the research plan is very challenging and has significant risks that may impact its successful completion. To help manage the risks associated with the project, the subcommittee believes that the project schedule should incorporate explicit decision points together with "go/no go" criteria to manage the risks associated with the research project.

Recommendation: The Subcommittee recommends that the FAA add decision points together with "go/no go" criteria to its project schedule its project schedule so research funds can be conserved in the event this research does not prove fruitful.

Finding: Regarding RPD145, 40-Year Pavement Life, the Subcommittee found that additional information was needed regarding the definition of what a 40-year pavement is as well as what would constitute a successful project outcome. To help manage the risks associated with the project, the subcommittee believes that the project schedule should incorporate explicit decision points together with "go/no go" criteria to manage the risks associated with the research project.

Recommendation: The Subcommittee recommends that the FAA provides the Subcommittee with a working definition of 40-year life and a list of expected pavement maintenance activities associated with 40-year pavement life-cycle at or before the next Subcommittee meeting. The Subcommittee also recommends that the FAA continues to solicit advice from the FAA Pavement Working Group, which meets twice a year, on this project. Finally, as with RPDs 155 and 147, the Subcommittee recommends that the FAA add decision points together with "go/no go" criteria to its project schedule so research funds can be conserved in the event this research does not prove fruitful.

Subcommittee on Human Factors

Finding: The subcommittee was briefed on the FY 2015 research plans for the Air Traffic Control (ATC)/ Technical Operations Human Factors Program and the NextGen Human Factors ATC/Technical Operations Program. The subcommittee was encouraged by the research plans themselves, and by the degree that the plans were generated in consultation with the sponsoring organizations within the FAA. Thus consultation serves both to call out to relevant organizations where human factors research is warranted, and to smooth the path for transition of the research into implementation. Further, the subcommittee was delighted by recent efforts to broaden the scope of the research methods and thus the impact that human factors research can have, through novel studies such as the use of Air Traffic Safety Action Program (AT-SAP) to identify operational issues. Such demonstrations highlight where human factors researchers can work closely with the operational community in examining concerns such as air traffic procedure design, in addition to the more-established role of human factors in system acquisition.

Recommendation: Continue as presented to the subcommittee with the FY 2015 research plans for "Air Traffic Control/ Technical Operations Human Factors Program" and "NextGen Human Factors ATC/ Technical Operations." In support of this research, continue with the close

collaborations with the research sponsors, and continue with efforts to expand the application of human factors research into supporting the operational organizations within ATO, such as assisting with air traffic procedure design.

Finding: The only significant gap noted by the subcommittee in the FY 2015 research plans for "Air Traffic Control/ Technical Operations Human Factors Program" and "NextGen Human Factors ATC/Tech Ops" is the lack of sponsorship of research into the human factors of the operation of Unmanned Aerial Systems (UAS) within current and NextGen air traffic operations. Human factors concerns in common air traffic operations, such as the resolution of a conflict between the UAS and a manned aircraft, can span the air traffic controller, the operator of the UAS, and the pilots of other aircraft. The subcommittee understands that a reasonable body of research is planned into the technical and operational concerns with UAS, which is not balanced by the highly-likely human factors concerns that will commensurately arise.

Recommendation: The Human Factors Research Division (ANG-C1) should coordinate with the ATO offices responsible for incorporating UAS into air traffic operations to develop research plans that examine the likely human factors concerns with the handling of UAS within current and NextGen air traffic operations, and should work to define and sponsor human factors research that is balanced with, and scheduled to provide research results timely relative to planned research into UAS vehicle systems and operation. Such research should also be closely co-ordinated with the flight deck human factors UAS research being sponsored by AVS through the UAS and Human Factors TCRGs, and with the UAS concept of operation development.

Finding: The subcommittee was briefed by the Air Traffic Control/ Technical Operations Human Factors Program within the FAA Human Factors Division (ANG-C1) about a strategic plan for air traffic human factors research that is under development. This plan is intended to specify long-range objectives and areas of emphasis that build upon traditional research areas and, most notably, outline new initiatives. This program intends to work closely with appropriate organizations throughout the FAA, including potential sponsors within the ATO and elsewhere within the FAA, to demonstrate where human factors research can apply new methods to address new and emerging problems.

Three specific new initiatives were presented to the subcommittee and the subcommittee recognized the value of each of them. The first is to expand human factors research contributions to (and work more collaboratively with) ATO operations. Of note, such research can address human factors concerns in the safety evaluation of current and proposed air traffic procedures (with RNAV arrival and departure procedures as a potential first area), conduct analyses of operational problem areas (for example, a recent analysis was conducted problems within 'hand-offs'), and provide longitudinal studies to monitor operations of interest following their implementation and/or modification. While these initial steps have focused on safety evaluation, the subcommittee believes this expansion can also be fruitful if it also extends to more direct collaboration with the ATO operations community. The subcommittee finds this initiative to be a valuable application of human factors research, particularly with the increased complexity of new air traffic operations and the need to identify human factors concerns throughout their design and implementation.

The second initiative addresses automation, and intends to support the air traffic operations organizations by providing an actionable philosophy to guide the development of automation at a high-level, as well as specific criteria in its design as can be applied by the software and program management community. Automation is a critical element in many of the plans for NextGen and modernization. There are core human factors related to automation, and these need to be clearly understood to support a core strategy. This is an important problem and the subcommittee is delighted to see the Program tackling the need to tie together prior research results and identify a coherent automation strategy for air traffic. The subcommittee also discussed with the program where more specificity will need to be provided in the Program's strategic plan as it moves forward.

The final initiative addressees change management, with a unique and vital focus on preparing the workforce for the introduction of significant changes to their systems and to their tasks. The workforce of interest includes not only the controllers, but also the other personnel in the facility whose tasks and functions may change significantly. The subcommittee finds this initiative to be critical not only in implementing change, but also in understanding the allowable rate of change within the work force.

Recommendation: The Air Traffic Control/ Technical Operations Human Factors Program within ANG-C1 should continue with the strategic plan development as presented to the subcommittee. The three new initiatives as presented should be further scoped and detailed. These initiatives should also explicitly identify where these initiatives touch on cross-cutting human factors concerns and thus can learn from, and coordinate with, other human factors research (completed in the pat and on-going) within the FAA, NASA, and other stakeholders in the aviation community. A specific area noted by the subcommittee is with parallel examinations of automation between the proposed flightdeck research requirements and the 'automation' new initiative identified here for air traffic research; a briefing should be provided to the subcommittee at the next meeting as to how and where cross-cutting research in automation exists and will be coordinated.

Finding: The subcommittee received a briefing by the chair of the Technical Community Research Group (TCRG) for Human Factors on the FY 2015 Requirements Reviews on Flightdeck / Maintenance/ Systems Integration Human Factors and on NextGen Flight Deck Human Factors. Overall, we find the FY 2015 requirements as presented to us to represent key areas of importance to the aviation community at large and to NextGen. Each of the requirements as presented describes has obvious safety implications that are either already emerging in the community or very likely to emerge in the near future; failure to address these concerns could delay critical NextGen developments and/or limit the ability to implement key safety improvements in many elements of the current system, including general aviation and rotorcraft.

Recommendation: The Office of Aviation Safety (AVS) should continue with planning the FY 2015 research requirements as presented to the subcommittee, recognizing that they represent key areas of importance to the aviation community at large and to NextGen as captured through a systematic requirements generation process.

Finding: The subcommittee recognizes that this annual review cycle is part of a systematic process looking out several years to enable informed certification and operational approval, based upon research results of appropriate depth and breadth that are available as they are required. Thus, we appreciate the benefits of this cycle with its substantial look-ahead; we also recognize the flip-side of this approach, which is the potential for some important issues to be 'missed' by the process, either by the TCRG or the subsequent AVS selection process, or because of issues that emerge on a faster-time scale than the multi-year cycle represented here. The Human Factors subcommittee thus views its role as also helping to monitor for any issues that have been missed or that may be emerging; from this perspective, the subcommittee identified the following three issues:

Issue 1: Within the funding profile presented from present day to FY 2015 and beyond, and within the proposed research requirements for FY 2015, the subcommittee was encouraged to see the emphasis on new systems such as Class 1 and Class 2 Electronic Flight Bags (EFB). These systems represent a larger class of concerns arising with new ways to certify (and provide operational approval for the use of) emerging technologies involving personal/consumer electronics in the cockpit, mixed levels of criticality, and management of information stemming from multiple sources and presented across multiple displays. Given the rapid rate of change in the enabling technologies, these concerns may not be isolated to EFB systems. Thus it will be necessary to monitor for where these concerns may also arise in other systems and the degree that research examining EFB systems can -- and cannot -- provide the required insight.

Issue 2: Likewise, given on-going plans within the aviation community for fatigue risk management systems (FRMS), the subcommittee was encouraged to see the requirement "Fatigue Mitigation in Flight Operations." The proposed timeline for this requirement is scaled to the latest deadlines required of operators for the implementation of FRMS. Where operators may chose to implement FRMS earlier, the proposed database for tracking carriers' application of FRMS may also need to be moved earlier.

Issue 3: Similarly, the subcommittee was encouraged to see the requirement "NextGen: DataComm Human Factors R&D." Many related concerns are already emerging in the community, even with current day systems, which this research requirement may both learn from and provide some insights into. These concerns include questions about digital Notices to Airmen (NOTAMs) and proper methods for amending Pre-Departure Clearances (PDCs) such that all relevant parties remain synchronized.

Recommendation: In addition, we recognize that Aviation Safety (AVS) has a process to reconsider research planning, selection and execution in light of emerging issues. Specific considerations that the subcommittee recommends considering at this time are:

- Concerns arising with human factors research sufficient to guide certification (and operational approval for the use of) emerging technologies involving personal/consumer electronics in the cockpit, mixed levels of criticality, and management of information stemming from multiple sources and presented across multiple displays, particularly where these concerns may extend beyond the planned research focused more specifically towards EFB systems.

- Where operators may chose to implement FRMS earlier, the proposed database for tracking carriers' application of FRMS may also need to be moved earlier.
- Related to on-going research within "NextGen: DataComm Human Factors R&D," concerns are already emerging in the community, including questions about digital NOTAMs and proper methods for amending Pre-Departure Clearances (PDCs) such that all relevant parties remain synchronized.

Finding: Of particular note, with the FY 2015 Flightdeck/Maintenance/Systems Integration Human Factors proposed Core Human Factor TCRG research requirements, the proposed Requirement "NextGen: Human Factors Considerations of Complex Systems" is a forward-looking initiative that can provide a broad look at an important phenomenon spanning almost all NextGen systems and operations. The subcommittee agrees that systems are rapidly becoming much more complex in day-to-day operations for human operators, and both Flight Deck and Air Traffic Control will encounter these issues in the near future. The subcommittee finds the proposed FY2015 research requirement in complexity to be a good start into this area, and further believes that broader perspectives on complexity will be required in future years, including examining not only of specific types of flightdeck systems but also complexity of operations and of integrated air-ground systems.

Recommendation: The Human Factors Subcommittee recognizes the value of the proposed FY 2015 research requirement in complexity and recommends that its planning continue in close consultation with its AVS sponsor. In addition, this effort should be considered a starting point for planning in future years to recognize the operational and technical factors creating system complexity, and to motivate novel, inter-disciplinary research approaches to what is fundamentally a cross-cutting concern.