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June 14 2017

The Honorable Michael P. Huerta
Administrator
Federal Aviation Administration

Dear Administrator Huerta:

Michael

Thank you for meeting with us at the recent REDAC meeting. We appreciate your comments on current technical issues and your insight on emerging issues.

As we discussed the REDAC is intending to focus on cyber security concerns over the next cycle. This will include review of the cyber security research and development plan as well as briefings on current cyber efforts.

The REDAC has been involved with developing the updated approach to the National Aviation Research Plan (NARP) and we are applaud the effort to provide a more integrated and agency wide view of the research portfolio. We expect that this new formant will provide the REDAC, the agency and the nation a better understanding of the full research activities within the agency.

The REDAC was pleased that there appears to have been progress on developing an UAS Research and Development plan but have only been briefed on the plan development process and have no insight into the substance. Consequently we cannot comment on the substance of the plan at this point. We hope to be able to be briefed on the full plan at our next meeting.

The REDAC also noted that early benefits analyses are critical to help prioritize research and development activities and to support those efforts which will ultimately be implementable in the system. The REDAC also noted that there appears to be a need for research on aviation centric benefit analysis methods as we move to a era of risk based approaches as well facing emergent or exogenous threats.

The detailed findings and recommendations of the subcommittees are also included below.

Thanks again for your support and for the opportunity to contribute.

Sincerely,

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

Enclosure

**Research, Engineering and Development Advisory Committee
Recommendations for Fiscal Year 2019 Research and Development Portfolio**

Subcommittee on Aircraft Safety

Finding: Propulsion Research Resource Targets - As modern aircraft have evolved to employ new and novel materials to improve efficiency and reduce life cycle costs the FAA has appropriately applied increased funding levels to conduct research in the area of advanced materials. The majority of this funding is being directed at aircraft composite structures. Engine manufacturers also continue to push for improvements in fuel economy and provide some of the enabling technologies to the advancements and benefits observed at the aircraft level. The funding levels associated with propulsion research continue to decline and are proposed at \$1.1M for FY19. This is nearly a 50% reduction from 2015 levels and compares unfavorably to the nearly \$7.2M planned for aircraft composites research.

The Subcommittee made a prior recommendation that the FAA consider funding of advanced inspection techniques, hot corrosion in nickel alloys, cold dwell fatigue in titanium and advanced computational methods for microstructure changes. These could be target areas for propulsion research in future years.

Recommendation: The FAA should evaluate the target funding levels for propulsion research with a goal of achieving a proper balance between aircraft advanced material and propulsion research budgets.

Finding: UAS Implementation Plan - The SAS REDAC reviewed the 2019 proposed research portfolio and specifically research related to UAS. Several of the smaller items in the presented plan were questioned (e.g. hi-visual contrast, air carrier operational considerations) for their necessity and safety value in relationship to our understanding of other possibly conflicting research being conducted in the same general areas. As we have noted in the past it is still hard to get a complete picture of the total research scope related to UAS. It is especially difficult to understand the context of this proposed research without appreciating the full picture of FAA-funded UAS-related research given that overwhelming majority of the UAS research resources are grants to the UAS COE (i.e., ASSURE). Visibility to safety research requirements in other areas of the UAS implementation plan need to be reviewed as well.

Recommendation: Complete, update and make routinely available to SAS REDAC the UAS implementation plan so that we may get a clearer picture of the complete UAS research plan. The REDAC SAS would also like to routinely receive information about the UAS research being conducted by ASSURE. To better understand how the significant research investment has benefited the FAA, we would like a briefing on the highlights of UAS research portfolio including ASSURE over the last two years and how this research has impacted FAA decisions with regard to UAS related regulations and other decisions.

Finding: Fatigue Research Program - The REDAC Subcommittee on Aircraft Safety (SAS) received a deep dive briefing on the FAA's overall fatigue research program. The Subcommittee was impressed with the progress that parts of the program are making, particularly the research on fatigue genomics and biomarkers. However, the Subcommittee remains concerned that the

FAA program is not taking a holistic approach to fatigue, which remains a widely acknowledged and pervasive risk to aviation safety. There is a concern that this may be a consequence of the reductions to the A11G BLI, which averaged 80% over the past 3 years.

Currently, there are no funded programs to detect and mitigate fatigue problems across the breadth of civil aviation -- other areas of aviation operations that have widely acknowledged fatigue concerns seem to have been overlooked. While aviation maintainers and air traffic controllers have been recently studied, other broad areas of aviation, including aeromedical ambulances, other commercial aviation, and general aviation operations are not being sponsored by any of the FAA policy holders and potential fatigue problems are not being addressed. Finally, there is no convincing plan to analyze data from FRMP or FRMS, to determine the utility and cost-effectiveness of these important FAA fatigue initiatives.

Recommendation: The Subcommittee recommends an expanded fatigue research program that integrates the different policyholders, funding programs, and research organizations within the FAA. This program should provide surveillance for early indicators of fatigue hazards across aviation operations in the US. The integrated research program should facilitate identification and advocacy for needed research and ensure sharing of results across aviation domains within the FAA.

Recommendation: The Subcommittee also recommends that a structured research program to assess the effectiveness of FRMP/FRMS in Part 121 passenger carrying operations be planned, given high priority for funding, and commenced immediately.

Subcommittee on Human Factors

Finding: Human Factors Portfolio Prioritization and Competencies - The Human Factors Subcommittee had a previous finding concerned about how HF research funding for NextGen and UAVs have significantly increased at the expense of core HF research areas like fatigue and training. The Subcommittee received a briefing on the prioritization process but it did not answer the question. Further Subcommittee discussion addressed how the HF research community manages its competencies whether organic, contract, or Centers of Excellence. The HF Community could not tell the HF Subcommittee how it assesses its technical competencies.

Recommendation: The Subcommittee recommends that the FAA HF research community establishes a process to define and assess its technical competencies in a Lead, Leverage, Watch, or similar construct to be able to determine the status of their ability to respond to changing FAA priority needs.

Recommendation: The Subcommittee recommends the FAA HF community report out to the HF REDAC Subcommittee at its next meeting.

Finding: NextGen HF Research Support - The Subcommittee has made previous recommendations on the need for HF research in NextGen. The Subcommittee received a briefing and was very pleased with the HF communities' response and proposed research plan for

FY19. However, due to current budget deliberations, this research was reflected as unfunded. The Subcommittee supports this proposed research.

Recommendation: The Subcommittee recommends the FAA assess the priority and funding of this HF NextGen research and report out the results at the next HF Subcommittee meeting.

Finding: Mixed-Capability NextGen Environment - For two years a recurring topic of discussion at the REDAC Human Factors Subcommittee meetings raised questions around HSI across multiple capabilities and operational changes converging at the human operator and users over the coming years. For NextGen to realize its planned operational benefits and capabilities, the human operators and users of the NAS, both on the flight deck and on the ground, must be willing and able to effectively utilize the combined suites of capabilities and operational changes they will be given by the system.

It is not clear to the Subcommittee whether, or to what extent, integrated assessments across the users and stakeholders of those combined suites of capabilities have adequately been done in order to reduce risk and ensure the delivery of benefits. Discussion around these questions inspired the Subcommittee to request that the FAA summarize what efforts have been made on this issue, so that the Subcommittee can provide appropriate and useful advice.

Recommendation: The Human Factors Subcommittee requests the FAA define the plan, including any research, for assessing the risks and alternative designs and procedural solutions related to the multiple capabilities across the NAS and increased complexity on the human role in Next Gen. This complexity includes the interaction of the various humans and systems as well as integrated human performance considerations on pilots, dispatchers, and controllers and traffic managers and report back to the HF committee on this research plan at the next meeting. This will enable the Subcommittee to assess the extent to which human-system collaboration concerns have been accounted for in the complex multi-capability of NextGen and to determine where more specific HF research may be warranted.

Subcommittee on Environment and Energy

The Environment and Energy (E&E) Subcommittee of the FAA Research, Engineering and Development Advisory Committee (REDAC) met in Washington, DC on February 28 – March 01, 2017. Per the guidance from the FAA Research Director, the Subcommittee focused on reviewing the R&D portfolio in Environment and Energy developed based on the strategic guidance provided to the FAA in the August 2016 Subcommittee meeting. FY19 portfolio plan and selected deep dives were included on the agenda for this purpose. Following is the report on the outcome of this meeting. The recommendations offered are all for inclusion in the REDAC report.

Finding: Noise Research - Noise research is making substantial progress in studies related to the understanding of impact of aviation noise on annoyance, sleep, health, and children's learning and in the planning of studies related to noise from supersonic aircraft, Unmanned

Aerial Systems (UAS), and commercial space. Some of the impacts of noise have become barriers to the implementation of NextGen.

Recommendation: Since the results of some of these studies will generate significant public interest, the Subcommittee recommends the FAA prepare a public outreach plan to proactively manage this public interest.

Finding: Aviation Environmental Design Tool (AEDT) - In response to the action from the last Subcommittee meeting, FAA provided clarity on improvements and further development needs for the Aviation Environmental Design Tool (AEDT). This will enable enhanced usability, improved airspace and airport design, continued support for analyses that support domestic and international decision-making. The FAA also identified key risks to AEDT development (e.g. availability of BADA 4 on airplane performance and noise) and has developed appropriate contingency plans.

Recommendation: The Subcommittee recommends the FAA continue the simultaneous (and balanced) development of usability improvements and enhanced features in the near term.

Finding: Continuous Lower Energy, Emissions, and Noise (CLEEN) Program - In partnership with industry, the Continuous Lower Energy, Emissions, and Noise (CLEEN) Program is maturing new technologies that will continue to show significant engine and aircraft performance benefits (fuel burn and operations improvement, noise and emissions reduction). The Commercial Aviation Alternative Fuels Initiative (CAAFI) also continues to make significant progress in advancing alternative jet fuels as a private public partnership between the FAA and industry.

CLEEN and CAAFI are both very successful industry/FAA cost-share programs as is the Aviation Sustainability Center (ASCENT), the FAA Center of Excellence for Alternative Jet Fuels and Environment. Three quarters of Environment and Energy research funds are generating 100% plus cost matching from non-federal partners (CLEEN, CAAFI, and ASCENT). This leverages scarce FAA R&D funds to accomplish significant advances and improvements.

Recommendation: The Subcommittee encourages Public Private Partnerships like CLEEN, CAAFI and ASCENT programs to leverage resources and recommends that FAA should continue to prioritize robust funding for these programs.

Finding: Operational Research Program - The operational research program is an important and impactful program in the Environment and Energy portfolio. These projects are being worked (or planned to be worked) in collaboration with the FAA Air Traffic Organization (ATO), FAA NextGen Office (ANG), FAA Office of Airports (ARP), NASA, and MassPort.

Recommendation: The Subcommittee is pleased to see this research included in the portfolio after having been impacted due to the reduction and eventual elimination of F&E funds for this category. We encourage FAA to pursue this research while recognizing the potential for environmental benefits thru operational changes in all phases of flight.

Finding: Staff Vacancy Expansion - The workload of FAA AEE staff has been increasingly driven by CO2 standard setting, global market based measure (CORSIA) development, non-volatile particulate matter standard settings, supersonic aircraft, and a broad range of noise work.

Staff vacancies within the organization are a big concern. These vacancies need to be filled. A lack of skilled personnel could delay completion of critical projects, and in the long term, prevent achievement of the core FAA mission, including improving efficiency of aviation system.

Recommendation: The Subcommittee recommends that the FAA place a high priority on filling staff vacancies to manage the AEE portfolio and support the expanding workload.

Finding: Collaborative Research Topic Priorities - The REDAC Environment and Energy Subcommittee had believed that water issues were proactively being addressed by the Airports and Safety REDAC Subcommittees, but learned that water research was not a priority on the 10 year research plan for the Airport Technology Research (ATR) Program.

Recommendation: REDAC Subcommittees DFOs should communicate amongst each other and develop a list of research topics that they believe are priorities but feel are within the domain of a different subcommittee.

Subcommittee on NAS Operations

Finding: Operations Concept Validation - The Subcommittee received briefings on Operations Concept Validation Modeling (BLI 1A11) and Operations Concept Development & Infrastructure (BLI: 1A01C). The Subcommittee found the briefings to reflect the high quality of the briefers and the excellent research and development work carried out in both areas. The Subcommittee notes that operations concept validation activity represents one of the most valuable programmatic risk mitigation investment tools available to the FAA for advancing the state of the art in airspace operations. Early identification and resolution of operational and integration issues yields tremendous cost avoidance during implementation.

The strategic context motivating FAA and NAS users' investment in ops concept validation includes both near and far term considerations. These considerations include the accelerating pace of change affecting all aspects of the Agency's NextGen portfolio. Examples include the pace of advancement in connected aircraft capabilities, increased confidence in investment decisions on the part of NAS users to complement FAA investments, community sensitivity to terminal airspace noise resulting from improved arrival and departure management schemes, as well as advancements in aircraft and airspace automation systems and concepts, among others.

The Committee observes that the priority given to Ops Concept Validation projects has been in decline over recent years. In particular, the work that was performed under BLI 1A11 was moved from a cross-cutting, enterprise-level F&E activity to within the NextGen portfolios. There, this activity competes directly for funding with the day-to-day pressures of NextGen implementation. Portfolio managers are very much focused on program implementation and thus it is very difficult for them to properly prioritize this work, particularly since the work

should be done well in advance of implementation. The Subcommittee notes that the result has been a significant decline in the level of effort devoted to operational concept validation across the FAA.

Recommendation: The Subcommittee recommends that the FAA increase the priority given to Ops Concept Validation investments, particularly those that are closer to implementation, as the most effective and affordable means of strategic risk mitigation in a time of rapid technological and business concept advancements affecting the NAS. The savings in time and implementation cost more than offset the relatively low cost of increased concept validation.

General Observation: Runway Incursion Reduction Program - The Runway Incursion Reduction Program (RIRP) has been developed to address the NTSB recommendation A-00-66 (July 6, 2000), which states:

“[The FAA should] require, at all airports with scheduled passenger service, a ground movement safety system that will prevent runway incursions; the system should provide a direct warning capability to flight crews. In addition, demonstrate through computer simulations or other means that the system will, in fact, prevent incursions.”

In 2015, the Subcommittee found that this NTSB recommendation failed to address the cost/benefit assessment that is required as part of an investment decision and recommended that the FAA should estimate the potential benefits of the Runway Safety Assessment (RSA) and Small Airport Surveillance Sensor (SASS) projects under RIRP.

In response to this recommendation, the FAA conducted a causal factor analysis and technology evaluation study under the Runway Incursion Prevention Shortfall Analysis (RIPSA).

Finding: The RIPSA project was intended to (1) identify the causal factors associated with runway incursions at small and medium airports and (2) identify feasible runway incursion prevention technologies to address those factors. The Subcommittee has previously noted that feasibility includes technical performance and cost/benefit. While the RIPSA analysis has examined the estimated cost and general technical performance of candidate technologies, the project did not estimate the benefits pool available to runway incursion prevention technologies as recommended by the REDAC in the Fall of 2015. The Subcommittee finds that the FAA cannot perform cost-effective research and development of runway incursion prevention technologies in the absence of any knowledge of the potential benefits pool that such technologies target.

Recommendation: The FAA should not invest any more funds in Runway Incursion Prevention technologies until they have estimated the benefits pool as previously recommended by the REDAC. Further technology development in these projects should be contingent upon an initial positive cost/ benefit estimate. REDAC looks forward to reviewing this benefits estimate in its Fall 2017 meeting.

Subcommittee on Airports

Finding: Cross-cutting Strategic Research - The Subcommittee supports the FAA's efforts to update its research strategy, goals, objectives via the NARP, particularly with respect examining how the FAA's various research programs can more effectively address research that cuts across multiple research areas (e.g., air traffic system operations, airports, safety, and environment). Such a cross-cutting approach to research has proven to be successful in the area of airport noise research involving both the Airport Technology Research Program and Environmental Research Program.

Recommendation: The Subcommittee recommends that the FAA seek additional opportunities to utilize cross-cutting approaches to research and development that draw on the skills and expertise from multiple research programs. In addition to aircraft noise, research areas that are ripe for this approach are (1) cyber-security, (2) unmanned aircraft systems (UAS), (3) time-based flow management (especially the surface elements of TBFM), (4) management of operations during irregular operations such as airport construction and adverse weather conditions, and (5) aviation safety management.

Finding: Airports Research Prioritizations - The Subcommittee placed a high priority on research into new categories of aeronautical vehicles--UAS and commercial space vehicles specifically--and their potential impacts on airport safety, operations, and infrastructure. Other high priority research areas are (1) pilot perception of light emitting diode (LED)-based airfield lighting systems (RPA S5), (2) aircraft rescue and firefighting agents (RPA S3), (3) runway incursion prevention technologies (RPA S1), and (4) noise standard development/refinement based on the findings of ongoing noise annoyance data collection (RPAs N2-N5).

Recommendation: The Subcommittee recommends that the FAA Office of Airports place a high priority on research associated with the research areas that include (1) pilot perception of light emitting diode (LED)-based airfield lighting systems (RPA S5), (2) aircraft rescue and firefighting agents (RPA S3), (3) runway incursion prevention technologies (RPA S1), and (4) noise standard development/refinement based on the findings of ongoing noise annoyance data collection (RPAs N2-N5), as well as, UAS and Commercial Space.

Finding: Research Programs Completion Projections - Although it understands that the timelines for research projects are inherently uncertain, the Subcommittee would like to have a better understanding of when research projects are expected to conclude and get periodic updates regarding their schedule for completion as the projects progress.

Recommendation: The Subcommittee recommends that the FAA provide information regarding the estimated schedules for completing new research projects and provide schedule updates regarding ongoing research projects in its briefings to the Subcommittee.

Finding: Research Completion Priorities - The Subcommittee finds that priority should be given to research projects that are close to completion (i.e., issuance of final research findings and/or conclusions), particularly those that have promising practical applications.

Recommendation: The Subcommittee recommends that the FAA prioritize research projects that are close to completion such as the regarding trapezoidal grooving project (RPD S.1.4).