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

Dear Administrator Huerta:

On behalf of the Research, Engineering and Development Advisory Committee (REDAC), I am enclosing the summary findings and recommendations from the spring 2012 meetings of the standing REDAC Subcommittees (Aircraft Safety, NAS Operations, Environment and Energy, Airports, and Human Factors).

The consensus of the full Committee is that the research, engineering and development portfolio is generally well aligned with agency priorities and is well managed given the limited resources available.

The Committee was also pleased to note that prior REDAC recommendations have been acted on with positive effect.

As always, the REDAC stands ready to assist if there is any way we can help in our common objectives of improving the safety, efficiency and capability of the air transportation system.

Sincerely,

A handwritten signature in black ink, appearing to read "R. John Hansman".

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

Enclosure

Research, Engineering and Development Advisory Committee
Recommendations on the FY 2014 R&D Portfolio

Subcommittee on Airports

Finding: The subcommittee was pleased with the progress to date on research underway in assessing extinguishing agents, methods and quantities for new composite aircraft materials and firefighting strategies for cargo aircraft. Current research is focused on aircraft skin penetration testing, and developing of test protocols for evaluating agent application and forcible entry. Aircraft skin penetration testing is focusing on how to best approach events on the upper decks of the new large aircraft (A380 and B747-8). The height of the second deck requires longer booms and needs to have proven penetration capability from a variety of angles (which is proving to be a difficult task).

Recommendation: The subcommittee is pleased with the progress made on this research and considers this as a high priority issue.

Finding: Research into Foreign Object Debris (FOD) detection systems is bearing fruit. The Subcommittee was impressed with a video from a FOD system used at Singapore Airport where the device immediately detected a blown tire on a departing aircraft, which left a large part of the tire on the runway. The pilot was not aware what happened, because of the FOD system the pilot was notified, and the large piece of the tire was quickly removed from the Runway.

Recommendation: Though existing technologies have proven adept at identifying FOD, U.S. airports have concerns with these technologies because of cost, liability, and perceived additional manpower requirements. It is recommended that an AIP-supported FOD pilot program be initiated at a number of airports as a method for better understanding the operational issues associated with the technology.

Finding: Research into trapezoidal runway grooving is promising and shows potential benefits as a method for more quickly removing water from runways and reducing the possibility of hydroplaning.

Recommendation: Issues such as proprietary cutting technology and questions regarding hydroplaning tests have slowed finalization of this research and publication of FAA guidance. FAA needs to take positive steps to indicate how they plan to close out this research (additional hydroplaning analyses, evaluation of other cutting technologies, publication of technical notes, or further studies).

Finding: The Subcommittee is pleased that work has begun to progress on aircraft noise and sleep annoyance. The surveys and analyses that established FAA's noise significance levels are 34 years old and need updating. Even with all the advances made in reducing the noise levels of modern aircraft, noise is still a significant issue for the aviation industry, affecting airports abilities to expand and FAA's desires to redesign the airspace. This is expected to be a multi-

year study and the results will be a very important component of future efforts to expand the capacity of the NAS.

Recommendation: To assure full coordination and make use of available expertise it is recommended that a member of the Environment and Energy Subcommittee be appointed to liaison with FAA and Airport Subcommittee staff on this project.

Finding: Research on heated pavement as a means of melting precipitation during winter storm events is evaluating renewable energy sources as a means for pavement heating. Two demonstration projects are under consideration. 1. An electrically conductive heated pavement overlay powered by solar power and 2. A hydronic heated concrete apron utilizing geothermal energy.

Recommendation: The committee is concerned whether this project will ever be a cost effective alternative to existing deicing technologies. The Subcommittee recommends that the FAA provide subcommittee members additional information on this project before the August meeting. The information should clearly spell out the definition of success, discuss the risk of a successful outcome, a cost/benefit analysis, and discuss the probability of eventual operational implementation.

Finding: The aircraft braking friction project is conducting testing of aircraft anti-skid brake systems on contaminated runway surfaces to enable more accurate prediction of aircraft landing performance. This research is partially in response to the Southwest Airlines overrun at Midway Airport in 2005 and the subsequent recommendations by NTSB to FAA for improving the capability of transport category aircraft to calculate, record and convey the braking ability required by an aircraft to stop a landing roll during winter time precipitation conditions. The project is a multi-year research effort that began in 2010.

Recommendation: The investment and risk associated with this research is significant. The Subcommittee has requested that the FAA provide additional detail on this project that outlines the definition of project success and break down the research schedule into go/no go milestones that can be assessed as the research effort proceeds.

Finding: The Runway Exit Design Interactive Model (REDIM) is used by airports for siting high-speed runway exits and was developed by Virginia Institute of Technology with FAA and NASA support in the 1990s. This model has not been updated since it was originally produced and does not include realistic aircraft exit speeds as it excludes most of the aircraft in the current commercial fleet relies on performance data from older aircraft.

Recommendation: The Subcommittee recommends that a new research project be initiated to update the REDIM model or create a new one for determining optimal exit taxiway locations to minimize runway occupancy time.

Subcommittee on Environment and Energy

Finding: Section 911 of the recently enacted FAA Reauthorization Act directs the Administrator to establish a research program for the development of alternate fuel sources. In addition, this Section provides that, “Not later than 180 days after enactment of FAA reauthorization, the Administrator may designate an institution as a Center of Excellence for Alternative Jet fuel Research in Civil Aircraft.”

Recommendation: Since there is already a robust alternate fuels program within the existing PARTNER structure, the Subcommittee urges the Administrator to meet the goals of Section 911 by expanding the existing program rather than creating yet another Center of Excellence.

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 fund the development and refining of 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.

Finding: In the area of technology research, the ongoing Continuous Lower Emission, Energy, and Noise (CLEEN) program, including its Commercial Aviation Alternative Fuels Initiative (CAAFI) alternative fuels component, continues to be one of the most promising projects in the environmental area.

Recommendation: The Subcommittee recognizes the continuing funding threat to the CLEEN program, but again strongly recommends that a high priority be given to this project. As technologies are developed and transitioned into the aircraft fleets, plans need to be in place for the next phase of the CLEEN program. In addition, the Subcommittee recommends that the Environment and Energy requests for “above-target” CLEEN funding for Fiscal Years 2014 through 2016 be adopted by the Agency.

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 CO₂ emissions standard.

Recommendation: The Subcommittee strongly recommends that funding necessary to support ICAO activities continue.

Finding: The Partnership for Air Transportation Noise and Emissions Reduction (PARTNER) program continues to provide significant benefits in a number of environmental areas. This program enables the Agency to leverage resources and advance the state of existing knowledge

Recommendation: The PARTNER program should continue to be an integral part of the FAA’s environmental research program.

Subcommittee on Human Factors

Finding: The Human Factors Subcommittee appreciated the briefings by key AVS sponsors of their proposed FY2014 research requirements. The briefings were also helpful for providing Subcommittee members with a better understanding as to how AVS coordinates with ANG-C1 and the research performers as part of a team effort to ensure the successful transition from “research to reality.” The Subcommittee also appreciated seeing the mapping between the research requirements for NextGen flight deck sponsored research and relevant Operational Improvements (OIs) as described in the Enterprise Architecture. These indications not only informed the Subcommittee, but also were indicators of appropriate tracking of research results and of using this tracking to better inform further research.

Recommendation: Continue the tracking of research results as appropriate to their sponsor, such as application of the research results by AVS sponsors and implementation of research results, to establish an on-going process by which all human factors research is assessed. Many insights should be sought from this process, including identifying the attributes of successful research to build into research plans and highlighting the utility of human factors research. Use these insights to further inform research plans at all stages from year of execution to out-year identification of research requirements.

Finding: The Human Factors Subcommittee was briefed on the human factors research selected by AVS to sponsor in FY2014. These research elements represent significant concerns in current operations and in the ability of the FAA to certify and approve developments within the aviation community within the foreseeable future. The Subcommittee appreciates the steps that have been taken jointly by the AVS research requirements prioritization group and relevant human factors specialists in AVS and human factors researchers. However, the Subcommittee understands that this prioritization and selection is tentative pending final determination of the FY2014 budget. The Subcommittee was not able to assess which of these research projects may be at risk of being not-funded with a reduction in the FY2014 budget from the current plan; it is our understanding the relevant researchers are also not informed as to whether they should prepare contingency plans for de-selection or down-sizing of research areas versus conduct current research towards the selected FY2014 activities. This lack of understanding results from the rankings of the tentatively selected projects not being made available to the AVS technical research sponsors, the researchers, or the Subcommittee.

Recommendation: AVS should continue its efforts to coordinate and communicate with its technical research sponsors and research teams as to the rankings of requirements, especially with regards to providing the information the technical sponsors and research teams require for longer-range planning. This includes an understanding of the potential for the research not being funded (e.g., providing rankings or identifying which projects would be funded under different budget scenarios) early enough to inform their on-going research and longer-range planning. A suitable time for releasing such information would be before the Spring meetings of the relevant REDAC Subcommittees.

Finding: For ATC related programs, many human factors requirements and research insights appear to be entering the system too late and hence appear to be only capable of driving training requirements after design has been more or less finalized, rather than impacting the actual design. Earlier inclusion of human factors requirements in ATC related programs would serve to reduce training requirements as well as enhance operator efficiency. While consideration of training needs for the system is important, industry best practices for Human System Integration call for the earliest inclusion of human factors requirements so that (1) design can be impacted early in the RE&D process, and so that (2) positive transfer effects building on established human expertise and capabilities can be built into the system. Without such early consideration, programs risk delaying the human-system integration work to a later point where it can only focus on identifying and mitigating unintended negative transfer effects.

Recommendations:

- a) For ATC related programs, ensure that industry best practices for early and comprehensive inclusion of human factors requirements is accomplished in the RE&D and F&E requirements processes regardless of organizational or process constraints. Among other things, such best practices might include a policy requirement by all programs, projects, or portfolios to conduct a human factors assessment and create (and monitor) a human-system integration plan initiated during the initial investment analysis.
- b) Ensure that design requirements call out for the consideration and analysis of both positive and negative transfer effects in the design of new human interfaces such as new workstation design support tools. This will facilitate the transition of new capabilities into the system.

Finding: Next Gen airspace contains three significant nodes of collaboration; Air Traffic Control (ATC), flight deck and Airline Operations Centers (AOCs). While these three nodes are identified in some areas, not all relevant research projects appear to recognize where ground based flight operations centers need to be considered in human factors research and implementation of Next Gen concepts of operation relying heavily upon collaboration and decision making by aircraft operators.

Recommendation: Ensure that all three nodes of collaboration, including AOCs, as appropriate, are explicitly identified as components in all areas of NextGen research and implementation where the three way collaboration either exists today or will exist in NextGen. Ensure research projects consistently evaluate which nodes of collaboration will be significant contributors to the aspects of NextGen that they are examining, and incorporate their concerns.

Finding: The Subcommittee was briefed on the core Air Traffic Control/Technical Operations (TO) and NextGen ATC Controller Efficiency programs. These research areas tackle significant concerns with both core and NextGen issues and they have been identified in close-collaboration with other organizations within the FAA to best integrate their activities and outcomes into broader FAA developments. This includes the Technical Operations research on maintenance of air traffic systems that serves a vital role, particularly as significant changes are made, including the implementation of automation. Projected funding, however, for the NextGen Controller Efficiency program is anticipated to be significantly reduced and would affect such activities as development of safety cases.

Recommendation: Articulate plans for developing safety cases for NextGen developments in the ATC/TO and NextGen ATC Controller Efficiency programs given termination of human factors research activities; these plans may require pushing back projected deliverable-dates for these programs to later points where required evaluations can be reestablished. Where research areas are being reestablished, these plans should examine mechanisms for leveraging off personnel and facilities in related research projects.

Finding: The Human Factors Subcommittee was pleased to see that significant progress has been made on the development of the Human System Integration (HSI) Roadmap. In addition, there have already been some important gaps identified in the implementation of NextGen through the use of the HSI roadmap. This is an important activity that needs to be continued and we were advised the senior staff member responsible for the Roadmap will be retiring soon.

Recommendation: Ensure staffing and resources are in place for the maintenance and use of the HSI roadmap, specifically addressing staffing risks in this area due to planned retirement of key personnel in ANG-C1.

Finding: The Human Factors Subcommittee was given a briefing on NextGen Flight Deck Human Factors research. Five research requirements have been identified and will be undertaken in FY 2014. The research is intended to address specific NextGen capabilities, Operational Improvements, and Segment Implementation Plan Increments. The budget enacted for FY 2012 was reduced by approximately 50 percent. The budget request for 2013 is further reduced to approximately 85 percent of the FY 2012 request. A similar reduction to the FY 2013 budget would be devastating and the implications would carry over into FY 2014 and beyond. The subcommittee finds that the research originally planned to sustained FY 2012 levels serves a vital role in reducing the risks associated with human performance while ensuring system safety and supporting NextGen efficiency and capacity goals.

Recommendation: To the extent possible within a volatile budget planning process, the projected funding cuts to these programs should be balanced with the additional technical and programmatic risks they establish for NextGen. The negative impacts of significant swings in year-to-year funding should be recognized and mitigated to avoid situations such as starting up projects that are then terminated before being able to provide some return on their research investment.

NAS Operations Subcommittee

Finding: The subcommittee appreciates the update on Staffed NextGen Towers (SNT) and was pleased that the FAA is now looking seriously at surveillance requirements, concepts of operation, and safety analysis for SNT at small and medium sized airports where this concept is perhaps most viable in the near- to mid-term. The FAA noted that SNT's budget and research goals have been de-scoped due to schedule slips associated with external airport-surface related research and development programs, specifically the Tower Flight Data Manager (TFDM) program.

Recommendation: Given the importance of airport surface research to NextGen, articulated for example by RTCA Task Force 5, we recommend that the subcommittee receive a more comprehensive review of FAA surface programs R&D at a future NAS Operations Subcommittee (NASOPS) meeting to help put the SNT work in context. We recommend that this review include a summary of NextGen funded activities including the FAA/Industry Surface Team, the ANG Surface Decision Support System (SDSS) prototyping, and TFDM concept development and prototyping.

Finding: The subcommittee felt that the Weather Program research in the areas of convection, turbulence, in-flight icing, ceiling and visibility, and other areas represents excellent scientific work by qualified researchers, and is clearly germane to enhanced aviation efficiency and safety. However, the committee would appreciate more insight into the process by which priorities are established for aviation weather research activities. In particular, the current portfolio appears to focus heavily on weather conditions germane to general aviation and, as a result, may not fully address capability needed to support NextGen concepts for collaborative air traffic management (ATM), trajectory based operations and/or high-density airport operations.

Recommendation: We recommend that the Weather Program research priorities be synchronized with atmospheric diagnosis and forecasting requirements associated with NextGen ATM concepts, particularly as identified by the NASOPS Weather/ATM Integration Working Group report, and request a briefing on how you plan to address that at an upcoming meeting.

Finding: The subcommittee appreciated the more focused approach that appears to be underway for the ATC/TO Human Factors part of the portfolio. However, as briefed, the training and selection analysis was focused on the midterm and concluded that there are no changes in the required aptitudes of FAA personnel in the near and midterm NextGen environment. The subcommittee noted that personnel hired in the near and midterm NextGen environment will likely be still operating as NextGen moves to the far term. In the “core” part of the briefing, when the lack of pursuing far term selection criteria was again questioned by the subcommittee, the answer was that the sponsoring organization (FAA HR) did not request or require anything beyond what is needed in the midterm. There is little doubt that, to varying degrees, the functions of the human in the NextGen far term environment will be different than in the current NAS environment, and the lack of research on the criteria for selection of individuals best suited to perform them is a serious gap. While the subcommittee agrees in principle with the FAA’s requirement that an operating organization “sponsor” all the RE&D budget work, the “sponsors” must understand that the principal objective of research and development is to look forward to address knowledge gaps. It seems reasonable to the subcommittee that some modest fraction (e.g., 10-15%) of the work should be allowed to address far term issues.

Recommendation: Subcommittee recommends that the FAA operational organizations take a longer view when “sponsoring” research work done under the RE&D budget. In this specific case, we recommend that the Human Factors Core work on personnel selection include exploration of far term selection criteria for the FAA personnel who will operate NextGen.

Subcommittee on Aircraft Safety

Findings:

- In March 2011, the Subcommittee was told that the FAA was about to finalize their UAS Airspace Integration Roadmap and it would soon be available to the subcommittee and others in the aviation community. The subcommittee feels that such a roadmap should be a critical driver for the identification of R&D requirements and establishment of a realistic Research Management Plan. In August 2011, we were told that the roadmap was 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 Unmanned Aircraft systems Aviation Rulemaking Committee (UAS ARC) that may recommend changes, which the FAA will then need to incorporate.
- While a number of operational and technical issues exist as barriers to UAS integration, there are likely to be several significant policy decisions required to be made by the FAA. These policy decisions are likely to be significant drivers to the R&D requirements.
- The R&D schedule appears to be out of synch with Congressional and UAS proponent expectations regarding integration of UAS. Given the expectations in the community, it would appear that the FAA is behind schedule.
- The consolidation of UAS airspace integration R&D activities into a single coordinated effort is a positive step.
- In the absence of a coordinated UAS Airspace Integration Roadmap and a Concept of Operations, the research that we heard identified appears to be right activities consistent with anticipated needs.
- The FAA and the aviation community still appear to be getting a handle on the complexity of the operational, technical, and policy challenges associated with UAS airspace integration. There may be insufficient resources devoted to the topic given the complexity and multiple dimensionality of the challenges.
- Establishing a single FAA executive who is focused full-time on UAS airspace integration across FAA lines of business is a very positive development.

Actions: At our deep dive on UAS R&D planned for August 2012, the subcommittee would like a detailed briefing on the FAA's UAS Airspace Integration Roadmap and Concept of Operations and how this material is being used to inform R&D planning.

Recommendations:

The FAA needs to identify the key policy decisions that are required and the operational/technical data required to inform decision-making to guide research planning.

While Congressional and UAS proponent timelines may appear unrealistic, the FAA needs to define realistic airspace integration timelines to guide research planning efforts, manage community expectations, and identify the appropriate resources required.

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.

Finding: The subcommittee finds the research being performed by the Aircraft Catastrophic Failure Prevention team to be relevant to new tools and materials for advanced analysis and risk assessment methods in un-contained failure. It is evident that the FAA team has formed a strong partnership with industry and academia in development of these capabilities.

Recommendation: The subcommittee recommends that, FAA, based on final outcome of this research project, create guidelines for analysis tools and material properties to facilitate future compliance and certification procedures.

Finding: The Aircraft Safety Subcommittee recognizes that the industry's use of composites is growing rapidly and will continue to do so for the foreseeable future. The comprehensive deep dive presentation in Advanced Materials/Structural Safety shows that the research being conducted is well structured and relevant. The development of education for use by all stakeholders, collaborative approach used by FAA, responsiveness to the needs of industry and demonstrated use of results are particularly noteworthy. One area of concern was the research being conducted on Structural Crashworthiness, particularly the desired areas of future research that have not been funded. The subcommittee feels that the suggested areas of research might not be specific enough and lack an in depth discussion on future needs. Additionally, the plan needs to lay out a roadmap with more detail and substance for the management of future R&D needs.

Recommendation: The subcommittee recommends that the proposed areas of future research be more clearly defined to include more details on specific requirements, relevant milestones, levels of performance, and a discussion of how the results will be used to support policy and certification.