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

Dear Administrator Huerta: Micharol

I am sorry that you were not able to join us at the fall REDAC meeting on October 6 due to your attendance at the signing of the historic Global Market Based Measures agreement at the ICAO Assembly.

The REDAC congratulates the FAA on the progress on small UAS integration and the intentions to increase the access of UAS in the NAS. Please let us know if we can be of assistance as the FAA approaches the challenges of integrated UAS and Manned aircraft.

The committee was encouraged by the NextGen discussion regarding Industry recommendation of the PBN Time Speed Spacing Strategy document.

The REDAC also strongly supports the current efforts to make the National Aviation Research Plan (NARP) a more integrated and strategic document that covers the entire FAA research portfolio. The REDAC has long struggled to have a comprehensive view of the FAA research portfolio. If successful, the enhanced NARP will provide a great mechanism to communicate the FAA research strategy to the community and will also be a strong tool to manage and coordinate research across the FAA and it's collaborating research partners.

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

Thanks for the opportunity to contribute.

Sincerely, R. John Hansman

Chair, FAA Research, Engineering and Development Advisory Committee

Enclosure

Federal Aviation Administration

Research, Engineering and Development Advisory Committee (REDAC) Guidance on the FY 2019 Research and Development Portfolio

Subcommittee on Aircraft Safety

Finding: Real Time System-Wide Safety Assurance - In the fall of 2014, the REDAC Aircraft Safety (SAS) Subcommittee identified, and defined, Real Time System-Wide Safety Assurance as a significant emerging issue worthy of future FAA research resource expenditure. NASA has also identified this subject, although possibly defined slightly differently, as one of its top strategic thrusts. The topic has risen to the level of a NASA/FAA Joint Research Transition Team item. SAS received a briefing on this subject and was pleased to enhance its knowledge of government efforts and strategic direction on this important topic. In particular the definition of "real-time" as meaning in time to mitigate the hazard is very appropriate. The Committee also supports the vision for a capability that is distributed among users who can employ system-wide knowledge to refine its emerging issue going forward in hopes of adding value to the Research Transition Team efforts.

<u>Recommendation</u>: The System-Wide Safety Research Transition Team should provide the SAS and other appropriate industry sectors with updates on progress toward real-time system-wide safety and solicit regular input from those stakeholders. We also recommend that focus be put on short term research deliverables (less than 5 years) as the need for the ability to make an impact for in-time mitigations is immediate and necessary.

Finding: Additive Manufacturing - The Subcommittee finds that progress has been made in accelerating research activities around the topic of additive manufacturing. The Additive Manufacturing National Team (AMNT) is in place with an approved charter and initial documents have been released to the Aircraft Certification Office (ACO) and Manufacturing Inspection District Office (MIDO) to aid in the certification of parts produced by additive manufacturing methods. Collaborations are also ongoing with industry organizations including Aerospace Industries Association (AIA) and Society of Automotive Engineers (SAE) to establish working groups and committees. An FAA Additive Manufacturing roadmap is under development which includes training and education, development of regulatory documents, Research and Development (R&D) plan and interagency communication. The roadmap and R&D plan were not shared with the Subcommittee.

<u>Recommendation</u>: The FAA should share the draft roadmap and accompanying R&D plan with the Subcommittee for review and comment.

Finding: Fatigue Knowledge Affecting Aviation Safety - FAA implemented science based flight and duty time regulations for commercial passenger carriers in February 2014. These rules were the first significant revisions made in over 60 years and greatly changed how the agency regulates airline operations. Evaluations are ongoing with the regulatory situation for large cargo carriers and smaller commercial operations. This is an acknowledgment from FAA that pilot fatigue remains a significant safety concern and must be addressed. The Subcommittee is

concerned because there is no evidence that significant FAA research into human fatigue incidence, effects, mechanisms, or countermeasures in US civil aviation is taking place. Without objective data or evidence gather by research, it is very difficult to validate existing regulations or develop new ones.

Experience and recent data suggests that even though the new regulations seem to be an effective mitigation to pilot fatigue in many cases, the fatigue problem has not been solved, and continues to create risk in various aspects of flight operations ranging from commercial to general aviation in both fixed-wing and rotary-wing aircrew. Experience from the Department of Defense (DOD) suggests that operator fatigue will be a problem in UAS operators as well.

The Subcommittee acknowledges comments from the FAA that fatigue research occurs in various programs across the research portfolio, but is unable to evaluate the efficiency, applicability and adequacy of the current and future programs since they have not been presented to the Subcommittee in any organized form.

Recommendation: The SAS requests that, in the upcoming SAS 2017 spring meeting, the FAA presents a coherent and holistic view of the fatigue problem in U.S. aviation. The presentation should include the knowledge gaps in fatigue potentially affecting aviation safety and the relevant research programs at FAA and other government agencies concerned with aviation and non-aviation fatigue, which can be both funded and unfunded and/or current and planned research activities. If the conclusion is that further research is not needed, the rationale for that conclusion should be provided.

Subcommittee on Environment and Energy

Finding: Strategic Aspects of the Environment and Energy R&D Plan - The Subcommittee reaffirms its previous finding that there is a strong strategic context to the Environment & Energy RE&D plan. The program identifies specific goals for noise, air quality, energy /efficiency, and climate. These goals are set to achieve environmental protection for sustainable aviation system growth. The plan is developed after consideration of the need to balance / prioritize projects related to the five pillars, i.e., improving scientific understanding and tools, developing technology for mitigating environmental impact, operational efficiency improvement, developing / qualifying sustainable alternative aviation fuel, and maintaining US leadership in global aviation environmental policy and market based measure development. The FAA, in consultation with the Subcommittee, has also rebalanced the portfolio when needed to fit the funding profile or to achieve time critical capabilities.

<u>Recommendation</u>: Given the current environmental landscape and the impact of the various environmental issues on the aviation system, the Subcommittee recommends the Environment & Energy portfolio focus on noise and operations, environmental impact reduction technology maturation (CLEEN), alternative fuels, and tools to support policy development. The Subcommittee also recommends that the FAA continue to consider the interdependencies between noise, air quality, and CO2 in these plans.

Operationally noise has become a constraint to the implementation of flight procedures that can deliver improved efficiency, and airport capacity and access. In addition to the development of efficient procedures, a better understanding of annoyance, acceptability, and effective community engagement are needed to make more progress on this NextGen goal. Thus the subcommittee feels that successful and rapid execution of the Noise roadmap is necessary.

While operational procedures will provide emissions reductions in the near term, in order to achieve the aggressive longer term goals, low emissions airplane / engine technologies need to be matured and validated for implementation in future designs. To achieve this the Subcommittee recommends the continuation and acceleration of CLEEN and alternative aviation fuel development and qualification.

Finding: Aviation Environmental Design Tool (AEDT) - The Subcommittee recognizes that this program has delivered an environmental assessment tool, the AEDT suite, which has and is enabling informed policy decisions and US leadership in International Civil Aviation Organization/Committee on Aviation Environmental Protection (ICAO/CAEP). The AEDT tool has also been released to stakeholders outside of FAA to perform environmental assessments. The development of these tools required significant resources from 2010 to 2015 funded by the NextGen F&E. Starting in 2017, the F&E funding has been zeroed out. But several functionality and usability related improvement needs have been identified for the AEDT tool.

Recommendation: Given the resource constraints, the Subcommittee recommends that the AEDT development needs list be reviewed and prioritized based on considerations of value and urgency. Improving usability that delivers additional value to a broader stakeholder group may be preferred over adding a capability that may help a limited stakeholder group except in situations of strategic importance in FAA's support of national and international initiatives. Improved usability may also bring additional users. Making the right priority choices is important since this development will now have to be covered in the RE&D funds that support the high-priority research identified earlier.

<u>Finding:</u> Inter-Agency Collaborations and Partnerships - The Subcommittee is pleased to see the continuing collaboration between the FAA and NASA and other government agencies.

<u>Recommendation</u>: As NASA executes on its revamped aeronautics program, the Subcommittee encourages FAA to look for more collaboration opportunities, including gathering noise and emissions data, that may help projects in the FAA portfolio, i.e., go beyond sharing plans and results.

Finding: Environmental Human Resources and Subject Matter Experts - Several Subcommittee members are concerned about staff availability at FAA-AEE to continue to execute this program efficiently with an ever-growing set of responsibilities.

<u>Recommendation</u>: The Subcommittee encourages the FAA to continue to feed their pipeline of environmental professionals.

Subcommittee on NAS Operations

General Observations: UAS Integration in the NAS - The Subcommittee commends the continuing progress that the FAA is making in responding to the challenge of integrating UAS in the NAS. In its previous meeting, the Subcommittee recommended that the FAA actively engage with the UAS stakeholder community and share the work it has done to date, including the FAA UAS Concept Maturation Plan. The Subcommittee further recommended that the FAA establish high level system engineering leadership that can prioritize UAS research and development across all the FAA organizations. The Subcommittee has the following findings and recommendations:

Finding: UAS Stakeholder Community Engagement - The FAA has begun to engage the UAS stakeholder community as part of the NASA UAS Traffic Management (UTM) workshops. The FAA has established a framework for future engagement through the Drone Advisory Committee and has developed a UAS External Stakeholder Plan. The Subcommittee finds that these are significant steps in the right direction.

Recommendation: The Subcommittee recommends that the FAA continue this momentum, placing considerable emphasis on communication of its technical and operational challenges to the user community, through sharing of documents such as the UAS Concept Maturation Plan, and in turn merging input received from a broad range of UAS stakeholders into future planning activities. While the FAA ultimately has the responsibility for the safety and efficiency of the NAS, it is the Subcommittee's strong opinion that an open dialogue of these issues with the user community will foster a more collaborative environment in which to solve them.

Finding: UAS Leadership Structure - FAA has recently established an agency-wide UAS leadership structure consisting of a senior UAS Board, a UAS Executive Committee, and a UAS Implementation Plan Working Group. These steps are valuable in accelerating the pace of FAA engagement with the burgeoning industry. However, the Subcommittee remains concerned about the adequacy of these actions alone to sustain the pace of engagement necessary to avoid having the industry and government lose ground in economic opportunities for the nation. In its briefing to the Subcommittee, the FAA stated that this structure was intended to organize and prioritize the UAS research, development, and implementation across the FAA. During its briefing on the FY2017 budget, the FAA provided the Subcommittee with the language that accompanied the House and Senate marks on the FY2017 RE&D budget request. In previous years, the Unmanned Aircraft Systems Budget Line Item (BLI) has been used to perform safetyrelated research (e.g., airframe safety and certification) overseen by AVS. The Subcommittee notes that the FY2017 language pertaining to Unmanned Aircraft Systems Research includes language that would allow the FAA to use a portion of that BLI to develop and validate operational concepts and procedures supporting the integration of UAS into the National Airspace System that are necessary to close the operational and technical shortfalls identified in the UAS Concept Maturation Plan. This would require participation of multiple FAA organizations to accomplish work within this single BLI. There is a clear need to prioritize and coordinate UAS research and development across the RE&D and F&E budgets and across FAA organizations.

<u>Recommendation</u>: The FAA should leverage the new UAS leadership structure to prioritize and plan UAS research and development across budget elements and across organizations. The UAS Concept Maturation Plan provides one potential framework for this plan.

Subcommittee on Airports

The following Findings and Recommendations were developed during the Airport Subcommittee deliberations.

Finding : National Airport Pavement Materials Research Center (RPA P2) - The Subcommittee is pleased with the work on reflective cracking under Research Project Area (RPA) P2, but believes the research needs to consider the effects vertical loads--both vehicular and environmental—have on such cracking.

<u>Recommendation</u>: The Subcommittee recommends that the FAA include vertical loads in its reflexive cracking test plan.

Finding: Asphalt Concrete Pavement Heat Exposure - The effects of environmental conditions—particularly sustained exposure to high temperatures—on asphalt concrete pavements are not being fully considered in current FAA pavement design guidance.

Recommendation: The Subcommittee recommends that pavement testing being undertaken Under RPA P2 provide necessary data to incorporate a wider range of environmental factors into FAA pavement design software, which is developed and refined under Software Program Development and Support (RPA P7).

Finding: Runway Surface Safety Technology (RPA S6) - Both Subcommittee and FAA staffs believe that additional subject matter expertise is needed to ensure that aircraft braking friction research being conducted under RPA S6 is producing valid data and is appropriately synchronized with other FAA and industry research regarding aircraft braking.

<u>Recommendation</u>: The Subcommittee strongly supports the creation of an expert working group that can advise and review FAA Airport Technology and Flight Standards Aircraft Braking research programs. This expert working group should involve representatives from the FAA, academia, aircraft/braking system manufacturers, and others that are developing runway braking friction assessment technologies.

Subcommittee on Human Factors

Finding: Mixed Equipage - The Human Factors (HF) Subcommittee asked if any HF research was going on in mixed equipage. Two years ago the REDAC Committee identified mixed equipage as one of the top issues the FAA will face in the next ten years. While an effort to address this began in FY 2015 with a literature review, there is currently no HF research addressing the mixed equipage issue.

<u>Recommendation</u>: HF researchers conduct a deep dive on mixed equipage and report out at a future HF Subcommittee meeting on their plan to conduct research in this area.

Finding: **Human Factors UAV Guidance** - The HF Subcommittee recommended that the FAA HF community provide HF guidance to UAV industry to influence UAV design and operation in the short term in a previous finding and recommendation. The Subcommittee was not fully satisfied with the HF community response as the response was to generate new specific guidance documents. The HF Subcommittee believes while this is useful for the long-term, it will take too long to impact current designers and that already existing guidance is sufficient to give initial guidance to UAS designers.

<u>Recommendation</u>: The FAA HF Community engages UAV industry quickly to share UAV HF guidance principles and report out on their progress at the next Subcommittee meeting.

Finding: **Human Factors Portfolio Prioritization** - The Subcommittee continues to observe that HF research funding is now focused more on Next Gen and UAVs and there is a significant reduction in HF Core research dollars. The Subcommittee is concerned about critical areas such as fatigue and other key HF research areas that may suffer as a result of this shift in emphasis. This is a previous action item.

<u>Recommendation</u>: The Subcommittee recommends the HF research community evaluate its overall portfolio and discuss with your key FAA stakeholders to ensure the HF research portfolio is focused on the top priorities including core research areas, and report out to the HF REDAC Subcommittee at its next meeting.

Finding: **Human Factors Consultation** - The HF subcommittee continues to be concerned about the FAA not meeting their Next Gen efficiency goals due to lack of Human Factors consideration. Recent results with Performance Based Navigation (PBN) is one area that this Subcommittee has previously identified as an issue and continues to be a problem as Next Gen implements new increments in the FAA system.

<u>Recommendation</u>: The HF Subcommittee recommends the FAA HF research community assess Next Gen implementation and identify areas where efficiencies could be increased with HF consultation or HF research and report out to the HF Subcommittee on their results.