

Recommendations for Fiscal Year 2016 Research and Development Portfolio

Subcommittee on Aircraft Safety

Finding: The Weather Technology in the Cockpit (WTIC) program is to be commended for the progress over the past several years in focusing their research program on the problem of reducing the impact of adverse weather on general aviation (GA) and Part 121 safety. Their approach complements the efforts of other in addressing this problem. Their quantitative analysis has done an excellent job of showing the impact of weather on GA accidents and identifying specific areas that needed to be addressed. They have not yet established the correlation between better weather information in the cockpit to GA pilots and accident reduction.

Action: Establish the correlation between better weather information in the cockpit and GA safety and weather related accident reduction and Part 121 efficiency in a timely manner. Report back to the Subcommittee at the August 2014 meeting.

Finding: The Weather Program has a sound portfolio. It was encouraging to see that the program makes use of discussion with a variety of stakeholders within and outside FAA to develop and prioritize this portfolio, although we did not see evidence of prioritization based on quantitative assessment of potential benefits of the different parts of the portfolio. The program is to be commended for performing a quality assessment of the products of the weather research.

Finding: Information about the likelihood of predicted weather events has the potential to lead to better operational decisions by airline operations center personnel, pilots, air traffic controllers, and flow management specialist. To make use of such information in the design of weather displays and in decision support tools and in the training for their use requires an understanding of how these people deal with probabilistic weather information.

Recommendation: There is a significant body of knowledge about how people deal with probabilistic information for decision making in situations involving risk. It is recommended that the Weather program get sufficient understanding, using such information where appropriate, to help them design weather forecast displays, decisions support tools, and associated training that make use of probabilistic weather information.

Finding: The Advanced Materials and Structures Program continues to produce valuable design and certification guidance for the FAA and industry. Continued coordination and involvement with industry stakeholders is noted and encouraged.

Finding: The Subcommittee continues to note and support the excellent work performed by Civil Aerospace Medical Institute (CAMI). Outputs and outcomes continue to be tightly coupled to identify research requirements. As a result CAMI continues to be an internationally recognized national asset. The Subcommittee further notes and supports the need for continued

modernization and refurbishment of CAMI facilities. Also noted is the importance of an in-house core of recognized subject matter experts.

Action: The Subcommittee asks that a deep dive into the Aeromedical Research Program be included as part of the Fall/Winter 2014 meeting.

Finding: The Subcommittee finds the work planned for FY 2016 supporting the Helicopter FDM Data Gathering and Analysis for Aviation Safety Information Analysis and Sharing (ASIAS) to be relevant to a stated safety requirement. It is noted that a requirement to extend the research beyond FY 2016 has not yet been identified.

Finding: Overall the Subcommittee continues to find the work of the Continued Airworthiness program (Structural Integrity Metallics, Flight Control-Mechanical Systems, Electrical Systems, Rotorcraft, and Maintenance & Inspection) to be relevant and well defined. The funding levels seemed consistent with the anticipated outputs. The Subcommittee noted that several activities were highly leveraged programs taking advantage of partners from industry, universities, and other government agencies to produce results responsive to sponsor requirements.

Findings: The FAA provided the Human Factors and Aircraft Safety Subcommittees the opportunity to review the FAA's *Integration of Civil UAS in the NAS Roadmap* which they released in November 2013. While a major step in the right direction, the Subcommittees found that the roadmap was at a high-level and did not on its own contain sufficient detail with regard to specific milestones and dates for the Subcommittees to make informed recommendations to the FAA on research requirements, priorities, and gaps. The Subcommittee believes that access to the FAA's Unmanned Aircraft Systems (UAS) Airspace Integration Concept of Operations and the "integration plan" currently under development would be important.

In addition, the Subcommittees have the following observations:

- Given that the FAA has no formal role in influencing the selection and/or execution of research conducted at the FAA UAS Test Sites there is a potential for missed opportunity and concern that the FAA may not get useful research results from the effort.
- While there appears to be an urgent need for research to inform FAA decisions and planning efforts, much of the research will not produce results for several more years. As a consequence, much of the research may be late to need.
- Sensor fusion research seems focused on a solution that is associated with a design concept which may be the purview of a proponent. It would seem more appropriate for FAA research to be focused on results which would be the basis for establishment of standards and/or inform certification approaches.
- The following UAS integration research is either minimally addressed or apparently missing from the FAA's research portfolio: air traffic management procedures and capability enhancements; operational procedures development; ground station and communication

requirements, the effectiveness of existing and planned procedural mitigations; and mechanisms for the safe response to failures and other contingencies.

Action: Considering the timing and content gaps of the existing UAS integration research and development portfolio, the FAA should identify programmatic risks, impacts on the integration roadmap, and implications for current operations.

Action: Related to the 3rd bullet in the findings, i.e., sensor fusion research, review the UAS research portfolio to ensure that the research is addressing moving forward on integrating UAS in the National Airspace System (NAS) without developing vehicle specific technology. This vehicle level system design research is appropriately handled by UAS vehicle manufacturers and not the Agency.

Recommendation: The FAA should develop a holistic implementation plan to include a detailed R&D strategy which would address the research needs from both the regulator and airspace operator perspectives.

Finding: The Subcommittee is pleased to see the research in Terminal Area Safety continues to be well structured and relevant. The research around advanced maneuvers and runway friction is progressing well as expected. The Subcommittee is very concerned that the research addressing development of stable approach criteria was stopped. The Subcommittee strongly supports the need to assure that research protocol and methodology produce a credible outcome. At the same time, priority needs to be placed on known safety issues that have been and continue to be causal in aviation accidents and incidents.

Action: The Subcommittee requests a briefing at the summer 2014 meeting with an update on the research addressing development of stable approach criteria- specifically covering research design and progress and funding of the research effort.

Finding: The Subcommittee finds the Propulsion and Fuel Systems research being done regarding the effect of volcanic ash on propulsion and fuel systems to be relevant and appropriate. The continued collaboration with other government agencies and industry is especially noteworthy and should assist with outcomes having wide applicability and reaching industry in a timely manner.

Finding: In the area of Software Digital Systems (SDS), the Subcommittee is pleased with the progress made by FAA at refining the focus of this activity by connecting the work program to specific outcomes. In addition, the Subcommittee appreciates the evidence provided of good coordination with other partners such as NASA. The Subcommittee feels that the work being undertaken seems reasonable and that there are no glaring gaps. However, the Subcommittee has noted that this is an extremely complex area with rapidly changing research drivers as well as progress being made in various domains that may have relevance for aviation. The Subcommittee remains apprehensive that the FAA can stay appropriately resourced to keep up

with the pace of change of SDS technologies and able to maintain the appropriate internal expertise.

Action: At the next meeting, the Subcommittee would like to hear the FAA strategy and actions for maintaining the appropriate level of internal expertise to support this important activity.

Finding: The Subcommittee finds that the Fire Research and Safety Program continues to be responsive to clear Office of Aviation Safety (AVS) and global aviation needs. At the same time the program is flexible to respond proactively to current and emerging needs such lithium battery concerns. The Subcommittee agrees that the recent survival rate of the Asiana B777 accident at San Francisco is a testimony to the success of this activity. The Subcommittee was also encouraged to hear of FAA efforts, such as the Internship Program, intended to foster the growth of internal expertise and succession planning.

Finding: The Catastrophic Failure Prevention research activity is focused on enabling the use of analytical methods to show regulatory compliance of engine containment designs against rotor burst or fan blade failures. Although a narrow focus, the research goals align with the much broader trend by industry to make use of analytical tools wherever possible. The Subcommittee endorses the relevance of this effort and concurs with the FY 2016 shift in focus towards engine designs using more composite materials.

Finding: The Subcommittee finds that the GA Fuels program to support the evaluation and fleet-wide safety approval of an unleaded aviation gasoline is well-defined and appropriate to meet the FAA strategic goal that a replacement for leaded avgas that is usable by most GA aircraft is available by 2018. Also, the Environmental Protection Agency (EPA) is currently conducting an endangerment finding for lead emissions from aircraft; this program will inform any regulatory action that may be taken and provide unleaded solutions. The program highly leverages industry participation through a public/private Piston Aviation Fuels Initiative (PAFI) for technical expertise, resources, services, equipment, and candidate replacement fuels. The Subcommittee notes that the overall complexity of this 5-year program and ability to meet the objective is directly dependent upon the performance properties of candidate unleaded fuels which are expected to be submitted by industry in response to a public solicitation which closes in July 2014.

Action: The Subcommittee asks that an overview of the GA Fuels program, updated to reflect the candidate fuels, be presented as part of the Fall/Winter Subcommittee meeting.

Subcommittee on Human Factors

Finding: While the Department of Transportation and the FAA do not have a DOD-like Human-System Integration (HSI) process for acquisition, the Advanced Concepts and Technology Development Office (ANG-C) has been integrating human factors (HF) into the acquisition process through an HF/AMS Integration Management Plan. Much of this effort has

entailed creating relationships and showing the value of HF within the acquisition process. A quarterly Human Factors Acquisition Working Group meeting has also been implemented. The Subcommittee found these and other elements to be great strides in the correct direction of fulfilling the FAA policy to systematically integrate HF into the planning and execution of functions of all FAA elements and activities associated with system acquisitions and systems operations. However, while necessary, these steps alone are insufficient to ensure that HF will be appropriately integrated and addressed in all acquisitions. What is also needed is a means to formally instantiate HF integration into the lifecycle management process. One possible means would be to create specific HF checklist items within the lifecycle management process requirements.

Recommendation: To ensure HF is appropriately included in all FAA acquisitions, formally instantiate HF integration into the FAA lifecycle management process. An example is the inclusion of HF-specific checklist items as part of the overall acquisition process.

Finding: The research plan is judged to be sound and reasonable given the erratic and sparse funding. There were a few noted concerns however: (1) the Human-System Integration (HSI) roadmap seems to under-represent the impact of NextGen on potential NAS actors' work environment, tasks and training (including controllers and pilots); and (2) the impact of Operational Improvements (OIs) on different NAS actors doesn't appear to be well described.

Action: Provide a briefing on using the integrated control structure approach to characterize how NextGen changes the tasks and methods of NAS actors.

Recommendation: The FAA responded to a previous recommendation (see response dated February 28, 2014) that, in the mid-term NextGen time frame, controller roles and responsibilities will not change. However, the tasks and task load of controllers, pilots, and other NAS actors are likely to change (e.g., different workload profiles, possible staff distribution across the facility, coordination between facilities, changes in communication load between controllers and between controllers & pilots, information requirements, training, etc.). Thus, ANG-C1 (HF Division) should perform an analysis of potential NAS actor task and work environment changes related to mid-term NextGen implementation and reflect the implications on the HSI roadmap.

Finding: The FAA provided the HF and Aircraft Safety Subcommittees the opportunity to review the FAA's *Integration of Civil UAS in the NAS Roadmap* which they released in November 2013. The HF Subcommittee concurs with the general finding and recommendation provided by Subcommittee on Aircraft Safety. Particularly, the HF Subcommittee was concerned that the following UAS integration research is either minimally addressed or apparently missing from the FAA's research portfolio: air traffic management procedures and capability enhancements; pilot/operator operational procedures development; ground station and communication requirements, the effectiveness of existing and planned procedural mitigations; and mechanisms for the safe response to failures and other contingencies. Further, the HF

Subcommittee has concerns, raised in earlier recommendations, that the research is not addressing UAS integration into the airspace from an air traffic perspective.

Action: Considering the timing and content gaps of the existing UAS integration research and development (R&D) portfolio, the FAA should identify programmatic risks, impacts on the integration roadmap, and implications for current operations.

Recommendation: The FAA should develop a holistic implementation plan to include a detailed R&D strategy which would address the research needs from both the regulator and airspace operator perspectives.

Finding: During the review of both the air and ground plans for HF research, the Subcommittee saw a lot of common themes across the domains, particularly in the NextGen research areas, and specific, focused topics where they are starting to integrate. These have a value also in identifying and mitigating risks earlier that may arise in the integration that can impact both air and ground developments. It is important the research sponsors be briefed on and fully understands the potential synergies and efficiencies that can be obtained and realized.

Action: Provide a briefing at the next HF Subcommittee meeting relaying where research projects are turning those interactions into synergies, and explaining the specific ways that the research efforts are not just interacting but leveraging across the domains. Further, include in the briefing a description of other potential interactions between research projects where the Subcommittee might provide a useful review and comment on the value of the interactions.

Recommendation: The FAA Air Traffic Organization (ATO) and Office of Aviation Safety, (AVS) organizations in coordination with NextGen Office (ANG), should develop a consensus top five assessment of human performance issues with NextGen air/ground integration to drive appropriate research.

Finding: The Subcommittee observed that the Weather Technology in the Cockpit (WTIC) program is making progress in an area of research important to aviation safety, and which has considerable HF implications. The WTIC Program has come up with a strategy for developing training that involves and leverages the Flight Standards (AFS) and Aircraft Owners and Pilots Association (AOPA) organizations experienced in training, and that inherently promotes dissemination. However, other aspects of the research are not as efficiently and effectively directed, particularly around experimental studies of pilot decision making. Based on the presentation they appear to believe that the problem to solve is in the information presentation, without an understanding that more (or higher quality) information will not entirely solve poor weather decision making. Results to date have been predictable.

Recommendation: The research plan needs to articulate the pilot decisions that they are aiming to support, and then analytically define how WTIC-provided information and portrayal of that information is expected to improve pilot decision making. Then, predict how information

portrayal may support or degrade these specific decisions based on the literature and use Human-In-The-Loop (HITL) to validate the analysis and predictions. Likewise, examine other ways of improving pilot decision making about weather, independent of the quality of the information, such as training for pilots about decision making about weather accounting for likely behaviors such as decision biases.

Action: It was also noted that there is a lack of clarity regarding the intended path to use the research to impact the industry. The WTIC should present at the next HF Subcommittee meeting their plan as to how they will impact industry with their developments.

Finding: The Subcommittee noted that the Air Traffic Control (ATC)/Tech Ops HF Core program has developed a promising strategic direction that involves tighter partnering with the ATO. Their strategy appears to be driven by what they can get initial traction on with ATO sponsors, and what they can do with limited resources. However, it is recognized that getting initial traction has a potential long-term benefit for highlighting the benefit of HF to a wide range of sponsors in ATO, and that the strategic direction can also be extended to more direct contribution to service analysis and strategic planning functions in the Acquisition Management System (AMS).

Action: The HF Subcommittee would like an update at the next meeting on the evolution of the strategy. Is the initial traction bearing fruit, and is it leading to more proactive work in partnership with the ATO? And what is the strategic direction for how the FAA should use core HF research in the AMS.

Recommendation: The strategic direction for ATC/Tech Ops HF Core program should also articulate how the FAA should use Core HF research in service analysis and strategic planning functions in the AMS.

Finding: In earlier findings and recommendations, the HF Subcommittee noted that the key role of development of a Fatigue Risk Management System (FRMS) database plays in (1) supporting the implementation of FRMS at air carriers, (2) guiding a standard implementation of FRMS at air carriers, and (3) allowing the FAA to monitor for continuing flight crew fatigue issues. Earlier recommendations noted that the proposed FY 2016 activities to develop this database are too late to be fully effective, and the proposed work should be moved earlier. Aggravating the need for this research since the earlier recommendations, the FAA has further implemented Code of Federal Regulation (CFR) 117, which implements new pilot scheduling requirements intended to further mitigate pilot fatigue risk. However, while the proposed research's value appears to be recognized by tentative selection within the AVS process, its tentative funding date remains at FY 2016.

Recommendation: To ensure that the pilot scheduling rules called for under CFR 117 are meeting their intended fatigue reduction goals, and for the reasons also cited in previous

recommendations, the proposed research developing a FRMS database should be moved earlier, i.e., viewed as a pop-up within FY 2014 and/or scheduled to start in FY 2015.

Finding: Both the HF and Aircraft Safety Subcommittees were pleased to see that the effort of the PARC/CAST Flight Deck Working Group has finally culminated into an excellent report that includes their findings and recommendations. It was noted that some of the recommendations have already been acted on by the FAA such as the Safety Alert for Operators (SAFO) notice issued on January 4, 2013 titled “Manual Flight Operations”. However, there are many additional findings in the report that indicate important action items and research that merit follow through.

Action: The hf Subcommittee requests a briefing on FAA plans to act upon the recommendations provided in the PARC/CAST Flight Deck Automation Working Group Report at the Summer 2014 meeting.

NAS Operations Subcommittee

Background: At its August 2013 meeting, the NAS Operations Subcommittee recommended that the FAA expedite its work with MITRE to develop an initial set of weather research requirements in early CY 2014 and that this work encompass both Aviation Weather Research (AWRP) and Weather Technology in the Cockpit (WTIC). The Subcommittee further recommended that the FAA rapidly identify those portions of the WTIC program that can provide quantitative NextGen and GA safety benefits and brief the Subcommittee on those benefits. In March 2014, the FAA briefed the Subcommittee on their progress with the MITRE Operational Weather Needs Analysis (OWNA), a formal, operationally-based analysis tool. The FAA also provided a briefing on the GA safety benefits of WTIC.

Finding: The Subcommittee found that the FAA has made significant progress with the MITRE OWNA tool in providing a stronger foundation for the requirements for the NextGen weather programs that will help the FAA prioritize its research initiatives across AWRP and WTIC. While OWNA provides an initial qualitative assessment, a significant amount of quantitative analysis may be required for prioritization of research initiatives. The Subcommittee was pleased that, for the example presented (Collaborative Airspace Constraint Resolution), the methodology was also used to analyze specific research needs for WTIC to provide NextGen benefits. The Subcommittee found that the portion of WTIC that is focused on GA safety is properly aimed at providing advisory material and standards for the content and presentation of weather information to GA pilots and was appreciative of FAA’s response to their recommendations.

Recommendation: The FAA should continue its use of the OWNA methodology with the goal of providing a comprehensive set of weather research needs across the AWRP and WTIC portfolios. The Subcommittee looks forward to reviewing these needs during their August 2014 meeting.

Finding: The Subcommittee would like to acknowledge the excellent work, presentation, and progress by the FAA NextGen Wake Turbulence team. Their briefing to the Subcommittee provided a complete answer to our recommendation with regard to aircraft design factors for wake strength. We understand that Airbus would like to see wake vortex core size included as an additional consideration in the prediction of aircraft wake separation and that this consideration is under review by the FAA.

Finding: The implementation of RECAT Phase I at Memphis (MEM) and Louisville has delivered substantial NextGen operational benefits to date and implementation will continue in FY 2014 (at Cincinnati, Miami, Philadelphia, Northern California, Southern California, and Atlanta). Preliminary FY 2015 budget numbers presented to the Subcommittee indicated that zero funding would be available to continue with Phase I implementation (at New York, Boston, Chicago, Anchorage, and Indianapolis). While the baseline Facilities and Equipment (F&E) budget of \$1.4 million for RECAT is projected to be restored in FY 2016, the Subcommittee is concerned that the FY 2015 budget reduction will result in a substantial opportunity cost due to the delay of the RECAT Phase I benefits at the affected airports. Even if the budget is fully restored in FY 2016, this delay is likely to extend beyond a year, due to the recovery time for the Phase I implementation team – a highly competent research team, assembled across Government and industry, that has matured over a period of many years.

Recommendation: The Subcommittee recommends that FAA estimate the annual benefits of RECAT Phase I at the airports scheduled for implementation in FY 2015 and use this estimate in its decision making on how to allocate budget cuts among the NextGen F&E budget line items. To this point, FedEx estimates an 18% improvement in throughput at MEM. While this benefit will scale according to unique attributes of traffic at other airports, this gain has significant potential value through expanded implementation. The Subcommittee encourages FAA to identify whether there are alternative means to continue translating the outcome of its wake turbulence research into achieved benefits, balancing these efforts with other priorities for procedures and airspace improvements.

Finding: Investments in Concept of Operations (ConOps) validation is a major source of NextGen implementation risk reduction, especially when the validation efforts integrate across the multiple, simultaneous changes that are being explored that affect operational personnel. ConOps validation includes a range of activities, including initial analyses and paper studies, table-top exercises, modeling and simulation, and full-fidelity HITL simulations. The Subcommittee is concerned that there are substantial reductions in the preliminary budget estimates for budget line items 1A08 (ATC/Tech Ops HF – Controller Efficiency Air Ground Integration) and 1A08D (Ops Concept Development Validation modeling) for FY 2015; and that these reductions will add risk to NextGen implementation.

Finding: The NAS Operations Subcommittee also observed that ConOps validation activities are spread across multiple organizations, including those in the FAA's NextGen line of business

(ANG) and the Air Traffic Organization (AJV). HF analysis appears to be performed in multiple ways, including use of FAA resources for some projects and external organizations for others. While the Subcommittee was informed that there is regular coordination between the two organizations, a clear strategy for management and allocation of work was not presented.

Recommendation: The Subcommittee recommends that the FAA manage its ConOps validation activities in the aggregate (including the full range of efforts from initial exercises to HITLs) to ensure that risk reduction efforts are appropriately resourced for NextGen implementation priorities. The Subcommittee recommends that the FAA report on its efforts in this regard at the next Subcommittee meeting.

Subcommittee on Airports

Finding: The Branch staff's request for a modest budget increase in FY 2016 for the Airport Technologies Research Program appears justified in light of the Branch's ongoing and planned future research projects.

Recommendation: We recommend that the FAA fund the Airport Technologies Research Program in accordance with FAA Branch staff requests.

Finding: Regarding the aircraft braking friction studies, the Subcommittee remains very interested in the Phase 1 goal of the project, which is to establish real relationships between surface conditions and tire dynamics. Branch staff continued to make progress on its data collection efforts for this important project over the past six months, despite a variety of technical challenges that have emerged during the testing program. Due to mechanical issues related to the test aircraft, only limited data was collected from snow-contaminated pavements during this past winter season. The Subcommittee is very interested in seeing if these data provide promising bases for evaluating pavement-tire interactions for snow-contaminated pavements. It appears that additional data collection efforts for snow-contaminated pavements will likely be needed next winter season.

Recommendation: We recommend that Branch staff provide an updated project schedule and "go/no go" decision points based on the need for additional data collection efforts during next year's winter season. We also recommend that staff assess ways in which the management of technical and schedule risks during the data collection process can be improved next season.

Finding: The Subcommittee notes that FAA Office of Airports has still not yet taken action on the Subcommittee's recommendation that FAA Office of Airports make necessary modifications to its advisory guidance—particularly Advisory Circular 150/5320-12C, *Measurement, Construction, and Maintenance of Skid-Resistant Airport Pavement Surfaces*—so that airport operators can use trapezoidal grooves to improve runway drainage and friction under wet conditions should they desire.

Recommendation: The Subcommittee reiterates its recommendation that FAA Office of Airports make necessary modifications to its advisory guidance—particularly Advisory Circular 150/5320-12C, *Measurement, Construction, and Maintenance of Skid-Resistant Airport Pavement Surfaces*—so that airport operators can use trapezoidal grooves to improve runway drainage and friction under wet conditions should they desire. If additional research is needed to address outstanding design, reliability, or durability issues, we recommend that the FAA expedite the development of research project requests for these additional activities and move ahead with this research quickly.

Finding: The Airport Technology Program is currently engaged in the development of an airport safety database as part of Research Planning Description (RPD)141. This database fuses information from the FAA’s wildlife strike database as well as accident and incident reports from FAA and NASA databases. Subcommittee members would like to ensure mechanisms exist for airport operators to view and assess the data for their facilities.

Recommendation: The Subcommittee recommends that mechanisms be established for airport operators to access the data in the airport safety database for their airports.

Finding: The FAA Office of Airports has worked to provide Subcommittee members with advance information regarding new “pop up” research projects that emerge between Subcommittee meetings. We appreciate these efforts to involve the Subcommittee in the development and prioritization of new research tasks.

Finding: The Subcommittee is satisfied with the direction of the pavement research program, which includes multiple RPDs. The Subcommittee appreciates that the Branch has established an expert industry panel to provide input and advice into the 40-year Pavement Research Program (RPD146) and is enthusiastically awaiting the new data collection efforts involving the Branch’s heavy vehicle simulator.

Subcommittee on Environment and Energy

Finding: Aircraft noise continues to be a major issue, with citizen complaints accelerating as the nation’s airspace is redesigned to take advantage of NextGen capabilities. The FAA Noise Research Roadmap has been designed to expand the Agency’s knowledge of the current state of aviation noise impacts on the general public and to provide the data necessary for future Agency activity in this area.

Recommendation: The Subcommittee recognizes the importance of the Noise Roadmap effort and recommends that sufficient funding continue to be allocated to ensure that this program is not unreasonably delayed. Findings made in the course of this research should be objective, fact based and data driven and should be used to update and implement Agency policy in the noise area.

Finding: As noted above, much progress has been made in all areas of Office of Environment and Energy (AEE) activity. The Subcommittee recognizes these successes but feels that they need to be better communicated both to government decision makers and the public at large.

Recommendation: The Subcommittee recommends that the FAA develop better methods of communication to ensure that the results of research efforts are distributed to those with the need to know or simply with interest in AEE activities. Specifically, the Subcommittee urges the FAA to improve its websites to make navigation easier and to highlight the activities that have resulted in significant environmental progress.

Finding: An area of AEE activity that demands continued prioritization is the ongoing Continuous Lower Emissions, Energy, and Noise (CLEEN)/Alternative Fuels program. As noted, efforts in these areas have already led to successes in accelerating the transition of research into products that can be incorporated into aircraft and engine design and in developing fuels that can be used as a substitute for traditional petroleum-based jet fuels. Continued funding is necessary as the Agency transitions from CLEEN I to CLEEN II and the effort to develop commercially viable alternative fuels progresses. In the past, Congress has recognized the importance of these projects by continually providing funds in excess of those requested in the President's Budget.

Recommendation: The Subcommittee strongly recommends that funding necessary to support the CLEEN/Alternative Fuels programs continue. Indeed, the Subcommittee continues to endorse the AEE above-target funding request for the continuation of these programs at the highest possible level.

Finding: The International Civil Aviation Organization (ICAO) efforts to establish worldwide environmental standards is ongoing and United States leadership in the ICAO Committee on Aviation Environmental Protection (CAEP) process continues to be an important priority.

Recommendation: Sufficient funding should be available to AEE to permit continued U.S. leadership in the ICAO arena. The current ICAO initiative to develop a worldwide CO₂ standard is moving forward, with specific deadlines that must be met. In addition, efforts have begun on some of the technical elements of a proposal for global market based measure (GMBM) for international aviation to be considered by the ICAO Assembly in 2016. It is important that the United States remain in a leadership position. AEE-developed tools are central to the work of ICAO/CAEP and sufficient funding should be available to maintain and update the existing tool suite. While the work on the technical elements of a GMBM proposal is extremely important and AEE should be a leader in this effort, it is critical to maintain focus and priority on the important CAEP work of establishing the CO₂ standard for aircraft and developing the basis for a Particulate Matter (PM) standard.

Finding: The FAA's cooperation with other federal agencies in the development of alternative jet fuels has enabled scarce government resources to be leveraged resulting in the most effective means of moving forward in the alternative fuels area.

Recommendation: The Subcommittee strongly recommends that this inter-governmental agency cooperation continue and specifically urges that the Alternative Jet Fuel Inter-Agency Coordination Group (ICG) framework continue to be supported in future efforts to align and leverage alternative jet fuel research.