**FAA REDAC Subcommittee on Environment and Energy**

**Recommendations for Developing Strategic R&D Plan**

**August 2014**

At its summer meeting in Washington, DC, the FAA REDAC Subcommittee on Environment and Energy deliberated in two separate teams to develop recommendations of issues and opportunities for the FAA to consider in defining a strategic R&D plan looking out 10+ years. The following represents recommendations from the E&E Subcommittee regarding research areas the FAA should include in the Strategic R&D Plan that is in addition to the currently established R&D portfolio and focused on the longer term. The subcommittee supports the consideration of longer term needs but is concerned that some of the near- to mid-term programs are not sufficiently funded to be able to achieve their objectives.

1. **Low Emissions Aviation Alternative Fuels:**

Alternative fuel is a significant component of aviation stakeholders’ strategy for environmentally sustainable growth. Research is needed to develop a fuel qualification based on chemical composition related to engine operational figures of merit. This would not only speed up the qualification of new alternative fuels but it also presents the opportunity to tailor fuel composition to reduce emissions (e.g. non-volatile particulate matter). This R&D would lead to alternative fuels with reduced climate and air quality impacts.

1. **Advanced Technologies and Configuration Maturation:**

The current research portfolio at NASA, FAA and industry for commercial aviation include many technologies and configurations that are significantly different than what we see today. A significant effort will be required to mature these technologies to a higher technology readiness level via demonstration in a relevant system to be a candidate for application to an airplane design. FAA’s Continuous Low Emissions Energy and Noise (CLEEN) program has been successful in achieving this for low NOx combustor, Composite Matrix Ceramic (CMC) nozzle and fan blades, advanced wing trailing edge, among others. CLEEN-2 is expected to mature several more technologies in the next 5 years. The advanced technologies being developed now (e.g., hybrid systems, morphing surfaces, manufacturing technologies, etc.) will require a follow on to CLEEN-2 for technology maturation after 5 years

1. **Technology Certification Process:**

As engine / airplane systems become more complex, demonstrating safety and environmental compliance is becoming more complicated, lengthy and costly. These processes need to be made more efficient. This can be accomplished by using more analysis and less testing for certification. A focused effort that advances and validates analysis procedures is required to accomplish this objective.

1. **Incorporation of “Growth / Diversification” Areas into NAS:**

The aviation system is rapidly evolving driven by traffic levels, passenger flight preferences, and new vehicle opportunities like Unmanned Air System (UAS), supersonic, Vertical Takeoff and Landing (VTOL), Personal Air Vehicle (PAV), and Commercial Space Transportation (CST). There is a need to establish methods and procedures to integrate these changes into the NAS. UAS operations at low altitudes and in urban environments are a particular area of concern environmentally.

1. **Big Data / Information Technology Integration:**

Real-time information-based decisions are critical to improving the operational efficiency and environmental impact of air vehicles. To enhance decision making, large datasets from airplane and airspace (e.g., vehicle health, ATC, environmental impact, etc) must be captured and processed. Technology that enables integration of relayed information (e.g., weather, 4D trajectories, etc) with cockpit information is needed. This will enable higher levels of onboard automation and the ability to further reduce the environmental impacts from aviation.

1. **Integrated Modeling and Simulation:**

The FAA has made significant progress in the development of tools to assess aviation environmental impacts and these tools are being used in both domestic and international policy development. For NextGen applications a pervasive integration of the entire FAA tool chain is desired. The tools also need enhancements in more probabilistic use of modeling and simulation as well as inclusion of future concepts of operations including autonomous operations. These improvements will enable strategic decision making and planning initially but ultimately they will enable informed decision making at a more tactical level (e.g., control of specific flights) for reduced environmental impact.