ADDENDUM A RESEARCH ISSUES & OPPORTUNITES FOR REDAC CONSIDERATION

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Subcommittee on Airports FAA Research, Engineering, and Development Advisory Committee

Issue 1: Integration of New Generation Aerospace Vehicles into the NAS

The emergence of commercial space operations and unmanned aerial systems (UASs)/remotely piloted aircraft (RPA) pose significant new challenges for the FAA, vehicle operators, airport/spaceport operators, and local communities. Despite defined research portfolios for both types of vehicles, critical research challenges remain. Perhaps more importantly, given the rapid development and proliferation of these new vehicles—especially UASs/RPA—these research challenges are extremely time critical.

Research can help address many of these concerns and identify how combinations of technology, procedures, and regulations can facilitate access to new generation vehicles without compromising the safety or efficiency of conventional aircraft operations in the air and on the ground

With respect to commercial space operations, additional research is needed regarding how both vertical and horizontal launch concepts can be integrated effectively into the NAS, safely and with minimal operational disruptions to conventional aircraft operations. Additional research is also needed regarding the physical infrastructure that will be required at spaceports to accommodate these space vehicles.

With respect to UAS/RPA operations, additional research is needed in multiple areas including aircraft certification, airspace and airfield operations, human/machine interactions, legal & regulatory frameworks, and safety & security assurance. The research needs to encompass the breadth of existing and likely future UAS/RPA users (military, commercial, and recreational), vehicle types, and vehicle uses.

Issue 2: Effects of Climate Change on Aviation Infrastructure and Operations

The scientific community has reached general consensus that anthropomorphic climate change is occurring, driven by global increases in the use of fossil fuels and other activities that generate greenhouse gases.¹ In the aviation sector, research is needed both to (1) determine best available measures to reduce the aviation's climate change impacts and (2) adapt aviation infrastructure and operations to reflect the impacts that do occur.

Considerable research has been conducted regarding the former area—including significant research and development into more fuel efficient engines and airframe designs. Such research should continue. Ongoing research and development regarding NextGen capabilities that improve the management of air traffic congestion both on the ground and in the airspace is also critically important. Such research can be expanded to include improving the energy efficiency

¹ See for example *Climate Change 2013, The Physical Science Basics,* published by the Intergovernmental Panel on Climate Change.

and reducing the resource consumption of airport infrastructure—including more efficient airfield lighting systems, less energy intensive paving and construction methods, and more efficient terminal and support building maintenance and operations systems.

In terms of adaptation, significant research is needed regarding the impacts climate change will have on critical infrastructure—including airports and ground-based navigational aids. For coastal airports that may be threatened by forecast sea level rise and/or storm surge, this research includes best practices for hardening airfield and terminal infrastructure, research into saltwater-resistant lighting systems, and in extreme cases, evaluation of alternative airport sites. Adaptation-related research is also needed regarding the performance of airfield pavements and navigational aids when exposed to extremely high temperatures, as well as the impact of such temperatures on construction processes. From a flight operations perspective, research and development efforts that focus on operations in very hot environments may also be needed.

Issue 3: Managing Airport Operations in a NextGen Environment

As NextGen capabilities are introduced over the next five to six years, they are expected to bring substantive improvements to airport capacity, shared situational awareness, and collaborative decision making. Many of these capabilities will directly affect airport surface operations as well as have secondary impacts on airport terminal and landside operations. Research is needed to assess the likely magnitude of these impacts and assess the best ways in which airport operators, the airlines, and other stakeholders can prepare for them.

Areas of research related to this issue include:

- Assessing how NextGen may shift capacity bottlenecks from terminal airspace and runway systems to apron, terminal or ground transportation systems, particularly during irregular operations events and developing planning guidance that accounts for such shifts.
- Improving methods for sharing data regarding airport operations among all key stakeholders, including the FAA Air Traffic Organization, airlines, other aircraft operators, airport operators, and ground service providers.
- Developing decision support technologies/tools that can be utilized to optimize airfield and terminal operations, enhance gate utilization, improve resource allocation, and bolster operational safety.
- Evaluating the potential consequences and mitigation actions that should be taken in the event of NextGen capability disruption (e.g., GPS outage).

Issue 4: NextGen and Noise in the Airport Environs

Not many years ago, the severity of aircraft noise problems on and around many major airports was seriously constraining the growth and expansion of such facilities, casting doubt on the degree to which such airports could be relied on to meet the needs of a growing civil aviation industry. In more recent years, the progression to less-noisy generations of aircraft, coupled with aggressive noise abatement steps such as flight path adjustments, residential and school sound-proofing, and land acquisition programs have established a new balance of interests that is more accommodating to airport growth and expansion. The perils to airport growth which noise

problems posed in the past are serious enough to warrant extreme care in anticipating and recognizing the potential of such issues to again arise as NextGen moves in the direction of increasing the density of overflight activity in the airport environs and in altering flight paths to accomplish that end.

The progress which has been made on this issue over the years resulted from a combination of federal and local actions. While the federal actions have concentrated on establishing increasingly stringent limits on aircraft noise output and on financial support for land acquisition and building soundproofing , the local airport operator actions have included proactive work with local land use and zoning authorities, noise monitoring and reporting systems, and a wide array of other community outreach and aviation advocacy efforts. In the course of these many local efforts it has been apparent that while the acoustic aspects of aircraft overflights is indeed, as the name suggests, a major part of the "noise problem", it is not the only ingredient. Community pushback was, and is, also a reflection of discomfort with the potential safety element of low-flying aircraft, with perceived deterioration of property values, and with the strength and vigor of political mobilization of community resistance. All in all, the "noise problem" is more complex than the simple notion of acoustic disturbance.

All of this gives rise to the need for extreme care in fashioning the flight regimes of NextGen and in recognizing that highly localized measures, tailored to deal with the technical and political factors found at specific locations, have been key to diffusing much of the "noise" issues of the past, and need to be understood and respected if the promise of NextGen is to be realized throughout the US aviation system.

Issue 5: Advanced Pavement Materials

Maintenance and reconstruction of airport pavement represents a major financial commitment to airports and the Federal Aviation Administration. Relatively minor improvement to the life of pavements can provide substantial cost savings both in direct repair /replacement costs and user delay costs. Improvement and innovation in paving materials represents the most direct way to extend pavement life. The fundamentals of current paving materials technology evolved in the 1940 and 50's. With the exception of polymers in asphalt and admixtures in concrete, current pavement technologies have not changed significantly. Nanotechnology represents a potential fundamental breakthrough in paving materials technology that has the promise to provide significant improvements in pavement materials.

Materials scientists are studying and experimenting with fundamentals in nanotechnology. More research is needed in applying nanotechnology to paving materials and in studying direct application to nanotechnology to pavements. The FAA's National Airport Pavement Test Facility is an excellent location to study these applications and bridge the gap between science and implementation by using accelerated testing.