

**Research, Engineering and Development Advisory Committee
Federal Aviation Administration
800 Independence Avenue, SW, Washington, DC**

September 23, 2009

Meeting Minutes

On Wednesday, September 23, 2009, the Federal Aviation Administration (FAA), Research, Engineering and Development Advisory Committee (REDAC), held a meeting in the Round Room, at 800 Independence Avenue, Washington, DC. Attachments 1 and 2 provide the meeting agenda and attendance, respectively.

Welcome and Introductory Remarks

Dr. John Hansman, REDAC Chair, welcomed everyone, reviewed the agenda and turned it over to Barry Scott.

Mr. Barry Scott, REDAC Executive Director, read the public meeting announcement and thanked everyone for attending. Mr. Scott stated that he got to all the subcommittee meetings except two.

NextGen Update – Michael Romanowski

Mr. Michael Romanowski, Director, NextGen Integration and Implementation Office, provided the Committee with an update on FAA plans for Next Generation Air Transportation System (NextGen) with a focus on research.

Mike summarized what he was planning to present. First he would discuss where there are with a number of things, how they are managing across the spectrum. Pam Whitley will then follow-up with how they are handling research for mid-term. Steve Bradford will then focus on the longer term.

He commented that with a change in the Administration/Administrator that NextGen is a National priority and that it would be reflected by the strong support in the budget.

He discussed the RTCA Task Force Study and how it brought the entire community together. Key message from the study – deploy NextGen – build off the system today.

Question was raised about the requirements to get to near-term. Are the roadmaps where you are getting the requirements? Mr. Romanowski replied that they are looking at everything. What adjustments are needed because of the Task Force recommendations? Looking at what adjustments are achievable and continue the coordination with industry.

Mike continued to discuss the following:

- Partnerships: Key to Demonstrating & Evaluating Capabilities
- FY 09/10 Demonstration Locations
- UAS Issue

The members engaged in a discussion on the following topics:

- Committee's Separation Standards Report. FAA's analysis techniques – can't make substantial changes. Is anyone looking at equipment deployment?
- How does the agency do safety analysis? Not sure we have the technical standards yet. Procedures do not exist.
- What are the appropriate standards? (i.e., Staffed NextGen Tower – radars not being used)

Pam Whitley, Manager, NextGen Solution Integration reviewed the following:

- FAA's Acquisition Management System
- Portfolio Management Framework
- Benefits of the Enterprise Architecture
- Facilities Roadmap (Staffed)
- Staffed NextGen Tower Evolution (notional)
- Project Level Agreements (Overview)

Steve Bradford, Chief Scientist, discussed the FAA/NASA Research Transition Teams (RTTs). He reviewed the following:

- RTT Coordination and Oversight
- Team Descriptions
- Activities (timeline)
- Progress

Update (Workforce/Weather Transition) – Barry Scott

Mr. Barry Scott, Director, Research and Technology Development, provided the Committee with an update on the research workforce. He reviewed the following:

- NextGen & Operations Planning Workforce
- Organization Changes
- AJP Weather Program Alignment
- Rationale for Realignment
- Current Focus in AJP-68
- NAS EA Infrastructure Roadmap: Supporting Activities

Mr. Scott updated the members on the hiring progress and that 51 positions expected to be filed by mid-November.

Mr. John Hickey, Deputy Associate Administrator, Aviation Safety, commented that AVS recently made an announcement regarding adding NextGen specialists in the regional offices.

Mr. Scott mentioned the recent job fair he attended and the enormous amount of talent they saw. They have many resumes they are reviewing and hope to be able to hire some of this talent. Ms. Vicki Cox discussed the Co-Op Program and if the members knew of any candidates to please send them to her.

Presentation of Subcommittee Reports

In August/September each subcommittees met to continue reviews of FAA's R&D investments in the areas of airports, aircraft safety, human factors, NAS operations, and environment and energy. Before adjourning, each subcommittee prepared recommendations. The Subcommittee Chairs listed below presented their Subcommittee's recommendations. Attachment 3 provides the recommendations presented by each Chair.

<u>Subcommittee</u>	<u>Subcommittee Chair</u>
Environment & Energy	Steve Alterman
Human Factors	Chris Wickens
Airports	Ed Gervais
Aircraft Safety	Joe Del Balzo
NAS Operations	Victor Lebacqz

The recommendations were approved and minor edits will be made per the discussion. The final recommendations will be submitted in the letter to the Administrator.

Committee Discussion

Dr. John Hansman and the members engaged in a discussion of the "Mega" topics that may be included in the letter to the Administrator. Those topics are below. (The letter to the Administrator is provided in Attachment 4.)

- Weather in the Cockpit
- Lack of Software and Digital Systems
- Importance of Environment
- Safety Standards for New Systems (appropriate and need for progress – unclear who has responsibility for safety process) Special Working Group may help.
- UAS Emergence

Concern was raised on understanding key barriers to the system – methodologies on safety analysis. What method should be used to determine something is safe. Method and analysis are going to be what makes the change.

Members were supportive of the new REDAC database and how it will help them track the recommendations. Once the database is complete, a search can be made of a previous recommendation and the status to date. Mr. Barry Scott commented that he too was excited about the database. It will allow us to track the results of recommendations, track the delays, and what may be the cause (i.e., rule).

Workshop 2010 Discussion

The members were asked what they would like to hear for the workshop in 2010. Below are comments that were discussed.

- More Content
- Modeling and Simulation
- RTCA Task Force – 5 recommendations and how they are being addressed.
- Cross-cutting work on safety analysis
- Confirm date as soon as possible so members can make summer plans.
- Location other than muggy DC in July

Dr. Hansman thanked everyone and the meeting was adjourned at 3:00 pm.

Attachment 1

**Research, Engineering and Development Advisory Committee
Federal Aviation Administration (FAA)
800 Independence Avenue, SW
Washington, DC 20591 – Round Room (10th Floor)**

September 23, 2009

Agenda

9:00 am	Welcome	Barry Scott John Hansman
9:15 am	Update (Workforce/Weather Transition)	Barry Scott
9:30 am	NextGen Update	Mike Romanowski
10:30 am	Break	
10:45 am	NextGen Update - Continued	Mike Romanowski
11:45 am	Committee Discussion	
12:15 pm	Lunch	

Subcommittee Reports

1:15 pm	Human Factors	Chris Wickens
1:30 pm	Environment & Energy	Steve Alterman
1:45 pm	Airports	Ed Gervais
2:00 pm	Aircraft Safety	Joe Del Balzo
2:15 pm	NAS Operations	Victor Lebacqz
2:30 pm	Break	
2:45 pm	Committee Discussion - Recommendations - Future Committee Activity - Workshop 2010	John Hansman Barry Scott
3:30 pm	Adjourn	

Attendance

Members:

John Hansman (Chair)
Steve Alterman
Sarah Dalton
Victor Lebacqz
Agam Sinha
Joe Del Balzo
Chris Wickens
Ed Gervais
Tom Irvine (for Jaiwon Shin)
Barry Scott, FAA/REDAC Executive Director

Other Attendees:

Tom McCloy, FAA	Robert Pappas, FAA	Cathy Bigelow, FAA
Mike Romanowski, FAA	Vicki Cox, FAA	Mohan Gupta, FAA
Mile Gallivan, FAA	Gloria Dunderman, FAA	Edmond Boulay, US-CREST
Geoff Shearer, Boeing	Robert Jacobsen, FAA/BAE	Frank Mangine, FAA
Sterling Wiggins, GAMA	Erik Amend, FAA	John Hickey, FAA
Jim Williams, FAA	Susan Mertes, AIA	Dino Piccione, FAA
Nelson Miller, FAA	Henry Felices, FAA	Michael O'Donnell, FAA
Pam Whitley, FAA	Steve Bradford, FAA	Denise Davis, FAA
Monique Morris, FAA	Michelle Whetstine, FAA	
Roger Stern, Lockheed Martin		

Subcommittee on Environment & Energy – Chris Wickens, Chair

**FAA REDAC Subcommittee on Environment and Energy
Meeting Report and Recommendations
Summer 2009**

The Environment and Energy Subcommittee of the FAA Research, Engineering and Development Advisory Committee (REDAC) met in Washington, D.C. on August 20-21, 2009. Following is the report on the outcome of this meeting.

Introduction – A review of the activities of the FAA Office of Environment and Energy (AEE) indicated that current priorities remain intact, with an emphasis on NextGen and support of ICAO CAEP activities dominating the agenda. It was noted, however, that the tilt toward NextGen is becoming more pronounced as long term planning is translated into short and mid-term implementation. In this regard, the Subcommittee commended AEE for its work on integrating environmental models into the ATO and JPDO processes. The Subcommittee also agreed that perhaps the most promising and important aspect of current research revolved around the certification and testing of alternative aviation fuels and strongly recommended that this program, through CAAFI, be given the highest priority.

Another recurring theme was the need for continued and expanded cooperation both within the FAA and between the FAA and NASA. Internally within the FAA, there was continuing concern that the “environmental message” was not being adequately heard by all levels of the Agency and there was a strong feeling that cooperation with NASA will become more important as more advanced technologies emerge. The new CLEEN project that has been funded by Congress will provide a vehicle for much of this FAA-NASA collaboration.

The Subcommittee also touched briefly on the REDAC subcommittee structure and how to handle issues that cut across the jurisdictions of several subcommittees. The unanimous opinion was that no further formal “cross-committee” structure is necessary, but that it is extremely important that each subcommittee is aware of the activities of all other subcommittees. Better communication between subcommittees was therefore urged.

In addition, the Subcommittee discussed the July REDAC Workshop and unanimously concluded that such workshops are useful and should be continued. At the same time, there was a strong feeling that the workshop program contained too much process and not enough substance. It was therefore suggested that future workshops concentrate on the research activities of each of the subcommittees and how those activities relate to the goals of the Agency.

In a somewhat related area, the Subcommittee was briefed on a new Agency initiative to establish a comprehensive data base of all research activities. While tracking the progress of research projects is certainly important, the Subcommittee expressed concern that the limited resources of the Office of Environment and Energy would be stretched even thinner by having to spend time inputting data into an essentially (at least for Environment and Energy) duplicative data base.

Finally, the Subcommittee expressed satisfaction in the increasing levels of funding for environmental research. In this regard, the Subcommittee noted that the House of Representatives version of the fiscal 2010 budget contains a “plus-up” of \$13 million over the Administration request to jump start work on alternative aviation fuels.

Recommendations – The recommendations of the Subcommittee are broken down into two sections – the first recommendation is intended to be included in the REDAC submittal to the FAA Administrator, while the remainder of the recommendations is intended to address specific areas of Subcommittee discussion.

(A) Recommendation for Inclusion in the REDAC Submittal to the Administrator

Finding: Although much progress has been made in integrating environmental considerations into the NextGen planning process, there is concern that there is not yet a complete acceptance that environmental issues are as important as safety and security as necessary components of airspace modernization.

Recommendation: It is important that all levels of FAA management understand the importance of environmental issues as they relate to the NextGen effort. Therefore, it is recommended that the Administrator ensure that an Environmental Management System (EMS) is effectively implemented by reinforcing the need for the EMS throughout the entirety of the FAA workforce.

(B) Recommendations to be Included in the REDAC Report

(1) Finding: The issue of global climate change is becoming a major driver of environmental policy. In spite of its importance, there is a lack of understanding of aviation’s impact on climate change, especially in the area of non-CO2 pollutants. A more robust research effort with respect to climate change is necessary to develop reasoned policy on this subject.

Recommendation: Current Aviation Climate Change Research Initiative (ACCRI) funding appears to be inadequate to fully study the non-CO2 impacts of aviation. The Agency should therefore ensure that future funding requests contain the resources necessary for emerging global climate change research.

(2) Finding: Alternative aviation fuels are probably the most promising near-term tools for managing aviation's impact on the environment. The CAAFI project to develop and certify such fuels represents a significant research effort and reflects the necessary industry/government and intra-government cooperation necessary to address this issue.

Recommendation: Continued funding and support for the CAAFI initiative is absolutely necessary, as is the continuing partnership between industry and government and between the FAA and partner government agencies. To the extent possible, the FAA should ensure that efforts by other public entities (such as the military) are included in research efforts to avoid an unnecessary duplication of effort.

(3) Finding: On the local level, the issue of aircraft noise remains a major priority for many citizens. In addition, the nature of noise-related complaints has somewhat shifted its focus to areas well beyond traditional areas of substantial impact.

Recommendation: The Office of Environment and Energy has embarked on a major new research effort to define the current noise landscape and to develop the actions needed to address any identified concerns. The Agency should endorse and encourage this effort by requesting adequate funding to continue this project.

(4) Finding: The PARTNER Center of Excellence continues to occupy a central role in environmental research activities.

Recommendation: The FAA should continue to request the funding necessary to support PARTNER activities. (Note: There was some concern expressed by Subcommittee members over the fact that current versions of the pending FAA Reauthorization bill include the formation of a new Center of Excellence for Alternative Aviation Fuel, when research in this area can be accomplished through PARTNER).

Subcommittee on Human Factors – Chris Wickens, Chair

F&R A (Administrator)

FINDING

* Majority of roadmaps and working groups are technology centered. Only HF is fully human centered.

- To be effective, NextGen must reflect **co-equal partnership** between human (pilot, controller and maintainer) and technology.
- Our concern is that HF budget is reflecting a technology-centered ratio, not a co-equal ratio. Funding for FY 2010 and 2011 is disproportionately low for the three HF budget lines.
- We are concerned that some NextGen programs could fail because design fails to fully consider HF and HSI issues, resulting in rejection by airspace workers. Example: STARS system. Advanced Automation System for ATC in the 1990s.

F&R A (Administrator)

•Recommendation A

- The subcommittee supports full funding for the NextGen human factors budget line items at the initial out year planning levels for FY 2012, using the original baseline in the FAA 2008 National Aviation Research Plan (NARP).

F&R B (Administrator)

•FINDING

•In the previous cycle, we observed that other NextGen programs, in particular weather and wake vortex, have vital components that concern human factors for both pilots and controllers. Yet we remain uncertain as to the extent that these programs are incorporating the extensive knowledge that exists within AJP61, regarding display, decision making and workload issues pertaining to wake and weather.

•RECOMMENDATION

- All programs in general, and these two (weather and wake) in specific are urged to be proactive in linking to expertise within AJP61, as well as to the human factors research base at NASA, where considerable additional expertise in these areas exists

FINDING E (AJP 61 only)

•FINDING

•The subcommittee is aware that several research programs within the FAA (particularly Michelle Merkel's simulations of operational concepts within AJP 66) are carrying out human-in-the-loop simulations for proof-of-concept demonstrations. By definition, these have human factors components.

•RECOMMENDATION

- The subcommittee would like to be briefed, or at least informed, as to what these efforts are, in order to fully understand the full breadth of ongoing human factors research within the FAA. It is quite possible that some of the results or observations from these

demonstrations can be leveraged to help identify Human Factors issues in NextGen concepts

FINDING F (AJP 61 only)

•FINDING

•The subcommittee was very impressed with the proactive efforts made by AJP61 to understand and collaborate with NASA human factors programs and harness NASA research expertise. We understand that the memorandum of agreement is about to be finalized and that efforts are already underway within the NASA Aviation Safety Program to develop research products of use for the FAA NextGen program. We observed that both Flight Deck and Air Traffic HF programs (within the FAA) have harnessed research within NASA's Aviation Safety Program. We were however less certain of the degree of collaborative involvement of NASA's airspace program in the FAA work.

RECOMMENDATION F

•RECOMMENDATION

- Continue the excellent progress of collaboration with NASA's IIFD project, within the Aviation Safety Program. Try to further engage human factors research within NASA's Airspace Systems program in collaboration, particularly with regard to the work carried on by this group in air-ground integration and collaborative decision making.
- NASA has carried out specific research defining and prioritizing NextGen human factors work, represented by a current program and by three published documents. AJP61 should leverage this work to evaluate its consistency with FAA's own Human Factors research prioritization scheme. High consistency will further validate the AJP's approach. Any inconsistencies may help identify neglected areas.

Attachment 3 (Cont.)

Subcommittee on Airports – Ed Gervais, Chair

Finding: The subcommittee is pleased with the progress of FAA on the research projects that are currently underway.

The Subcommittee is pleased that the Airport Cooperative Research Program is well established, fully funded, and is achieving the goals that were set when it was initiated. We see no redundancies between the two programs as they are proving to be complimentary to one another.

Recommendation: The subcommittee recommends that FAA reach out to other lines of business for inclusion on appropriate ACRP project technical panels.

30 new projects initiated for FY 10 covering environmental, capacity & delay, general aviation subjects and risk management (from 2004 thru 2008 ACRP completed 119 projects on-time and within budget).

Finding: The Technical Center’s research into bird radar systems, as part of the Wildlife Hazard and Mitigation research area, is progressing steadily.

Recommendation: As other detection sensors and technologies are being explored (such as: laser; optical; thermal imaging; and sound, etc.) the subcommittee recommends that coordination be pursued with MIT Lincoln Lab on radar research and development, and also that the research team initiate coordination with ATO researchers to explore the integration of avian radar research with terminal surveillance activities into a concept of operations to communicate bird hazards that are identified by avian radar.

FAA Bird Radar History

- 1999 - 2001: Use of Airport Surveillance Radar and NEXRAD to detect biological targets by MIT Lincoln Laboratories.
- 2001 – 2002: FAA Initiates R&D under USAF Dual Use Science and Technology (DUST) Program to develop a dedicated airport bird radar.
- 2002 – 2004: R&D and testing of 94 GHz “Birdar” at DFW and JFK.
- 2006: FAA announced intention to assess commercially available bird radars and invited all vendors to participate.
- 2007: FAA deploys first Accipiter radar system to SEA-TAC
- 2009: Additional Project radar units deployed to JFK and ORD for performance assessment.

Finding: The subcommittee is pleased to see the continuing R&D activities on Aircraft Rescue and Fire Fighting (ARFF), especially the efforts on composite material fire fighting, improved RFF equipment and agents, and work regarding the operation of new large aircraft.

Recommendation: Continue this research with a high priority.

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**Finding:** The Subcommittee continues to have keen interest in the progress of research in the NextGen area.

**Recommendation:** Keep the Subcommittee informed of NextGen tasks, especially as they relate to airports and airport issues.

**Specific Recommendations directed to AJP-6310:**

The Airport Subcommittee continues to have keen interest in taxiway and runway deviation studies (including lateral touchdown locations to possibly reduce runway widths to 200 feet if the data supports the reduction).

Ground vehicle all-weather and reduced visibility navigation system development should continue as planned and be coordinated across the FAA.

The Subcommittee supports the development of proposed REDAC Database.

The Subcommittee suggested that the effort to re-compete the Centers of Excellence program be considered as some sort of multi-disciplinary fashion with perhaps the COE being headed by a primary University and other Universities or Institutes join in via a consortium or as associates.

The Subcommittee has been very pleased with the work that has been done in support of FAA research by the University of Illinois and the Rensselaer Polytechnic Institute and it would hope that these kinds of support will continue to be available to the FAA Airport Technology Research Branch.

Visual Aids Research Task – Incursion Prevention

- The FAA Advisory Circular AC 150/5340-30D “Design and Installation details for Airport Visual Aids” states:

*For displaced threshold areas over 700 feet in length and used for takeoffs, the centerline lights in the displaced area are circuited separately from the centerline lights in the non-displaced runway area to permit turning “off” the centerline lights in the displaced area during landing operations.*

- Teterboro has this situation at both ends of runway 1/19

- ATC is indisposed to operate the switch that manually controls the centerline lights.
- The research task will evaluate and determine the feasibility of using surveillance technology and safety logic to automate the activation / deactivation of Runway Centerline Lighting at displaced thresholds to support takeoff and landing operations. The researchers will install the preferred technology at Teterboro and observe the utility of the installation.

Subcommittee on Aircraft Safety – Joe Del Balzo, Chair

**Programs Reviewed**

- **AVS FY 2012 STRATEGIC GUIDANCE**
- **FIRE RESEARCH and SAFETY PROGRAM**
- **SOFTWARE and DIGITAL SYSTEMS**
- **ASIAS**
- **WAKE VORTEX and WIND SHEAR MODELS**
- **AEROSPACE MEDICAL RESEARCH**
- **VOLCANIC ASH PROJECT**
- **NextGen WEATHER TECHNOLOGY IN THE COCKPIT**
- **NextGen SELF SEPARATION and AIR GROUND INTEGRATION HUMAN FACTORS PROGRAM**
- **UNMANNED AIRCRAFT SYSTEM (UAS) RESEARCH PROGRAM**
- **SYSTEM SAFETY MANAGEMENT**
- **FLIGHT DECK/AVIATION MAINTENANCE/SYSTEM INTEGRATION HUMAN FACTORS PROGRAM**
- **MAINTENANCE and INSPECTION PROGRAM**
- **TRANSPORT STRUCTURAL INTEGRITY METALLIC R&D PROGRAM**
- **ELECTRICAL SYSTEMS PROGRAM**
- **ROTORCRAFT RESEARCH**
- **PROPULSION RESEARCH**
- **GENERAL AVIATION BASIC ENVELOPE PROTECTION PROJECT and FLY BY WIRE RESEARCH**
- **CENTERS OF EXCELLENCE PROJECT**
- **AIRCRAFT ICING PROGRAM**

(The WORD document below was discussed from the bullets listed above)

Subcommittee on Aircraft Safety

August 2009

1. **Finding:** The Aircraft Safety Subcommittee noted that AVS FY 2012 Strategic Guidance requires that each Research Requirement describe the expected outcome desired by the sponsor and include an implementation plan describing how the outputs of the research will be used and implemented by the sponsoring organization in support of the desired outcome. The subcommittee noted that posing the research question is a best practice and an essential starting point for all projects.

**Recommendation:** The Subcommittee recommends that the AVS FY 2012 strategic guidance referenced in the above finding be retroactively applied across the entire AVS Research Portfolio. Adoption of this recommendation will ensure that research projects

start with a desired end state in mind. The Subcommittee recommends that the research question for each project be carefully posed by the researcher in close coordination with the sponsor.

- 2. Finding:** The Aircraft Safety Subcommittee found the Fire Research and Safety Program to be relevant, well managed and directly responsive to aircraft safety requirements.

**Recommendation:** The Subcommittee recommends that FAA ensure the Fire Research and Safety Program continue to be adequately staffed and funded.

- 3. Finding:** The Aircraft Safety Subcommittee again noted the lack of a comprehensive and integrated Software and Digital Systems Project Plan and noted little progress in acquiring the specialized expertise required to support this critical research program.

**Recommendation:** The Subcommittee again recommends that a comprehensive and integrated program be developed and appropriate specialized expertise be acquired to spring board the FAA to a leading position in complex software and digital system safety. Inability to attract specialized talent should no longer be an acceptable excuse for lack of progress in establishing a core capability.

- 4. Finding:** The Aircraft Safety Subcommittee found the Aviation Safety Information Analysis Sharing (ASIAS) project is directly responsive to the need of safety analysts within the FAA and aviation industry to understand emerging risks before they become potential safety issues and applauds the progress made in increasing the number of airline ASIAS participants. The Subcommittee notes that the ASIAS program does not address general aviation at the present time.

**Recommendation:** The Subcommittee recognizes that the attempt to automatically monitor for unknown risk based on complex data mining capabilities and seamless data sources is in fact the most difficult challenge in ASIAS and recommends that parameters be developed to indicate when the quest to accomplish this objective should be re-examined.

- 5. Finding:** The Aircraft Safety Subcommittee expressed concern about the realism of wake vortex and wind shear characteristics being used for research in advanced maneuver capable flight simulators.

**Recommendation:** The Subcommittee recommends that FAA take particular care in validating wake vortex and wind shear models with real world aircraft response data.

- 6. Finding:** The Aircraft Safety Subcommittee noted and applauds the progress made in achieving a limited amount of F&E funding in support of the Aerospace Medical Research Program.

**Recommendation:** The subcommittee encourages the other research laboratories to pursue similar funding options applying the aeromedical approach.

7. **Finding:** The Aircraft Safety Subcommittee noted that the Volcanic Ash Project under the Aviation Weather Research Program is not consistent with previous SAS recommendations.

**Recommendation:** The Subcommittee again recommends that research be limited to a very focused approach on how to detect and avoid a volcanic ash encounter. The Subcommittee does not believe the research related to the development of onboard technologies to detect or harden an aircraft against volcanic ash is warranted. The Subcommittee recommends that the research be limited to the development of procedures for getting tactical information to flight crews so they can effectively avoid the hazardous areas. Finally the Subcommittee believes that even this limited scope for research is relatively low priority in the broad research portfolio.

8. **Finding:** The Aircraft Safety Subcommittee expressed concern about the apparent lack of a comprehensive and integrated program plan for the NextGen Weather Technology in the Cockpit Program.

**Recommendation:** The Subcommittee recommends that the REDAC NAS Operations Subcommittee do a “deep dive” review of the Weather in the Cockpit Program at their next review meeting.

9. **Finding:** The NextGen Self Separation and Air Ground Integration Human Factors Program was briefed at a macro level. As a result the Subcommittee was unable to determine whether the program was focused on very specific and real research requirements.

**Recommendation:** The Subcommittee recommends that the REDAC Subcommittee on Human Factors do a “deep dive” review of the NextGen Self Separation and Air Ground Human Factors Program at their next review meeting.

10. **Finding:** The Aircraft Safety Subcommittee noted the positive progress made in the Unmanned Aircraft System (UAS) Research Program related to UAS regulations and standards.

11. **Finding:** The Aircraft Safety Subcommittee noted good progress by the System Safety Management Team in the development of prognostic safety assessment models intended to predict the safety impact of proposed improvements to the NAS. When completed and validated, it is essential that FAA use the tools to guide NextGen implementation.

12. **Finding:** Under the Flight Deck/Aviation Maintenance/System Integration Human Factors Program, the SAS found the 30 plus projects to be responsive to the research questions posed by the sponsor, but did not find a documented basis for the research questions. The Subcommittee also noted the lack of a priority process related to current projects in the program.

**Recommendation:** The Subcommittee recommends that FAA perform a gap analysis of the current projects against data driven requirements for increased safety.

- 13. Finding:** The Aircraft Safety Subcommittee noted the good work being performed under the Maintenance and Inspection (M & I) Program and looks forward to the results being transmitted into practice.
- 14. Finding:** The Aircraft Safety Subcommittee found the research conducted by FAA in cooperation with industry, under the Transport Structural Integrity Metallic R & D Program, to be relevant and a good example of self funding through industry cost sharing and engineering support complemented by the benefits from commercialization.
- 15. Finding:** The Aircraft Safety Subcommittee found the Electrical Systems Program to be a practical approach to advance the knowledge of FAA in anticipation of the introduction of new technology. The Subcommittee looks forward to seeing this knowledge translated into regulatory guidance.
- 16. Finding:** The Aircraft Safety Subcommittee fully supports the FAA taking advantage of the Rotorcraft research work being done by the Department of Defense related to Health Usage Monitoring System.

**Recommendation:** The Subcommittee recommends that FAA stay in lock step with the outputs of the U.S. Army rotorcraft R&D program. It is essential that FAA not fall behind.

- 17. Finding:** The Aircraft Safety Subcommittee appreciated the Propulsion Research Program review, particularly the field event history that provided the motivation for the research portfolio. The data presented shows a significant reduction in the number of aircraft threatening non-contained rotor fracture events over time. It is evident that the FAA team has formed a strong partnership with industry to develop and enact effective improvements in the design, manufacture and inspection methods for engine rotors.
- 18. Finding:** The FC&MS activities presented had a clear focus with relevant objectives. Specific findings were as follows;

The Aircraft Safety Subcommittee did not review the results of the FAA Rudder Study. However, it was presented as a FY09 accomplishment with the final report due in FY09. The Subcommittee is anxious to receive copies of the final report when available and believes it will provide useful training guidance to the transport pilot community.

The General Aviation Basic Envelope Protection effort was reported as completing phase 1. The concept has the potential of protecting against GA loss of control in flight. However, the Subcommittee believes there are significant human factors issues that must be initially considered before designing a GA envelope protection system. For example, how does the system account for pilot in the loop control inputs when an automatic control device is also attempting to recover the aircraft from an upset? Under what

circumstances should control be taken from the pilot? Should the automatic recovery system provide guidance cues to the pilot who then implements the recovery maneuver? The Fly-by-Wire Research is long past due given that fly-by-wire aircraft have been certified and in operation for several years. The focus of this activity is documenting what has already been done, rather than new research. The output from this activity will enable future designs to not require certification under special conditions.

**Recommendation:** The General Aviation Envelope Protection activity must include human factor/performance issues, in particular pilot in the loop scenarios, when developing design and performance requirements for a GA Basic Envelope Protection Concept.

**19. Finding:** The Aircraft Safety Subcommittee was impressed with the research activities underway at the Centers of Excellence for: Airliner Cabin Environment; Advanced Materials and; General Aviation Research. The subcommittee believes that when complemented with FAA management competence and leadership, these cost sharing arrangements represent cost effective ways to conduct relevant research and advance the knowledge of FAA. The subcommittee found that to be the case in the programs reviewed.

**20. Finding:** The Aircraft Safety Subcommittee noted the good work being performed under the Aircraft Icing Program and looks forward to the research results being translated into regulatory guidance. The subcommittee does however question the operational benefit related to 3D icing studies.

**Recommendation:** The subcommittee recommends that FAA review the requirement to generate 3D ice shapes.

**NAS Operations Subcommittee – Victor Lebacqz, Chair**

***General***

- *Finding*
  - NASOPS heard briefings on Modeling and Simulation, the Weather Program, Concept Development Research, Staffed NextGen Tower, Environment, NEXTOR Center of Excellence, UAS in the NAS, GBAS, Demonstrations, the Budget, and the FAA's response to the Working Group on Separation Standards. In general, the subcommittee found all of the briefings to be of high quality and providing useful information. The FAA is commended for working to achieve a more uniform briefing template and a higher level of technical information in the briefings.
- *Recommendation*
  - The briefing by Michele Merkle, which included a risk assessment of the projects and a clear description of the research methodologies employed, is a useful template for briefings to NASOPS.
- *Finding*
  - In several cases, the subcommittee observed that the safety standard being applied to "new" systems, technologies, or demonstrations may be overly conservative (e.g. the separation standards). Requirements must be defined, particularly for the 2018 capability.
- *Recommendation*
  - Understanding that the safety evaluation must be independent of R&D activities, NASOPS nonetheless recommends that a working relationship between the safety regulator and the R&D organization be established to assess the proper relationship between the concept definition and the safety requirement for demonstration.

***Modeling and Simulation***

- *Finding*
  - The NextGen design still (see last year's findings) appears to be based on intuition and consensus, rather than modeling, analysis, simulation, and demonstration or testing. The FAA needs both a facile high level analysis tool (such as NASPAC and its derivatives) and a detailed modeling and simulation capability to support detailed system design trade studies to inform the NextGen design, both mid-term and far-term.
- *Recommendations*
  - Utilize the capabilities of NASA, JPDO and other government or private partners to achieve the modeling and simulation capability needed to support detailed system design studies for all phases of NextGen.
  - The FAA should brief the plan to achieve the needed modeling and simulation capabilities to the REDAC NASOPS subcommittee.

- *Finding*
  - An upgraded NASPAC model is being used to estimate system wide benefits of alternative near and mid term NextGen implementations. Although this tool is intended for (and only suited to) high level system wide evaluation, its fast run time and ease of use make it valuable for cost benefit studies. The model fails some validation tests, is used too narrowly and is not suited to evaluation of long term NextGen alternatives.
- *Recommendations*
  - The causes of validation failures in Total Delay, Taxi-Out Delay & Airborne Delay should be found and corrected.
  - Extend the validation process (and the analyses) to use some anomalous days in addition to the eight historical days (four seasons; two demand levels) now used.
- *Finding*
  - Although the organization using the NASPAC model for benefit analysis has the responsibility for cost analysis/estimating, it is not resourced to perform this function. It is important that the cost estimates for proposed alternative solutions be performed on a consistent basis. Absent these consistent cost estimates, meaningful cost benefit comparisons will not be possible.
- *Recommendation*
  - The NextGen Systems Analysis Organization should be provided the resources to produce the consistent cost estimates needed to support cost benefit comparisons.

## ***Weather***

- *Finding*
  - The subcommittee was pleased with the first version of the ATM-Weather Integration Plan. Integration is now happening, with a good example being an Integrated Departure Reroute Planning (IDRP) by CAASD / MIT LL, but it is still a significant challenge.
- *Recommendation*
  - The FAA Plan should become an ATM-Weather Integration R&D Program with ATO, CAASD, and FAA ATM research components, and the use of modeling and simulation to understand the benefits. NASOPS encourages the FAA to be expeditious in this development.
- *Finding*
  - The Weather-in-the-Cockpit program was recently formed as RED program in ATO. NASOPS found that it lacks a clear mission, goals, or a connection to NextGen requirements. In addition, weather information is already reaching many GA cockpits, and the connectivity to existing technology was not clear.
- *Recommendation*

- The FAA should review this program with lead weather researchers to establish clear objectives consistent with other activities, the FAA mission, and Next Gen objectives. An example goal might be to consider an aircraft role as airborne weather sensing node feeding NNEW

### **Concept Development**

- *Finding*
  - The REDAC NAS OPS Subcommittee was very impressed by this briefing. The format and substance resonated with the group and seemed to address past concerns and feedback from the group for improved methods of presentation by FAA principles. The member's positive comments included an appreciation of meaningful budgetary numbers, identified risk(s), clarity of the R&D approach, schedule and deliverables, demonstrable R&D leadership, and actual use of the Enterprise Architecture. Concept Development work appears to be under outstanding leadership, on the right track to deliver real R&D concept validation and system design.
- *Finding*
  - While the Subcommittee was pleased with the substance and format of the Concept Development briefing, there is still a need to better understand the overall context of the research needs and fit of the work being done into a plan for NextGen development.
- *Recommendations*
  - Provide the subcommittee future briefings on context and fit between the concept development and exploration research and the NextGen plans and Enterprise Architecture. Specific focus on the open and yet unanswered research questions in the context of connecting the research to the solution sets and OI's is needed.
  - As was recommended by NASOPS previously, more resources should be devoted to this activity in order to understand other NextGen drivers (e.g. UAS, see below).

### ***Staffed NextGen Tower***

- *Findings*
  - The subcommittee recognizes the need for a Staffed NextGen Tower capability to improve safety in an affordable way and was pleased to learn of the FAA's plans. However, relying primarily on the high cost of tower construction, refurbishment, and maintenance as business case justification for the SNT may not be sufficient because of the political factors associated with tower construction and placement decisions.
- *Recommendation*
  - The subcommittee recommends that the business case for SNT be strengthened with the value of additional operational efficiency and safety improvements.

- *Findings*
  - The operational concept and demonstration plan could benefit from further development of details. For example, it appears that undue emphasis may be placed on using only certified ASDE-X data for the surveillance source when other options (e.g., non-certified ASDE-X, ADS-B, MLAT, radar) may be better suited for particular applications.
- *Recommendations*
  - The subcommittee recommends that the use of other forms of surveillance should be explored (e.g., non-certified ASDE-X, ADS-B, MLAT, radar). These alternatives need to be considered in the context of how SNT might roll-out into the NAS (e.g., whether starting at smaller airports or larger airports first or timing relative to aircraft equipage).
  - It is recommended that the data needed to support the OMB 300 investment decision be defined early in the demonstration planning process.
  - The historical runway incursion event database should be mined to create scenarios which mimic these historical events for SNT simulations.

### ***Environment***

- *Finding*
  - It was excellent for NASOPS to be brought up to speed on the environmental tool AEDT. FAA is to be commended for developing this tool, and particularly for assisting in its use in the NASA NRA examining the impact of new vehicles in the NAS—this is a model of how the use of such tools can be accelerated and improved to provide one input into decision making and system design. Without significant changes to NASPAC, however, AEDT and NASPAC are inconsistent tools, which may hinder their use together.
- *Recommendation*
  - The AEDT tool could be used in an iterative fashion in the FAA design and decision-making process to ensure that environmental issues are assessed early, rather than in an “ex post facto” fashion to assess the impact of previously developed routes, procedures, etc.

### ***NEXTOR (COE)***

- *Finding*
  - *While a few members have had engagement with NEXTOR and reported positive experiences, the majority of the NAS OPS Subcommittee members were not familiar with the center and its work and found it to be too insular. The use of the TRB as the venue for reporting results does not disseminate valuable NEXTOR results to the broader research community. The subcommittee clearly needs broader exposure or participation in the work of NEXTOR in order to better evaluate its work.*
- *Recommendation*

- *The NASOPS will request further engagement with NEXTOR COE principals and a review of some of its work in greater detail beyond its report out at the TRB.*

### ***UAS Integration in the NAS***

- *Finding*
  - *A number of projects and demonstrations with various elements of DOD were presented. These evaluations and demonstrations did not appear to flow from any top-down research and development plan for UAS integration. While encouraged that the FAA is beginning to address UAS integration in the NAS, NASOPS considers the current approach inadequate to meet the outcomes needed and timing requirements of both government and industry.*
- *Recommendations (next chart)*
- *Recommendations*
  - *Establish, in partnership with DHS and DOD, a Government internal civil-military concept of operations for UAS, as a prelude to developing public-private partnering relationship strategies for incremental implementation.*
  - *Establish a partnership design process, with industry and the appropriate FAA, DOD, and DHS organizations to produce a relationship strategy. Focus the initial stages of the design process on (1) reaching a shared view of demand, and (2) establish a shared concept of operations, and (3) decide on best approaches to the partnership design, implementation, and operation.*

### ***Ground-Based Augmentation System (GBAS)***

- *Finding*
  - *The deployment of WAAS based, near Cat-I LPV approaches is underway, and are expected to be designated as precision approach in the near future. For LAAS (GBAS ) based Cat II and III, field trials are underway at Newark with equipment from one manufacturer towards an FAA decision point. The current GBAS Cat I work is a stepping-stone to the Cat II/III certification.*
- *Recommendation*
  - *Since precision approach monitoring, and therefore parallel runway separations for bad weather approaches, are dependent, in part, on the lateral deviations of arriving aircraft, the FAA should conduct a data collection during the Newark field demonstration to determine whether those deviations are significantly less than that used to certify PRM installations back in the early 1990s.*

## **Demonstrations**

- *Finding*
  - *The FAA presentation on Government-Industry partnerships for demonstrations highlights the FAA's early efforts to increase the level of accountability and management across activities that involve the more highly visible collaborative projects. This is a very positive step towards improved management of the FAA's research portfolio. The NAS Operations Subcommittee looks forward to receiving updates in this area.*
  
- *Recommendation*
  - *The FAA should document and publish the specific research objectives associated with each demonstration and report regularly to the NAS Operations SC the performance of the demonstrations against the previously-defined objectives, including measures of positive outcomes as well as shortfalls in meeting those objectives.*
  
- *Finding*
  - *There is a clear intention of the FAA to invest in laboratory infrastructure that can be used for future collaborative efforts in a broad set of NextGen areas. NASOPs has some concerns, however, on whether this additional infrastructure is a cost-effective use of government resources.*
  
- *Recommendation*
  - *The FAA should examine the proposed new laboratory capabilities against other capabilities to which the Agency has access, and should identify the anticipated utilization of this new investment as well as the level of sustained use of present capabilities.*

## **FAA Response to WG on Separation Standards**

- *Finding*
  - *The FAA's actions relative to the blunder model were very encouraging, and show responsiveness to the Working Group's recommendation. It appears that the research will result in a change in the blunder assumption, which could significantly enhance capacity throughout the NAS. It also appears that the FAA has responded to several of the other recommendations related to RNP separation. However, the information reported on the longer-term recommendations of the report was vague.*
  
- *Recommendation*
  - *NASOPS recommends that the FAA continue to pursue the "longer-term" Working Group recommendations, several of which could be incorporated into the FAA's research program to prepare for Next Gen.*
  
- *Finding*
  - *It was reported that the target level of safety has been increased to 10-E9. This level does not appear to be statistically achievable to NASOPS.*
  
- *Recommendation*

- *The target level of safety needs to be reassessed for its reasonableness and applicability. Safety levels of new systems should be compared against a baseline which is defensible based on current operations and statistical analyses.*
- *Finding*
  - *Responsibility for separation standards in the FAA was not clearly defined. While ATO apparently has the ultimate responsibility, coordination with AVS was unclear.*
- *Recommendation*
  - *Given possibly different operating paradigms in NextGen, the FAA should have clear points of responsibility for the development and implementation of separation standards.*

### ***Research Area Funding***

- *Finding*
  - *It is not possible to assess relative funding among the Subcommittee research areas from the budget material as presented.*

## Attachment 4

October 19, 2009

The Honorable J. Randolph Babbitt  
Administrator  
Federal Aviation Administration  
800 Independence Avenue, SW  
Washington, DC 20591

Dear Administrator Babbitt:

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

The full committee also made the following general observations:

*Excessive Safety Standards for New Systems* - The safety standards and target levels of safety being applied to new systems, technologies, or demonstrations appear to be overly conservative. While it is important to maintain and improve the high level of safety in the system, excessive safety requirements put NextGen at risk and can actually degrade safety through increased complexity, cost, delay, and uncertainty in gaining operational approval. The responsibility for safety assessment is distributed throughout the agency and there does not appear to be a clear system level process for managing risk and arbitrating safety requirements for new systems or new procedures such as reduced separation standards. The REDAC recommends an independent review of the safety standards and processes being applied to new systems and recommendations for a balanced approach to safety.

*Growing Importance of Environmental Issues* - Environmental issues, particularly those relating to green house gas emissions, are emerging as key constraints on the air transportation system. The REDAC urges that environmental issues be given the same consideration as capacity issues in research and strategic planning as they are just as significant a risk to the future viability of the air transportation system.

*NextGen Research Requirements* - The REDAC was encouraged to see the beginning of a well defined process for generating NextGen research requirements from the Enterprise Architecture. The REDAC is concerned that the architecture may be more complex than necessary and cautions that the process could become unwieldy or intractable if not carefully managed.

*Software and Digital Systems* - The FAA has a unique need for expertise on critical software and digital systems both for its certification and acquisition responsibilities. The REDAC reiterates its concern that there has been inadequate progress in developing the core competency and technical workforce in this area. The REDAC recommends that this be given urgent priority.

*Unmanned Air Systems* - There continues to be pressure to develop a long term Con-Ops for UAS operations in the NAS for DOD and civil users. The current Certificate of Authorization processes are short term solutions and are unable to keep pace with the demand. While there has been some progress, the REDAC considers the current approach inadequate to meet the needs of government and industry.

*Weather in the Cockpit Research Program* - The recently formed Weather in the Cockpit research program was found by several REDAC subcommittees to lack a clear mission, goals or connection to NextGen requirements. The program should be focused or terminated.

We hope that these observations are useful to you and the agency. 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,

R. John Hansman

Chair, FAA Research, Engineering and Development Advisory Committee

Enclosure

**Research, Engineering and Development Advisory Committee  
Guidance on the FY 2012 R&D Portfolio**

**Subcommittee on Human Factors**

**Finding (1)**: In the previous cycle, the REDAC Human Factors Subcommittee had expressed some concern regarding the extent to which human factors was “being adequately addressed in NextGen programs beyond the efforts of AJP 61”. On the basis of the Administrator’s response to those concerns, released on 9/22, we were quite gratified with the extent to which attention is given to these issues. We also feel confident that this attention will be enduring as NextGen progresses, given the criticality of avoiding major human factors bottlenecks that have caused substantial setbacks in some previous FAA developmental efforts (e.g., the STARS system and the AAAS system in the 1990s). The briefing given by Kathy Abbott, CSTA for flight deck Human Factors, which the subcommittee received in our September meeting provided compelling evidence for the high priority offered to human factors in some units outside of AJP61. Furthermore, we are quite gratified with the appointment of the Chief Systems Engineer for Human Factors within the NextGen I&I program, which we assume will be a permanent position with the authority to properly influence NextGen decisions as required. In order to facilitate this influence, we would also hope that this would grow into a full-time position.

**Recommendation (1a)**: Continue to place strong emphasis on human factors issues, as reflected in the Human System Integration Roadmap.

**Recommendation (1b)**: Assure in particular that human factors issues related to levels of automation in decision aiding, such as out-of-the-loop performance degradation, and human operator response to unexpected off-nominal events (e.g., automation failures) receive utmost priority and sustained funding, for both flight deck and air traffic research.

**Recommendation (1c)**: Following the excellent briefing from Flight Deck Certification, the subcommittee wishes to continue to receive briefings from other program elements within the FAA, which have direct human factors components, or involve human-in-the-loop simulation. These include, in particular, planned and completed simulations of concepts of operation within AJP66, and on all research on weather displays, and weather-related decision aids.

**Finding (2)**: The subcommittee was very impressed with the proactive efforts made by AJP61 to understand and collaborate with NASA human factors programs and harness NASA research expertise. We understand that the memorandum of agreement is about to be finalized and that efforts are already underway within the NASA Aviation Safety Program to develop research products of use for the FAA NextGen program. We

observed that both flight deck and air traffic (within the FAA) have harnessed research within NASA's Aviation Safety Program (specifically the Integrated Intelligent Flight Deck project, regarding which we were well briefed). We were however less certain of the degree of collaborative involvement of NASA's airspace program in the FAA work.

**Recommendation (2a):** Continue the excellent progress of collaboration with NASA's Integrated Intelligent Flight Deck project, within the Aviation Safety Program.

**Recommendation (2b):** Try to further engage human factors research within NASA's Airspace Systems program in collaboration, particularly with regard to the work carried on by this group in air-ground integration and collaborative decision making.

### **Subcommittee on Airports**

**Finding (1):** The subcommittee is pleased with the progress shown by FAA on the projects that are currently underway. The Subcommittee is likewise pleased to see that the Airport Cooperative Research Program (ACRP) program is well established, fully funded, and is achieving the goals that were hoped for when it was initiated. We see no redundancies between the two programs as they are proving to be complimentary to one another.

**Recommendation:** The subcommittee recommends that FAA reach out to other Lines of Business for consideration of the inclusion of other lines of business (such as ATO) on appropriate ACRP project technical panels.

**Finding (2):** The Technical Center's research into bird radar systems, as part of the Wildlife Hazard and Mitigation research area, is progressing steadily.

**Recommendation:** As other detection sensors and technologies are being explored (such as: laser; optical; thermal imaging; and sound, etc.) the subcommittee recommended that coordination be pursued with MIT Lincoln Lab on radar research and development, and also that the research team initiate coordination with ATO researchers to explore the integration of avian radar research with terminal surveillance activities into a concept of operations to communicate bird hazards identified by avian radar.

**Finding (3):** The subcommittee is pleased to see the continuing R&D activities on Aircraft Rescue and Fire Fighting (ARFF), especially the efforts on composite material fire fighting, improved RFF equipment and agents, and work regarding the operation of new large aircraft.

**Recommendation:** Continue this research with a high priority.

**Finding (4)**: The Subcommittee continues to have keen interest in the progress of research in the NextGen area.

**Recommendation**: Keep the Subcommittee informed of NextGen tasks, especially as they relate to airports and airport issues.

### **Subcommittee on Environment and Energy**

**Finding (1)**: The issue of global climate change is becoming a major driver of environmental policy. In spite of its importance, there is a lack of understanding of aviation's impact on climate change, especially in the area of non-CO2 pollutants. A more robust research effort with respect to climate change is necessary to develop reasoned policy on this subject.

**Recommendation**: Current Aviation Climate Change Research Initiative (ACCRI) funding appears to be inadequate to fully study the non-CO2 impacts of aviation. The Agency should therefore ensure that future funding requests contain the resources necessary for emerging global climate change research.

**Finding (2)**: Alternative aviation fuels are probably the most promising near-term tools for managing aviation's impact on the environment. The CAAFI project to develop and certify such fuels represents a significant research effort and reflects the necessary industry/government and intra-government cooperation necessary to address this issue.

**Recommendation**: Continued funding and support for the CAAFI initiative is absolutely necessary, as is the continuing partnership between industry and government and between the FAA and partner government agencies. To the extent possible, the FAA should ensure that efforts by other public entities (such as the military) are included in research efforts to avoid an unnecessary duplication of effort.

**Finding (3)**: On the local level, the issue of aircraft noise remains a major priority for many citizens. In addition, the nature of noise-related complaints has somewhat shifted its focus to areas well beyond traditional areas of substantial impact.

**Recommendation**: The Office of Environment and Energy has embarked on a major new research effort to define the current noise landscape and to develop the actions needed to address any identified concerns. The Agency should endorse and encourage this effort by requesting adequate funding to continue this project.

**Finding (4)**: The PARTNER Center of Excellence continues to occupy a central role in environmental research activities.

**Recommendation:** The FAA should continue to request the funding necessary to support PARTNER activities. (Note: There was some concern expressed by Subcommittee members over the fact that current versions of the pending FAA Reauthorization bill include the formation of a new Center of Excellence for Alternative Aviation Fuel, when research in this area can be accomplished through PARTNER).

### **Subcommittee on Aircraft Safety**

**Finding (1):** The Aircraft Safety Subcommittee noted that AVS FY 2012 Strategic Guidance requires that each Research Requirement describe the expected outcome desired by the sponsor and include an implementation plan describing how the outputs of the research will be used and implemented by the sponsoring organization in support of the desired outcome. The subcommittee noted that posing the research question is a best practice and an essential starting point for all projects.

**Recommendation:** The Subcommittee recommends that the AVS FY 2012 strategic guidance referenced in the above finding be retroactively applied across the entire AVS Research Portfolio. Adoption of this recommendation will ensure that research projects start with a desired end state in mind. The Subcommittee recommends that the research question for each project be carefully posed by the researcher in close coordination with the sponsor.

**Finding (2):** The Aircraft Safety Subcommittee found the Fire Research and Safety Program to be relevant, well managed and directly responsive to aircraft safety requirements.

**Recommendation:** The Subcommittee recommends that FAA ensure the Fire Research and Safety Program continue to be adequately staffed and funded.

**Finding (3):** The Aircraft Safety Subcommittee again noted the lack of a comprehensive and integrated Software and Digital Systems Project Plan and noted little progress in acquiring the specialized expertise required to support this critical research program.

**Recommendation:** The Subcommittee again recommends that a comprehensive and integrated program be developed and appropriate specialized expertise be acquired to spring board the FAA to a leading position in complex software and digital system safety. Inability to attract specialized talent should no longer be an acceptable excuse for lack of progress in establishing a core capability.

**Finding (4):** The Aircraft Safety Subcommittee found the Aviation Safety Information Analysis Sharing (ASIAS) project is directly responsive to the need of safety analysts within the FAA and aviation industry to understand emerging risks before they become potential safety issues and applauds the progress made in increasing the number of airline

ASIAS participants. The Subcommittee notes that the ASIAS program does not address general aviation at the present time.

**Recommendation:** The Subcommittee recognizes that the attempt to automatically monitor for unknown risk based on complex data mining capabilities and seamless data sources is in fact the most difficult challenge in ASIAS and recommends that parameters be developed to indicate when the quest to accomplish this objective should be re-examined.

**Finding (5):** The Aircraft Safety Subcommittee expressed concern about the realism of wake vortex and wind shear characteristics being used for research in advanced maneuver capable flight simulators.

**Recommendation:** The Subcommittee recommends that FAA take particular care in validating wake vortex and wind shear models with real world aircraft response data.

**Finding (6):** The Aircraft Safety Subcommittee noted and applauds the progress made in achieving a limited amount of F&E funding in support of the Aerospace Medical Research Program.

**Recommendation:** The subcommittee encourages the other research laboratories to pursue similar funding options applying the aeromedical approach.

**Finding (7):** The Aircraft Safety Subcommittee noted that the Volcanic Ash Project under the Aviation Weather Research Program is not consistent with previous SAS recommendations.

**Recommendation:** The Subcommittee again recommends that research be limited to a very focused approach on how to detect and avoid a volcanic ash encounter. The Subcommittee does not believe the research related to the development of onboard technologies to detect or harden an aircraft against volcanic ash is warranted. The Subcommittee recommends that the research be limited to the development of procedures for getting tactical information to flight crews so they can effectively avoid the hazardous areas. Finally the Subcommittee believes that even this limited scope for research is relatively low priority in the broad research portfolio.

**Finding (8):** The Aircraft Safety Subcommittee expressed concern about the apparent lack of a comprehensive and integrated program plan for the NextGen Weather Technology in the Cockpit Program.

**Recommendation:** The Subcommittee recommends that the REDAC NAS Operations Subcommittee do a “deep dive” review of the Weather in the Cockpit Program at their next review meeting.

**Finding (9):** The NextGen Self Separation and Air Ground Integration Human Factors Program was briefed at a macro level. As a result the Subcommittee was unable to determine whether the program was focused on very specific and real research requirements.

**Recommendation:** The Subcommittee recommends that the REDAC Subcommittee on Human Factors do a “deep dive” review of the NextGen Self Separation and Air Ground Human Factors Program at their next review meeting.

**Finding (10):** The Aircraft Safety Subcommittee noted the positive progress made in the Unmanned Aircraft System (UAS) Research Program related to UAS regulations and standards.

**Finding (11):** The Aircraft Safety Subcommittee noted good progress by the System Safety Management Team in the development of prognostic safety assessment models intended to predict the safety impact of proposed improvements to the NAS. When completed and validated, it is essential that FAA use the tools to guide NextGen implementation.

**Finding (12):** Under the Flight Deck/Aviation Maintenance/System Integration Human Factors Program, the SAS found the 30 plus projects to be responsive to the research questions posed by the sponsor, but did not find a documented basis for the research questions. The Subcommittee also noted the lack of a priority process related to current projects in the program.

**Recommendation:** The Subcommittee recommends that FAA perform a gap analysis of the current projects against data driven requirements for increased safety.

**Finding (13):** The Aircraft Safety Subcommittee noted the good work being performed under the Maintenance and Inspection (M & I) Program and looks forward to the results being transmitted into practice.

**Finding (14):** The Aircraft Safety Subcommittee found the research conducted by FAA in cooperation with industry, under the Transport Structural Integrity Metallic R & D Program, to be relevant and a good example of self funding through industry cost sharing and engineering support complemented by the benefits from commercialization.

**Finding (15):** The Aircraft Safety Subcommittee found the Electrical Systems Program to be a practical approach to advance the knowledge of FAA in anticipation of the introduction of new technology. The Subcommittee looks forward to seeing this knowledge translated into regulatory guidance.

**Finding (16):** The Aircraft Safety Subcommittee fully supports the FAA taking advantage of the Rotorcraft research work being done by the Department of Defense related to Health Usage Monitoring System.

**Recommendation:** The Subcommittee recommends that FAA stay in lock step with the outputs of the U.S. Army rotorcraft R&D program. It is essential that FAA not fall behind.

**Finding (17):** The Aircraft Safety Subcommittee appreciated the Propulsion Research Program review, particularly the field event history that provided the motivation for the research portfolio. The data presented shows a significant reduction in the number of aircraft threatening non-contained rotor fracture events over time. It is evident that the FAA team has formed a strong partnership with industry to develop and enact effective improvements in the design, manufacture and inspection methods for engine rotors.

**Finding (18):** The Flight Controls and Mechanical Systems (FC&MS) activities presented had a clear focus with relevant objectives. Specific findings were as follows;

The Aircraft Safety Subcommittee did not review the results of the FAA Rudder Study. However, it was presented as a FY09 accomplishment with the final report due in FY09. The Subcommittee is anxious to receive copies of the final report when available and believes it will provide useful training guidance to the transport pilot community.

The General Aviation Basic Envelope Protection effort was reported as completing phase 1. The concept has the potential of protecting against GA loss of control in flight. However, the Subcommittee believes there are significant human factors issues that must be initially considered before designing a GA envelope protection system. For example, how does the system account for pilot in the loop control inputs when an automatic control device is also attempting to recover the aircraft from an upset? Under what circumstances should control be taken from the pilot? Should the automatic recovery system provide guidance cues to the pilot who then implements the recovery maneuver?

The Fly-by-Wire Research is long past due given that fly-by-wire aircraft have been certified and in operation for several years. The focus of this activity is documenting what has already been done, rather than new research. The output from this activity will enable future designs to not require certification under special conditions.

**Recommendation:** The General Aviation Envelope Protection activity must include human factor/performance issues, in particular pilot in the loop scenarios, when developing design and performance requirements for a GA Basic Envelope Protection Concept.

**Finding (19):** The Aircraft Safety Subcommittee was impressed with the research activities underway at the Centers of Excellence for: Airliner Cabin Environment; Advanced Materials and; General Aviation Research. The subcommittee believes that when complemented with FAA management competence and leadership, these cost sharing arrangements represent cost effective ways to conduct relevant research and advance the knowledge of FAA. The subcommittee found that to be the case in the programs reviewed.

**Finding (20):** The Aircraft Safety Subcommittee noted the good work being performed under the Aircraft Icing Program and looks forward to the research results being translated into regulatory guidance. The subcommittee does however question the operational benefit related to 3D icing studies.

**Recommendation:** The subcommittee recommends that FAA review the requirement to generate 3D ice shapes.

### **NAS Operations Subcommittee**

**Finding (1):** (Modeling and Simulation) The NextGen design still (see last year's findings) appears to be based largely on intuition and consensus, rather than modeling, analysis, simulation, and demonstration or testing. The FAA needs both a facile high level analysis tool (such as NASPAC and its derivatives) and a detailed modeling and simulation capability to support detailed system design trade studies to inform the NextGen design, both mid-term and far-term.

**Recommendation (1a):** Utilize the capabilities of NASA, JPDO and other government or private partners to achieve the modeling and simulation capability needed to support detailed system design studies for all phases of NextGen.

**Recommendation (1b):** The FAA should brief the plan to achieve the needed modeling and simulation capabilities to the REDAC NAS Operations Subcommittee.

**Finding (2):** (Weather Program) The subcommittee was pleased with the first version of the ATM-Weather Integration Plan. Integration is now happening, with a good example being an Integrated Departure Reroute Planning (IDRP) by CAASD / MIT LL, but it is still a significant challenge.

**Recommendation:** The FAA Plan should become an ATM-Weather Integration R&D Program with ATO, CAASD, and FAA ATM research components, and the use of modeling and simulation to understand the benefits. The subcommittee encourages the FAA to be expeditious in this development.

**Finding (3):** The Weather-in-the-Cockpit program was recently formed as RED program in ATO. Subcommittee found that it lacks a clear mission, goals, or a connection to NextGen requirements. In addition, weather information is already reaching many GA cockpits, and the connectivity to existing technology was not clear.

**Recommendation:** The FAA should review this program with lead weather researchers to establish clear objectives consistent with other activities, the FAA mission,

and Next Gen objectives. An example goal might be to consider an aircraft role as airborne weather sensing node feeding NNEW.

**Finding (4):** (Concept Development ) While the subcommittee was pleased with the substance and format of the Concept Development briefing, there is still a need to better understand the overall context of the research needs and fit of the work being done into a plan for NextGen development.

**Recommendation (4a):** Provide the subcommittee future briefings on context and fit between the concept development and exploration research and the NextGen plans and Enterprise Architecture. Specific focus on the open and yet unanswered research questions in the context of connecting the research to the solution sets and OI's is needed.

**Recommendation (4b):** As was recommended by the NAS Operations Subcommittee previously, more resources should be devoted to this activity in order to understand other NextGen drivers (e.g. UAS, see below).

**Finding (5):** (Staffed NextGen Tower) The subcommittee recognizes the need for a Staffed NextGen Tower capability to improve safety in an affordable way and was pleased to learn of the FAA's plans. The operational concept and demonstration plan could benefit from further development of details. For example, it appears that undue emphasis may be placed on using only certified ASDE-X data for the surveillance source when other options (e.g., non-certified ASDE-X, ADS-B, MLAT, radar) may be better suited for particular applications.

**Recommendation:** The subcommittee recommends that the business case for SNT be strengthened with the value of additional operational efficiency and safety improvements. The subcommittee recommends that the use of other forms of surveillance should be explored (e.g., non-certified ASDE-X, ADS-B, MLAT, radar). These alternatives need to be considered in the context of how SNT might roll-out into the NAS (e.g., whether starting at smaller airports or larger airports first or timing relative to aircraft equipage).

**Finding (6):** (Environment) It was excellent for the subcommittee to be brought up to speed on the environmental tool AEDT. FAA is to be commended for developing this tool, and particularly for assisting in its use in the NASA NRA examining the impact of new vehicles in the NAS—this is a model of how the use of such tools can be accelerated and improved to provide one input into decision making and system design. Without significant changes to NASPAC, however, AEDT and NASPAC are inconsistent tools, which may hinder their use together.

**Recommendation:** The AEDT tool could be used in an iterative fashion in the FAA design and decision-making process to ensure that environmental issues are

assessed early, rather than in an “ex post facto” fashion to assess the impact of previously developed routes, procedures, etc.

**Finding (7):** (UAS Integration in the NAS) A number of projects and demonstrations with various elements of DOD were presented. These evaluations and demonstrations did not appear to flow from any top-down research and development plan for UAS integration. While encouraged that the FAA is beginning to address UAS integration in the NAS, the subcommittee considers the current approach inadequate to meet the outcomes needed and timing requirements of both government and industry.

**Recommendation (7a):** Establish, in partnership with DHS and DOD, a Government internal civil-military concept of operations for UAS, as a prelude to developing public-private partnering relationship strategies for incremental implementation.

**Recommendation (7b):** Establish a partnership design process, with industry and the appropriate FAA, DOD, and DHS organizations to produce a relationship strategy. Focus the initial stages of the design process on (1) reaching a shared view of demand, and (2) establish a shared concept of operations, and (3) decide on best approaches to the partnership design, implementation, and operation.

**Finding (8):** (Demonstrations) The FAA presentation on Govt-Industry partnerships for demonstrations highlights the FAA’s early efforts to increase the level of accountability and management across activities that involve the more highly visible collaborative projects. This is a very positive step towards improved management of the FAA’s research portfolio. The subcommittee looks forward to receiving updates in this area.

**Recommendation:** The FAA should document and publish the specific research objectives associated with each demonstration and report regularly to the subcommittee the performance of the demonstrations against the previously-defined objectives, including measures of positive outcomes as well as shortfalls in meeting those objectives.

**Finding (9):** It is a clear intention of the FAA to invest in laboratory infrastructure that can be used for future collaborative efforts in a broad set of NextGen areas. Subcommittee has some concerns, however, on whether this additional infrastructure is a cost-effective use of government resources.

**Recommendation:** FAA should examine the proposed new laboratory capabilities against other capabilities to which the Agency has access, and should identify the anticipated utilization of this new investment as well as the level of sustained use of present capabilities.

## **FAA UPDATED RESPONSE TO THE SEPARATION STANDARDS WORKING GROUP REPORT**

**Finding (10):** It was reported that the target level of safety has been increased to 10-E9. This level does not appear to be statistically achievable to the NAS Operations Subcommittee.

**Recommendation:** The target level of safety needs to be reassessed for its reasonableness and applicability. Safety levels of new systems should be compared against a baseline which is defensible based on current operations and statistical analyses.

**Finding (11):** The NAS Operations Subcommittee ascertained that the responsibility for separation standards in the FAA was not clearly defined. While ATO apparently has the ultimate responsibility, coordination with AVS was unclear.

**Recommendation:** Given possibly different operating paradigms in NextGen, the FAA should have clear points of responsibility for the development and implementation of separation standards.