

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

April 21, 2010

Meeting Minutes

On Wednesday, April 21, 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 and commented that several folks were on tight schedules and would be testifying on the Hill in the afternoon.

Mr. Barry Scott, REDAC Executive Director, read the public meeting announcement and thanked everyone for attending. Mr. Scott reviewed the agenda and introduced Dr. Karlin Toner.

Joint Planning and Development Office (JPDO) – Dr. Karlin Toner

Dr. Karlin Toner, Director of the Joint Planning and Development Office, briefed the committee on the NextGen leadership and the impact of the new organization. She explained the role of the JPDO in implementation. Members engaged in a discussion of the following topics with Dr. Toner.

- The coordination between JPDO and Vicki.
- Future coordination with NASA, Department of Homeland Security, etc.
- Nine working groups and review process of which are the right groups.
- Focus more on policy issues, role to define research or passed off to implantation.
- 2025 what are the driving requirements, no role for innovation.

Dynamics for Change – Vicki Cox

Ms. Vicki Cox, Senior Vice President for NextGen and Operations Planning, discussed a potential working group for REDAC. Below are the details of how the committee can assist the Agency in addressing the dynamics of change.

Dynamics of Change for 2018 and Beyond

Based on your experience dealing with fundamental change related to the insertion of advanced technologies, the FAA is requesting the REDAC provide an *integrated* set of recommendations regarding:

- Strategies to foster FAA and industry acceptance of change associated with NextGen technologies for 2018 and beyond given the cultural and economic realities
- Social and cultural factors to consider as we transition beyond 2018 (building on current research)

Members engaged in a discussion with Ms. Cox relating to the issues that could be considered in a working work.

- Overcoming cultural issues, ideas of how to move forward.
- What are the gaps?
- Barriers and the economic impact.
- Struggle with innovation within FAA.
- Plan for 2018 and the challenges.
- Better position more acceptable to the community.
- Develop set of issues for REDAC to address using their knowledge and expertise.

Members were supportive of creating a working group. The terms of reference will be drafted and membership will be considered both from the committee and outside.

NextGen Integration and Implementation – Ann Tedford

Ms. Ann Tedford, Manager, NextGen Planning Group, briefed the committee on what is happening with NextGen. She discussed the following items:

- The 2010 NextGen Implementation Plan (members received a copy)
- Consensus Target for 2018
- RTCA Task Force 5 Recommendations (FAA response available on website)
- Industry and FAA have agreed how to move forward.
- Incremental Approach to Implementing NextGen.
- Delivering Benefits Today and Tomorrow (Reduce delays, CO₂ Emissions, & Fuel use)
- Near-term NextGen Applications
- Airfield Development FY 2009-10
- Surface surveillance and data sharing.
- FY 10 ADS-B deployment moving rapidly.
- Current coverage for ADS-B Stations: on track for 2013 completion.
- Approach: integrated airspace and procedures emphasis on high priority areas.
- Performance Based Navigation (PBN).
- Wide Area Augmentation System (WAAS).

Ms. Tedford invited members to explore the on-line resource at www.faa.gov/nextgen.

REDAC Membership – Barry Scott

Mr. Barry Scott, REDAC Executive Director, reviewed the REDAC membership, affiliations and process for appointing subcommittee members. The process below will be used for appointing members on a subcommittee.

- Submit names to Gloria Dunderman
- Names forwarded to REDAC chair, DFO, and Associate Administrators
- If approved, Gloria Dunderman notifies subcommittee chairs and DFO
- Members serve 2 years with optional 2 year renewals – no limit

Each subcommittee chair should review their membership and decide if changes are needed. Below are items to consider when reviewing the membership.

- Balanced Representation
- Expertise
- Budget (i.e. travel, logistics)
- Size of Subcommittee
- New Viewpoints
- Harmony

Mr. Scott commented that the FAA has changed drastically and that new viewpoints would be helpful for the subcommittees and the FAA.

Subcommittee Reports

Each year in February/March, the standing subcommittees review FAA's R&D investments in the areas of airports, aircraft safety, human factors, NAS operations, and environment and energy. After reviewing the respective portfolios proposed by the FAA, each subcommittee generates recommendations. The Subcommittee Chairs listed below presented their Subcommittee's recommendations. Attachment 3 provides the recommendations/observations presented by each Chair.

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

The recommendations were approved and the minor edits will be made per the discussion.

The members engaged in a discussion of recommendations that should be included in the letter to the Administrator. Dr. Hansman will prepare the draft and circulate for concurrence. Below are the topics members agreed would be included in the cover letter.

- Level of expertise (i.e., software position).
- R&D, full picture review for committee, suggest deep dive of one solution set at next subcommittee meeting(s).
- What is not clear is whether FAA has identified programmatic risk areas and, if any, what research is planned to mitigate those risks. Human factors and software digital systems are two program areas that are good examples where there are program risks for NextGen.
- What research do we need to do? What is in the plan and plan for success. FAA to identify research and how to achieve.

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

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

April 21, 2010

Agenda

9:00 am	Welcome	Barry Scott John Hansman
9:15 am	JPDO	Karlin Toner
10:15 am	REDAC Membership	Barry Scott
10:30 am	Break	
10:45 am	NextGen Integration and Implementation	Ann Tedford
11:15 am	Dynamics of Change	Vicki Cox
11:45 am	Committee Discussion - Recommendations	
12:00 pm	Lunch	

Subcommittee Reports

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

Research, Engineering and Development Advisory Committee
April 21, 2010

Attendance

Members:

John Hansman (Chair)	Steve Alterman	Joseph Del Balzo
Ed Gervais	Victor Lebacqz	Agam Sinha
Amy Pritchett		
Barry Scott (Executive Director)		

Other Attendees:

Jens Hennig, GAMA	Catherine Harrison, FAA	Dawn Zimmer, FAA
Mohan Gupta, FAA	John Reinhardt, FAA	Tom McCloy, FAA
Cathy Bigelow, FAA	Andrea Schandler, FAA	Erik Amend, FAA
Art Shantz, OIG	Monique Morris, FAA	Sonya Smith, Howard Univ.
Nelson Miller, FAA	Art Politano, FAA	Richard Ozmore, FAA
Karlin Toner, JPDO	Lee Olson, FAA	Ann Tedford, FAA
Rob Pappas, FAA	Denise Davis, FAA	Jim White, FAA
Mike Gallivan, FAA	Vicki Cox, FAA	Charlie Leocha, Media
Nick Stoer	Bill Spencer, PSD	Charles Ruehle, FAA
Gloria Dunderman, FAA	John Hickey, FAA	Carl Burleson, FAA
Nancy LoBue, FAA	Michele Whetstine, FAA	Ed Feddeman, House Sci. Com.

Subcommittee Presentation – Aircraft Safety Subcommittee – Chair/Joseph Del Balzo

The Aircraft Safety Subcommittee of the FAA Research, Engineering and Development Committee, REDAC, met at MITRE's Center for Advanced Aviation Systems Development on March 9-11, 2010. The meeting included tours of the CAASD Integrated ATM Lab with demonstrations of CDTI/ADS-B Applications and Runway Incursion-Flight Deck-based Direct Warning. The primary purpose of the meeting was to review FY12 Research Requirements and included detailed reviews, "Deep Dives" into several research programs.

General Observations

- The SAS again found the presentations given by FAA managers and researchers to be of uniformly high quality.
- The method of summarization and content presentation of the many complex topics continues to improve and were readily comprehensible at a management level.
- The prioritization process of research proposals appears to be effective.
- The SAS believes that the portfolio content is substantially correct, but is concerned that several research programs lack a sufficient level of technical expertise to assure success.
- The SAS found no programs that should be eliminated.
- The extent to which FAA leverages the work and expertise of other government agencies, industry and academia continues to be an effective way to conduct relevant research.
- The SAS finds FAA to be extremely responsive in responding to subcommittee comments and recommendations.
- Specific Findings and Recommendations on individual areas of research reviewed and discussed by the subcommittee follow.

Icing Program

Finding: The Aircraft Icing program is well defined and poised to deliver high value. The icing program has built important collaborative research relationships with other FAA programs, NASA, Canadian research organizations, European research organizations and the aerospace industry. This is to be commended as it will enable the FAA to expand its icing research portfolio and increase their impact by conducting collaborative research programs on high priority programs of mutual interest. The high ice-water content, engine icing program is such a high priority program and leverages many of these relationships. This program addresses the engine malfunctions due to ice crystals that have occurred on many commercial flights in

convective weather primarily in the tropics. The Appendix C research including the work on 3D ice accretion and icing aerodynamics certification methods is well conceived and is important to the FAA mission of flight safety. This program is currently building an international coalition and research plan and this should be encouraged. Finally, aircraft icing is an important safety area where the FAA has significant interests and responsibility. The icing program has several high priority programs and very limited in-house expertise. They rely heavily on partners and grantee/contractors to manage their programs. Concern exists within the Subcommittee regarding the lack of FAA “bench strength” in this important area.

Recommendation: The FAA needs to continue to support the high priority high ice-water content, engine icing research program and support the Appendix C research on 3D ice accretion. The Subcommittee recommends that FAA review the current “bench strength” and take appropriate hiring action to assure continuity in technical strength well into the future in the aircraft icing research area.

Weather In The Cockpit

Finding: The Weather in the Cockpit program appears to be on the right track using a gap analysis to help define the needed research requirements. A concern remains regarding the planned timing of research completion in 2015 intended to support the mid term NextGen implementation of 2018.

Recommendation: Assure the research deliverables are progressively released to enable industry to respond to them in formulating solutions to the Weather in the Cockpit imperative.

Propulsion Malfunction Research

Finding: The Subcommittee found the planned Propulsion Malfunction research plan would benefit from deep engagement with engine and airframe manufacturers contributing their knowledge & expertise in this area.

Recommendation: The FAA should develop an industry partnership approach to assist & accelerate the Propulsion Malfunction research activity.

Unmanned Aircraft System

Finding: The ongoing Unmanned Aircraft System research is urgently needed to define a path to permit safe operation of UAS vehicles in the NAS. Although this broad and difficult area has been hampered by several leadership and organizational changes in the past few years, the SAS has noted good traction in the recent past.

Recommendation: The Subcommittee recommends that the research sponsoring office & the research performing technical community continue to jointly refine the development of the research requirements and firmly establish the optimum path to achieve the important goal of enabling UAS operation in the NAS.

Aviation Safety Information Analysis Sharing- ASIAS

Finding: The SAS found that the ASIAS research project has made significant progress and continues to be directly responsive to the need of safety analysts within the FAA and aviation industry. The subcommittee commends the work being done by MITRE CAASD and notes the increased degree of trust that has developed from ASIAS industry participants. ASIAS is clearly an integral component of a Safety Management System designed to bring today's safe aviation system to even higher levels of safety.

Recommendation: The SAS recommends that the FAA continue efforts to increase the number of airline participants and ensure that the ASIAS program continues to be a safety tool that is increasingly used to identify emerging risks before they become potential safety issues.

Conduct of Research and Development

Finding: The SAS commends FAA for the advancing the development of a monthly reporting template to monitor progress in achieving measurable milestones and deliverables of all research activities in the Aviation Safety R&D portfolio.

Recommendation: The SAS recommends that FAA adopt a monthly reporting template and move quickly to implement it across the entire Aircraft Safety R&D portfolio.

Finding: The SAS continues to believe that successful conduct of research and development demands a series of sponsor-performer arrangements and conditions, all of them often urged on FAA by various groups.

1. Although a partnership in the execution of the research including shaping the approving methods and products expected is required, it is essential that the responsible sponsor organization have a strong voice not only in the setting of requirements – but also the funding authority.
2. The responsible sponsor organization must have a strong voice in the design and performance of the work, and must clearly monitor and have oversight of the work so that meaningful results can emerge.

3. The responsible sponsor organization must itself have the technical and management skills to fully understand and monitor the work of the performing organization – whether it is within or outside the FAA. While this cadre of expertise may need to be small, it must be able to understand and guide the work. Experience in R, E&D has shown that in the absence of such skills in FAA, the results are almost always poor.

Recommendation: The subcommittee recommends that FAA review the structure of the Aircraft Safety Research Program to ensure that the current roles of the sponsor and performing organizations are best suited for successful conduct of safety research. This review should include roles related to authority over and management of research funds.

The Proper Role of TCAS

Finding: TCAS was intended to be an independent safety net in the ATC system. It was recognized from the beginning that the independence would not be total, since TCAS depends on the Mode S data link and the barometric altimeter. However, every attempt was made to provide as much real separation and independence from the ATC system tools as possible.

Recommendation: The SAS believes that as the community explores the closer integration of TCAS with other systems such as ADS-B and aircraft autopilot systems the potential safety risks associated with the reduction of independence need to be carefully considered. The SAS requests further detail from the FAA on this issue and how these potential safety risks are assessed.

Structural Integrity/Composites

Finding: The Subcommittee on Aircraft Safety considers the research effort on **Structural Integrity/Composites** to be a model program. With a very small but clearly expert internal FAA management resource, this effort leverages the work and expertise of other government agencies and the industry on a critical safety matter. The focus on developing standards and guidance based on theory and practical experience, and the emphasis on providing usable guidance to FAA people, and many others, makes this a valuable example of how to do things right. The Subcommittee endorses the proactive approach to composite structure maintenance and inspection being executed. Staying ahead of the composite aircraft fleet is very important to assure future continued operational safety.

FAA FACILITIES AND LABORATORIES

Finding: The Aircraft Safety Subcommittee wishes to reemphasize an earlier recommendation on FAA funding and support for facilities and efforts which serve not only FAA but are also resources for the world. These facilities and efforts – such as much of the work of the Civil Aeromedical Institute and the William J. Hughes Technical Center – have a world-wide impact and contribute in important ways to the eminence and high reputation of FAA. Support of these

efforts and increasing public knowledge and understanding of these activities is critical to the success of research activities in support of NextGen, self-separation, human factors, reduction of spacing between parallel runways, RNP, etc. Even in difficult budget periods, adequate funding must be provided not only for the modernization, care and feeding and operation of existing facilities but funding must also be provided to ensure that laboratories with required capabilities to support future research are available when needed. Precedence for the use of F&E funding for the procurement, upgrade, repair or operation of facilities and equipment at the Tech Center and CAMI has been established. The procurement of equipment for CAMI, the support of the Pavement Test Facility and repair of R&D facilities at the Tech Center are examples recently cited by Tech Center Counsel.

Recommendation: The subcommittee recommends that FAA seriously explore creative ways outside of the RE&D budget to support the modernization and operation of existing laboratories and the establishment of laboratory capabilities to support future research requirements.

Software and Digital Systems

Finding: The Software and Digital Systems Program appears to be moving in the right direction to meet the near-term and mid-term needs of the NextGen program. A notable accomplishment in FY 10 was the development and submission of a SDS comprehensive research plan which is intended to consolidate the SDS research planning that has taken place and show how FAA objectives are being met. The baseline regulatory support programs in addition to the FY12 research requirements provide a solid context within which to assess the research initiatives. It was also noted that the research currently planned will not meet the anticipated far-term needs of the NextGen.

Recommendations: The FAA needs to continue to support the SDS program and ensure the staffing and resources needs are adequate to meet the research needs. In order to address NextGen far-term requirements the SDS program should develop a joint research plan with NASA to ensure the far-term research being done by NASA will transition to the FAA and address the complex system integration expectations of the NextGen by 2025.

Finding: The SAS remains concerned about whether FAA's internal core capability can successfully carry out the Software and Digital Systems research plan. It was noted that the Chief Scientific and Technical Advisory positions for Aircraft Computer Software and Advanced Avionics remain vacant. It was also noted that one hire was made at the Tech Center in FY 2010 which puts the staff even with the FY09 with 1 additional hire planned for FY11. The SAS strongly asserts that the absence of a critical mass of talent in this program will lead to unsatisfactory research results.

Recommendation: The SAS again recommends that FAA aggressively take action to acquire the specialized expertise to support this critical program.

FAA Core Research Capability:

Finding: The SAS is concerned that several research programs lack a sufficient level of technical expertise to ensure success. The Icing Program and the Software and Digital Systems Program are obvious examples.

Recommendation: The SAS recommends that the FAA Sponsor Organization and Performing Organization jointly undertake a study to quantify the core capability required for both organizations to support all critical research programs and take steps to obtain FAA support to acquire the needed core capability.

The Impact of Computers/Automation on Aircraft Safety

Finding: The SAS noted the challenges related to obtaining the optimum balance between the role and power of the pilot and of the automation systems on the aircraft along with the optimal method of information display to the pilot. The challenges increase as computers and Automation Systems become more powerful. These same challenges and issues apply to the increasing levels of automation being introduced into the Air Traffic Management Systems on the ground.

Recommendation: The SAS recommends that FAA consider the need for additional research to ensure that the optimum balance between the power of the pilot and of the automation systems.

Recommendation: The SAS recommends that FAA consider the need for additional research to devise better, more fool-proof methods of testing automation systems for fault detection as well as for single and multiple fault survivability.

Rotorcraft Research

Finding: The Subcommittee is pleased to see the rotorcraft research work being conducted in a coordinated effort with the Army as was recommended. The research supporting addressing tiltrotor safety assurance approach is very much needed.

Recommendation: The Fly-by-Wire Research work being done in support of the certification approach for the advanced tiltrotor Bell 609 aircraft should be accelerated to assure it is rapidly transitioned to guidance and regulatory material.

FAA Center of Excellence for General Aviation Research: CGAR

Finding: The SAS continues to be impressed with the research activities at the COE for GA Research. The CGAR is another example of how cost sharing arrangements, complemented by FAA management competence and leadership, can be an effective way to conduct relevant research and advance the knowledge of FAA staff.

Recommendation: The FAA needs to continue to support relevant research activities at CGAR.

Finding: The UAS/Conventional Aircraft certification requirements matrix developed at a COE appeared to be of value to the UAS community. It was not clear as to why the matrix is not yet publicly available.

Recommendation: The subcommittee requests further details on the public availability and intended use of the UAS matrix.

Subcommittee Presentation – Human Factors Subcommittee – Chair/Christopher Wickens
(Amy Pritchett presented for Dr. Wickens)

Background: Previous recommendation and FAA response letter dated January 29, 2010.
Recommendation: Continue to place strong emphasis on human factors issues, as reflected in the Human System Integration Roadmap

FAA Response: We agree that the Human System Integration (HSI) Roadmap is pivotal to addressing human factors issues for NextGen. ATO-P Office of Human Factors Research and Engineering (AJP-61) is identifying and tracking areas for improvement in the next annual update to start in the second quarter of FY 2010, and will continue to keep the Human Factors Subcommittee abreast of these activities.

Finding (1): As noted in the the FAA's response to this recommendation, human factors is receiving gradually increasing emphasis as the FAA moves forward with NextGen. In particular, this evidence was provided by:

- A sustained high budgeting level in critical human factors research areas, both within Flight Deck and Air Traffic , particularly with regard to self separation including the various options for delegating responsibilities to the flight crew, and air-ground integration (and their implications for human-automation interaction), as well as the F&E budgeting for the controller workforce.
- The January meeting, held with Steve Bradford, that initiated discussions into key needs for R,E & D in NextGen to address human factors issues within.
- The human factors portfolio about which we were briefed provides a very suitable vehicle for integrating and disseminating HF research to the wider NextGen design community.
- The emphasis in the FAA's response on understanding pilot and controller response to off-nominal events.

Recommendation (1a): Continue the progress toward deeper involvement of human factors in NextGen planning and research. We believe that continued development of the HSI roadmap is a major vehicle for making this happen. However, this planning effort must also extend beyond the research planning focus of AJP-61 to an extensive review of NextGen plans for the need to address human factors issues. This review should consider where assumptions about human performance in future NextGen operations establish technical and programmatic risks that need to be mitigated by a risk management strategy that preemptively identifies and seeks mitigations to the most likely and significant risks. Likewise, this planning effort must plan for the key decision points and critical path items contingent upon addressing human factors in NextGen development.

Recommendation (1b): We recommend that the NextGen I&I office (AJP-A) vigorously pursue the appointment of a full time position for Chief Systems Engineer for-Human Factors. This position must be given the responsibility and authority to examine NextGen plans for situations where human factors considerations must be addressed, both to meet the NextGen plans as articulated, and to mitigate technical and program risks established by assumptions about human

performance. In addition, this position should serve to foster the appropriate application of human factors knowledge throughout NextGen developments, as well as identifying areas needing research. Thus, this position will additionally serve as a vital link between the research focus of AJP-61 and development and engineering aspects of NextGen developments applying human factors. We recommend that AJP-61 personnel have input in assessing the qualifications of potential hires for this position

Recommendation (1c): As we have in the past, we recommend that every effort be made to select a permanent replacement for the head of AJP-61, following the departure of Karlin Toner.

Recommendation (1d): As we have in the past (September Rec 1c), we recommend that the subcommittee be briefed on two critical areas with HF components (but outside the funding lines of AJP-61): (1) Human factors aspects of the weather program by AJP-68, and (2) concepts of operations and research by AJP-66. We recognize that such briefings could not be scheduled for the recent March meeting because of time constraints.

Recommendation (1e): Assure that the new human factors research portfolio makes contact with (articulates in general form) all of those HF efforts within the FAA that lie outside of the direct funding line of AJP-61.

Recommendation (1f): We recommend that the current FAA research program continue to follow the guidance of the Administrator's response, and insure that human in the loop simulations include off-nominal events, and focus on evaluating pilot and controller responses to those events.

Background: Previous recommendation and FAA response letter dated January 29, 2010.
Recommendation: Continue the excellent progress of collaboration with NASA's Integrated Intelligent Flight Deck project, within the Aviation Safety Program.

FAA Response: We agree and AJP-61 will continue collaboration to ensure involvement with the NASA Aviation Safety Program's Integrated Intelligent Flight Deck Project with particular emphasis on applications such as merging and spacing and closely spaced parallel operations. We will also emphasize transitioning NASA research products to FAA for integration as part of our NextGen Air Ground Integration research efforts.

Finding (2): We were fully satisfied with the FAA's response that such collaboration remains in force and is expanding. In particular the research portfolio of Flight Deck NextGen projects reflects a very high level of coordination with and FAA funding of research performed by NASA that leverages their expertise and resources.

Recommendation: Continue this line of collaboration; in particular, we hope that the FAA will soon exploit the results of the FAA-funded NASA project that provides recommendations regarding ATC priority research issues for NextGen.

Finding (3): The subcommittee received a series of excellent briefings from human factors researchers at MITRE, regarding HITL simulations of various concepts that will appear in NextGen. From this briefing it appeared that the FAA, through AJP-61 has taken a good step forward for keeping closely in touch with the conduct and products of this high quality and NextGen-relevant human factors-related research. This briefing also provided an opportunity for AJP-61 staff to learn about MITRE CAASD research in related areas, and establish direct contacts.

Recommendation: The FAA (via AJP-61) should continue the coordination and look for opportunities to progress the coordination with MITRE, as much of it appears to fit directly into issues within the HSI roadmap, and has profound implications for future concepts (e.g., potential increase in controller workload, resulting from the more rapid updates associated with ADS-B driven displays.)

Subcommittee Presentation – NAS Operations Subcommittee – Chair/Victor Lebacqz

General

- ***Finding***
 - The subcommittee held its meeting at the MIT Lincoln Laboratory, and heard briefings on MIT/LL's surveillance research, weather forecasting research, weather-ATM integration research, and air traffic control tower research. Additionally, briefings were given on the FAA's PARTNER program, the FAA's RED budget, and the FAA's NAS Operations PPT research. The MIT/LL briefings were at an excellent level of technical depth, and gave the subcommittee members unusually clear insight into the way some of this work for the FAA is being conducted.

Safety and Risk Management

- ***Finding***
 - The committee was briefed on two programs which will require new approaches to evaluating safety: Unmanned Aircraft Systems (UAS) Airspace Access, and Staffed NextGen Tower (SNT). Both introduce new operating paradigms, with new and significantly different human roles and responsibilities. Overly conservative requirements, with insufficient analysis, will inhibit the addition of new capabilities. The subcommittee reaffirms the statement in the October 19, 2009 REDAC letter to the Administrator that "there does not appear to be a clear system-level process for managing risk and arbitrating safety requirements for new systems or procedures."
- ***Recommendation***
 - The NASOPS subcommittee recommends an independent, in-depth review of the safety standards and processes being applied to new systems, with appropriate risk management applications to safety.

NextGen R&D Budget

- ***Finding***
 - The budget briefing contained the RED budget request for FY11 and one line (BLI 1A08) from the F&E budget devoted to NextGen, but information from other CIP BLIs, such as those for the NextGen Solution Sets, was not forthcoming. Clearly, R&D (as defined by OMB) for NextGen is being performed in these other lines (e.g. RWI). Without complete budgetary and programmatic context of the FAA's R&D program, NASOPS is unable to give balanced advice on the overall allocation of R&D efforts and whether the most important work is being undertaken. NASOPS has raised this issue before.
- ***Recommendation***
 - All Research and Development for NextGen should be presented to NASOPS, which would include that performed in funding under Solution Sets, Transformational Programs, and/or cross-cutting R&D

Long-Term NextGen Research

- ***Findings***

- The majority of NextGen R&D presented emphasizes Part 121 NextGen implementation, with little attention focused on on-demand commercial air carriers, air taxis, charter, business, corporate, private and other GA operators. Without addressing the unique aspects of these operators, NextGen implementation may be delayed and opportunities for innovation will be missed.
- The FAA's R&D investments are weighted to enable the mid-term implementation of NextGen capabilities. The leads for longer term NextGen outcomes require sustained investment beginning now to ensure timely implementation. The subcommittee is concerned that these areas are inadequately funded, and that the FAA is not planning to leverage innovation in the private sector (e.g., using incentives such as the "X prize", public-private collaborations, or the establishment of notional performance requirements) for these long-term objectives.
- **Recommendations**
 - Develop an overall R&D strategy, identifying top research issues and key decisions the research will drive, for all classes of aviation, and recommend the overall strategy for fostering and maturing research and development for both mid-term and long-term time periods. The strategy should include R&D focused on activities in Parts 135 and 91, as well as UAS and rotorcraft operations.
 - This R&D should explicitly include consideration of how to incentivize users to equip

Concept Development

- **Finding**
 - There remains a need to better understand the overall context of the research needs and fit of the Concept Development work being done relative to NextGen development. Additionally, this area has been cut in funding, contrary to previous recommendations.
- **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 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. Current funding does not permit far term concept development (e.g. > 2018), or research on concepts not currently in the portfolio (e.g. dynamic airspace resectorization, TFM evolution ConOps, 4-D trajectory management.)

Weather and Weather-ATM Integration

- **Findings**
 - The MIT/LL briefings were a "deep dive" into weather forecast technology and the interaction with TFMM mechanisms. The committee was very pleased with the quality of the work. The evolution of weather research at MIT/LL, NOAA, ESRL, and NCAR into development of useful products now including CoSPA is a testimonial to the value of this research, and MIT/LL staff did an excellent job noting the inclusivity of efforts among these labs.

- These briefings showed progress in addressing some of the recommendations of the WAIWG by the work at MIT/LL, but the remainder of the weather-ATM integration R&D being accomplished elsewhere needs to be addressed in this regard. For example, the committee was told that the FY10 funding for the RWI and NNEW areas has been delayed due to internal FAA processes.
- **Recommendations**
 - NASOPS will request a complete FAA weather R&D briefing, with a strategy for addressing the WAIWG recommendations and equivalent levels of detail for work being funded elsewhere, at an upcoming meeting.

Traffic Manager Selection and Training

- **Finding**
 - Traffic managers are concerned with managing the scarce NAS resources to best meet the needs of NAS users. They have become specialized in their roles as managers of the NAS assets and flows. This is a very different job from that performed by controllers, but traffic managers are nonetheless selected from the ranks of the Air Traffic Controllers and were originally selected with the controller skill set in mind. We were encouraged to hear that the FAA human factors research is exploring (mid-term) NextGen controller selection criteria and training, but, there is currently little or no human factors focus on the unique and growing role of Air Traffic Managers.
- **Recommendation**
 - Initiate a human factors research program to identify the specific skill set required for Air Traffic Managers in the present and 2018 NextGen systems. This research should culminate in selection and training standards for Air Traffic Managers.
 - Initiate a research effort to identify the skill sets required for Air Traffic Controllers and Airspace Managers for 2025 and beyond, since the people who will be hired in the next 5-10 years will still be in these jobs in that time frame, but the role of controllers airspace managers will undergo significant changes in that timeframe.

PARTNER Program

- **Findings**
 - NASOPS was impressed with the breadth of projects in the FAA's COE E&E program PARTNER. Overall funding has increased to \$8M for the current FY, and the funding appears to be stable. A strong cadre of partner universities participates in PARTNER with good support from industry in the projects. NASOPS did not, however, receive sufficient insight into the overall program to judge quality and portfolio adequacy.
- **Recommendation**
 - NASOPS requests "deep dive" briefings on PARTNER to (a) understand how it fits into the overall E&E program, (b) assess ATM-related projects being conducted, and (c) understand PARTNER processes for technology transfer

Subcommittee Presentation – Airports Subcommittee – Chair/Ed Gervais

REDAC Airport Subcommittee -
Spring 2010 Recommendations

Finding: The subcommittee appreciates the efforts of FAA to assess new technologies (new foaming agents, quantity requirements and delivery systems) in reducing the amount of ARFF agents to extinguish fires.

Recommendation #1: Standards need to be developed from the culmination of test fires to establish firm requirements for the amount of ARFF agent needed at US Airports that are receiving NLA service.

FOD & Wildlife Detection Systems:

Finding: The subcommittee is pleased with the advances made on FOD detection equipment that is focused on performance standards, not product endorsements.

Finding: The subcommittee is also pleased with the advances made with wildlife detection systems that is focused on criteria to alert tower personnel when avian or other wildlife presence is detected, as opposed to developing tools that would require full-time attention to monitoring devices.

Recommendation: The subcommittee recommends that FAA partner with industry to implement best management practices in implementing new systems, and to develop performance and specification-based Advisory Circulars on these topics.

Runway Friction & Condition Reporting:

Finding: Friction research is coalescing with the Takeoff and Landing Performance Advisory Committee – Aviation Rulemaking Committee (the so-called “TALPA- ARC”).

Participation from across the industry:

Airports

Airplane Manufacturers

Airplane Operators (Parts 121 / 125 / 135 & 91)

Regulatory Authorities

Industry Associations

The Goal is to establish a unified and standardized means of expressing runway friction in a way that will communicate braking action in to pilots and which will establish a single means by which surface contamination can be assessed and communicated.

Recommendation: FAA should actively push for adoption worldwide

Basic Steps of Runway Assessment:

- Determine whether a runway is dry, wet or contaminated
- If contaminated, identify the type, depth and percent of coverage

- Determine the contaminate / runway surface temperature, or OAT if surface temperature is unavailable
- Determine the Runway Condition Code
- Report the Code and the Field Condition Description
- Pilots will use the Runway Condition Code when they calculate landing performance requirements.

.. a single, uniform, worldwide method will eliminate confusion.

Alternative Paint and Marking materials:

Finding: The subcommittee is pleased with the work of FAA on the effectiveness of various paints and markings that on runway, taxiway and apron surfaces.

Recommendation: The subcommittee recommends that future guidance on the application and effectiveness of proven materials should be included in Advisory Circulars and / or Engineering Briefs so that airports could benefit from the most up-to-date information available.

Low Cost Ground Surveillance System:

Finding: The development of a low cost ground surveillance system by FAA shows remarkable effectiveness for both surveillance and promoting awareness of proximity to active runways.

Recommendation: The subcommittee recommends that the FAA R&D Branch engage other lines of business (such as ATO) for possible synergies.

GPS-based Ground Vehicle Navigation:

Recommendation: The subcommittee recommends that FAA reach out to the Airport GIS Program to develop future technology and system requirements.

Recommendation: In the area of digitizing airport surface and PDARS data, FAA should seek out vendors already integrating ASDE-X and PDARS into SIMMOD simulation software for possible applications.

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Subcommittee Presentation – Env. & Energy Subcommittee -Chair/Steve Alterman

The Environment and Energy Subcommittee of the FAA Research, Engineering and Development Advisory Committee (REDAC) met in Kansas City, Missouri, on February 24-25, 2010. 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 continue to remain intact, with an emphasis on NextGen and support of ICAO CAEP activities again dominating the Environment and Energy agenda.

In carrying out these program priorities, the Subcommittee notes that increased funding for the CLEEN program could accelerate achieving a number of environmental goals and that a small amount of additional funding will enable the work on the Noise Roadmap to continue at a faster pace.

The Subcommittee applauds the efforts of Environment and Energy to work cooperatively both within the FAA structure and with NASA. Stronger partnerships with the Department of Defense in the area of alternative fuel development and with the Environmental Protection Agency were strongly encouraged.

The Subcommittee appreciates the responses to the recommendations made in September 2009 and accepts the decisions made. Specifically with respect to the decision that increased ACCRI funding is not necessary at this time, the subcommittee agrees, but requests that this issue be revisited later this year to determine if further funding is necessary at that time.

Finally, a consistent question to be addressed is whether the existing committee structure is effective. The answer is “yes” and we suggest that this question be dropped from future reports.

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: In reviewing future year budget estimates for environmental research, the subcommittee noted that the proposed funding levels are essentially flat for the years 2013 and beyond. Since, as a practical matter, the costs of doing business in these years will increase, this “flat-lining” leads to an effective reduction in research funds available while the research needs and complexities are increasing.

Recommendation: While the subcommittee understands the problems in projecting out-year funding levels, we recommend that out-year budgets at least

provide a factor for inflation in order not to project a practical decrease in funding levels. In addition, the Agency should attempt to communicate to the subcommittee its actual needs in future years so effective advice can be given.

(B) Recommendations to be Included in the REDAC Report

(1) Finding: The subcommittee noted the progress being made in the development of a new noise roadmap. At the same time, it appears that there is a funding shortfall that has the potential of slowing progress in this area. Specifically, there does not appear to be funding to conduct required community surveys.

Recommendation: The Office of Environment and Energy should work with the Office of Airports to determine whether funding in the airports research program to fund the \$1.5 million necessary to conduct community noise surveys is available.

(2) Finding: The subcommittee notes, and is encouraged by, the continuing cooperation with NASA in a variety of environmental research areas.

Recommendation: The subcommittee recommends that the growing cooperation between the FAA and NASA in the area of environmental research must continue and expand. This expansion is especially important in the Agency's relationship with NASA's Airspace Systems and Fundamental Aero programs.

(3) Finding: The subcommittee notes that the FAA and the EPA appear to be better engaged in addressing aviation environmental issues.

Recommendation: The subcommittee recommends that cooperation between the FAA and the EPA should expand. Specifically, the FAA should request that the EPA actively participate in the REDAC Environmental Subcommittee.

(4) Finding: The subcommittee finds that the cooperation between the Office of Environment and Energy and ATO is an excellent example of breaking down barriers between Agency organizations. One specific area of cooperation that merits mention is the requirement for NEPA compliance in the modernization effort. The subcommittee appreciates these continuing efforts to integrate environmental considerations into operational decisions.

Recommendation: Building on the growing relationship between the operational and environmental components of NextGen will be crucial as the Agency moves forward with its modernization efforts. This intra-agency cooperation should therefore continue and expand. In order to facilitate the subcommittee's assessment of ongoing environmental research needs, we recommend and request that ATO provide a briefing to the subcommittee on exactly how environmental considerations are being integrated into the NextGen models.

- (5) Finding: AEE's research efforts to support the ICAO/CAEP process continue to be a priority. The issues being considered in the ICAO process are increasingly complex and need to be informed by good science. Communication of these efforts to the stakeholder community is essential, especially the explanations of how the research underpinnings are integrated into the formation of the U.S. policy.

Recommendation: The FAA needs to continue communicating strategic planning and the status of research efforts that inform environmental policy decisions. Specifically, it is recommended that the FAA should conduct a workshop for stakeholders, including the international community, to communicate the status and underlying assumptions of the use of the Agency's Aviation Environmental Portfolio Management Tool (APMT).

- (6) Finding: The PARTNER Center of Excellence appears to be maturing and making excellent contributions to the environmental research effort. We continue to remain concerned about proposed Congressional language in the FAA Reauthorization bill that calls for the establishment of a new Center of Excellence on alternative fuels. The existing PARTNER structure already has the capacity to conduct this research.

Recommendations: If an additional Center of Excellence is established, existing COE's should be encouraged to compete for selection and the Agency should consider the additional costs associated with administering a new COE when conducting its source selection.

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).

In response to a request from the Senior VP for NextGen, the REDAC is planning to form a working group to investigate the dynamics of change of the NAS. The objective is to identify strategies and research which would increase the probability of success of NextGen.

The full committee also made the following general observations:

Concern on Level of Technical Expertise in Key Areas - The FAA has a unique need for expertise in key areas such as critical software and digital systems and human factors both for certification and acquisition. The REDAC reiterates its concern that there has been inadequate progress in developing the core competency and technical workforce in this and other key areas. The problem is recognized by the agency but progress has been limited due to the inability of the FAA to compete on the market for highly desirable talent. The REDAC recommends maintaining the priority in this area and investigating internal approaches for workforce development in key areas including hiring high potential junior staff with "fast track" training and responsibility paths.

NextGen Technical and Program Risk Management - The REDAC observes that much of the NextGen planning has been success based and it is unclear if technical and program risks have been fully identified. The REDAC recommends that the FAA should review NextGen plans to identify assumptions which establish technical and program risk in key areas such as human factors and software certification. These risks should be mitigated by risk management strategies which validate or dispute assumptions through early research and identify mitigations to the most likely and significant risks. In addition, there should be consideration given to how the NextGen plans would adapt to unfavorable research and development test results.

Need for a Comprehensive View of FAA Research and Development Portfolio - The REDAC has had difficulty meeting its responsibility to evaluate the FAA R&D portfolio due to the complexity of how research and development are funded and managed within the agency for historical and operational reasons. It would be useful to the REDAC and the Agency to have a comprehensive mapping of all research and development related activity.

Nav Lean - The REDAC was encouraged by the plan to investigate Lean processes for certification, safety and operational approval motivated, in part, by prior REDAC concerns regarding excessive safety standards for new systems. The REDAC looks forward to the results of this study and would like to support this effort.

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

Recommendations on the FY 2012 R&D Portfolio

Subcommittee on Airports

The Subcommittee was pleased to learn that the funding for the Airport Technology Branch was \$22.47M in the Omnibus Appropriation, that staff at the Tech Center are creating 10-year research plans for both the Safety and Pavements area, and that the many projects underway are being handled responsibly and with obvious expertise.

Finding (1): In the ARFF area, the subcommittee expressed significant interest in the research to develop standards for determining the amount of agent needed on New Large Aircraft (NLA). The subcommittee appreciated the point that new technologies may offset the need for new agent types, quantities, or delivery systems, but the highest priority remains to complete the research that will establish if FAA needs to change its requirements for the amount of firefighting agent needed for U.S. airports receiving NLA service.

Recommendation: The FAA should continue the high priority ARFF research to answer the question on the amount of firefighting agent required for airports receiving NLA service.

Finding (2): The Subcommittee was pleased with the advances made on FOD detection equipment, and is pleased that the research is focusing on performance standards rather than individual product acceptance. Likewise, in the area of wildlife detection equipment, the research is aiming at criteria that will provide alerts to tower personnel as opposed to demanding full time attention to what amounts to yet another monitoring device.

Recommendation: The subcommittee recommends that in the case of both the FOD detection and the Wildlife detection radars the FAA provide guidance on best management practices in implementing and operating the systems along with the system performance specifications..

Finding (3): The subcommittee also found that FAA's friction research is coalescing with the Takeoff and Landing Performance Advisory Committee. Research is close to concluding a single runway friction assessment tool that will resolve pilot inputs, airport operations inputs and even friction measuring devices into a single classification to assess and declare the condition of a runway.

Recommendation: FAA should support the implementation of the TALPA-ARC method and should promote its use worldwide.

Finding (4): The subcommittee was pleased with the presentation from the FAA's National Planning and Programming Office (APP) on the progress of the NextGen program and the impact on airports. The Subcommittee believes this is a very important area, and the brief demonstrated that FAA has considered the recommendations stated in previous REDAC reports.

Recommendation: The FAA should continue to provide updates at future subcommittee meetings on NextGen and its impact on airports.

Finding (5): The Subcommittee was pleased with the research in the area of alternative paint /marking materials.

Recommendation: The subcommittee recommends that future guidance should contain information on how to apply the materials. Also, the subcommittee recommends that guidance on the use of Type I / III glass beads in airport paints should clearly state which type would be more appropriate for airport use. There is currently a disparity in the existing guidance and recent research results, and airports would benefit by having the latest, up-to-date information on this topic.

Finding (6): The subcommittee also found that the research on developing a low cost ground surveillance (LCGS) system for airports is very promising. The purpose of the research is to review and evaluate LCGS systems, with a focus on how they can be used by airports to improve airport surveillance. The subcommittee commented that the proposed Airports solution appears to be much more robust than that being investigated in Air Traffic Organization's LCGS program.

Recommendation: The subcommittee recommended that whatever solution is found for the LCGS program needs to have ATO involvement, since both systems may be used by either airport operations or ATC. The subcommittee felt that it is critical that LCGS be focused on the airport operator.

Finding (7): In the GPS ground-vehicle navigation project, a project has been initiated to evaluate current technologies, provide a list of implementation and operational recommendations, and to provide cost estimates for equipment procurement. The subcommittee found that the research currently underway is well executed.

Recommendation: The Subcommittee recommends that the research team work with the Airport GIS program to develop future technology / system requirements (e.g. maps in vehicle display). The GPS ground vehicle research team is also investigating the challenge of how the equipment might provide zone / proximity alerts to the driver of a vehicle operating on an airport with a complex geometry. The subcommittee recommends that human factors issues should be considered when determining how often a driver is alerted. A system that provides constant alerts may give drivers a false sense of security and cause them to not be as vigilant as they otherwise would be when traversing an airport.

Finding (8): The subcommittee is pleased that the research aimed at developing an airport and airspace simulation model is being coordinated with the Airports GIS program staff. The main elements of this project are to: build the airport database; improve the digitization of airports; develop a process to use PDARS data; and build airport latitude and longitude data in a way that is consistent with the directives of FAA Advisory Circular 150/5300-18B (Airport Data – Geographic Information System Standards).

Recommendation: The Subcommittee recommends that the FAA follow-up with a vendor who may have already been able to incorporate ASDE-X and PDARS data into typical simulation software.

Finding (9): Pavement research continues to provide benefits to the airport industry.

Recommendation (a): In the area of Alkali-Silica Reactivity (ASR) testing, the subcommittee recommends that the existing research projects construct additional slabs of known non-reactive aggregates that have been appropriately screened with the proper ASTM testing protocols as a control group. This approach would provide data to indicate if the anti-icing agents are causing a deleterious reaction or exacerbating the deleterious reaction of inferior materials. Preliminary research through the IPRF indicates that improper screening of aggregates may in fact pose a greater threat to deleterious reactions in concrete than the anti-icer itself.

Recommendation (b): Additionally, the subcommittee recommends that the Technical Center consider research into the load-transfer effectiveness of dowelled and un-dowelled pavements. It is recommended the FAA consider constructing "dummy" contraction joints following the specifications listed in FAA Advisory Circular 150/5320-6E, and measure the load transfer across these joints. This data would also provide engineers valuable information when designing and specifying joint types for airfield pavements. The national costs for using steel dowels in pavement construction are rising, and research into this subject may help airport operators reduce future construction costs by eliminating unnecessary design features.

Subcommittee on Aircraft Safety

The Subcommittee on Aircraft Safety (SAS) of the FAA Research, Engineering and Development Committee (REDAC) met at MITRE's Center for Advanced Aviation Systems Development on March 9-11, 2010. The meeting included tours of the CAASD Integrated ATM Lab with demonstrations of CDTI/ADS-B Applications and Runway Incursion-Flight Deck-based Direct Warning. The primary purpose of the meeting was to review FY12 Research Requirements and included detailed reviews, "Deep Dives" into several research programs.

General Observations

- The SAS again found the presentations given by FAA managers and researchers to be of uniformly high quality.
- The method of summarization and content presentation of the many complex topics continues to improve and were readily comprehensible at a management level.
- The prioritization process of research proposals appears to be effective.
- The SAS believes that the portfolio content is substantially correct, but is concerned that several research programs lack a sufficient level of technical expertise to assure success.

- The SAS found no programs that should be eliminated.
- The extent to which FAA leverages the work and expertise of other government agencies, industry and academia continues to be an effective way to conduct relevant research.
- The SAS finds FAA to be extremely responsive in responding to subcommittee comments and recommendations.
- Specific Findings and Recommendations on individual areas of research reviewed and discussed by the subcommittee follow.

Finding (1): (Icing Program) The Aircraft Icing program is well defined and poised to deliver high value. The icing program has built important collaborative research relationships with other FAA programs, NASA, Canadian research organizations, European research organizations and the aerospace industry. This is to be commended as it will enable the FAA to expand its icing research portfolio and increase their impact by conducting collaborative research programs on high priority programs of mutual interest. The high ice-water content, engine icing program is such a high priority program and leverages many of these relationships. This program addresses the engine malfunctions due to ice crystals that have occurred on many commercial flights in convective weather primarily in the tropics. The Appendix C research including the work on 3D ice accretion and icing aerodynamics certification methods is well conceived and is important to the FAA mission of flight safety. This program is currently building an international coalition and research plan and this should be encouraged. Finally, aircraft icing is an important safety area where the FAA has significant interests and responsibility. The icing program has several high priority programs and very limited in-house expertise. They rely heavily on partners and grantee/contractors to manage their programs. Concern exists within the Subcommittee regarding the lack of FAA “bench strength” in this important area.

Recommendation: The FAA needs to continue to support the high priority high ice-water content, engine icing research program and support the Appendix C research on 3D ice accretion. The Subcommittee recommends that FAA review the current “bench strength” and take appropriate hiring action to assure continuity in technical strength well into the future in the aircraft icing research area.

Finding (2): (Weather In The Cockpit) The Weather in the Cockpit program appears to be on the right track using a gap analysis to help define the needed research requirements. A concern remains regarding the planned timing of research completion in 2015 intended to support the mid term NextGen implementation of 2018.

Recommendation: Assure the research deliverables are progressively released to enable industry to respond to them in formulating solutions to the Weather in the Cockpit imperative.

Finding (3): (Propulsion Malfunction Research) The Subcommittee found the planned Propulsion Malfunction research plan would benefit from deep engagement with engine and airframe manufacturers contributing their knowledge & expertise in this area.

Recommendation: The FAA should develop an industry partnership approach to assist & accelerate the Propulsion Malfunction research activity.

Finding (4): (Unmanned Aircraft System) The ongoing Unmanned Aircraft System research is urgently needed to define a path to permit safe operation of UAS vehicles in the NAS. Although this broad and difficult area has been hampered by several leadership and organizational changes in the past few years, the SAS has noted good traction in the recent past.

Recommendation: The Subcommittee recommends that the research sponsoring office & the research performing technical community continue to jointly refine the development of the research requirements and firmly establish the optimum path to achieve the important goal of enabling UAS operation in the NAS.

Finding (5): (ASIAS) The SAS found that the ASIAS research project has made significant progress and continues to be directly responsive to the need of safety analysts within the FAA and aviation industry. The subcommittee commends the work being done by MITRE CAASD and notes the increased degree of trust that has developed from ASIAS industry participants. ASIAS is clearly an integral component of a Safety Management System designed to bring today's safe aviation system to even higher levels of safety.

Recommendation: The SAS recommends that the FAA continue efforts to increase the number of airline participants and ensure that the ASIAS program continues to be a safety tool that is increasingly used to identify emerging risks before they become potential safety issues.

Finding (6): (Conduct of Research and Development) The SAS commends FAA for the advancing the development of a monthly reporting template to monitor progress in achieving measurable milestones and deliverables of all research activities in the Aviation Safety R&D portfolio.

Recommendation: The SAS recommends that FAA adopt a monthly reporting template and move quickly to implement it across the entire Aircraft Safety R&D portfolio.

Finding (7): The SAS continues to believe that successful conduct of research and development demands a series of sponsor-performer arrangements and conditions, all of them often urged on FAA by various groups.

4. Although a partnership in the execution of the research including shaping the approving methods and products expected is required, it is essential that the responsible sponsor organization have a strong voice not only in the setting of requirements – but also the funding authority.
5. The responsible sponsor organization must have a strong voice in the design and performance of the work, and must clearly monitor and have oversight of the work so that meaningful results can emerge.

6. The responsible sponsor organization must itself have the technical and management skills to fully understand and monitor the work of the performing organization – whether it is within or outside the FAA. While this cadre of expertise may need to be small, it must be able to understand and guide the work. Experience in R, E&D has shown that in the absence of such skills in FAA, the results are almost always poor.

Recommendation: The subcommittee recommends that FAA review the structure of the Aircraft Safety Research Program to ensure that the current roles of the sponsor and performing organizations are best suited for successful conduct of safety research. This review should include roles related to authority over and management of research funds.

Finding (8): (The Proper Role of TCAS) TCAS was intended to be an independent safety net in the ATC system. It was recognized from the beginning that the independence would not be total, since TCAS depends on the Mode S data link and the barometric altimeter. However, every attempt was made to provide as much real separation and independence from the ATC system tools as possible.

Recommendation: The SAS believes that as the community explores the closer integration of TCAS with other systems such as ADS-B and aircraft autopilot systems the potential safety risks associated with the reduction of independence need to be carefully considered. The SAS requests further detail from the FAA on this issue and how these potential safety risks are assessed.

Finding (9): (Structural Integrity/Composites) The Subcommittee on Aircraft Safety considers the research effort on **Structural Integrity/Composites** to be a model program. With a very small but clearly expert internal FAA management resource, this effort leverages the work and expertise of other government agencies and the industry on a critical safety matter. The focus on developing standards and guidance based on theory and practical experience, and the emphasis on providing usable guidance to FAA people, and many others, makes this a valuable example of how to do things right. The Subcommittee endorses the proactive approach to composite structure maintenance and inspection being executed. Staying ahead of the composite aircraft fleet is very important to assure future continued operational safety.

Finding (10): (FAA Facilities and Laboratories) The Aircraft Safety Subcommittee wishes to reemphasize an earlier recommendation on FAA funding and support for facilities and efforts which serve not only FAA but are also resources for the world. These facilities and efforts – such as much of the work of the Civil Aeromedical Institute and the William J. Hughes Technical Center – have a world-wide impact and contribute in important ways to the eminence and high reputation of FAA. Support of these efforts and increasing public knowledge and understanding of these activities is critical to the success of research activities in support of NextGen, self-separation, human factors, reduction of spacing between parallel runways, RNP, etc. Even in difficult budget periods, adequate funding must be provided not only for the modernization, care and feeding and operation of existing facilities but funding must also be provided to ensure that laboratories with required capabilities to support future research are available when needed. Precedence for the use of F&E funding for the procurement, upgrade, repair or operation of facilities and equipment at the Tech Center and CAMI has been established. The procurement of equipment for CAMI, the support of the Pavement Test Facility

and repair of R&D facilities at the Tech Center are examples recently cited by Tech Center Counsel.

Recommendation: The subcommittee recommends that FAA seriously explore creative ways outside of the RE&D budget to support the modernization and operation of existing laboratories and the establishment of laboratory capabilities to support future research requirements.

Finding (11): (Software and Digital Systems) The Software and Digital Systems Program appears to be moving in the right direction to meet the near-term and mid-term needs of the NextGen program. A notable accomplishment in FY 10 was the development and submission of a SDS comprehensive research plan which is intended to consolidate the SDS research planning that has taken place and show how FAA objectives are being met. The baseline regulatory support programs in addition to the FY12 research requirements provide a solid context within which to assess the research initiatives. It was also noted that the research currently planned will not meet the anticipated far-term needs of the NextGen.

Recommendation: The FAA needs to continue to support the SDS program and ensure the staffing and resources needs are adequate to meet the research needs. In order to address NextGen far-term requirements the SDS program should develop a joint research plan with NASA to ensure the far-term research being done by NASA will transition to the FAA and address the complex system integration expectations of the NextGen by 2025.

Finding (12): The SAS remains concerned about whether FAA's internal core capability can successfully carry out the Software and Digital Systems research plan. It was noted that the Chief Scientific and Technical Advisory positions for Aircraft Computer Software and Advanced Avionics remain vacant. It was also noted that one hire was made at the Tech Center in FY 2010 which puts the staff even with the FY09 with 1 additional hire planned for FY11. The SAS strongly asserts that the absence of a critical mass of talent in this program will lead to unsatisfactory research results.

Recommendation: The SAS again recommends that FAA aggressively take action to acquire the specialized expertise to support this critical program.

Finding (13): (FAA Core Research Capability) The SAS is concerned that several research programs lack a sufficient level of technical expertise to ensure success. The Icing Program and the Software and Digital Systems Program are obvious examples.

Recommendation: The SAS recommends that the FAA Sponsor Organization and Performing Organization jointly undertake a study to quantify the core capability required for both organizations to support all critical research programs and take steps to obtain FAA support to acquire the needed core capability.

Finding (14): (The Impact of Computers/Automation on Aircraft Safety) The SAS noted the challenges related to obtaining the optimum balance between the role and power of the pilot and of the automation systems on the aircraft along with the optimal method of information display to the pilot. The challenges increase as computers and Automation Systems become more

powerful. These same challenges and issues apply to the increasing levels of automation being introduced into the Air Traffic Management Systems on the ground.

Recommendation (a): The SAS recommends that FAA consider the need for additional research to ensure that the optimum balance between the power of the pilot and of the automation systems.

Recommendation (b): The SAS recommends that FAA consider the need for additional research to devise better, more fool-proof methods of testing automation systems for fault detection as well as for single and multiple fault survivability.

Finding (15): (Rotorcraft Research) The Subcommittee is pleased to see the rotorcraft research work being conducted in a coordinated effort with the Army as was recommended. The research supporting addressing tiltrotor safety assurance approach is very much needed.

Recommendation: The Fly-by-Wire Research work being done in support of the certification approach for the advanced tiltrotor Bell 609 aircraft should be accelerated to assure it is rapidly transitioned to guidance and regulatory material.

Finding (16): (FAA Center of Excellence for General Aviation Research: CGAR) The SAS continues to be impressed with the research activities at the COE for GA Research. The CGAR is another example of how cost sharing arrangements, complemented by FAA management competence and leadership, can be an effective way to conduct relevant research and advance the knowledge of FAA staff.

Recommendation: The FAA needs to continue to support relevant research activities at CGAR.

Finding (17): The UAS/Conventional Aircraft certification requirements matrix developed at a COE appeared to be of value to the UAS community. It was not clear as to why the matrix is not yet publicly available.

Recommendation: The subcommittee requests further details on the public availability and intended use of the UAS matrix.

Subcommittee on Environment and Energy

Finding (1): In reviewing future year budget estimates for environmental research, the subcommittee noted that the proposed funding levels are essentially flat for the years 2013 and beyond. Since, as a practical matter, the costs of doing business in these years will increase, this “flat-lining” leads to an effective reduction in research funds available while the research needs and complexities are increasing.

Recommendation: While the subcommittee understands the problems in projecting out-year funding levels, we recommend that out-year budgets at least provide a factor for inflation in order not to project a practical decrease in funding levels. In addition, the Agency should

attempt to communicate to the subcommittee its actual needs in future years so effective advice can be given.

Finding (2): The subcommittee noted the progress being made in the development of a new noise roadmap. At the same time, it appears that there is a funding shortfall that has the potential of slowing progress in this area. Specifically, there does not appear to be funding to conduct required community surveys.

Recommendation: The Office of Environment and Energy should work with the Office of Airports to determine whether funding in the airports research program to fund the \$1.5 million necessary to conduct community noise surveys is available.

Finding (3): The subcommittee notes, and is encouraged by, the continuing cooperation with NASA in a variety of environmental research areas.

Recommendation: The subcommittee recommends that the growing cooperation between the FAA and NASA in the area of environmental research must continue and expand. This expansion is especially important in the Agency's relationship with NASA's Airspace Systems and Fundamental Aero programs.

Finding (4): The subcommittee notes that the FAA and the EPA appear to be better engaged in addressing aviation environmental issues.

Recommendation: The subcommittee recommends that cooperation between the FAA and the EPA should expand. Specifically, the FAA should request that the EPA actively participate in the REDAC Environmental Subcommittee.

Finding (5): The subcommittee finds that the cooperation between the Office of Environment and Energy and ATO is an excellent example of breaking down barriers between Agency organizations. One specific area of cooperation that merits mention is the requirement for NEPA compliance in the modernization effort. The subcommittee appreciates these continuing efforts to integrate environmental considerations into operational decisions.

Recommendation: Building on the growing relationship between the operational and environmental components of NextGen will be crucial as the Agency moves forward with its modernization efforts. This intra-agency cooperation should therefore continue and expand. In order to facilitate the subcommittee's assessment of ongoing environmental research needs, we recommend and request that ATO provide a briefing to the subcommittee on exactly how environmental considerations are being integrated into the NextGen models.

Finding (6): AEE's research efforts to support the ICAO/CAEP process continue to be a priority. The issues being considered in the ICAO process are increasingly complex and need to be informed by good science. Communication of these efforts to the stakeholder community is essential, especially the explanations of how the research underpinnings are integrated into the formation of the U.S. policy.

Recommendation: The FAA needs to continue communicating strategic planning and the status of research efforts that inform environmental policy decisions. Specifically, it is recommended that the FAA should conduct a workshop for stakeholders, including the international community, to communicate the status and underlying assumptions of the use of the Agency's Aviation Environmental Portfolio Management Tool (APMT).

Finding (7): The PARTNER Center of Excellence appears to be maturing and making excellent contributions to the environmental research effort. We continue to remain concerned about proposed Congressional language in the FAA Reauthorization bill that calls for the establishment of a new Center of Excellence on alternative fuels. The existing PARTNER structure already has the capacity to conduct this research.

Recommendation: If an additional Center of Excellence is established, existing COE's should be encouraged to compete for selection and the Agency should consider the additional costs associated with administering a new COE when conducting its source selection.

Subcommittee on Human Factors

Background: Previous recommendation and FAA response letter dated January 29, 2010.
Recommendation: Continue to place strong emphasis on human factors issues, as reflected in the Human System Integration Roadmap

FAA Response: We agree that the Human System Integration (HSI) Roadmap is pivotal to addressing human factors issues for NextGen. ATO-P Office of Human Factors Research and Engineering (AJP-61) is identifying and tracking areas for improvement in the next annual update to start in the second quarter of FY 2010, and will continue to keep the Human Factors Subcommittee abreast of these activities.

Finding (1): As noted above in the FAA's response to this recommendation, human factors is receiving gradually increasing emphasis as the FAA moves forward with NextGen. In particular, this evidence was provided by:

- A sustained high budgeting level in critical human factors research areas, both within Flight Deck and Air Traffic , particularly with regard to self separation including the various options for delegating responsibilities to the flight crew, and air-ground integration (and their implications for human-automation interaction), as well as the F&E budgeting for the controller workforce.
- The January meeting, held with Steve Bradford, that initiated discussions into key needs for R,E & D in NextGen to address human factors issues within.
- The human factors portfolio about which we were briefed provides a very suitable vehicle for integrating and disseminating HF research to the wider NextGen design community.
- The emphasis in the FAA's response on understanding pilot and controller response to off-nominal events.

Recommendation (a): Continue the progress toward deeper involvement of human factors in NextGen planning and research. We believe that continued development of the HSI roadmap is a major vehicle for making this happen. However, this planning effort must also extend beyond the research planning focus of AJP-61 to an extensive review of NextGen plans for the need to address human factors issues. This review should consider where assumptions about human performance in future NextGen operations establish technical and programmatic risks that need to be mitigated by a risk management strategy that preemptively identifies and seeks mitigations to the most likely and significant risks. Likewise, this planning effort must plan for the key decision points and critical path items contingent upon addressing human factors in NextGen development.

Recommendation (b): We recommend that the NextGen I&I office (AJP-A) vigorously pursue the appointment of a full time position for Chief Systems Engineer for-Human Factors. This position must be given the responsibility and authority to examine NextGen plans for situations where human factors considerations must be addressed, both to meet the NextGen plans as articulated, and to mitigate technical and program risks established by assumptions about human performance. In addition, this position should serve to foster the appropriate application of human factors knowledge throughout NextGen developments, as well as identifying areas needing research. Thus, this position will additionally serve as a vital link between the research focus of AJP-61 and development and engineering aspects of NextGen developments applying human factors. We recommend that AJP-61 personnel have input in assessing the qualifications of potential hires for this position

Recommendation (c): As we have in the past, we recommend that every effort be made to select a permanent replacement for the head of AJP-61, following the departure of Karlin Toner.

Recommendation (d): As we have in the past (September Rec 1c), we recommend that the subcommittee be briefed on two critical areas with HF components (but outside the funding lines of AJP-61): (1) Human factors aspects of the weather program by AJP-68, and (2) concepts of operations and research by AJP-66. We recognize that such briefings could not be scheduled for the recent March meeting because of time constraints.

Recommendation (e): Assure that the new human factors research portfolio makes contact with (articulates in general form) all of those HF efforts within the FAA that lie outside of the direct funding line of AJP-61.

Recommendation (f): We recommend that the current FAA research program continue to follow the guidance of the Administrator's response, and insure that human in the loop simulations include off-nominal events, and focus on evaluating pilot and controller responses to those events.

Background: Previous recommendation and FAA response letter dated January 29, 2010.
Recommendation: Continue the excellent progress of collaboration with NASA's Integrated Intelligent Flight Deck project, within the Aviation Safety Program.

FAA Response: We agree and AJP-61 will continue collaboration to ensure involvement with the NASA Aviation Safety Program's Integrated Intelligent Flight Deck Project with particular emphasis on applications such as merging and spacing and closely spaced parallel operations. We will also emphasize transitioning NASA research products to FAA for integration as part of our NextGen Air Ground Integration research efforts.

Finding (2): We were fully satisfied with the FAA's response that such collaboration remains in force and is expanding. In particular the research portfolio of Flight Deck NextGen projects reflects a very high level of coordination with and FAA funding of research performed by NASA that leverages their expertise and resources.

Recommendation: Continue on-going collaboration in the areas of Air Traffic and Airspace Systems. Of note out of FAA-funded reimbursable tasks to be completed by NASA, we hope that the FAA will soon exploit the results of the task generating recommendations regarding ATC priority research issues for NextGen.

Finding (3): The subcommittee received a series of excellent briefings from human factors researchers at MITRE, regarding HITL simulations of various concepts that will appear in NextGen. From this briefing it appeared that the FAA, through AJP-61 has taken a good step forward for keeping closely in touch with the conduct and products of this high quality and NextGen-relevant human factors-related research. This briefing also provided an opportunity for AJP-61 staff to learn about MITRE CAASD research in related areas, and establish direct contacts.

Recommendation: The FAA (via AJP-61) should continue the coordination and look for opportunities to progress the coordination with MITRE, as much of it appears to fit directly into issues within the HSI roadmap, and has profound implications for future concepts (e.g., potential increase in controller workload, resulting from the more rapid updates associated with ADS-B driven displays.)

NAS Operations Subcommittee

Observation: The subcommittee held its meeting at the MIT Lincoln Laboratory, and heard briefings on MIT/LL's surveillance research, weather forecasting research, weather-ATM integration research, and air traffic control tower research. Additionally, briefings were given on the FAA's PARTNER program, the FAA's RED budget, and the FAA's NAS Operations PPT research. The MIT/LL briefings were at an excellent level of technical depth, and gave the subcommittee members unusually clear insight into the way some of this work for the FAA is being conducted.

Finding (1): The committee was briefed on two programs which will require new approaches to evaluating safety: Unmanned Aircraft Systems (UAS) Airspace Access, and Staffed NextGen Tower (SNT). Both introduce new operating paradigms, with new and significantly different human roles and responsibilities. Overly conservative requirements, with insufficient analysis, will inhibit the addition of new capabilities. The subcommittee reaffirmed the statement in the October 19, 2009 REDAC letter to the Administrator that "there does not appear to be a clear

system-level process for managing risk and arbitrating safety requirements for new systems or procedures.” At the REDAC meeting in April, the Chair learned with pleasure of the “lean” process instituted by AVS and ATO as an excellent first step to have such a process.

Recommendation: The NASOPS subcommittee requests a briefing to the full subcommittee on the new processes for assessing safety levels developed by AVS and ATO.

Finding (2): The budget briefing contained the RED budget request for FY11 and one line (BLI 1A08) from the F&E budget devoted to NextGen, but information from other CIP BLIs, such as those for the NextGen Solution Sets, was not forthcoming. Clearly, R&D (as defined by OMB) for NextGen is being performed in these other lines (e.g. RWI). Without complete budgetary and programmatic context of the FAA’s R&D program, NASOPS is unable to give balanced advice on the overall allocation of R&D efforts and whether the most important work is being undertaken. NASOPS has raised this issue before.

Recommendation: All Research and Development for NextGen should be presented to NASOPS, which would include that performed in funding under Solution Sets, Transformational Programs, and/or cross-cutting R&D

Findings (3): The majority of NextGen R&D presented emphasizes Part 121 NextGen implementation, with little attention focused on on-demand commercial air carriers, air taxis, charter, business, corporate, private and other GA operators. Without addressing the unique aspects of these operators, NextGen implementation may be delayed and opportunities for innovation will be missed.

Recommendation: Develop an overall R&D strategy, identifying top research issues and key decisions the research will drive, for all classes of aviation, and recommend the overall strategy for fostering and maturing research and development for both mid-term and long-term time periods. The strategy should include R&D focused on activities in Parts 135 and 91, as well as UAS and rotorcraft operations.

Findings (4): The FAA’s R&D investments are weighted to enable the mid-term implementation of NextGen capabilities. The lead for longer term NextGen outcomes require sustained investment beginning now to ensure timely implementation. The subcommittee is concerned that these areas are inadequately funded, and that the FAA is not planning to leverage innovation in the private sector (e.g., using incentives such as the “X prize”, public-private collaborations, or the establishment of notional performance requirements) for these long-term objectives.

Recommendation: This R&D should capitalize on innovation from the private sector, partly by including consideration of how to incentivize users to equip (e.g. “first adopters”).

Finding (5): There remains a need to better understand the overall context of the research needs and fit of the Concept Development work being done relative to NextGen development. Additionally, this area has been cut in funding, contrary to previous recommendations.

Recommendations (a): 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 connecting the research to the solution sets, infrastructure roadmaps (e.g. automation and human factors), and OI's is needed.

(b) As was recommended by NASOPS previously, more resources should be devoted to this activity. Current funding does not permit far term concept development (e.g. > 2018), or research on concepts not currently in the portfolio (e.g. dynamic airspace resectorization, TFM evolution ConOps, 4-D trajectory management.)

Finding (6): The MIT/LL briefings were a "deep dive" into weather forecast technology and the interaction with TFMM mechanisms. The committee was very pleased with the quality of the work. The evolution of weather research at MIT/LL, NOAA, ESRL, and NCAR into development of useful products now including CoSPA is a testimonial to the value of this research, and MIT/LL staff did an excellent job noting the inclusivity of efforts among these labs.

These briefings showed progress in addressing some of the recommendations of the WAIWG by the work at MIT/LL, but the remainder of the weather-ATM integration R&D being accomplished elsewhere needs to be addressed in this regard. For example, the committee was told that the FY10 funding for the RWI and NNEW areas has been delayed due to internal FAA processes.

Recommendation: NASOPS will request a complete FAA weather R&D briefing, with a strategy for addressing the WAIWG recommendations and equivalent levels of detail for work being funded elsewhere, at an upcoming meeting.

Finding (7): Traffic managers are concerned with managing the scarce NAS resources to best meet the needs of NAS users. They have become specialized in their roles as managers of the NAS assets and flows. This is a very different job from that performed by controllers, but traffic managers are nonetheless selected from the ranks of the Air Traffic Controllers and were originally selected with the controller skill set in mind. We were encouraged to hear that the FAA human factors research is exploring (mid-term) NextGen controller selection criteria and training, but, there is currently little or no human factors focus on the unique and growing role of Air Traffic Managers.

Recommendations (a): Initiate a human factors research program to identify the specific skill set required for Air Traffic Managers in the present and 2018 NextGen systems. This research should culminate in selection and training standards for Air Traffic Managers.

(b) Initiate a research effort to identify the skill sets required for Air Traffic Controllers and Airspace Managers for 2025 and beyond, since the people who will be hired in the next 5-10 years will still be in these jobs in that time frame, but the role of controllers airspace managers will undergo significant changes in that timeframe.

Finding (8): NASOPS was impressed with the breadth of projects in the FAA's COE E&E program PARTNER. Overall funding has increased to \$8M for the current FY, and the funding appears to be stable. A strong cadre of partner universities participates in PARTNER with good support from industry in the projects. NASOPS did not, however, receive sufficient insight into the overall program to judge quality and portfolio adequacy.

Recommendation: NASOPS requests "deep dive" briefings on PARTNER to (a) understand how it fits into the overall E&E program, (b) assess ATM-related projects being conducted, and (c) understand PARTNER processes for technology transfer