

T. WILSON PROFESSOR OF
AERONAUTICS AND ASTRONAUTICS
DIRECTOR
INTERNATIONAL CENTER FOR AIR TRANSPORTATION

ROOM 33-303
77 MASSACHUSETTS AVENUE
CAMBRIDGE, MASSACHUSETTS 02139
(617) 253-2271 FAX (617) 253-4196
E-MAIL: rjhans@mit.edu

March 26, 2008

The Honorable Robert Sturgell
Administrator
Federal Aviation Administration
800 Independence Avenue, SW
Washington, DC 20591

Dear Administrator Sturgell:

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

The full committee also made the following general observations which we would like to bring to your attention:

NEXTGEN Requirements Flow Down - Research efforts to support NEXTGEN are hampered by the lack of clear requirements flow down sufficient to define the research requirements and priorities. The JPDO Integrated Work Plan V 0.2 is unfocused, unprioritized and does not clearly define key research questions or development goals.

New Standards for New System Capabilities - A critical component of system modernization will be the development and approval of new standards and operating procedures which reflect the capabilities of the NEXTGEN infrastructure. This has been highlighted by the REDAC focused study on Separation Standards and is emerging as an issue in ADS-B transition. In addition there appear to be near term opportunities to improve system capability such as reduced separation standards for ILS/RNAV and RNAV/RNAV paths to adjacent and nearby airports (e.g. LGA and JFK). In order to be most effective this will require an integrated approach to connect R&D with standards development. This effort should include AVS and ATO and should not be constrained by organizational barriers.

Weather Information - Weather is a key factor influencing both the safety of flight and the performance of the NAS. The rapid growth of information distribution channels and weather products creates a dynamic environment for weather information in the cockpits and ATC facilities. The agency should encourage weather products which support pilot, controllers, and dispatchers while avoiding any adverse impacts. The REDAC supports a vigorous FAA weather research program with nodes in AVS focused on flight safety and in ATO focused on operational efficiency.

High Confidence Software Development Strategy - There is an increasing reliance on software based system for high criticality applications both in aircraft systems and in ATC systems. The current software development and maintenance processes are cumbersome, expensive and incomplete. The FAA is not unique in this regard as other federal agencies and industries struggle with issues of software criticality. The REDAC suggests that this be a priority area both for FAA internal development and for inter-agency coordination.

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

REDAC Recommendations for FY 2010**Subcommittee on Human Factors**

The subcommittee offers the following recommendations.

- a. The FAA needs to develop a clear roadmap of NextGen Human Factors challenges which elaborates and prioritizes required human factors research per solution set. These research requirements should be linked with current and planned HFRE efforts as well as priorities for workforce training and design. Gaps and opportunities for research progress and impact on FAA mid-term capabilities should be identified with cost and schedule projections.
- b. Increased hiring of experienced research managers is urgently needed to meet NextGen planning and execution challenges. Current management shortfalls are limiting the ability of the HFRE group to staff key planning and development meetings with NextGen partners.
- c. Increased hiring of experienced human factors research and engineering staff at the FAA Tech Center is urgently needed to address emerging, critical research challenges in air-ground integration. There is a specific need to acquire research expertise in flight deck human factors to complement the outstanding existing competency in NextGen air traffic management human factors.
- d. In order to effectively address Human Factors issues within the timetable for NEXGEN, the FAA needs to aggressively augment and leverage available Human Factors knowledge, resources, and facilities across different sectors of the aviation Human Factors research community.
- e. Increased emphasis must be placed on computational modeling and simulation as part of formal analytic methods for NextGen systems design and evaluation.

Subcommittee on Airports

Recommendation 1: The Technical Center should continue research on Foreign Object Debris (FOD) radar to accelerate development of performance standards for utilization of this new technology on airports.

Recommendation 2: The ongoing fire research on the double deck mockup of a new large aircraft at Tyndall Air Force Base should continue as a high priority. It is important that this research develop answers to questions if changes to the quantity requirements of fire fighting agent are needed for airports receiving new large aircraft service such as the A-380.

Recommendation 3: The Subcommittee strongly supports the FY 2010 initiative to start development of a visual aid test bed facility. This will significantly increase the ability of the Technical Center to easily configure and install prototype lighting systems for testing and evaluation.

Subcommittee on Aircraft Safety

Overview: Process-specific Recommendations

Recommendations: (note recommendations 1 and 1a are made jointly by the Safety and NAS Ops Subcommittees)

- 1) The FAA should ensure that clear, detailed requirements for all NextGen R&D are defined and that a transparent and effective means is provided for their flow-down to R&D program planning and execution. The Subcommittees offer assistance to the FAA in developing and implementing this process.
 - a. Subcommittees recommend that the FAA immediately jumpstart this requirements generation process by prioritizing needs based on NextGen programmatic risk, starting with the 183 research issues listed in the NextGen Concept of Operations (ConOps), and focusing FAA research at addressing the most critical issues.
- 2) The FAA and NASA should jointly develop clear and actionable integrated roadmaps spanning all NextGen-required safety R&D and other safety-related R&D. The roadmaps should identify timelines, deliverables, and decision and transition points for the R&D's insertion into infrastructure or regulatory products. Absent a more mature description of research needs, the Safety Subcommittee suggests that the 183 research issues from the ConOps be used as the basis for launching the NextGen-related roadmap process.
- 3) The Safety Subcommittee recommends that the FAA update the TCRG planning process to:
 - a. Improve communications & transparency with stakeholders.
 - b. Expand the planning process to ensure the process extends beyond the AVS boundaries and into other key organizations such as ATO. The process should recognize the full slate of safety-related R&D being considered and ensure maximum synergy is developed in response to requirements.
 - c. Monitor the performance of program elements to agreed-upon timelines and product delivery expectations, including well-defined success criteria. Multi-year funding profiles should be developed and used to ensure programs that are performing well towards their defined success criteria remain on track. However, programs that are not achieving the necessary results should be modified, redirected, or terminated.
 - d. Ensure top-level NextGen requirements are clearly flowed into the process and that well-integrated programs are developed to address them.
 - e. Identify key priority safety themes based on data and clearly articulated emerging issues/areas that cut across TCRGs and other FAA organizations. Develop integrated programs constructed to make significant impact on these critical areas. Possible areas for focus include: advanced software and digital systems integration, reducing general aviation accidents related to inadvertent flight into IMC conditions, improving runway safety, or identification and assessment of emerging risks. These areas are notional, however. The FAA should conduct a thorough review to determine the actual listing of critical areas based on current data and an understanding of emerging issues/areas.
 - f. Identify key core competencies and capabilities needed for the FAA research organization. The FAA should ensure that a means is developed to advance these key core competencies and capabilities beyond the current state-of-the art. Absent a more effective means, the FAA should consider dedicating a percentage of the overall R&D budget this area.

Program-specific Recommendations

- 4) The safety subcommittee recommends that the FAA immediately identify clear customers and associated requirements for the weather-related safety R&D and ensure that its program is fully aligned to these needs. Immediate adjustments should be made as necessary to the 2008 – 2010 weather program to ensure the program is fully aligned to customer-driven requirements and success metrics, and that actions are taken to implement its products into use.

Software and Digital Systems

- 5) The Safety Subcommittee recommends that the complex software and digital systems integration area should be significantly elevated in priority and identified as a key safety theme. The subcommittee recommends that a comprehensive and integrated program should be developed and appropriate resources allocated to springboard the FAA to a leading position in complex software and digital system safety.

Fatigue and Lining-related Proposals

- 6) The Safety Subcommittee recommends that the RS-10-04 and SIM-10-02 program elements be terminated and the resources for these efforts be allocated to other efforts. The Safety Subcommittee further recommends that the FAA certification organization determine if guidance material is required for the restricted category rotorcraft community and the fixed-wing general aviation community on acceptable means of compliance related to these issues. If so, the FAA should issue this guidance to the respective communities to enable them to perform the required work.

Subcommittee on Environment and Energy

The subcommittee identified the following specific issues as matters to bring to the attention of the Administrator.

Issue 1: The subcommittee noted that the Fiscal Year 2010 budget very clearly reflects the shifts in priorities recommended by the subcommittee to support NextGen. The program is well balanced and the right priorities and projects proposed.

Recommendation 1: For solutions to become viable, the subcommittee recommends that the environmental research budget grow to the levels suggested in the NARP (\$35M in RE&D, \$20M in ATO-Cap) by 2011.

Issue 2: The committee feels strongly that procurement competition is crucial to ensure excellence. Members feel that the Center of Excellence (COE) process – which was competitively selected – has proven to be a successful way to perform quality research and should continue.

Recommendation 2: The committee recommends that, as the resources grow, the FAA ensure that performers are competitively selected.

Issue 3: The subcommittee noted that the Partnership for AiR Transportation Noise and Emissions Reduction (PARTNER) Center of Excellence (COE) had made substantial progress addressing environmental issues since its inception about four years ago.

Recommendation 3: The subcommittee recommends that FAA continue supporting research through PARTNER at a robust level.

Issue 4: The committee noted that there are many areas of noise research that need to be reviewed/assessed to address emerging topics and establish the research requirements to deal with these issues

Recommendation 4: The subcommittee recommends that the FAA put together a draft of a comprehensive integrated noise research plan and brief to the subcommittee in August.

Issue 5: The subcommittee commended the Commercial Alternative Aviation Fuels Initiative (CAAFI) process and noted the tremendous progress made in alternative fuels, particularly qualification and assessing environmental impacts.

Recommendation 5: The subcommittee recommends that the FAA continue to carefully consider the life cycle emissions/environmental impact of alternative fuels.

Issue 6: The committee noted that the climate aspects of the Aviation environmental Portfolio Management Tool (APMT) tool are very reliant on emerging science. It is important that developers continue to incorporate the latest science and improvements that could be made as appropriate. It will be important to not treat APMT as a black box, with a need to be well aware of existing uncertainties and gaps in any uses of the tool.

Recommendation 6: The FAA needs to ensure that the latest scientific advice and sound uncertainty analyses are incorporated into APMT. The subcommittee asked for a briefing on the peer review to date of APMT and plans to continually improve the fundamental science of APMT. The subcommittee also asked for a briefing on how uncertainties are treated.

NAS Operations Subcommittee

The subcommittee offers the following overall comments.

With respect to the R&D Program in the OEP to support NextGen, the subcommittee agrees that facilitating NextGen should be a major focus of the R&D program. However, how this facilitation is being done was not clear because the R&D program elements were not clearly mapped to NextGen relevance. The linkage between the research being planned and the actual research requirements (from either the OEP or the JPDO's Integrated Work Plan (version 1) was not clearly defined. In addition, the NextGen system analysis is not yet detailed enough to allow a quantitative evaluation of the R&D efforts. Therefore, the subcommittee thinks that the FAA cannot realistically assess R&D project relevance. From the information presented to the subcommittee, it seems that additional investment is required in analytical tools to properly evaluate the system design. Some policy decisions need to be made for NextGen progress to be made. For example, the decision about how much responsibility the air vehicle pilot will have for separation is pivotal in determining future research directions and final concepts.

The research and development plans were presented to the subcommittee for each OEP solution set. The following are specific comments for each one presented:

Solution Set: Initiate Trajectory Based Operations

- The research content and funding appear appropriate for the shorter-term goals described, but the relevance to NextGen is limited to high altitude airspace.
- The Weather aspects of the described efforts are not integral to the air traffic management R&D effort, and this must be corrected.

Solution Set: Increase Arrivals/Departures at High Density Airports

- The research content and funding appear adequate for the shorter term goals described, although some near term gaps were noted:
 - FAA should pursue reduced separation standards for ILS/RNAV and RNAV/RNAV paths to adjacent and nearby airports, e.g., La Guardia and JFK.
 - Weather parameters for CAVS need to be defined to maximize operator benefits.

Solution Set: Increased Flexibility in Terminal Environment

- There appears to be overlap and interdependencies between solution sets that is not explicitly stated and could be overlooked. For example,
 - Enhanced Tower data link (NR7 for TBO) and Surface Management (NR2 for High Density Airports)
 - Pre-departure clearance in TBO and Pre-departure clearance in CATM)
- The project to provide surface surveillance data to aircraft, ANSPs and Safety systems is very important
- Wake Project achieved early successes
 - Wake Turbulence Mitigation for Departures
 - St Louis Closely-Spaced Parallel Runway Waiver Proposal

Solution Set: Improve Collaborative ATM

- The research content and funding appear adequate for the shorter term goals described

Solution Set: Reduce Weather Impact

- Weather ATM Integration research
 - Current CAASD effort should be accelerated for early field trials (2009)

- It is unclear if air traffic managers developers are participating in decision-making tools
- No evidence was presented of assessing required weather information requirements in terms of levels of system capability
- Legacy Aviation Weather Research Program (AWRP) efforts need to be reevaluated and reprioritized in a way to make them closer to NextGen needs and weather-ATM integration
- New Initiatives appear good
 - NNEW 4D Data Cube using NEO technology, to serve as the backbone of NextGen weather data
 - Weather to the Cockpit to reduce accidents; weather node
- Weather – ATM Integration needs models of how flight crews react to weather in flight
 - Collaboration with Safety Subcommittee Recommended

The NAS Ops Subcommittee offers the following recommendations:

1) The FAA should review their R&D programs for the items listed below that the subcommittee perceived as R&D Gaps. For those items that the FAA agrees are gaps, resolve how the gap will be addressed. The gap could be schedule based or resource based. In other words, the FAA may have some work being done in these areas, but it may not be of sufficient levels to meet the NextGen goals in a timely and complete fashion.

- The Subcommittee is concerned by apparent lack of the following research:
 - Probabilistic traffic flow management: Research that explores weather forecasts that both incorporate probabilistic outcomes and the anticipate impact on flows
 - UAS Impact on air traffic management: Research that explores the impact on controller workload, air traffic safety, flow efficiency/capacity, and potential new air traffic management procedures associated with more routine operation of UAS in controlled airspace
 - Operational requirements: Research that identifies all the activities and development needed to obtain approvals for the required NextGen policies, procedures, operations, or implementation of technology.
 - Equipage: Research that defines what system performance can be accomplished at various levels of equipage and equipage mixture, and what are the barriers
 - Policy: Research that informs policy changes necessary to achieve NextGen goals (e.g. equipage, first-come-first-served, avionics)

The NAS Operations and the Aircraft Safety Subcommittees jointly offer the following recommendations:

(2) The FAA should ensure that clear, detailed requirements for all NextGen R&D are defined and that a transparent and effective means is provided for their flow-down to R&D program planning and execution. The Subcommittees offer assistance to the FAA in developing and implementing this process.

(3) The Subcommittees recommend that the FAA immediately jumpstart this requirements generation process by prioritizing needs, based on NextGen programmatic risk, perhaps starting with a review of the 167 research issues listed in the NextGen Concept of Operations (ConOps), and focusing FAA research at addressing the most critical issues.