

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

May 2, 2005

The Honorable Marion C. Blakey
Administrator
Federal Aviation Administration
800 Independence Avenue, SW
Washington, DC 20591

Dear Administrator Blakey:

On behalf of the Research, Engineering and Development Advisory Committee (REDAC), I wanted to again thank you for your participation in the April 12-13 meeting.

Enclosed are the recommendations of the standing REDAC subcommittees on Aircraft Safety; Environment and Energy; Air Traffic Services, Airports; and Human Factors,

As you know, the REDAC has also been addressing several specific issue areas of importance to the agency.

- The Air Traffic Services subcommittee has been evaluating issues of technology transition in the National Airspace System to identify barriers to transition and recommend approaches to improve the transition process. I have forwarded their interim report to you under a separate cover
- The Human Factors subcommittee has been addressing issues related to the skills, training and needs of the next generation of the controller workforce in anticipation of upcoming retirement replacement needs. You heard the preliminary findings at the September 12 meeting. At your suggestion the subcommittee will continue and expand this effort.
- A working group led by Jerry Thompson of the Air Traffic Services subcommittee is investigating approaches to financing the modernization of the Air Traffic System.
- The JPDO advisory subcommittee led by John Hamre will continue to support the JPDO efforts at the strategic level.
- At the joint request of NASA (Victor Lebacqz) and the FAA (Charles Keegan) the REDAC and the NASA Aeronautics Research Advisory Committee (ARAC) will jointly review the relevant research and development programs and activities within the FAA in NASA in the context of the JPDO roadmaps to identify the degree of alignment between current research activities and the needs of the Next Generation Air Transportation System (NGATS).

The REDAC and the communities which the members represent committed to maintaining the health and viability of our air transportation system as we face the technical, operational and financial challenges ahead. We stand ready to help in this regard.

Thank you again for your interest and participation. I, and the other members of the REDAC, are available if you would like to discuss these, or other, issues in more detail.

Sincerely,

R. John Hansman
Co-Chair
FAA Research, Engineering and Development Advisory Committee

REDAC Subcommittee Recommendations for FY 07

Subcommittee on Air Traffic Services

ATS Subcommittee Recommendations On FAA/NASA Pursuit Of Major Core Technologies

The following are the ATS Subcommittee's six specific research and development recommendations. While safety and security are high on our priority list, capacity and productivity are our focus:

ATC Automation

There is increasing evidence that air traffic controllers are reaching the limit of what they can achieve in providing separation services to ever increasing volumes of traffic. Since we do not want to limit the growth of aviation artificially, we must dramatically increase research efforts to understand the architectures and functional definitions of more highly automated systems to support air traffic services. Research and development to address these issues has been initiated within NASA, but it is the considered position of this committee that this research must be dramatically increased, with complementary efforts at the FAA, if the country is to be able to respond to the projected growth in air travel.

A Seamless, Highly Fault-Tolerant System

Closely associated with the automation developments, but with a scope including the entire NAS CNS/ATM system, is the need for research and development to devise an integrated ATM system with less artificial separation between terminal, enroute, oceanic, and airport surface environments. Such a system might also include shared air/ground responsibility for separation, and must be viable in all weather and wake vortex situations as outlined in our recommendations below. An integral part of this work must be the development and implementation of a highly reliable, robust, and fault-tolerant ATM system. The resulting system may be distributed, centralized, or have some functions distributed and others centralized.

Weather Impacts to Aviation

The Subcommittee is keenly aware of a broad array of advanced aviation weather products that have been continually emerging from the weather research community under the auspices of the FAA weather research activity. To maximize the impact of these products, particularly in safety and capacity area associated with forecasts of thunderstorms, it is critical that these products are integrated with much greater emphasis to increase the effectiveness of the rapidly-developing air traffic system being developed and closely related to the ATO-P and JPDO activities.

Wake Turbulence Separation Reduction Operational Enhancement

Techniques to minimize the additional wake turbulence separation, beyond radar or visual separation at congested airports, are critically needed. A Wake Vortex avoidance system is needed, that predicts when weather conditions will produce "wake independent conditions" on arrival and departure paths.

Development of Rational Separation Standards

A serious research and development effort is needed to assess current separation standards and develop methods to safely accommodate blunders. The study should consider the use of time-based separation as a possible alternative to distance based separation.

Support for Research and Development

The successful development of these core technologies is clearly dependent on the availability of funding and commitment from the FAA, NASA, and CAASD. In light of the recent reductions in the NASA Aeronautics Program that have been reported in the press, the continued downward trend of research dollars within the FAA, and the reductions in budget for CAASD in the out years, the subcommittee is concerned that the research and development to support these critical core technologies will not be available in a timely manner. Therefore, it is recommended that the FAA executive leadership work with the JPDO in developing a compelling case to assure that the resources are made available to support the research to meet the need for increased capacity and productivity in the future.

Subcommittee on Airports

In its review of the Airport Technology Research program F/Y '05 projects currently underway and the proposed F/Y '06 projects, the subcommittee generally supports the proposed program and makes the following specific recommendations:

The development of the Engineered Materials Arresting System (EMAS) by the airport research program has contributed positively to the reduction of risk and aircraft damage in several overrun accidents to date. However, this successful system is currently available only through sole source procurement from a single vendor. The subcommittee urges the program to commit seed money to encourage other technologies or suppliers to participate in the further development and refinement of this highly valuable tool.

The recently completed assessment of the suitability of taxiway centerline lighting fixtures installed at 12.5 foot spacing on curved sections, as is currently required by FAA standards; instead of the 25 foot spacing allowed by ICAO standards indicated that the FAA-approved lighting fixture installed at the ICAO 25 foot spacing do not provide adequate guidance under low visibility conditions. However, the assessment did not address the underlying question of whether the use of an ICAO-specified fixture at the ICAO-specified spacing satisfies the visibility requirements. The subcommittee urges the program to continue this research to determine whether the ICAO standards and fixtures provide adequate guidance, while allowing a reduction in the spacing, with an accompanying reduction in installation costs for these very expensive lighting systems.

The subcommittee supports the development of an in-house pavement testing laboratory at the National Pavement Test Facility to reduce turn-around time for pavement quality

control tests and improve reliability of quality control of pavements constructed for destructive testing at the facility.

The subcommittee also supports a modest increase in the level of program staffing in order to adequately manage research contractors used in the program. However, it is our feeling that staff increases need to be related to actual increases in the level of funding in the program.

In the event that the requested higher funding levels are not achieved in the F/Y '06 budget, the subcommittee recommends that proposed modifications to the pavement test machine to evaluate 10-wheel landing gear and the development of lighting standards for vertical IFR landings be eliminated. Investigation of 10-wheel gear, while intellectually interesting, are required only for speculative aircraft designs, such as blended-body/wing concepts and for the AN-224 and certain military airplanes, that see only very limited service at US commercial airports. Development of vertical flight lighting standards for IFR operations will, at present, have application at only one heliport and could be deferred in the event of funding shortfalls.

The current joint program with DoD to develop a high resolution, low cost radar for the detection of birds in the vicinity of airports offers significant safety potential. However, the subcommittee is concerned that the focus of this research project seems to be more on the enhancement of existing bird hazard data bases than on the development of an operational tool to provide real-time warnings to air crews. The subcommittee urges FAA to address the human factors issues that will need to be resolved to put such real-time radar into the pilot/controller interaction at busy airports.

The subcommittee is concerned that substantial research effort is being proposed by the Technical Center to investigate issues relating to the introduction of A380 airplanes into service in areas that either do not lie within the airports line of business, or for which research has not been requested by the AAS sponsor. Issues such as the certification of the airplane to operate on 150-foot wide runways, cockpit forward visibility, the adequacy of upper deck evacuation systems and the need to provide second-level access for fire fighting will be resolved by the FAA Regulation and Certification line of business as part of the JAA/FAA aircraft certification process, now underway, and do not require research by the airports research program. Proposed research into the adequacy of the Modifications of Standards submitted by individual airports to accommodate A380 operations appeared to surprise the AAS sponsor, and seems not to be needed. The subcommittee urges that AAS and XXX develop formal statements of research needs in this area to eliminate any confusion over exactly what research is being requested by the sponsor.

Subcommittee on Human Factors

Human Factors in Maintenance and Inspection

Recommendation: The Human Factors Subcommittee endorses the appointment of the Chief Scientific and Technical Advisor in this area. He should work closely with the TCRG to ensure a well-developed implementation path from requirements generation, through research to implementation, as well as a balance between short-term and long-term research requirements.

Selection, Training and Staffing of Air Traffic Control

Recommendation 1: The Human Factors Subcommittee recognizes the urgency of the controller replacement problem, but also sees this as an opportunity for human factors research addressing controller job performance so as to better understand the effectiveness of introducing new technology and training methods. The Subcommittee recognizes the complexity of the problem with multiple layers of agreements/constraints, historical labor/management issues and facility-specific training needs.

Recommendation 2: The Human Factors Subcommittee appreciates the improvements in AT/SAT selection procedures and training programs. The Human Factors Research and Engineering Division should work closely with other offices such as systems engineering, workforce planning, and air traffic training to model the impact of future concepts of operation, technology, and procedures on controller staffing, selection and training requirements. The development of methods, tools, and processes for modeling the controller job is needed as part of that collaboration.

Recommendation 3: The predicted time sequence of retirements and replacements may lead to a system-wide saturation with trainees (developmentals) within the next five years. With a ceiling of 35% developmentals at each facility (with which we agree) specific facilities will exceed this level. A dynamic staffing model needs to be facility specific so that such situations do not occur.

Recommendation 4: The FAA should continue, and even improve, the culture of collaboration with the Air Traffic Collegiate Training Initiative Schools. This is one area of opportunity in the training process, as the controller workforce increasingly comes through these programs. This means propagating new technology and future requirements to these schools so that they can better prepare future controllers. The CTI training should be a preferred entry route into the controller training process.

Recommendation 5: The job of controller is socially embedded, uses new technologies and will continue to be critical to safety of the air traffic system. Successful improvements in productivity are more likely to come from collaborative socio-technical systems approaches than from confrontation over relatively minor personnel issues.

Subcommittee on Aircraft Safety

1. Last year, SAS recommended that aircraft safety research be moved from ATO's Operations Planning into, preferably, AVS or into an independent R&D organization. SAS was – and remains - concerned that the needs and priorities of aircraft safety research do not naturally align with ATO's primary mission of meeting demand for increased airspace capacity under the OEP and might consequently be accorded a lower management and funding priority than required to properly support the FAA's safety mission.

This mismatch between primary institutional priorities may have become even greater (between JPDO and safety research) with the recent assignment of one and the same individual to the dual positions of Director of JPDO and ATO Vice President of Operations Planning. While SAS fully realizes that it is the FAA's goal to achieve the necessary capacity increase while improving safety, it fears that the institutional goals and resulting management priorities of JPDO, independently of the director, may not always be fully compatible with those necessary for oversight of safety research. Whereas JPDO's extremely important brief is to define and implement the NGATS for 2025, it is the role of safety research to support the FAA's safety mission today and over the next few years, as well as long-term. However, the near to mid-term safety research needs are not inherently of primary concern to JPDO. Thus, SAS repeats its recommendation from last year that safety research oversight be placed within AVS.

2. The newly-established Center of Excellence for Airliner Cabin Environment Research (ACER) has assembled a strong academic research team and an impressive group of cost-sharing and actively engaged industrial partners. This is a clear indication of the recognition of the importance of its work. Its mission will take years to complete. While it is funded for at the next two years, it is an "above-target" program for '07. The research is sufficiently important, not least because of its potential public health benefits and its contribution to strengthening U.S. competitiveness in response to an ambitious European research program in the same area, that it needs to be continued in '07 and beyond. Continuation may require that the program be included in the base budget, and that the money would have to be taken from other base programs if earmarked funds were to become unavailable.

3. SAS continues to support Unmanned Aerial Systems (UAS) as an above-target program. The Subcommittee still thinks that the private sector is perceiving a significant emerging market opportunity and thus has a strong incentive to contribute to its success. Other government agencies, such as DHS and DOD, also have a major stake in a successful UAS and should contribute resources to its implementation.

4. The prospect of shrinking budgets for safety research at both NASA and FAA makes more urgent the need for effective collaboration between the agencies, including the establishment of an efficient technology alignment and transfer process. Also, the FAA needs to define a balanced process with a set of criteria for a periodic assessment of each project as to whether it should be continued or brought to conclusion.

5. SAS received its first weather research briefing since weather was added to its portfolio. SAS recommends that industry be engaged and that the researchers have an understanding of the process by which technology is transferred into the cockpit, not least in order to make industry engagement effective. The research should also be coordinated with that into the effects of weather on aircraft and the air traffic system.

6. The aircraft industry is introducing new materials, mainly composites, and new joining processes at the fastest pace in decades. SAS recommends that their long-term failure behavior needs to be understood through appropriate research before catastrophic failures occur. The need for such research appears to be underscored by the recent and as yet unexplained break-up of the composite rudder of an A310 under perfectly normal flying conditions.

7. There is no funding in '07 for support of the Mil-Handbook-5 project. This document is of fundamental importance for a large segment of the aviation community. It is an essential tool for maintaining the safety of the fleet. This project needs continued funding.

8. The SASO (System Approach for Safety Oversight) requirements briefing at the recent SAS meeting helped members to better understand this complex program. It is understood that reaching the objectives of the program is of fundamental importance to the FAA's safety goal. While the general research approach appears to be sound, SAS recommends that more industry input is needed to assure relevancy of the research output.

Subcommittee on Environment and Energy

The Subcommittee was very pleased with the quality of the presentations and the responses to prior recommendations. However, they observed that their ability to give substantive advice was a function of the point in the program development process at which that advice was received. Thus, they specifically requested that they be more engaged in the conceptual phase of program development as this would allow them to provide better advice.

The Subcommittee commended the Director for his leadership of the Environmental Integrated Product Team (IPT) of the Joint Planning and Development Office (JPDO), the significant effort that AEE has made in supporting the inclusion of the environmental issues in the plans for and programs of the JPDO, and the decision to establish a dedicated, division-level, AEE tool development-lead position as they felt that this would bring the focus that was necessary to develop the very complicated tools that the FAA is committed to developing. They observed that the structure of the JPDO is set up for discussion and opined that R&D and implementation would require fully coordinated budgets and a single OMB examiner. They also questioned whether the staffing level and structure within AEE was sufficient to continue to support the JPDO efforts but they are

satisfied that AEE is addressing and will continue to address their previously voiced concerns.

The following specific issues were identified as matters that should be raised to the attention of the Administrator.

Issue 1: NASA Aeronautics Budget Cuts

The FAA and NASA have had a very successful partnership in the area of noise and emissions reduction. While much of this success is due to the individuals involved, it would not have been possible without each agency appropriating the relevant funding to support the synergistic research agendas. It is clear to us -- based on the report on the NASA budget and the research programs for the 2006 fiscal year that we received from the NASA representative on the sub-committee -- that NASA will not have the resources to continue to support noise and emissions reduction at the levels envisioned by REDAC. The vehicle systems program has been drastically reduced in terms of both budget and scope resulting in a significant refocus of the Quiet Aircraft Technology program and the slashing of the Ultra-Efficient Engine Technology program altogether. Given the critical role that environmental concerns play in the ability of airports to expand to meet the transportation needs of the public, and the fact that the FAA budget in this area is predicated on a certain level of NASA involvement, the sub-committee is very concerned that these reductions will result in a situation where the US is left with no significant near- to medium-term mechanisms to address noise and emissions constraints.

Recommendation:

The Subcommittee requests that the FAA administrator determine the impact that the reduction in the NASA budget will have on the ability of the FAA to meet the environmental challenges facing or are likely to face the aviation systems and develop strategies within the agency and the JPDO to mitigate these effects, especially as they relate to the Next Generation Air Transportation System (NGATS).

Issue 2: Aviation Portfolio Management Tool

The development of the Aviation Portfolio Management Tool (APMT) has been slowed due to budgetary constraints. This prioritization is understandable given the need to develop the Aviation Environmental Design Tool (AEDT). However, the committee is concerned that any further delay in the development of the APMT will significantly weaken the ability of the US to conduct the analyses necessary to form the US position for and influence the other members of the ICAO Committee on Aviation Environmental Protection (CAEP). The need for work on APMT is especially critical given what appears to be some disagreement among the US stakeholders about what portfolio management means within the context of aviation policy. For some, portfolio management is simply the monetization of technology and policy alternatives i.e. APMT is an add-on to AEDT. To others, portfolio management is the optimization of policy given uncertainty in technology and in the operating environment i.e. AEDT is a component with an APMT

that is a decision support tool. These conflicting views must be resolved soon. Thus, there is a critical need for funding to get product definition and development underway.

Recommendation:

The Subcommittee requests that the FAA administrator do all that is possible to ensure that APMT is adequately funded and that the Office of Environment and Energy be instructed to define portfolio management within the context in which APMT will be used.

Issue 3: Particulate Matter and Hazardous Air Pollutants

Particulate Matter (PM) and Hazardous Air Pollutants (HAPs) continue to be a concern for airports. However, there is great uncertainty as to the contribution of aircraft to this problem. This situation may lead to restriction on aviation that are not necessary.

Recommendation:

The Subcommittee requests that the FAA administrator do all that is possible to ensure that PM and HAPs research is adequately funded and that the Office of Environment and Energy be instructed to provide a timeline for when the contribution of aircraft will be determined.