



Dr. Deborah A. Boehm-Davis

Chair, Research, Engineering and Development Advisory Committee

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

Dear Ms. Blakey:

I am delighted that you were able to join us at our Federal Aviation Administration (FAA) Research, Engineering and Development (REDAC) Advisory Committee meeting this April. The Committee members enjoyed your remarks and the opportunity to engage in a discussion with you. The Committee members also valued the participation of several associate administrators in the most recent meeting. We look forward to a continued and fruitful dialogue with these members of your senior management team in future meetings.

On the basis of our meeting, we have developed several recommendations.

- We recommend that FAA develop a mechanism for supporting deployed technology, especially that technology designed or developed by FAA. FAA needs to maintain the expertise needed to keep systems (such as TCAS) functional.
- We continue to believe that funding R&D out of F&E accounts creates several impediments to the conduct of research. Placement of money in this category of funding makes it difficult to identify what is being spent on research; it makes it easy to divert funds intended for research to other activities; and it does not allow funding to go to universities, where much research is conducted. The committee would like the opportunity to work with you to inform Congress of the difficulties created by funding R&D out of F&E funds.
- Lack of access by researchers to aviation-related facilities continues to be an impediment to research. Access to airports, air traffic control and maintenance facilities, and to the cockpit is needed to ensure that research focuses on actual practice rather than a researcher's interpretation of what practice might be based on available documentation. Although the committee recognizes the paramount importance of safety and security precautions, we recommend that mechanisms be developed to allow legitimate researchers to gain access to relevant facilities for the conduct of their research.
- We support the formation of a Joint Program Office on the Next Generation Air Transportation System to increase interagency coordination, focus on moving R&D products into operations, and develop a strong systems engineering basis for decision-making.

- We ask that you continue to encourage senior associate administrators to meet with the REDAC to help identify emerging needs. We feel that continued dialogue such as that begun at our last meeting can help move the agency's research program beyond work focused solely on today's operations and help prepare the country for the NAS of the future.

In addition, individual subcommittees developed recommendations for your office. Those recommendations are presented in the attachment.

I am interested in discussing these recommendations with you at your earliest convenience. The Committee continues to be dedicated to providing you with advice and recommendations on any R&D issue that you may need us to review. I look forward to the selection of a new Advisory Committee chair and I stand ready to work with you and the new chair on a smooth transition.

Sincerely,

Deborah A. Boehm-Davis, Ph.D.

Chair

FAA Research, Engineering and Development Advisory Committee

ATTACHMENT
Subcommittee Recommendations

Air Traffic Services

General Recommendations concerning the President's FY04 Budget and FAA's planning for FY05:

1. Current FAA Program Lacks Long Term Research & Development Component:

Our review of the FAA R,E&D and the F&E Activity One research and development budget plans reveals that the planned research and research support is limited to activities necessary to meet FAA's Operational Evolution Plan (OEP) milestones and is narrow in scope with only safety-related R&D.

Operational costs of both users and the FAA are skyrocketing. Continuing the OEP work is essential to the aviation industry's near term health but mid and longer term research activities are needed to develop approaches to bringing operational costs under control and providing the capacity needed in the future when the public resumes its full utilization of the air transportation system.

The Commission on the Future of the United States Aerospace Industry in its November 2002 report, recommended "Rapid deployment of a new, highly automated Air Traffic Management System, beyond the FAA's Operational Evolution Plan, so robust that it will efficiently, safely and securely accommodate an evolving variety and growing number of aerospace vehicles and civil and military operations; accelerated introduction of new aerospace systems, by shifting from product to process certification and providing implementation support; and streamlined new airport and runway development." This Subcommittee agrees with these Commission recommendations.

We need to begin now to design, develop, and plan the implementation of the "next generation" air transportation system that will enable the U.S. to achieve a higher standard of living and quality of life while maintaining/enhancing the US share of the world's aviation market. The time to improve capacity is before it is needed and not after it is required. It is very difficult and doubly expensive to implement improvements in a system under stress. Failure to make these R&D investments in a timely way will surely cause the nation's air transportation system to constrain future U.S. economic growth.

Recommendation: A broad based R&D program that addresses the future needs of the nation and the FAA is needed. In addition to the items currently shown in the FY-05 R,E&D budget planning, the FAA should request sufficient funding to support its role in defining, developing, and implementing the "next generation" air transportation system.

- 2. Joint Program to Establish Next Generation Air Transportation System:** As part of the Commission on the Future of the United States Aerospace Industry November 2002 report's recommendation for the deployment of a new, highly automated Air Traffic Management System, the Commission also recommended that a Next Generation Air Transportation System Joint Program Office be formed from the resources of FAA, NASA, DoD, DHS,

NOAA, and other government organizations. This Subcommittee agrees with the Commission's recommendation. A interagency office that is responsible for the overall strategies, transformational planning, and agencies' performance of assigned tasks is the only way that government can provide the leadership necessary to move to the "next generation" air transportation system. **Recommendation:** The Federal Government should form an interagency office to guide the creation and implementation of the "next generation" air transportation system.

3. **Funding to Accomplish FAA's R&D Role of Transitioning Research to Implementation:** FAA's role is to be a catalyst for NASA, CAASD, and other research to assure that advances toward transformation of the National Airspace System (NAS) are developed in an orderly, effective manner; then, gather the resulting research products and integrate them into the NAS. FAA must have a research and development budget to study and plan the evolution of the NAS, evaluate research products, and adapt them for integration into the NAS. Included in this requirement, is the need to sponsor parallel research with NASA and other agencies on promising technologies that the FAA has identified as the likely path of evolution. This budget requirement is different from NASA's, which is aimed at supporting the FAA and other users of the NAS in addressing fundamental issues and in providing high risk, but high pay-off alternatives. FAA requested funding to accomplish its roll role has been reduced so much that we believe FAA will be unable to accomplish this role to such an extent that we believe that much of the research to improve the air transportation system, on-going within NASA and else where will be lost. **Recommendation:** The FAA should either increase its funding request in FY05 for this work (as part of a "next generation air transportation system" funding request) or look to research organizations, needing this role to be accomplished by the FAA, to fund the FAA for this transitioning work.

Specific Comments/Recommendations on the President's FY04 Budget Request and the FAA's FY05 Budget Planning:

1. **Aviation Weather Research:** FAA's FY04 Budget Request and current FY05 budget plan eliminated the Aviation Weather Research Program's funding for capacity/efficiency related weather research and reduced the Program's funding for the remaining safety related research parts of the program. The Aviation Weather Research Program has produced effective, needed products and has more of them under development. Reductions in FY04/05 will either halt or slow work in many productive research areas including ceiling and visibility forecast products for Alaskan users, 2 – 4 hour frozen precipitation forecasts for users flying hazardous mountain terrain, and in-flight icing and convective weather induced turbulence forecasts for oceanic flight planners. **Recommendation:** We recommend that the Aviation Weather Research Program be funded in FY05 at least at its appropriated FY03 level.
2. **Traffic Flow Management (TFM):** We are pleased to see that research is being proposed to address how FAA copes with uncertainty in TFM. This is a very important area to improve the NAS's efficiency. As weather forecasts become more capable, the effectiveness of TFM will increase, provided that TFM can effectively utilize the forecast improvements.

FAA has also proposed research to better integrate TFM into the overall NAS command and control structure. The current TFM system grew in place to solve discrete problems, with

possibly shortsighted objectives. It is important to fund this proposed research that potentially can integrate the distinct TFM tools into a system for achieving the nation's broader traffic flow management objectives.

We are concerned that these proposed TFM research programs will not survive in the smaller Free Flight Phase 2 requested budget in FY04 and planned budget for FY05.

3. **Safe Flight 21:** The program appears to be going well, and may well be a stepping-stone to the next generation air traffic control/management system. We believe that Safe Flight 21 must develop, as part of its program, a strong business case so promising results of this program will be incorporated into the NAS.
4. **Runway Incursion Reduction Program:** The program briefing we received proposed an evaluation of Runway Status Lights utilizing AMASS as the data source. Our concern is that prior work by Lincoln Laboratory and Volpe National Transportation Systems Center has shown that AMASS by itself is not an acceptable data source. The Committee suggests that Multilateration and possibly ADS-B data would also be needed to adequately drive a runway status lights system.
5. **Wake Turbulence Research:** This activity holds significant promise for great payoff in safety and capacity benefits. A joint FAA/NASA program has been formulated whose content and research strategy agree with the recommendations of an independent joint study by Lincoln Laboratory and MITRE/Center for Advanced Aviation System Development. The research, if successful, will provide near term increases in runway throughput through procedural changes, mid term benefits using weather dependent procedures, and long term benefits by incorporating automation enabled decision support tools. Potentially this research will yield a low-cost, high payoff method for increasing airport capacity.

The Subcommittee is aware that FAA's FY04 Budget Request contained no contract funding for Wake Turbulence research due to higher budget priorities. If no contract funds are appropriated for this work in FY04, it is recommended that FAA insure that government personnel working on the wake turbulence program continue the research even in the absence of contract funds. It is also recommended that the FAA request steady funding for this Program in FY05 and beyond (as identified in the Wake Turbulence Research Management Plan) to allow the Program to deliver its planned products.

6. **Research Associated with Free Flight Phase 2:** We are concerned with the FAA decision to curtail funding the research support activities of the Free Flight Phase 2 Program. This will dramatically slow the pace at which needed new capabilities can be introduced into the National Airspace System. (This is a specific example of the problem discussed under our General Recommendation 3 – "Funding to Accomplish FAA's R&D Role of Transitioning Research to Implementation.")
7. **Aeronautical Data Link Applications: CPDLC Build 1, Build IA, Flight Information Services:** This is an essential enabler of NAS modernization and global standardization, and an area where air carrier investment in equipment has not received FAA support for real benefit. Specifically, use of FANS has been extremely limited in US airspace. Efforts in this

FAA data link applications area should include convergence between oceanic and domestic environment.

8. **Phased Array Radar (PAR):** This is currently a congressionally directed technology application research program being managed by the staff at the FAA WJH Technical Center. Work is being done in close collaboration with the Office of Naval Research and NOAA's National Severe Storms Laboratory. FAA should include in its FY05 budget request continued funding of its share of this collaborative research effort because a high-resolution, solid state phased array radar, similar to systems used by the Navy on Aegis Cruisers and by the USAF Dew Line, has the potential of satisfying all FAA surveillance needs (weather, aircraft) with a single system.

The National Research Council has recommended that serious consideration be given to making the next generation NEXRAD a phased array radar. The next generation NEXRAD is now beginning its development and FAA participation in this research and development – through the PAR research program - is vital to insuring FAA's future needs are incorporated into the next generation NEXRAD development. FAA, NOAA and the USAF jointly funded the development of the current NEXRAD radar.

9. **Software-Intensive System Methodology.** It is imperative that the FAA procure ATC systems efficiently and preclude the loss of potential RE&D funds to pay for delays and overruns. Given the relative maturity and availability of CNS equipments and systems and the inherent difficulty of developing and upgrading software-intensive systems in the FAA's challenging environment of users, it is recommended that the FAA convene an independent panel to review the FAA's procurement methodology for complex software-intensive systems. The panel should also address if there are additional mechanisms for FAA to augment RE&D funds through greater exploitation of commercial RE&D programs.

Aircraft Safety

Observations: The System Approach for Safety Oversight (SASO) end goal of PMI standardization is good. The industry has objected because there was no industry involvement and some of the guidelines are not relevant to safety. Recently, the SASO Program Manager in the Flight Standards Service, under the Associate Administrator for Regulation and Certification, has prepared a tentative composition for the SASO group to include representation from the top 10, national, regional, and cargo airlines. The SAS also recommended an OEM (manufacturer). The Program Manager has further considered industry labor organizations (e.g. ALPA) but plans to concentrate on the DOS/Safety department community first. Although the project is moving in the right direction, the committee was disappointed that its recommendations from the last meeting had not been carried out yet.

Recommendation. The FAA should continue to get more industry involvement, especially with Directors of Safety at airlines. (This recommendation focuses on issues of implementation and not on the research.)

Airports

The Airport Technology Research Program has struggled for several years to balance the need to operate the expensive pavement test facility and maintain the scheduled airport pavement testing needed to support the development of new pavement design methodology with increasingly pressing needs to address airport safety issues. FAA has attempted to gain increased funding above the F/Y '02 level of approximately \$7.5 Million so that these additional needs can be met without reducing the funding available for the paving research. In the F/Y '04 administration request, currently before the Congress, the funding would be increased to approximately \$16 Million; a level that the subcommittee feels will allow that balance to be achieved, should it be enacted. The F/Y '05 budget being developed will, for the first time, propose funding the Airport Technology Research Program under F&E. This is recognition of the Congressional action that has for several years moved the FAA's Airport Technology Research program from its AIP request to F&E.

The internal process for developing the F&E budget level for funding the program is currently underway and it is not clear what the ultimate funding level will be for this program. The subcommittee is increasingly concerned that, if substantial new funding does not become available for expansion of research in the safety area, we may not be able to continue to support the full range of pavement research contained in the base budget. Should additional funding not become available in either the F/Y '04 appropriation or the F/Y'05 budget request, we recommend that FAA work with the subcommittee to examine ways to re-allocate a portion of the pavement research to provide additional funding for safety issues in a way that continues to support the core needs of developing new pavement design tools.

With that caveat, the subcommittee supports the FAA F/Y '05 proposed funding program. Among the non-paving projects in the program the subcommittee feels should have high priority are:

Research regarding New Large Aircraft, with particular emphasis on quickly completing the taxiway deviation studies and assessing the need for new ARFF requirements.

Wildlife hazard abatement. However, there is some concern that FAA efforts to develop a low cost radar capable providing real time warnings of bird hazards would benefit by better coordination with research underway by Transport Canada and MITRE.

Runway safety initiatives, including runway incursion prevention, runway friction measurement, development of new arrestor materials and pavement roughness measurement.

Deicing fluid studies to develop standards that foster improved environmental compatibility and reduced risk of aircraft corrosion.

In addition, the subcommittee wishes to express support for the various capacity enhancing research efforts being undertaken in other parts of the FAA that are crucial to meeting the long term needs of airports, particularly the ongoing wake vortex research.

Environment and Energy

Observation: AEE has developed a holistic vision for noise and emissions research in support of their mission.

Recommendation: Move forward aggressively with the holistic approach.

Observation: AEE has developed a needs-based budget for their holistic vision that is comprehensive and well balanced.

Recommendation: Increase the RE&D funding for AEE to \$22M to support the vision starting in FY05.

Observation: AEE has proposed a center of excellence in aircraft noise mitigation. This is a significant step in the right direction but only addresses part of the holistic vision.

Recommendation: Expand the scope of the center to include both noise and emissions.

Observation: In addition, the re-authorization for the FAA includes allocation of up to \$20M from the AIP noise set-aside for noise and emissions research. The idea of setting aside additional funding for research is a good idea.

Recommendation: Set aside a fixed fraction of the AIP to support noise and emission research.

Observation: AEE program changes will require an expanded staff skill set and better external communication of research and ideas.

Recommendation: Build skills and tools necessary to support programs, and be more rigorous about publishing and disseminating research results.

Human Factors

The Human Factors Subcommittee reviews a portion of the research portfolio at each of their meetings. At its most recent meeting, the committee reviewed the maintenance research program. In evaluating that part of the R&D portfolio, the committee felt that some elements were missing. These included work on:

1. **Cultural Issues.** Specifically, the subcommittee felt that the role of cultural diversity in the maintenance workforce and the impact of cultural differences across countries on transition issues and organizational safety was not being adequately addressed.
2. **Fundamental Work on Human Role in Automated Systems.** Specifically, the subcommittee felt that more basic research was needed to understand how productive and effective are humans in the automated systems loop.
3. **Capturing “Lessons Learned” from introducing New Technologies.** The subcommittee felt it is important to capture reports of difficulties arising from the introduction of new technologies so that these data can be collated and systematically analyzed.

The subcommittee felt that one element of the proposed research program, the Sport Pilot Element, should have a lower priority for funding than it currently has.

The subcommittee felt strongly that neither industry nor the REDAC and its subcommittees have been as effective as they might be in helping the FAA prioritize research and in suggesting new avenues for research that might be appropriate. Specifically, the HF Subcommittee felt that it is important for REDAC subcommittee guidance to find its way into the Technical Community Representative Groups (TCRG) deliberations. Further, they feel that the Commercial Aviation Safety Team (CAST) should be used as a mechanism to link the research with industry needs.

In discussing this issue, the subcommittee suggested that it may be worthwhile to consider the implementation of focused study panels (e.g., in the area of safety culture and cultural-technical change) to develop proposals about research that the FAA might consider funding. The output from the study panels could be integrated into the priorities arising in the TCRGs.

Finally, the subcommittee noted that access to facilities is critical for human factors work. This includes access to Air Traffic Control, Maintenance and Cockpit facilities. Although recognizing the need for safety and security precautions, lack of access to facilities will return research to the status of “ivory tower” work, disconnected from actual practice.