

APPENDIX A

RESEARCH, ENGINEERING AND DEVELOPMENT ADVISORY COMMITTEE

The FAA values the ongoing involvement of the R,E&D Advisory Committee in reviewing its current and planned R,E&D programs. A formal process has been established whereby the agency replies to the Committee's reports. This document summarizes recent Committee recommendations and FAA responses.

Since preparation of the 1999 FAA National Aviation Research Plan, the Committee submitted the following reports:

- *Report of the Subcommittee on Runway Incursion*, dated January 29, 1998 (FAA responses received and incorporated).
- *Committee Guidance for FAA's Planned Fiscal Years 2001-2005 Research and Development Investments*, dated November 18, 1998 (FAA responses received and incorporated).
- *Committee Recommendations from the Air Traffic Services Subcommittee*, dated March 5, 1999 (FAA responses received and incorporated).
- *Committee's Recommendations on Fiscal Year 2001-2005 R,E&D Investment Portfolio* (FAA responses pending).

In 2000, FAA expects to receive the Committee's recommendations on FAA's planned research and development investments for fiscal year 2002, including detailed recommendations from the standing subcommittees.

Response to the Report of the Subcommittee on Runway Incursion (Report dated January 29, 1998)

STATUS OF RESEARCH, ENGINEERING, AND DEVELOPMENT ADVISORY SUB-COMMITTEE RECOMMENDATIONS

Recommendation 1. The Federal Aviation Administration (FAA) should expeditiously amend Federal Aviation Regulation 91.129(1) to require a specific air traffic control clearance to

cross any runway: MITRE is studying the impact of this change. Action plan reference: 1Bb. Tasks and target dates are as follows:

- Build baseline airport model. Completed on March 29, 1999.
- Document and deliver modeling results. Completed on May 3, 1999.
- Site selection and coordination for field trial. Ongoing.
- Evaluation of field trial. Completion to be determined (TBD).
- Deliver final report. Completion TBD.

Recommendation 2. The FAA should provide directions to airport operators regarding expanding the size, number, and conspicuity of runway holding positions markings.

Action plan reference: 4B.

- Revision to Advisory Circular (AC) 5340-1H. Completed on March 15, 1999.
- Publication of Revision. Completed, September 30, 1999.

Recommendation 3. The FAA should encourage use of runway entrance lighting. Action plan reference: 4B.

Completed with publication of AC's 150/5340-28 and 5345-46B on September 1, 1998.

Recommendation 4. The FAA should develop a standard procedure for use of aircraft lights during surface operations. Action plan reference: 2Ea.

- Review Society of Automotive Engineers (SAE) Committee A-20, with a view toward drafting and presenting a proposed rule project record for aircraft lighting conspicu-

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ity, for inclusion in the fiscal year (FY) 2000 agenda for the Regulation and Certification (AVR) Safety Target Area Team. Completed on February 15, 1999.

- Report sent to the SAE Committee on evaluation of runway occupied lighting and lighting/painting schemes. Completed on April 15, 1999.
- Develop standard procedure for use of aircraft lights during surface operations. Completed on July 15, 1999.
- Procedural update forwarded and will be included in the January 2000 change to the Aeronautical Information Manual.

Recommendation 5. The FAA should research ways to improve aircraft conspicuity, particularly to make aircraft more visible from the rear.

- Flight Standards has included guidance in the Aeronautical Information Manual providing suggestions to improve aircraft conspicuity, e.g., turn on lights when operationally practical. In addition, Flight Standards presented the REDAC's request for Conspicuity Research to the RE&D Aircraft Safety TAT on October 20, 1999. The Safety TAT believes the FAA may have already completed research in this area. Flight Standards will forward any such available research to the REDAC within the next 30 working days. After the REDAC has reviewed the existing literature, Flight Standards will entertain any further REDAC requests for additional Conspicuity research.

Recommendation 6. The FAA, in conjunction with industry, should develop specific training for all general aviation pilots to address techniques for surface error prevention. Action plan reference: 2Ba

- Seminar-in-a-Box, a joint Aircraft Owners and Pilots Association, Runway Safety Program, ATO-102, and Aviation Safety Program effort. Items include safety advisors, a 26-minute video, and a Discussion Leader's Guide. Seminars have been conducted by

AFS safety personnel for the general aviation pilot community. Completed on April 1, 1999.

- ATO-102 provided each region with runway incursion information for the Flight Standards District Office (FSDO) safety program manager quarterly safety meetings. Completed on August 18, 1999

Recommendation 7. The FAA should provide direction to the airline industry to develop standardized cockpit procedures for surface movement to minimize runway incursions.

- This recommendation was completed on September 3, 1999, with the issuance of a Flight Standards policy letter.

Recommendation 8. The FAA should expand the use of Runway Incursion Action Teams (RIAT). Action plan reference: 4Cb.

- FY 1998 - 7 RIAT meetings accomplished.
- FY 1999 - 20 RIAT meetings accomplished. Twenty scheduled for FY 2000.
- Runway Safety Program order published. Detailed guidance for RIAT makeup and the evaluation process. Completed in August 1999.

Recommendation 9. The FAA should develop an objective method for determining when airport surface markings need repainting. Action plan reference: 4Ac.

Project included in FY 2000 Research and Development Plan submitted to Congress. Completion September 30, 2000.

Recommendation 10. The FAA should continue research on low-cost airport surface detection equipment (ASDE), other ground surveillance, and in-cockpit technologies geared to short-term implementation. Action plan references: 2D, 3Bc, 3C, 4Aa.

- X-Band Surface Detection Radar at the Milwaukee International Airport (MKE) - The MKE air traffic controllers, as part of an extended operational demonstration, are currently using the Raytheon pulse X-band radar at MKE. The Raytheon ASDE system has been able to track targets in low-visibility conditions and inclement weather. The FAA is in the process of executing an agreement with Raytheon to extend the period of this demonstration for up to 3 additional years.
- LOOP Technology - The FAA is considering extending the testing of the Long Beach inductive LOOP system during FY 2000.
- Phased Array Radar at the Norfolk International Airport - The formal evaluation of the Norfolk phased array ASDE radar was completed in February 1999. The evaluation was delayed due to technical problems experienced during the system test. Most of the problems were corrected and the system has been operating as part of an informal air traffic controller evaluation since February 1999. The completion date for this informal evaluation has not been determined.
- DFW is in the process of testing a multi-lateration surface sensor system that fuses data from other sensor subsystems (i.e., ASDE-3, LOOP, and ADS-B) to provide seamless airport surface coverage. Integration of all system components and data collection has commenced, November 1999. The final demonstration will be in January 2000.

Recommendation 11. The FAA should provide immunity/remedial training for gathering safety data. Action plan references: 1Cf, 1Db,

1Dc.

- A memorandum from AFS-1 to all Flight Standards division managers was issued September 20, 1999.
- Mandatory refresher training for air traffic controllers developed and sent to the field. Completed on April 1, 1999.
- Runway incursion computer-based instruction (CBI) course for air traffic controllers. Completed on March 31, 1999.
- CBI distribution to the field. Completed on October 30, 1999.
- Remedial training for air traffic controllers involved in surface incidents already exists in FAA Order 3120.4, Air Traffic Technical Training.
- Airport operator remedial training program for drivers involved in surface incidents will be accomplished via Cert Alert. Completed September 30, 1999.

Recommendation 12. The FAA should study runway exiting to determine ways pilots can ensure that the aircraft tail is clear of the runway. Action plan reference: 4Ab.

An analysis indicated there was no significant trend attributable to this occurrence. Completed on September 15, 1998.

Recommendation 13. The FAA should extend the charter of the Runway Incursion Subcommittee. Action plan reference: 1Eb.

The Runway Incursion Subcommittee officially disbanded on April 12, 1999.

Response to Committee Guidance on FAA's Planned Fiscal Year 2001-2005 Research and Development Investments (letter dated November 18, 1998)

Each year in September, the Committee provides recommendations on how FAA should invest its R,E&D funds. The Committee provided guidance for FAA's planned fiscal year 2001-2005 research and development investments in a letter to the Administrator dated November 18, 1998. The recommendations and FAA's responses are provided below.

- a. **Recommendation:** FAA should develop a plan for ATM modernization expressed in terms of quantitative goals for evolving operational capabilities and user benefits. The Concept of Operations and the NAS Architecture should be tied to this ATM Modernization Plan. Furthermore, the R&D plans should in turn be tied to the Concept of Operations and NAS Architecture and should explain what R&D needs to be done, and by when, in order to support these plans.

Response: FAA agrees and is in the process of quantifying benefits for the NAS Architecture. Benefits are first being identified qualitatively for the capability provided in terms of flexibility, predictability, delay reduction, etc. Quantitative evaluations of benefits are part of Concept Validation, which has just begun in fiscal year (FY) 1999.

- b. **Recommendation:** FAA's Airport Pavement Program is an important program that is providing critical information for establishing pavement design standards that will affect every nation that is a member of the International Civil Aviation Organization (ICAO). Increasing pavement life by as little as 10 percent as a result of pavement research would yield cost savings of \$200 million per year. The Committee recommends that FAA continue to fund this important effort.

Response: FAA concurs with this recommendation and will continue to pursue this

program. However, at the current R&D budget levels, funding may be less than desired for the most effective program.

- c. **Recommendation:** The Committee recommends that FAA continue to concentrate R&D efforts in FY 2001, and beyond, on the issues arising from aging aircraft fleets. New technology aircraft will exhibit different problems as they age. In conjunction with advancing inspection and maintenance technologies, FAA must continue to develop the safety database and related analyses techniques that will generate leading indicators of potential safety problems. The feedback from this analysis must be incorporated into operating regulations and certification standards in a timely manner so as to prevent new accident modes.

Response: FAA concurs with this recommendation and will continue to pursue this program and expand it to include nonstructural systems.

- d. **Recommendation:** The Committee recommends that programs dedicated to prevention and containment of fire, both on board and post crash, continue to receive the highest priority for funding. As recent events demonstrate, ignition sources will be present on aircraft in their electrical systems, in luggage, or in cargo containers. Every effort must continue toward the elimination of ignition sources. The containment of a fire before an aircraft is lost either on the ground or in the air, must continue as a top priority in FY 2001 and beyond. The Committee feels that NASA could and should invest more money in long-term fire research.

Response: FAA agrees that fire is an important risk factor and will continue to support a strong R&D program. Important criteria and test standards for insulation flame promulgator and burn through are about to be com-

pleted. FAA will ask NASA to conduct research in fire safety. However, FAA disagrees that fire safety should receive higher priority than other safety issues that place passengers at greater risk. These include crew errors and weather.

- e. **Recommendation:** Current FAA environmental research is a limited effort which, if not strengthened adequately within the agency, will eventually restrict the growth of the aviation system. An increased level of focused strategic research is needed to (1) advance abatement technology, (2) identify appropriate environmental standards, and (3) develop environmental assessment computer models. The Committee recommends that FAA give priority to increasing environmental assessment capability in the areas of engine emission certification as well as model development for mandated requirements.

Response: FAA plans to sustain the environment and energy program with only modest growth. Currently, FAA is in the process of increasing the environment and energy program's R&D staffing with operations

researchers for the purpose of model development. To increase funding significantly would take away from higher priority areas of safety, NAS efficiency, and/or security.

- f. **Recommendation:** The Committee recommends that FAA reconsider diverting 20 percent of its planned investments in aviation security to high priority requirements for air traffic services research. We do not feel that the money is being misused, but that it would be more in the National interest to support NAS modernization and the transition to free flight. In the past, FAA has disagreed with this recommendation citing the results of the Gore Commission and the Nation's concern over security. The Committee recommends that FAA reconsider it at this time.

Response: Aviation security R&D remains a high interest area of Congress. We do not believe Congress would support shifting funds from security to other R&D programs. We believe the multidimensional threat environment requires a strong R&D program that supports future security equipment deployment and training.

Committee Recommendations from the Air Traffic Services Subcommittee (dated March 5, 1999)

The Air Traffic Services Subcommittee is one of the six standing subcommittees established in January 1997 to provide recommendations to the FAA on its proposed R,E&D investment portfolio and to conduct annual reviews of FAA's research and development program.

The Subcommittee Report was approved by the Committee on January 21, 1999 and provided by letter to the Administrator on March 5, 1999. The following response was presented to the Committee by letter dated July 1, 1999.

GENERAL RECOMMENDATIONS:

- a. **Recommendation:** FAA lacks any real long-range air traffic services research and development programs.

Response: There are some efforts devoted to long-range research and development in the air traffic services area. These include human factors R&D, which addresses long-term issues in air traffic and airway facilities, and aviation weather R&D. Mid- and long-range ATC automation decision support tools R&D are part of a joint FAA/NASA ATM R&D program, which includes substantial efforts by NASA, FAA, CAASD, MIT/LL, and Volpe Center. However, we agree that the ATS R&D program has not been presented to the REDAC in a cohesive manner and could be improved.

- b. **Recommendation:** The transfer of funds from R&D to F&E and operations further weakens and confuses the R&D program.

Response: We agree it may cause confusion, particularly to those outside FAA. FAA is trying to minimize confusion by coordinating the R,E&D and F&E Advanced Technology and Prototyping planning processes to produce a balanced R&D program. The ATS

Subcommittee will continue to have overview of both elements.

- c. **Recommendation:** There is virtually no focus on the major challenge of system and airport capacity, of which capacity-increasing technologies and procedures are a part.

Response: Although we may not be doing all we should, FAA is pursuing several capacity-increasing programs. These include the following:

- Technologies to increase capacity in the terminal airspace and airport surface include TMA, FAST, CDM, SMA, and other advanced tools under development.
- Capacity increasing R&D is included under the Ops Concept Validation Program and the System Capacity Program.

We welcome specific recommendations for additional high payoff R&D in systems and airport capacity.

SPECIFIC RECOMMENDATIONS:

- 1. **Recommendation:** Based on the priority being given to near-term system improvements, we note again that the current efforts are seemingly all directed at implementing things on which the real R&D was done years ago. These things need to be implemented rapidly and we support them enthusiastically. However, there appears to be little, if any, real R&D efforts associated with the integration of the near-term improvements to a more capable system for the future. There is acknowledgement within the FAA that the absolutely crucial work for the future is not being addressed. Without a vigorous R&D program, nothing will be ready to be implemented after Free Flight Phase 1. This lack of early planning could easily lead to a long gap in implementation of completed research. Our NASA friends have pointed

out that NASA's research stops short of fieldable systems and requires important FAA R&D to complete the efforts if the NASA research is to be successful. Others outside the United States are doing meaningful R&D and the U.S. will inevitably lose its eminent role.

Response: FAA concurs with this comment. Products resulting from a vigorous R&D program from 1991 to 1995 allowed FAA to pursue Free Flight Phase 1 (FFP1). However, over the last 4 years, FAA's ATM R&D budget has decreased substantially. NASA and CAASD continue developing advanced tools, but there is little FAA investment to be prepared for implementation beyond FFP1 because of severe budget problems in the Facilities and Equipment (F&E) budget.

2. **Recommendation:** The R&D situation has been further aggravated by the shift of money to F&E and Operations. Congress moved most of the Air Traffic Management programs and all of the Airports technology programs to the Facilities and Equipment (F&E) budget, reflecting the emphasis on the near-term at the expense of the longer-term. With the R&D funding and responsibilities for implementation separated into so many different pots, the R&D management, focus and effort have been seriously compromised. The new Architecture and the new Operations Concept, on which ARA and ATS have been working hard and effectively, are of limited value if they don't clearly show where we need to go – regardless of funding. However, without adequate funding, solutions will neither be achieved promptly or easily. The FAA should not indulge in the pretense that system modernization can be carried out with the present funding. Ms. Garvey, the FAA must find a way to convince Congress that the R&D budget must be increased. This budget issue requires exceptional action.

Response: FAA shares your concerns and agrees with the need for an increased R&D budget. Unfortunately, part of the price of balancing the United States budget is reduced spending. Right now, FAA R&D cannot compete with the other pressing priorities of our constrained budget.

3. **Recommendation:** We were briefed on the development and active pursuit of a new "Architecture" tool (which is an overall planning and scheduling tool depicting the steps to NAS modernization) being developed by FAA with its TRW contractor. It is potentially a very powerful tool, and we strongly encourage its wide internal and external use. Further work is required to evolve to provide the service evolution, as well as work to define the metrics of resultant benefits. It may be tempting to some to downplay or hide this powerful tool, because it will show starkly the consequences of inadequate funding, inadequate organization and inadequate system engineering, but it deserves your strong support.

Response: FAA notes the Committee's concern, but we are promoting its use, not hiding it. FAA plans to provide the tool to the desktop of all FAA executives as a decision support system.

4. **Recommendation:** Several of us have the impression that the close melding of the ARA Architecture and the ATS Operations Concept, which has been a major and highly welcome FAA accomplishment, is perhaps unraveling a bit. There is great value and importance of them staying close and fully tracking in unison, just as it is important that the new "Architecture" tool remain in lock step with these activities.

Response: We believe this is a misperception. The Architecture and Ops Concept are closely coupled. The Architecture Tool database is continuously updated to reflect

changes in budget or the Joint Government Industry Concept and FAA 2005 Concept.

5. **Recommendation:** We had a good briefing on the evolution of Flight 2000 (intended as a real life “beta test” of some of the new technologies) to Safe Flight 21. While this redirection is brand new, it is highly promising and we think it deserves strong support. While FAA is using RTCA as its advisory body on operational matters of Safe Flight 21, we stand ready to help on the R&D aspects of it.

Response: FAA appreciates the Committee’s support and its offer of assistance.

6. **Recommendation:** The lack of adequate and enough technical competence in FAA remains a critical matter, one which can not be resolved by hiring more support contractors and external body shops – it requires a critical mass of good people inside the FAA. Additional good program and technical managers, system and software engineers are needed.

Response: FAA agrees. We are in the process of hiring several highly experienced Chief Systems Engineers and a few program

technical managers. With a new staffing approach, we have more flexibility to hire personnel based on requirements and available budget; however, because of tight budgets, FAA may not be able to fill all of its staffing requirements.

7. **Recommendation:** FAA and NASA are trying, at the top level, to work together a bit more closely than before. However, the union is not yet nearly close enough, especially since NASA has a substantial part of the available R&D funds. We know about, and support, the efforts of Steve Zaidman and Sam Armstrong to bring the agencies together. As noted above, our NASA friends have pointed out that NASA’s research stops short of fieldable systems, and requires an important FAA R&D effort. It will need unflagging attention from the highest levels in FAA – both ARA and ATS – if the money and efforts are to result in useful and timely products.

Response: FAA agrees with the Committee’s observations and is working to increase FAA’s involvement with NASA R&D. The new FAA/NASA Executive Committee will facilitate a closer partnership, coordinated planning, and executive level monitoring.

Committee's Recommendations on Fiscal Year 2001-2005 R,E&D Investment Portfolio (dated June 11, 1999 – response pending)

At the April 21, 1999, Committee meeting, the Committee reviewed FAA's planned FY 2001-2005 R,E&D Investment Portfolio and provided recommendations to FAA in a letter dated June 11, 1999 from Committee Chairman Mr. Robert Doll to Administrator Jane Garvey.

Recommendations:

We are now working with the appropriate people in NASA to assure the maximum coordination of our respective advisory committee efforts and RE&D programs we are charged to oversee. A coordinating committee composed of members of the REDAC and NASA's ASTAC has been formed for the purpose of coordinating the goals of the agencies. An initial meeting of the new committee will be held June 22 through June 24.

All of the concerns that have been underlying the REDAC's efforts for the past few years are still prevalent and, in fact, growing in many areas. Of particular concern is the continuing lack of funds appropriated to the FAA and NASA to support research for aviation and the shift of significant RE&D budget allocations to F&E accounts.

Not a meeting goes by without a discussion of the serious consequences of the continued under funding of the RE&D aviation budget. The comparative level of RE&D expenditures within the European Union continues as a topic of interest to the REDAC. The U.S. aviation industry produces hundreds of billions of gross revenue dollars annually and accounts for a large proportion of our foreign trade revenues. The percentage of the gross revenues that the U.S. aviation/aerospace industry spends on RE&D is scandalously small. The responsibility lies with both the government and the private sector.

If we do not pay attention to developing the systems, facilities and equipment needed to handle the growth that our economy demands of the air

transportation system, the growth of our economy will be adversely affected. This is a very simple equation.

I understand from industry sources that a major new study of European aviation related expenditures, including RE&D expenditures, is about to be released. I believe that this report will show that the US continues to be dramatically outspent in absolute terms by the EU in all areas of aviation RE&D.

We face the very real prospect of losing our lead in air traffic management systems and standards and the related hardware that we have traditionally supplied to the global aviation community. The potential impact to our economy of the loss of industry leadership is difficult to estimate.

A visit by a high level FAA team will take place with European leaders this month. We understand that US interests are entitled by treaty to share in the results of European RE&D efforts. We need to take advantage of this right to access the RE&D work in Europe. We strongly support this meeting.

The idea that the portion of RE&D expenditures funding needed for facilities and equipment is not related to RE&D but to project implementation is a bad idea. Equipment and facilities acquisitions are an integral part of the RE&D process. To remove these expenditures from the RE&D budget incurs a high risk of the money disappearing from RE&D availability over the longer term. It is imperative that any RE&D funds that have been moved to the F&E Budget be effectively "fenced" for RE&D like activities.

In our eyes, the acquisition of facilities and equipment for RE&D outside of the purview of RE&D personnel is fraught with danger. We fear that the research requirements for specific fea-

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tures of that equipment could be lost on F&E acquisition personnel.

This is a major concern in the Airport Technology RE&D budget where all of the dollars were moved to F&E. What may not be apparent to the decision-makers is that the Pavement Test Facility is completed. There will be very little spending required on F&E in the future for Airport Technology RE&D. Therefore there is no rationale for having Airport Technology funding in the F&E budget.

The REDAC supports the FY 2001 RE&D budget as constructed by the roll-up of the individual RPD requirements. We believe that a strong effort to meet this funding level is required of the FAA before the GAO and Congress. We hope that the idea of Flagship Initiatives is pursued to provide a significant boost to FY 2001 funding

The high-level budget requirements for FY 2001 were presented to us in our April meeting. The FY 2001 requirements and the comparable previous year request and authorizations are:

Category	FY 1999	FY 2000	FY 2001
	Appropriation	President's Budget	RPD Requirements
Aircraft Safety	\$ 34.9	\$ 39.6	\$ 60.0
Aviation Security	\$ 51.7	\$ 53.2	\$ 66.3
Environ & Energy	\$ 2.9	\$ 3.5	\$ 7.4
Human Factors	\$ 25.1	\$ 26.2	\$ 29.7
R&D Management	\$ 2.2	\$ 2.7	\$ 2.7
ATM	\$ 90.9	\$ 94.0	\$ 132.2
Safe Flight 21*	\$ 16.0	\$ 16.0	\$ 30.0
Airport Technology**	\$ 5.0	\$ 7.2	\$ 10.0
CAASD ATM R&D***	\$ 31.8	\$ 35.8	\$ 37.4
Total	\$ 260.5	\$ 278.2	\$ 375.7

- *** FY 1999 Safe Flight Funds are in the F&E Account**
- **** All Funding is in the F&E Account**
- ***** Funds are provided from the RE&D and F&E Accounts**

Congress has essentially mandated the level of the Aviation Security expenditure. The explicit Human Factors portion of the entire budget is significant and includes monies dedicated to Aircraft Safety and ATM RE&D projects. We would like to see more money spent in Human Factors but the practicalities of anticipated funding and mandates do not allow reallocation of money from other RPDs into the explicit Human factors efforts. We believe that industry must step up to supporting efforts such as Human Factors and Aircraft Safety to bring themselves more in line with the benefits they derive from those efforts.

The severe budget cuts proposed for NASA are truly alarming to the REDAC. The prevailing view in the industry is that NASA may need to be renamed NSA, dropping any reference to "Aeronautics" in their name if the present budget cuts are sustained. NASA's leaders have stated that they will eliminate efforts related to aeronautics in order to maintain their space program expenditures.

The REDAC believes that progress on aircraft engine emissions and noise-related research will be severely impacted as NASA is forced to wind down current research efforts. The cessation of funding for noise and emission research is not in

the public interest. The FAA will be hampered in its future efforts to effectively certify new systems and to produce effective regulation for the air transport system. Discontinuities in basic research can't be recovered. The simple fact is

that, even if money could be transferred from the NASA research budget to the FAA RE&D budget, the money would not be effectively spent as the FAA is not equipped or staffed to accomplish basic RE&D.

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