



# 2005

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## Federal Aviation Administration National Aviation Research Plan

### Appendix A R&D Program Descriptions



U.S. Department of  
Federal Aviation

## February 2005

Report of the Federal Aviation  
to the United States  
pursuant to 49 United States Code



**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

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\* Budget line item numbers are not used for these programs within the Ops and AIP appropriations.

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FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A11.c	Advanced Materials/Structural Safety	\$2,613,000

### Supports FAA Strategic Goal: Increased Safety

**Program Goals and Intended Outcomes:** The Advanced Materials/ Structural Safety Program helps achieve the FAA’s strategic safety goal by working to reduce aviation fatalities. Specifically, the program assesses and addresses the safety implications of new and present-day composites, alloys and other materials, and associated structures and fabrication techniques. By FY 2008, researchers will develop a knowledge base that will result in safe use of advanced materials in aircraft.

The program is also increasing crash survivability by enhancing aircraft crashworthiness, fire resistance, and evacuation practices. Researchers are developing the knowledge, tools, and standards to improve the crash characteristics of aircraft structures and systems. By FY 2006, the program will develop occupant protection criteria for side-facing seats.

Advanced materials research focuses on:

- Developing analytical and testing methods for worldwide standardization
- Understanding how design, loads carried, and damages sustained can affect the remaining life and strength of composite aircraft structures
- Developing maintenance and repair methods that are standardized and correlated with training and repair station capabilities

Structural safety research focuses on:

- Enhancing occupant survivability and reducing personal injury from accidents
- Improving crash characteristics of aircraft structures, cabin interiors, auxiliary fuel tank systems, and occupant seat/restraint systems
- Improving the efficiency of aircraft certification through the use of better analytical modeling of crash events that occur on land and water

**Agency Outputs:** The Advanced Materials/Structural Safety Program provides technical support for rulemaking and develops guidance to help the aviation industry to comply with agency regulations.

#### *Advanced Materials*

The FAA establishes rules for the certification of safe and durable materials for use in aircraft construction. While the rules are the same for composite or metal structure, different behavioral characteristics of structural materials call for different means of compliance. Although Advisory Circular (AC) 20-107A, “Composite Structure” has been published, advances in technologies and materials require periodic updates and expansion of the AC. The FAA National Resource Specialist Program disseminates current technical information to regulatory personnel through technical reports, handbooks, and guidance. The goal of this data exchange is to allow regulatory processes to keep pace with industry advances and benefit from state-of-the-art technology and design.

#### *Structural Safety*

The FAA revises or updates crashworthiness-related Federal Aviation Regulations to accommodate new information for overhead stowage bins, auxiliary fuel tanks and fuel systems, aircraft configurations, and seat/restraint systems.

**Customer/Stakeholder Involvement:** The Advanced Materials/Structural Safety Program complies with or cooperates with the following legislation and industrial/government groups:

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- Public Law 100-591, the Aviation Safety Research Act of 1988, and House of Representatives Report 100-894 – sets priorities to develop technologies, conduct data analysis for current aircraft, and anticipate problems related to future aircraft
- The Aviation Rulemaking Advisory Committee (ARAC)
- The Aircraft Safety Subcommittee of the FAA Research, Engineering and Development Advisory Committee (REDAC) – subcommittee representatives from industry, academia, and other government agencies review the activities of the Advanced Materials/Structural Safety Program annually
- Technical Community Representative Groups – representatives from FAA headquarters and the directorates apply formal guidelines to ensure that the program’s R&D projects support new rulemaking and comply with existing rules
- Recent accident investigation of AA587 A-300 has indicated that more research is needed in composite structures

**Accomplishments:** The Advanced Materials/Structural Safety Program provides technical reports, handbooks, ACs, and certification guidance to aircraft manufacturers, maintainers, and operators. Program accomplishments include:

### *Advanced Materials*

- Established a Joint Center of Excellence for Advanced Materials at University of Washington and Wichita State University
- Released a major FAA policy memorandum on the procurement and processing of composites that has resulted in a published AC
- In the past two years, issued/updated one AC, one handbook, and over 10 technical reports, articles and papers
- Co-sponsored two technical conferences during the past two years involving over 200 experts
- Developed an economical data reduction method including the use of shared databases to statistically characterize composite materials for General Aviation industry but which is now used worldwide

### *Structural Safety*

- Published draft report of ATR42-300 drop test
- Published report on the use of safety foams in aircraft fuel tanks to mitigate post-crash fires
- Developed computer models of B737 fuselage sections and the ATR42 regional transport airplane
- Developed Head Injury Criteria component tester for use in lieu of full-scale sled test
- Developed aircraft seat cushion replacement methodology in lieu of full-scale sled test

**R&D Partnerships:** The advanced materials and the structural safety areas benefit from a close working relationship with the FAA’s Center of Excellence Program. The research performed under this program is leveraged by the monetary and intellectual contributions of its core universities.

### *Advanced Materials*

To better leverage research expenditures, the FAA concentrates on safety and certification issues, including testing, while NASA retains the lead in analysis and design issues. Plans are underway for closer cooperation with DoD. The FAA also partners with the Rotorcraft Industry Technology Association to share in rotorcraft composite materials research.

With the help of other government agencies, the FAA sponsors MIL-HDBK-17, a primary and authoritative handbook for the statistical characterization data of current and emerging composite materials. The best available data and technology source for testing and analysis, this international reference tool also includes guidance on data development and usage. On recommendations by the ARAC, material data contained in this handbook will be acceptable for use in the certification process.

*Structural Safety*

The program maintains cooperative interagency agreements in the structural safety area with the U.S. Army and U.S. Navy in the analytical modeling area.

Memoranda of cooperation and exchange of personnel have been established between the program and the French, Italian, and Japanese Governments in the crash testing area. The program has worked closely with Wichita State University and Drexel University to develop dynamic crash computer modeling codes.

**MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:**

*Advanced Materials*

- Develop analytical methods for bonded joints
- Validate analytical methodology to predict residual strength of a composite sandwich structures following an impact event
- Create a template for control of woven materials with resin infusion processes including adhesives
- Identify maintenance and repair actions that need to be standardized and correlated with training requirements and repair station capabilities

*Structural Safety*

- Continue to develop human neck injury criteria for side-facing aircraft seats
- Publish draft technical report on computer modeling of aircraft water impacts to help determine revised rotorcraft water impact/ditching standards
- Publish final report on ATR42-300 dynamic crash test results
- Review in-house commuter crash test results to compile summary report to develop seat/restraint system certification criteria
- Review auxiliary fuel tank crash and sled test results to compile summary report for certification service review
- Review overhead stowage bin crash and sled test results to compile summary report
- Publish draft report for design of crash resistant fuel systems

**FY 2006 PROGRAM REQUEST:**

*Ongoing Activities*

The program will continue to focus on aging composite control surfaces on transport airplanes. There will also be program linkage to aircraft safety issues involved with control surface performance. To reduce maintenance costs, the feasibility of using imbedded sensors to monitor in-service damage will be explored. Safety of damage tolerance of friction stir-welded parts and fiber/metal laminates that are being used in proposed aircraft will be queried. In addition, the program will continue to develop data applicable to rotorcraft and fan blades, including high-cycle fatigue. Research will continue on certification methodology for new materials and applications.

Research will continue into identifying occupant injury protection criteria applicable to side-facing seating in business jets.

Research will be continued on analytical modeling of aircraft water impact crash events and on crash resistant fuel systems.

*New Initiatives*

No new initiatives are planned in FY 2006.

**KEY FY 2006 PRODUCTS AND MILESTONES:**

*Advanced Materials*

- Assess the severity of control surface stiffness degradation and its effect on dynamic characteristics

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- Develop analytical models that predict durability of braided materials
- Evaluate aging composite aircraft by teardown and destructive testing

### *Structural Safety*

- Continue human neck injury criteria development research for side facing aircraft seats
- Publish final report on aircraft water impact analytical modeling to revise the current water impact requirements for rotorcraft
- Publish draft summary report on aircraft overhead bin testing
- Publish draft summary report on aircraft auxiliary fuel tank testing
- Publish draft summary report of commuter airplane crash tests
- Publish draft technical report for the design of crash resistant fuel systems
- Publish final technical report for the design of crash resistant fuel systems

### **APPROPRIATION SUMMARY**

	Amount (\$000)
Appropriated (FY 1982-2004)	\$75,631
FY 2005 Enacted	6,643
FY 2006 Request	2,613
Out-Year Planning Levels (FY 2007-2010)	10,513
<b>Total</b>	<b>\$95,400</b>

<b>Budget Authority (\$000)</b>	<b>FY 2002 Enacted</b>	<b>FY 2003 Enacted</b>	<b>FY 2004 Enacted</b>	<b>FY 2005 Enacted</b>	<b>FY 2006 Request</b>
Contracts:					
Advanced Materials	962	921	5,676	5,087	1,105
Structural Safety	808	797	202	96	184
Personnel Costs	1,091	1,058	1,234	1,345	1,247
Other In-house Costs	113	75	111	115	77
<b>Total</b>	<b>2,974</b>	<b>2,851</b>	<b>7,223</b>	<b>6,643</b>	<b>2,613</b>

<b>OMB Circular A-11, Conduct of Research and Development (\$000)</b>	<b>FY 2002 Enacted</b>	<b>FY 2003 Enacted</b>	<b>FY 2004 Enacted</b>	<b>FY 2005 Enacted</b>	<b>FY 2006 Request</b>
Basic	0	0	0	0	0
Applied	2,974	2,851	7,223	6,643	2,613
Development (includes prototypes)	0	0	0	0	0
<b>Total</b>	<b>2,974</b>	<b>2,851</b>	<b>7,223</b>	<b>6,643</b>	<b>2,613</b>

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A11c – Advanced Materials/Structural Safety Product and Activities	FY 2006 Request (\$000)	Program Schedule					
		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
<b>062-111 Advanced Materials Structures</b>							
<b>Advanced Materials</b>	<b>\$1,105</b>						
Develop Analytical Methods for Bonded Joints		◆					
Validate Analysis to Predict Residual Strength after Impact		◆					
Identify Maintenance and Repairs for Standardization		◆					
Create Template to Control Woven Materials and Adhesives		◆					
Ascertain the Effect of Stiffness Loss Due to Damage for Dynamic Characteristics			◇				
Develop Analytical Models that Predict Durability of Woven Materials			◇				
Teardown and Destructive Testing of Aging Composite Aircraft			◇				
Establish Feasibility of Embedded Sensors to Track Damage				◇			
Develop Safety Criteria as They Concern Damage Tolerance of Fiber/Metal Laminates and Friction Stir Welded Joints				◇			
Develop Certification Methodology for High Cycle Fatigue					◇		
Identify Data for Certification of Materials at Elevated Temperatures						◇	
Initiate Research in Ceramic Composites							◇
<b>062-110 Structural Safety</b>							
<b>Structural Safety</b>	<b>\$184</b>						
Complete Draft Report on Computer Modeling of Aircraft Water Impact Research		◆					
Report on a Vertical Drop Test of High-Wing ATR42-300 Commuter Aircraft		◆					
Publish Draft Technical Report on Crash Resistant Fuel Systems		◆					
Publish Final Report on Aircraft Water Impact Analytical Modeling to Revise the Current Water Impact Requirements for Rotorcraft			◇				
Publish Final Technical Report on Crash Resistant Fuel Systems			◇				
Publish Draft Summary Report of Commuter Airplane Crash Tests			◇				
Publish Draft Summary Report of Auxiliary Fuel Tank Crash and Sled Tests			◇				
Publish Draft Summary Report of Overhead Stowage Bin Crash and Sled Tests			◇				
Develop Neck Injury Criteria for Side-Facing Seats				◇			
Identify Methods to Improve Crashworthiness of Fuel Tanks					◇		
Identify Crashworthiness Certification Issues of Non-Metallic Fuselage						◇	
Generate Data for Crashworthiness Certification of Non-Metallic Fuselage							◇
<b>Personnel and Other In-House Costs</b>	<b>\$1,324</b>						
<b>Total Budget Authority</b>	<b>\$2,613</b>	<b>\$6,643</b>	<b>\$2,613</b>	<b>\$2,596</b>	<b>\$2,621</b>	<b>\$2,647</b>	<b>\$2,649</b>

Note: Out year numbers are for planning purposes only. Actual funding needs will be determined through the annual budget process.

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FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A11.j	Aeromedical Research	\$6,889,000

### Supports FAA Strategic Goals: Increased Safety, Greater Capacity, Organizational Excellence

**Program Goals and Intended Outcomes:** The Aeromedical Research Program helps achieve the FAA's safety goals by:

- Investigating and analyzing injury and death patterns in civilian flight accidents and incidents to determine their cause and develop preventive strategies
- Supporting FAA regulatory and medical certification processes that develop safety and health regulations covering all aerospace craft occupants and their flight environments
- Recommending and developing equipment, technology and procedures for optimal:
  - Evacuation and egress of all humans from aerospace craft
  - Dynamic protection and safety of all humans on aerospace craft
  - Safety, security and health of all humans on aerospace craft

This program is developing increased aviation community knowledge and understanding of current operations and potential accident causes by developing a broadened understanding of biomedical, toxicological, and human performance factors that can contribute to accidents. By FY 2009, researchers will develop enhanced medical/toxicological intervention methodologies to support standards and guidelines that will enhance the health, safety, and security of pilots, flight attendants and passengers.

This program is also reducing accidents associated with the performance of pilots and aircrews, maintainers, inspectors, and others who fill roles important to the safety of the national airspace system by developing knowledge, guidance, and standards for bioaeronautical factors affecting aviation safety. By FY 2006, researchers will develop operational sensors to provide real-time detection and warning to ensure aircraft cabin air quality.

This program is increasing crash survivability by enhancement of aircraft crashworthiness, fire resistance, and evacuation practices by developing knowledge and design and procedural guidelines to enhance the effectiveness, speed, and safety of aircraft evacuation. By FY 2008, researchers will update cabin evacuation guidelines.

In addition, the program is reducing the adverse health impacts associated with the cabin environment by developing knowledge, recommendations, and guidelines to reduce health risks to aircraft crews and passengers from hazards including poor air quality, cosmic and other radiation, and sudden decompression. By FY 2007, researchers will develop guidelines for acceptable ozone levels in the aircraft to ensure health and safety of aircrew and passengers.

Research program outcomes are: improved safety, security, protection, survivability, and health of aerospace craft passengers and aircrews.

The Civil Aerospace Medical Institute (CAMI) is authorized and uniquely equipped to exploit new and evaluate existing bioaeronautical guidelines, standards, and models for aerospace craft cabin equipment, procedures, and environments. Aeromedical research serves as the basis for new regulatory action and evaluation of existing regulations to continuously optimize human performance and safety at the minimum cost to the aviation industry.

This research program analyzes pilot medical and flight data, information from accidents and incidents, and advanced biomedical research results to propose standards and assess certification procedures that optimize performance capability. The complex mix of pilot, flight attendant and passenger activities in a wide range of environmental, behavioral, and physiological factors is evaluated to propose standards and guidelines that will enhance the health, safety and security of all aerospace travelers.

**Agency Outputs:** Aeromedical Research has accomplished experimental projects in support of the following regulatory and certification operations:

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- Integrated analysis of biomedical, toxicological and molecular biological factors and stressors in uneventful flight and in aerospace craft incidents and accidents
- Quantitative bioengineering criteria related to:
  - Optimum aerospace craft seat and restraint system certification
  - Enhanced egress, flotation and onboard life support/rescue equipment certification
- Quantitative bioaeronautical data associated with:
  - Health, safety and security risks for flight deck, cabin crew and other occupant regulatory oversight
  - Aerospace radiation and environmental factors and their threat to all aerospace craft occupants
  - Bioaeronautical, bioengineering and performance factors required to support cabin evacuation certification
- Quantitative biomedical and performance criteria and recommendations to support development of:
  - Optimum life support equipment, emergency medical equipment, and operational procedures certification
  - Aircrew medical standards, assessment/certification procedures, and pilot special medical issuance

**Customer/Stakeholder Involvement:** The Aeromedical Research program direction is consistent with the bioaeronautics agenda set forth in the *National Plan for Civil Aviation Human Factors: An Initiative for Research and Application*: “Improve the health, safety, protection, survivability and security of aerospace craft passengers and crews through identification of human tolerances, capabilities, and failure modes (physiological, psychological, and performance) both in uneventful flight, and during incidents and accidents.”

The program is an integral participant and research provider under the FAA, Joint Aviation Authorities, and Transport Canada Aviation Aircraft Cabin Safety Research Plan established in 1995 as a coordinated, living plan to maximize the cost-benefit of aerospace craft cabin safety research nationally and internationally. The research budget assignment satisfies the Congressional mandates for the agency in the Wendell H. Ford Aviation Investment and Reform Act of the 21<sup>st</sup> Century enacted in 2000 and the FY 1994 Appropriation Act. It has supported various multi-year collaborative studies by the FAA and other government and industrial entities to evaluate flight crew and passenger symptomatology and disease. Currently, the program is supporting the establishment of an FAA Cabin Environment Research Center of Excellence to conduct partnership research with academia, industry and other governmental agencies associated with Congressional directives to evaluate cabin environmental safety, security and health.

**Accomplishments:** Program highlights include:

- *Integrated toxicological and biomedical data of all aerospace craft accidents and significant incidents.* Advanced integrated data analysis and recommendations are continuously provided to research sponsors. Current findings indicate that about one in four of the pilots fatally injured in civilian aircraft accidents shows evidence of using a prescription drug; one in six has taken an over-the-counter drug; one in twenty-two has ingested “significantly positive” alcohol; and one of ten is using a significant controlled dangerous substance. State of the art techniques and methodology are continuously maintained in this world-class research program
- *Biodynamic evaluations were conducted for test devices developed via FAA contracts with academic and government institutions.* The test devices, a Head-injury-criteria Component Tester and a seat cushion impact tester, were developed to support the FAA seat certification streamlining project. The objectives of the streamlining project were to reduce the cost and simplify seat certification testing while maintaining safety. Results from impact simulations using the alternative test devices were compared to results from dynamic impact sled tests to determine applicability and effectiveness. Test results indicated that the alternative test devices could realistically duplicate the sled tests in some conditions and that further developmental work was required. In addition to impact testing, mathematical modeling was conducted to assess the performance of the test devices and to aid the development of modeling capability. Development of computer-modeling methods using the

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Mathematical Dynamic Model and component test devices will help provide faster, safer, more cost-effective aircraft certification decisions

- *The computational fluid dynamics model of aircraft airflow and particle distribution, developed by the University of Tennessee and CAMI, was used to conduct development and testing of an aircraft cabin decontamination procedure.* The aircraft decontamination testing was conducted under a Cooperative Research and Development Agreement (CRDA) with the STERIS Corp. to evaluate the potential of a Vaporized Hydrogen Peroxide process to decontaminate an aircraft. The VHP technology may support a decontamination/rehabilitation process allowing aircraft contaminated with chemical or biological agents to be returned to operational status. The threats of terrorist attack, intensified by the events of 9/11/2001, and contagious disease transmission, such as SARS have magnified requirements for this research thrust. Other CRDAs with industrial organizations involving new methods to enhance cabin environmental quality have also been initiated
- *Web-based and other widely available advisory materials for enhancing human health.* Information on in-flight cosmic and solar radiation exposures and cabin air quality is continuously provided for all human occupants of aerospace craft. The system provided a near, real time warning of several FY 2004 solar events with recommendations for reduced aircraft flight altitudes and potential diversions for polar routes
- *Development of cabin evacuation computer models.* Transport aircraft are currently certified by manned testing to determine if the aircraft evacuation capability meets requirements. These certification tests are expensive, can injure test subjects, and generally evaluate specific scenarios that may not be representative of actual evacuation requirements. Advancements in bioinformatics coupled with the high monitoring and human research subject costs of testing require cabin evacuation models to replace streamline portions of the manned tests. These modeling efforts are under development.

**R&D Partnerships:** The program collaborates and leverages its research activities with many government and non-government colleagues, organizations and agencies.

Program staff also cooperate directly on research processes with airlines, aircraft manufacturers and equipment manufacturers responsible for safety products (seats, restraint systems, oxygen masks, evacuation slides, etc.). They are also integral members of the Cabin Safety Harmonization Working Group, Seat Certification Streamlining Effort, AirBus A380 Cabin Safety Working Group and National Safety Council, and hold memberships, fellowships and leadership positions in all scientific, medical and bioengineering societies associated with aerospace medicine and safety.

FAA program staff also serve on every Society of Automotive Engineers committee addressing safety research related to the work of this program. Program personnel serve on subgroups of organizations such as the Aerospace Medical Association, the Civil Aviation Medical Association, and the Professional Aeromedical Transport Association. They directly collaborate with the U.S. military and NASA on human research issues involving crashworthiness, in-flight turbulence, aerospace medicine, ocular injury from lasers, and exposure to cosmic radiation. They also work with NATO aerospace medical advisory groups, the European Union, and many independent scientific organizations and academic institutions. Additionally, the program develops Cooperative Research and Development Agreements (CRDAs) with industry to develop collaborative projects that benefit both the FAA and the aviation industry.

National Research Council post doctoral associates conducted research in molecular biology and space medicine research studies at CAMI. Academic collaboration (with more than 10 students/faculty annually participating in aeromedical research) rounds out the full scope of medical and scientific partnerships of this world-renown program.

### MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS

The program expects to achieve the following results in FY 2005:

### Complete:

- Evaluation to determine the effect of aircraft exit height and variations of passenger personal flotation equipment on the speed and safety of water evacuations
- Report to sponsors on Non Destructive Inspection/Non Destructive Testing (NDI/NDT) vision standards
- Biodynamic evaluations of alternative test devices to streamline seat certification
- Epidemiological assessments of biochemical, toxicological and molecular biological factors associated with fatal civilian aviation accidents

### Evaluate:

- Autopsy data from fatal aviation accidents to support the development of a safety index
- Time to prepare a narrow-body aircraft for clear air turbulence
- Effect of passenger knowledge on aircraft evacuation and cabin safety
- Effectiveness of an enhanced narrow body cabin egress test facility designed to allow simulation of more aircraft types and configurations

### Develop:

- Support for FAA and American Society of Heating, Refrigeration and Air-conditioning Engineers cabin air quality assessment programs
- Recommendations for life support equipment and medical requirements in civilian spacecraft (provided to FAA sponsors for evaluation and potential use in space operations guidelines)
- Advisory circulars, medical screening procedures and recommended vision standards for NDI/NDT.
- Research recommendations for Aviation Rule-Making Advisory Committee reviews of cabin air quality and altitude safety rules
- User friendly database to provide advanced statistical and graphical analysis to evaluate mechanisms of injury in aircraft accidents/incidents
- In-house and extramural research program on crew and passenger safety requirements for very high altitude air or spacecraft

### **FY 2006 PROGRAM REQUEST:**

Complex medical decisions, based on epidemiological assessments, accompany initial and follow-up medical assessments of airmen who request special medical issuances to allow them to continue flying despite clinical abnormalities without resulting in unexpected or increased aircraft accident risk. Cabin safety, health and security for all human occupants of civilian aerospace craft requires careful, cost-effective certification and regulation. The following research is planned to continually improve aeromedical certification through provision of a sound scientific basis for all decisions.

### *Ongoing Activities*

#### Evaluate:

- Trends in toxicological, biochemical, molecular biological, physiological, and clinical findings from all major civil aviation aircraft crashes using advanced bioinformatics analytical systems
- In-flight medical kit/automatic external defibrillator use to determine their effectiveness and utility
- Effectiveness of programs dedicated to the enhancement of passenger safety, health, security and performance in emergencies and uneventful flight
- Performance and protection characteristics of aircrew eye/respiratory protective equipment, including protection from chemical/biological agents
- Risk posed by pilots with special medical issuances

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### Recommend:

- Safer aircraft cabin evacuation certification guidelines/procedures
- Effective limits to radiation exposure (laser and ionizing)
- Methods to reduce head, neck, torso, and extremity injuries in aircraft crash environments and improve certification procedures

### Support:

- Aviation Rule-Making Advisory Committee reviews of cabin air quality and altitude safety rules

### Develop:

- User-friendly aeromedical research accident database that quickly provides advanced statistical and graphical analyses for aerospace regulation and certification functions

### *New Initiatives*

- Implement molecular biological techniques in forensic toxicological investigations of aircraft accidents
- Support development of a coordinated research effort to define cabin air quality and analyze requirements for occupant protection and aircraft decontamination
- Data collection, analysis and modeling of passenger/crew injury patterns in accidents and incidents
- Publish guidelines for maintaining aircraft cabin occupant health to include re-evaluation of the effectiveness of AEDs in the flight environment.

## KEY FY 2006 PRODUCTS AND MILESTONES

### Analyze:

- Bioaeronautical research data supporting aeromedical certification to reduce in-flight sudden or subtle incapacitation
- Accuracy of pilot-reported medication usage compared with actual toxicology findings
- Use of molecular biological laboratory methods to enhance forensic toxicological investigation of aircraft accidents/incidents
- The rate at which postmortem alcohol can be produced in specimens from fatal aviation accident victims to aid in the discrimination between ethanol ingestion and postmortem formation
- Accident experience of sport category pilots relative to medical certification requirements

### Enhance:

- Guidelines for maintaining aircraft cabin occupant health, including the CARI-6 radio-biological computer program covering large solar particle events

### Develop:

- Process to evaluate the use of component tests and mathematical modeling for improved aircraft seat certification criteria and anthropomorphic test devices to establish the correlation of occupant injury and measured impact dynamics

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

**APPROPRIATION SUMMARY**

	Amount (\$000)
Appropriated (FY 1982-2004)	<u>\$98,747</u>
FY 2005 Enacted	10,079
FY 2006 Request	6,889
Out-Year Planning Levels (FY 2007-2010)	28,747
Total	<u>\$144,462</u>

<b>Budget Authority (\$000)</b>	<b>FY 2002 Enacted</b>	<b>FY 2003 Enacted</b>	<b>FY 2004 Enacted</b>	<b>FY 2005 Enacted</b>	<b>FY 2006 Request</b>
Contracts:					
Aeromedical Research	491	385	2,801	3,776	1,658
Personnel Costs	4,268	4,451	4,611	4,761	5,091
Other In-house Costs	1,362	1,357	1,418	1,542	140
<b>Total</b>	<u><b>6,121</b></u>	<u><b>6,193</b></u>	<u><b>8,830</b></u>	<u><b>10,079</b></u>	<u><b>6,889</b></u>

<b>OMB Circular A-11, Conduct of Research and Development (\$000)</b>	<b>FY 2002 Enacted</b>	<b>FY 2003 Enacted</b>	<b>FY 2004 Enacted</b>	<b>FY 2005 Enacted</b>	<b>FY 2006 Request</b>
Basic	0	0	0	0	0
Applied	6,121	6,193	8,830	10,079	6,889
Development (includes prototypes)	0	0	0	0	0
<b>Total</b>	<u><b>6,121</b></u>	<u><b>6,193</b></u>	<u><b>8,830</b></u>	<u><b>10,079</b></u>	<u><b>6,889</b></u>

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

<b>A11.j - Aeromedical Research Product and Activities</b>	<b>FY 2006 Request (\$000)</b>	<b>Program Schedule</b>					
		<b>FY 2005</b>	<b>FY 2006</b>	<b>FY 2007</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>
<i><b>086-110 Aeromedical Research</b></i>							
<b>Cabin Health and Environmental Guidelines</b>	<b>\$ 1,302</b>						
Assess Flight Crew Health Risks During a Flying Career		◆	◇	◇	◇	◇	◇
Model Air Flow and Disease/Chemical Biological Agent Transmission/Dissemination in Aircraft Cabins		◆	◇	◇			
<b>Human Survival and Protection in Civil Aviation</b>	<b>\$ 191</b>						
Analyze the Suitability for Component Tests as an Alternative to Showing Regulatory Compliance with Crashworthiness Standard for Aircraft		◆	◇	◇	◇	◇	◇
Assess Impact Protection Performance of Aircraft Seating Systems		◆	◇	◇			
Develop Performance-Bases Narrow and Wide-Bodied Aircraft Cabin Evacuation Approval Guidelines		◆	◇	◇	◇	◇	◇
Develop Protective Equipment Fit, Comfort, and Performance Standards		◆	◇	◇	◇	◇	◇
Develop Dynamic Modeling Capabilities in Support of Cabin Safety, Protection, and Aircraft Accident Research		◆	◇	◇	◇	◇	◇
<b>Medical/Toxicology Factors of Accident Investigations</b>	<b>\$ 165</b>						
Perform Epidemiological Assessment of Toxicology Factors from Fatal Civilian Aviation Accidents		◆	◇	◇	◇	◇	◇
Develop Guidelines to Reduce In-Flight Sudden/Subtle Incapacitation		◆	◇	◇	◇	◇	◇
Evaluate Autopsy Data from Fatal Aviation Accidents to Determine Protective Equipment and Design Practices		◆	◇	◇	◇	◇	◇
Develop Advanced Molecular Biochemical Techniques to Enhance Aviation Forensic Toxicology			◇	◇	◇	◇	◇
Develop Instructional Material on the Radiation (Cosmic and Visual) Environment during Air Travel		◆	◇	◇	◇		
Establish an Aircraft Accident Medical Database		◆	◇	◇	◇		
Develop Vision Standards for Maintenance Non Destructive Inspection and Testing		◆	◇				
Analyze Advanced Aeromedical and Pilot Certification Data		◆	◇	◇	◇	◇	◇
<i><b>Personnel and Other In-House Costs</b></i>	<b>\$5,231</b>						
<b>Total Budget Authority</b>	<b>\$6,889</b>	<b>\$10,079</b>	<b>\$6,889</b>	<b>\$6,975</b>	<b>\$7,119</b>	<b>\$7,268</b>	<b>\$7,385</b>

Note: Out year numbers are for planning purposes only. Actual funding needs will be determined through the annual budget process.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A11.e	Aging Aircraft	\$19,007,000

### Supports FAA Strategic Goal: Increased Safety

**Program Goals and Intended Outcomes:** The Aging Aircraft Program helps achieve the FAA’s safety goals by developing technologies, technical information, procedures, and practices to help ensure the continued airworthiness of aircraft structures and systems in the civil transport fleet. The program is reducing the number of accidents associated with the failure of aircraft structures, components, and systems, and is developing the knowledge, inspection tools, and techniques to address safety hazards associated with the aging of airframe structures, engine components, and mechanical and electrical systems. By FY 2008, the program will develop new inspection tools to ensure the continued airworthiness of aircraft structures and components. These new tools will be used to find damage such as small cracks, in aircraft structures before those cracks become a problem.

Research focuses on:

- Assessing causes and consequences of widespread fatigue damage of aging aircraft structures
- Ensuring the continued safe operation of aircraft electrical and mechanical systems
- Detecting and quantifying damage such as cracking, corrosion, disbonding, and material processing defects through nondestructive inspection techniques
- Acquiring, analyzing, and publishing operational loads usage data to update and validate airworthiness standards
- Establishing damage-tolerant design and maintenance criteria for rotorcraft and commuter airplanes
- Standardizing methods and data for aircraft certification and continued airworthiness

**Agency Outputs:** The FAA publishes rules for aircraft design, construction, modification, inspection, maintenance, and repair. Aircraft operators and manufacturers refer to these materials to learn how to comply safely and efficiently with related FAA regulations.

The agency also provides limited-distribution technical and policy materials to its field personnel.

**Customer/Stakeholder Involvement:** The Aging Aircraft Research Program directly supports the Aviation Safety Research Act of 1988 (Public Law 100-591), the legislation that first directed the FAA to focus on maintaining the airworthiness of the aging commercial fleet. The program also addresses the safety recommendations of the White House Commission on Safety and Security to maintain and improve aging non-structural systems on the fleet.

Program staff coordinates with an extensive network of government and industry groups including:

- The Subcommittee on Aircraft Safety (SAS) of the FAA Research, Engineering and Development Advisory Committee (REDAC) – subcommittee representatives from industry, academia, and other government agencies review the activities of the Aging Aircraft Research Program annually
- Technical Community Representative Groups (TCRGs) – representatives from FAA headquarters and the directorates apply formal guidelines to ensure that the program’s R&D projects support new rulemaking and comply with existing rules
- The Aviation Rulemaking Advisory Committee (ARAC) – proposes cost-effective rulemaking and research to address aging aircraft issues
- The Aging Transport Systems Rulemaking Advisory Committee – provides public recommendations regarding revisions to the Federal Aviation Regulations and associated guidance material to ensure the continued airworthiness of aging non-structural systems in transport airplanes

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

**Accomplishments:** In the course of its aviation community involvement, the program has:

- Developed and flight tested two aircraft arc-fault circuit breaker (AFCB) prototypes. AFCBs are now in limited production and at least two operators have installed AFCBs in select circuits on their commercial aircraft. The use of arc-fault circuit breakers is expected to reduce the incidence of electrically ignited in-flight fires and multiple-system failures resulting from cascading arc-faults
- Completed several test programs addressing aircraft structural integrity using the Full-Scale Aircraft Structural Test Evaluation and Research facility, at the FAA William J. Hughes Technical Center. The tests confirmed the ability of advanced computational models developed by the FAA and NASA to simulate crack growth and residual strength in panels that have sustained multiple-site damage (MSD). Several areas of aircraft structural integrity research have been undertaken, including the initiation and development of MSD, effects of MSD on the residual strength behavior, and methods to reduce fatigue-related problems.
- Published the first version of FAA-accepted material properties handbook “Metallic Materials Properties Development Standards” (MMPDS-01), the replacement document to MIL-HDBK-5. The MMPDS is now the only government-recognized source in the U.S. of published design-allowable properties for metallic commercial and military aircraft structures and mechanically fastened joints. A government-industry consortium is being developed to maintain the MMPDS document and process for establishing statistically based material allowable indefinitely.
- Developed and tested new and enhanced inspection technologies and structural repair techniques in support of rulemaking:
  - Completed a study that assessed traditional and advanced inspection devices for their ability to inspect composite honeycomb structures for damage such as disbonds
  - Completed the development of a second generation thermosonic inspection prototype that has imaged widespread fatigue cracking and kissing disbonds
  - Assessed the efficacy of second and third-layer crack inspection procedures and suggested procedural changes to improve crack detectability
  - Developed an improved inspection prototype using magneto-optic technology that has demonstrated the ability to sort alodine and anodized rivets efficiently and detect small cracks previously undetectable
  - Validated a composite repair patch that is less disruptive to aircraft structure and more cost-effective for aircraft operators than mechanically fastened repair patches
- Sponsored the development of Supplemental Structural Inspection Documents (SSIDs) for two typical small aircraft. These SSIDs demonstrate the feasibility and practicality of maintaining older aircraft to safer and more effective damage-tolerance standards
- Acquired, analyzed, and published flight, landing and ground loads operational usage data for civil transports. The data is used by ARAC to recommend updates the FAA rules and policy
- In collaboration with the engine industry, developed and tested new and enhanced inspection technologies for nickel and titanium billet and titanium forgings. Techniques developed under this program, including a multizone ultrasonic inspection systems and phased array ultrasonic inspection systems, showed greatly improved sensitivity over more conventional techniques
- Developed a Micro-Energy High-Voltage (MEHV) wire test system. The MEHV method specifically identifies those insulation breaches that are likely to result in short circuiting or sparking
- Published report handling qualities and flight safety implications of rudder control strategies and systems in transport aircraft
- Published a Final report on engineering studies of cleaning and drying process for fluorescent penetrant inspection

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

**R&D Partnerships:** Program activities are closely coordinated with related initiatives being undertaken by industry, NASA and DOD. Interagency agreements are in place between the FAA and NASA, the U.S. Navy, the U.S. Air Force, and DOE. The FAA, DOD, and NASA have cosponsored seven joint Aging Aircraft Conferences.

The FAA collaborates closely with several private and public organizations including:

- The Joint Council on Aging Aircraft, established to leverage resources and coordinate the efforts of the DoD services for common aging aircraft issues
- The FAA Center of Excellence for Airworthiness Assurance (AAACE), a consortium consisting of twenty-nine core universities partners with Sandia National Laboratories
- The Center for Aviation Systems Reliability, a consortium of three lead universities, Iowa State University, Northwestern University, and Wayne State, and several adjunct institutions
- The Airworthiness Assurance Nondestructive Inspection Validation Center, an FAA partnership with Sandia National Laboratory to test and evaluate inspection techniques and to enhance technology transfer
- The Engine Titanium Consortium, comprised of Iowa State University, Pratt & Whitney, General Electric, and Honeywell, formed to develop methods for the inspection of engine components
- The National Institute for Aviation Research, at Wichita State University
- The Center for Aviation Research and Aerospace Technology, comprised of Ohio State University and the University of Dayton Research Institute

Cooperative Research and Development Agreements (CRDAs) are in place with a number of domestic and international airline operators as part of the flight loads data collection program.

### **MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:**

- Complete destructive testing of large fuselage sections taken from a retired Boeing 727. The results of this task will help to formulate policy regarding the use and interpretation of the teardown data in applications for continued airworthiness certification
- Publish a handbook of FAA-accepted material properties – MMPDS. The databook is an essential reference for both aircraft design engineers and FAA certification engineers
- Publish an airworthiness evaluation report of two high-time Cessna 402 airplanes
- Install enhanced specialized flight data recorders on firefighting and agricultural aircraft
- Complete field ready remote field eddy current inspection prototype that can inspect aircraft lugs without bushing removal
- Validate an embedded crack monitoring system for DC-9 wing spars using vacuum sensing
- Complete a first-phase prototype of magnetic carpet probe for rapid and wide area inspection and perform laboratory assessment of its capability. The prototype will be evaluated to determine whether it can provide a faster, more consistent and reliable inspection than the FPI process
- Complete the establishment of degraded system detection requirements for the Health and Usage Monitoring Systems (HUMS). The established requirements will be used to validate the AC on HUMS
- Complete wire insulation material testing research and compare results with test data from the recently developed indenter wire test equipment.
- Test under field conditions:
  - Tera-Hertz wire inspection system
  - Broad-band impedance inspection system for aircraft wiring

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

- Publish:
  - Publish capability report on emerging inspection technologies with application to detect cracks, disbonds and corrosion
  - A final report on Inspection Development for Titanium Forgings
  - An operational loads monitoring report for the B-777 and A-340 airplanes used in overseas service
  - A Video Landing Parameter Survey Report for LHR Heathrow International Airport
  - An operational loads usage report for airplanes used in the U.S. Forest Service firefighting fleet
  - Two reports documenting failure risk analyses of the Boeing 757 elevator control system and the Airbus A320 rudder control system
  - A report on the invasive inspection and testing of Boeing 737 and 747 flight control linkages.
  - Assessment of Helicopter Health and Usage Monitoring System Requirements (HUMS)
  - A Final Report on Contaminated Billet Study for titanium billets used in the manufacture of aircraft engine-rotating components
  - Report entitled The Effects of Related and Unrelated Maintenance on Integrity of Aircraft Electrical Wiring Interconnect System (EWIS)
  - 115Vac Single phase Arc Fault Circuit Breaker Flight Test Report
  - A report on the Effects of Mixed wire Types in Aircraft EWIS
  - Final Report on Experimental Investigation of Multiple-Site Damage Behavior in Fuselage Structure
  - Final Report for Fatigue Crack Growth Database for Damage Tolerance Analysis
  - Final Report on the Evaluation and Verification of Advanced Methods to Assess Multiple Site Damage (MSD) of Aircraft Structure
  - Final Report on Bulging Factor Solutions for Cracks in Longitudinal Lap Joints of Pressurized Aircraft Fuselage Structure

### **FY 2006 PROGRAM REQUEST:**

#### *Ongoing Activities*

The program will continue to focus on the areas listed at the beginning of the GOALS section above. Efforts in Aging Aircraft Systems will receive a greater portion of the Aging Aircraft funding, while some structural integrity research will be phased-out. Tasks to develop enhanced inspection ability for flaws in engine turbine disks will continue. Airframe structural inspection research will remain constant, while application-specific projects addressing rotorcraft and commuter aircraft will receive reduced funding.

#### *New Initiatives*

There will be no new initiatives in Aging Aircraft in FY 2006.

### **KEY FY 2006 PRODUCTS AND MILESTONES:**

- Publish a handbook of FAA-accepted material properties - Metallic Materials Properties Development and Standardization. The databook is an essential reference for both aircraft design engineers and FAA certification engineers.
- Publish final results from the destructive evaluation and extended fatigue testing of fuselage sections taken from a retired Boeing 727. The results of this project will help to formulate policy regarding the use and interpretation of the teardown data in applications for continued airworthiness certification.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

- Complete development of second-generation (115Volt/3-phase and 28Volt DC) arc-fault circuit breakers. The production-ready circuit breaker will reduce the possibility electrically ignited fires on aircraft.
- Complete development of Pseudo Random Binary Sequence Reflectometry and the Pulse Arrested Spark Discharge Wiring Diagnostic and Inspection prototypes for the inspection of aircraft wiring
- Complete a study to assess capabilities of traditional and advanced inspection devices to detect hidden flaws in thick composite laminates
- Complete a second-phase prototype of magnetic carpet probe for rapid and wide area inspection and perform laboratory assessment of its capability. The prototype will be evaluated for field implementation.
- Demonstrate a highly automated rivet inspection system for large transport aircraft
- Complete assessment study of variables affecting the performance of fluorescent penetrant inspection
- Publish operational loads data report for the Boeing B-737/700 airplane. The data from these reports allow aircraft manufacturers and the FAA to assess the validity of design assumptions and take preemptive action if usage and loads are more severe that the original design.
- Publish findings of Emergency Evacuation System study. The study will identify causes and solutions to the most critical failure modes of emergency escape slides and doors.
- Publish findings of Mechanical Systems Risk Assessment Study. This research will explore and develop methodologies for analyzing and locating areas of potentially catastrophic mechanical system failure.
- Develop a software for load spectra generation and complete fatigue test of riveted coupons under spectrum loading for fatigue life evaluation of small airplanes
- Complete assessment and validation of fatigue crack growth and threshold data test methodologies for propeller and rotorcraft. The results will be used to support revision of AC-29.2A and 27.1A
- Update usage and spectrum for modern helicopters to support revision of FAA Order 8110.9
- Publish final report on Establishment of Degraded System Detection Requirements for HUMS

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

**APPROPRIATION SUMMARY**

	Amount (\$000)
Appropriated (FY 1982-2004)	\$317,583
FY 2005 Enacted	18,998
FY 2006 Request	19,007
Out-Year Planning Levels (FY 2007-2010)	73,763
<b>Total</b>	<b>\$429,351</b>

<b>Budget Authority (\$000)</b>	<b>FY 2002 Enacted</b>	<b>FY 2003 Enacted</b>	<b>FY 2004 Enacted</b>	<b>FY 2005 Enacted</b>	<b>FY 2006 Request</b>
Contracts:					
Aging Aircraft	27,351	25,000	15,633	13,852	14,081
Personnel Costs	4,041	4,100	4,478	4,609	4,631
Other In-house Costs	608	308	387	537	295
<b>Total</b>	<b>32,000</b>	<b>29,408</b>	<b>20,498</b>	<b>18,998</b>	<b>19,007</b>

<b>OMB Circular A-11, Conduct of Research and Development (\$000)</b>	<b>FY 2002 Enacted</b>	<b>FY 2003 Enacted</b>	<b>FY 2004 Enacted</b>	<b>FY 2005 Enacted</b>	<b>FY 2006 Request</b>
Basic	0	0	0	0	0
Applied	32,000	29,408	<b>20,498</b>	18,998	19,007
Development (includes prototypes)	0	0	0	0	0
<b>Total</b>	<b>32,000</b>	<b>29,408</b>	<b>20,498</b>	<b>18,998</b>	<b>19,007</b>

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

<b>A11e - Aging Aircraft Product and Activities</b>	<b>FY 2006 Request (\$000)</b>	<b>Program Schedule</b>					
		<b>FY 2005</b>	<b>FY 2006</b>	<b>FY 2007</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>
<b><i>065-110 Aging Aircraft</i></b>							
<b>Structural Response Simulation And Modeling</b>	<b>\$1,932</b>	◆	◇	◇	◇	◇	◇
Continue Support for Mil-Handbook 5 (Standard Reference)							
<b>Inspection Systems Research And Development</b>	<b>\$1,480</b>	◆	◇	◇			
Develop Crack Detection Technologies Including Pulsed Eddy Current for DC-10 Crown Splice							
Develop Corrosion and Disbond Inspection Systems		◆	◇	◇	◇		
Perform Validation of Inspection Technologies		◆	◇	◇	◇	◇	
Conduct Visual and Fluorescent Penetrant Inspection Research		◆	◇	◇	◇		
Develop Enhanced Aircraft Repair Techniques		◆	◇	◇			
<b>Airborne Data Monitoring Systems</b>	<b>\$895</b>	◆	◇	◇	◇		
Publish Reports on Large Transports and Commuter Loads Surveys							
<b>*Structural Integrity Of Commuter Aircraft</b>	<b>\$735</b>	◆	◇				
Conduct Teardown of Two High-Time Commuter Aircraft							
Evaluate the Airworthiness Of Commuter Aircraft and Provide Information For Policy Guidance		◆	◇	◇	◇	◇	
<b>Rotorcraft Structural Integrity And Safety</b>	<b>\$4,743</b>	◆	◇	◇	◇		
Develop Rotorcraft Damage Tolerance Methodologies							
<b>Continued Airworthiness Of Aircraft Engines</b>	<b>\$1,055</b>	◆	◇	◇			
Develop Enhanced Production Inspection Systems Including Multizone and Forging Inspection Systems							
Assess and Verify Inspection Systems Performance		◆	◇	◇	◇		
Conduct Propeller Damage Tolerance Evaluation			◇	◇	◇	◇	
<b>*Aging Mechanical Systems</b>	<b>\$630</b>	◆	◇				
Publish Report on Destructive Testing of Flight Control							
Conduct Risk Assessment for Aging Mechanical Systems		◆	◇	◇	◇	◇	
<b>Aging Electrical Systems</b>	<b>\$2,611</b>	◆	◇	◇	◇		
Conduct Wire Degradation Assessment							
Develop Wire Testing Equipment		◆	◇	◇			
Develop Advanced Circuit Protection Devices Including Second Generation Arc-Fault Circuit		◆	◇	◇	◇		
Conduct Risk Assessment For Aging And Modified Wire		◆	◇	◇	◇	◇	
<b><i>Personnel and Other In-House Costs</i></b>	<b>\$4,926</b>						
<b><i>Total Budget Authority</i></b>	<b>\$19,007</b>	<b>\$18,998</b>	<b>\$19,007</b>	<b>\$18,541</b>	<b>\$18,524</b>	<b>\$18,508</b>	<b>\$18,190</b>

Note: Out year numbers are for planning purposes only. Actual funding needs will be determined through the annual budget process.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A11.i	Air Traffic Control/Airway Facilities Human Factors	\$9,654,000

### Supports FAA Strategic Goals: Increased Safety, Greater Capacity, Organizational Excellence

**Program Goals and Intended Outcomes:** The Air Traffic Control/Airway Facilities Human Factors (ATC/AF) Program assists the FAA in achieving its safety and capacity goals by developing increased aviation community knowledge and understanding of current operations and potential accident causes. The program develops methodologies to identify and mitigate risk factors in automation-related operator errors. By FY 2007, researchers will evaluate methods for assessing causal factors of human error in air traffic control operations to mitigate the potential for incidents and accidents.

The program is also reducing accidents associated with the performance of controllers, maintainers, and others who fill roles important to the safety of the National Airspace System (NAS) by developing knowledge, guidance, and standards to assess and improve their performance. By FY 2007, the program will assess and develop guidance to improve FAA technical operations personnel work flows and communications.

The program is developing requirements, knowledge, guidance and standards for design and use of automation-based technologies, tools and support systems. By FY 2007, the program will complete development of JANUS as the web-based operational error data collection tool. Additionally, the program will complete development of the web-based version of the FAA Employee Attitude Survey to reduce administration costs and enhance data analysis.

The program is developing and designing a system safety approach to provide a better understanding of the causes of human error and develop interventions to reduce those errors. By FY 2008, researchers will identify error patterns of controllers and maintenance personnel, and identify precursors to those errors.

In addition, the program develops tools, knowledge, guidance, requirements, models, and standards for information management and display systems. By FY 2008, the program will develop design guidelines and human factors standards for integrating advanced technologies.

The program also develops knowledge, guidance, requirements, and tools for selection of controllers and maintenance technicians.

The program works to improve the ATC contribution to system safety by:

Developing:

- Implementation methods that apply new tools to report, investigate, analyze, and mitigate ATC operational errors and AF incidents
- Human factors/safety assessment techniques to manage human error hazards and their consequences, and recovery methods in the early stages of system design or procedural development
- Improved methods to present weather information to air traffic specialists for severe weather avoidance

Improving:

- Methods to prevent human error through human-system integration at all stages of acquisition including mission analysis, requirements definition, and design and testing of ATC automation systems
- Approaches to understanding the effect of age on the work force and how to identify exceptional specialists

The program works to improve the ATC contribution to system capacity by:

Developing:

- Enhanced ATC work station concepts that enable the delivery of air traffic services and operational improvements for the NAS of the future with its increased traffic load

Improving:

- The relationship between the flight deck and air traffic automated systems as advanced technology allows a new allocation of roles and interactions within the aviation community
- Roles and responsibilities between air traffic service providers and pilots as technology evolves to meet future demands

**Agency Outputs:** The Air Traffic Control/ Airway Facilities Human Factors Program provides customers in the ATC operational and system development communities with products that specify the capabilities and limitations of humans in the context of ATC systems. These outputs are shaped by the program's research on human performance and other human-system integration issues associated with the concept of operations, system architecture, acquisition, operation, and maintenance of ATC systems.

Our simulations and work station prototypes will provide a proving ground for advanced concepts to determine their viability in the future NAS in terms of human performance. Improvements in how errors are investigated and reported will foster effective safety interventions. Continuing research will increase our understanding of how to effectively deal with regulations associated with workforce attrition due to retirement.

**Customer/Stakeholder Involvement:** The ATC/AF Program emerges from renewed coordination between its ATC/AF operational and system development customer base. Research projects are sponsored by organizations in the air traffic community with operational and developmental responsibility.

For its research activities, the ATC/AF program receives recommendations and guidance primarily from the Air Traffic/Airway Facilities Research Groups.

- Advanced Air Traffic Systems Research Group – The ATC and systems development communities articulate human factors research requirements due to increased traffic demand and new technology
- Individual and Team Performance Research Group – Identifies human factors research needs in human performance such as operational errors, intra-team communication, and runway incursion prevention
- Airway Facilities Research Group – Recommends research for airway facilities including specification of displays, controls, and maintainability features of AT systems
- Personnel Selection Research Group – Addresses personnel selection and retention including the “age 56 rule” for air traffic controller retirement, in the context of the human capital planning process

**Accomplishments:** The ATC/AF Program has performed or influenced research resulting in the following :

*Advanced Air Traffic Systems*

- Performed a simulation to assess the impact of improved weather product displays in the terminal environment for severe weather avoidance and capacity enhancement
- Initiated development of a prototype advanced en route controller workstation to integrate decision support tools provided by NASA, MITRE, and acquisition programs
- Completed an analysis of the operational improvements and enhanced services specified in the NAS Architecture 5.0 and Target System Description with respect to the human integration issues
- Conducted a simulation of en route traffic management human factors issues when dynamic resectorization is used to balance loads across ATC sectors

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

### *Individual and Team Performance*

- Implemented a new method for the reporting and analysis of operational errors at an ATC facility using the JANUS tool to improve the determination of causal factors
- Investigated intra-team communication in air traffic control towers to reduce runway incursions caused by operational errors
- Implemented an automated method to aid in the assignment of runway incursion severity to incidents
- Developed and distributed a tool to aid in the mitigation of fatigue within the AF workforce

### *Airway Facilities*

- Completed a study of communication and coordination with AF to assess the effectiveness of the Operational Control Centers to reduce costs and technician workload
- Completed a set of design recommendations for visual and auditory alarms in the AF workstation
- Completed a set of design recommendations for icons and standard symbology sets for AF displays

### *Personnel Selection*

- Developed a set of candidate guidelines for identifying exceptional controllers that may be allowed to continue in the workforce past the mandatory retirement age of 56
- Continued the development of secure and equivalent forms of the Air Traffic Selection and Training (AT-SAT) test battery for controller selection
- Developed the capability to objectively and rapidly evaluate job applicants for AF positions relative to specified knowledge, skills and abilities that address changes in technology being used by the FAA

**R&D Partnerships** Collaborative research with EUROCONTROL addresses human error in the design and operation of ATC systems. This partnership is largely responsible for the international use of JANUS as a tool for the prevention of operational errors.

The FAA human factors research program routinely participates in the Interagency Integrated Product Team which provides a framework for coordination with NASA and MITRE. An area of particular interest is to assure that human factors considerations are integrated at the appropriate technology readiness levels.

## **MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:**

### *Advanced Air Traffic Systems*

- Establish human performance benefits in terms of safety and capacity when using enhanced weather products such as storm movement and wind shear at the terminal controller's workstation
- Demonstrate an electronic flight data handling system for the tower that will aid in the reduction of runway incursions and enhance human performance supporting increased airport throughput
- Assess the effectiveness of candidate concepts for dynamic resectorization

### *Individual and Team Performance*

- Perform an analysis of the initial set of ATC operational error data generated by the JANUS tool to determine if it should be nationally deployed
- Demonstrate the final automated runway severity index tool for use on a national level
- Conduct an evaluation of new JANUS tools for the analysis of pilot deviations and ground vehicle operators in runway incursions

### *Airway Facilities*

- Complete an initial set of specifications for the design of AF workstations and displays
- Complete a set of recommendations to improve the communications and coordination process in AF organizations

*Personnel Selection*

- Complete a parallel form to the AT-SAT test battery
- Complete longitudinal validation of screening and testing tools used to select job applicants
- Complete the first stage of a study dealing with the effect of mandatory age 56 retirement on staffing and NAS performance

**FY 2006 PROGRAM REQUEST**

The proposed program supports the Air Traffic Organization with research that addresses human performance issues in the acquisition, design, operation, and maintenance of ATC systems over the next several years. Research projects will provide timely information to answer critical human factors questions.

*Ongoing Activities:*

The ATC/AF Program participates in defining advanced en route controller and maintainer workstations to enable the human element of AT and AF to deliver the services and manage the traffic load projected for 2015.

The program will continue its work in human error analysis and reporting by expanding the use of JANUS to prevent runway incursions. The data resulting from the use of JANUS has the potential for being applied to procedures, concepts of operation, and system design to identify the hazards associated with human error.

Program researchers will also continue to: investigate countermeasures to fatigue in the AF work force; develop displays for advanced flight data handling techniques; develop methods to assess the impact of color displays on controllers; evaluate candidate methods to reduce runway incursions; assess intra-team communications to reduce operational errors; and, assess the complexity of airspace and ATC displays.

Research will also continue to validate the air traffic selection processes, assess management training shortfalls that limit succession planning, and address human capital planning issues such as controller retirement age.

*New Initiatives:*

Air-Ground Integration

The advent of new cockpit technologies such as Cockpit Display of Traffic Information and increased use of data link will affect the roles and responsibilities of pilots and controllers. As pilots and controllers alter their traditional roles associated with the safe and efficient movement of air traffic, human factors issues associated with information transfer, human information processing, human decision making, and the communication between pilots and controllers will likely change. Research is needed to determine what issues need mitigation and how to effectively and safely conduct aviation operations in the changing environment.

Tower Controller Workstation Development

Tower workstations are a collection of displays and controls that were developed to provide specific and narrow functions. The airport environment is arguably one of the most critical nodes in the NAS. Airport capacity is sensitive to a number of factors (e.g., weather) and is at the root of most air traffic delays. The human factors research program will address the human integration issues in both the safety and capacity areas to achieve operational improvements on the surface and in the immediate airspace.

**KEY FY 2006 PRODUCTS AND MILESTONES:**

*Advanced Air Traffic Systems*

- Demonstrate the initial prototype for the electronic display and control of flight data in towers as an initial step toward an integrated tower workstation
- Conduct a simulation of an initial en route controller workstation to demonstrate the effectiveness of advanced concepts to integrate decision support tools
- Finalize the results of simulations and demonstrations of weather displays at terminal controller workstations for severe weather avoidance and capacity enhancements

## **2005 FAA NATIONAL AVIATION RESEARCH PLAN**

### *Individual and Team Performance*

- Develop training for the use of JANUS at field sites in anticipation of national deployment
- Report on the dynamics of intra-team communications in air traffic control towers to determine how operational errors can be prevented and how to design new tower display systems that enhance team communications
- Identify fatigue countermeasures for AF flight check crews and other members of the AF work force

### *Airway Facilities*

- Deliver human factors engineering specifications and standards for AF workstations that provide guidance for enhanced maintainability and rapid monitor and control of ATC systems
- Provide recommendations for system outage reporting that provide data regarding design-induced human error and performance degradation

### *Personnel Selection*

- Deliver job task analyses that capture the knowledge, skills and abilities required for AF specialists in the future NAS using advanced technology
- Develop a means to rapidly and objectively screen job applicants to assure that a high quality work force is maintained with the necessary skills
- Identify the human factors aspects of individual and organizational factors that influence retirement and attrition decisions in the AF work force

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

### APPROPRIATION SUMMARY

	Amount (\$000)
Appropriated (FY 1982-2004)	\$133,503
FY 2005 Enacted	9,391
FY 2006 Request	9,654
Out-Year Planning Levels (FY 2007-2010)	39,117
<b>Total</b>	<b>\$191,665</b>

Budget Authority (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Contracts:					
Air Traffic Control/Airway Facilities Human Factors	2,756	1,742	2,747	2,756	4,330
Personnel Costs	4,071	4,002	4,445	4,765	5,079
Other In-house Costs	1,673	1,646	1,654	1,870	245
<b>Total</b>	<b>8,500</b>	<b>7,390</b>	<b>8,846</b>	<b>9,391</b>	<b>9,654</b>

OMB Circular A-11, Conduct of Research and Development (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Basic	0	0	0	0	0
Applied	8,500	7,390	8,846	9,391	9,654
Development (includes prototypes)	0	0	0	0	0
<b>Total</b>	<b>8,500</b>	<b>7,390</b>	<b>8,846</b>	<b>9,391</b>	<b>9,654</b>

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

A11i – Air Traffic Control/Airway Facilities Human Factors Product and Activities	FY 2006 Request (\$000)	Program Schedule					
		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
<b>082-110 Air Traffic Control/Airway Facilities Human Factors</b>							
<b>Advanced Air Traffic Systems</b>	<b>\$1,842</b>						
Advanced En Route Workstation Development		◆	◇	◇	◇	◇	◇
Advanced Terminal Workstation Development		◆	◇	◇			
HF Aspects of Electronic Flight Data Handling		◆	◇	◇			
HF Simulation of Dynamic Resectorization		◆	◇	◇	◇	◇	◇
<b>Individual and Team Performance</b>	<b>\$918</b>						
E-JANUS expansion		◆	◇	◇	◇		
JANUS Flight and JANUS Ground for Runway Incursions		◆	◇	◇	◇	◇	◇
Intra-Team Communications in Towers		◆	◇	◇	◇		
<b>Airway Facilities</b>	<b>\$635</b>						
HF Aspects of Technology for Productivity		◆	◇	◇	◇	◇	◇
AF HF Design Specifications		◆	◇	◇			
HF Aspects of Outage and Human Error Reporting		◆	◇	◇	◇		
<b>Personnel Selection</b>	<b>\$635</b>						
Age 56 "Exceptional Controller" Criteria Development		◆	◇	◇	◇		
AT-SAT Longitudinal Validation		◆	◇	◇	◇	◇	◇
AT-SAT Parallel Form Development		◆	◇	◇			
<b>Air-Ground Integration</b>	<b>\$100</b>						
Tower Controller Workstation Development			◇	◇	◇	◇	◇
<b>Tower Controller Workstation Development</b>	<b>\$200</b>						
			◇	◇	◇		
<b>Personnel and Other In-House Costs</b>	<b>\$5,324</b>						
<b>Total Budget Authority</b>	<b>\$9,654</b>	<b>\$9,391</b>	<b>\$9,654</b>	<b>\$9,627</b>	<b>\$9,742</b>	<b>\$9,859</b>	<b>\$9,889</b>

Note: Out year numbers are for planning purposes only. Actual funding needs will be determined through the annual budget process.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A11.f	Aircraft Catastrophic Failure Prevention Research	\$3,340,000

### Supports FAA Strategic Goal: Increased Safety

**Program Goals and Intended Outcomes:** The Aircraft Catastrophic Failure Prevention Research Program assists the FAA in achieving its aviation safety goal by developing technologies and methods to assess risk and prevent occurrence of potentially catastrophic defects, failures, and malfunctions in aircraft, aircraft components, and aircraft systems. Researchers are assessing the use of advanced materials to protect aircraft critical systems and passengers in the event of catastrophic engine failures. By FY 2008, the program will conduct research needed to develop and publish guidelines for the use of advanced materials for engine containment protection.

The program also uses historical accident data and National Transportation Safety Board (NTSB) recommendations to examine and investigate:

- Turbine engine uncontainment events, including mitigation and modeling of uncontainment and aircraft vulnerability to uncontainment (AC20-128, phase II)
- Propulsion malfunction indications research in response to Aerospace Industries Association (AIA) recommendations and proposed solutions

**Agency Outputs:** With technical input from the Aircraft Catastrophic Failure Prevention Program, the FAA establishes certification criteria for aircraft and supports revisions to the regulations to allow new technologies to be certified. The Agency also publishes Advisory Circulars (ACs) to outline acceptable means for meeting these rules. The program's objective is to ensure safe aircraft operation in the public domain.

**Customer/Stakeholder Involvement:** The Aircraft Catastrophic Failure Prevention Program complies with Public Law 100-591 (the Aviation Safety Act) and Public Law 101-508 (the Omnibus Reconciliation Act), which together established the aircraft catastrophic failure prevention program.

The program collaborates with a broad cross section of the aviation community, including the following, to ensure a balanced, responsive Aircraft Catastrophic Failure Prevention Program:

- The Subcommittee on Aircraft Safety (SAS) of the FAA Research, Engineering and Development Advisory Committee (REDAC) – subcommittee representatives from industry, academia, and other government agencies review the activities of the Aircraft Catastrophic Failure Prevention Program annually
- Technical Community Representative Groups (TCRG) – representatives from FAA headquarters and the directorates apply formal guidelines to ensure that the program's R&D projects support new rulemaking and comply with existing rules
- The Aviation Rulemaking Advisory Committee (ARAC) – this committee and its subcommittees help to ensure the effectiveness of the agency's rulemaking by identifying R&D requirements and priorities, providing guidance for the update of documents such as AC20-128, and encouraging industry's full participation in implementing new rules
- FAA-sponsored workshops on turbine engine uncontainment characterization, modeling, and mitigation – this ongoing forum brings industry and government (civil and military) experts together to review progress and recommend future action
- Partnerships with industry, through an ARAC working group, to develop a toolkit for modeling engine uncontainment events

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

- Partnerships with industry and academia under the Airworthiness Assurance Center of Excellence to perform technology transition of armor technologies for engine containment and engine rotor burst protection
- The Aerospace Industries Association - Transport Committee – with participation of the FAA and industry - this committee has examined propulsion system malfunctions, identified inappropriate crew response, and recommended development of specific regulations and advisory materials to correct safety hazards
- Preliminary AIA efforts on propulsion issues with implications for follow-on ARAC work on FAR 25.1305

**Accomplishments:** Results of Aircraft Catastrophic Failure Prevention Program research are provided to certification officials to form the technical basis for rule changes as well as new or modified ACs. Results are also provided to airframe and engine manufacturers and designers. Program accomplishments include:

### *Engine Uncontainment Research*

- Delivered the Uncontained Engine Debris Damage Assessment Model (UEDDAM), version 2.02 for evaluation of uncontained engine debris hazards to aircraft for ARAC evaluation and comment
- Conducted a workshop for DOD and ARAC on UEDDAM
- Completed a collaborative effort with NASA, the U.S. Navy, and the U.S. Air Force to perform the first full-scale engine disk crack detection demonstration. A crack was propagated .025 inches during 4,470 cycles on a running engine
- Completed a mitigation test for uncontained engine failure damage to pressurized fuel lines
- Completed University California, Berkeley Airworthiness Assurance Center of Excellence (AACE) Grant on “Lightweight Ballistic Protection of Flight-Critical Components on Commercial Aircraft – Phase I” Test data developed under the program was used to improve analytical modeling of fabric shielding
- Completed Arizona State University AACE Grant on “Explicit Finite Element Analysis Modeling of Multi-Layer Composite Fabric for Gas Turbine Engine Containment Systems, Phase I”. A significant database of small and full-scale test data was developed to understand the interaction of multiple layers in containment systems
- Completed University California, Berkeley AACE Grant on “Statistical Testing of Aluminum, Titanium, Lexan, and Composites for Transport Airplane Rotor Burst Fragment Shielding – Phase I” Test data developed under the program was used to improve analytical modeling of fabric shielding
- Conducted two workshops for engine certification engineers on non-linear finite element modeling of containment systems

### *Propulsion Malfunction*

- Completed phase I work on Indications of Propulsion System Malfunctions. Reviewed 80 in-service events and provided in-depth analysis and recommendations for propulsion indication improvement. Reported results to Aerospace Industries Association Propulsion Indications Task Team
- Completed Phase I SBIR titled “A Low Cost Engine Monitoring System For Real-Time Propulsion System Malfunction Detection and Diagnosis”

**R&D Partnerships:** Through interagency agreements, grants, and contracts, program activities are closely coordinated with governmental, academic, and commercial experts to leverage the full advantage of existing knowledge and technologies. Significant program benefits are realized from the following agreements:

- Interagency agreement with Naval Air Warfare Center Weapons Division, China Lake – with industry, modifies tools for analyzing the vulnerability of the military’s turbine engines to uncontainment events for use with commercial transport aircraft

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

- AACE Grant with Arizona State University (ASU) – with Honeywell Engines and SRI International, develops “An Explicit Finite Element Model of Multi-layer Composite Fabric for Gas Turbine Engine Containment Systems”
- Interagency Agreement with NASA Glenn for cooperation on turbine engine uncontainment – NASA provides test support to the AACE Grant with ASU for Engine Containment
- AACE Grant with UC Berkeley – with Boeing and SRI International, develops “Lightweight Ballistic Protection of Flight-Critical Components on Commercial Aircraft”
- NAVAIR, U.S. Air Force, and NASA Glenn partnership – develops engine disk crack detection technologies

### MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:

#### *Engine Uncontainment Research*

- Continue NASA/FAA sponsored quality control program for modeling aircraft problems in the manufacturer’s supported finite element code (known as LSDYNA)
- Complete AACE Grant at ASU - Phase II testing of fabric gas turbine engine containment system

#### *Propulsion Malfunction*

- Deliver Draft Report of Phase II Propulsion Malfunction Indications. Primary focus in phase II is the propulsion system requirements for identification on the malfunction

### FY 2006 PROGRAM REQUEST:

#### *Ongoing Activities*

- Research on uncontained engine failures mitigation
- Development of engine malfunction materials to better define a variety of propulsion malfunctions, and develop demonstration system
- Engine containment modeling development and training for certification support
- NASA/FAA sponsored quality control program for modeling aircraft problems in LSDYNA

#### *New Initiatives*

No new initiatives are planned in FY 2006.

### KEY FY 2006 PRODUCTS AND MILESTONES:

#### *Uncontained Engine Failures*

- Release improved titanium material models for incorporation into the LSDYNA model
- Issue revised UEDDAM vulnerability code incorporating industry recommendations
- Initiate uncontained engine crack detection demonstration on large commercial engine

#### *Propulsion Malfunction*

Develop demonstration of advanced propulsion malfunction indications.

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

**APPROPRIATION SUMMARY**

	Amount (\$000)
Appropriated (FY 1982-2004)	\$27,946
FY 2005 Enacted	1,107
FY 2006 Request	3,340
Out-Year Planning Levels (FY 2007-2010)	12,808
Total	<u>\$45,201</u>

<b>Budget Authority (\$000)</b>	<b>FY 2002 Enacted</b>	<b>FY 2003 Enacted</b>	<b>FY 2004 Enacted</b>	<b>FY 2005 Enacted</b>	<b>FY 2006 Request</b>
Contracts:					
Aircraft Catastrophic Failure Prevention Research	2,101	1,319	259	833	2,737
Personnel Costs	621	463	468	241	566
Other In-house Costs	72	27	31	33	37
<b>Total</b>	<u><b>2,794</b></u>	<u><b>1,809</b></u>	<u><b>758</b></u>	<u><b>1,107</b></u>	<u><b>3,340</b></u>

<b>OMB Circular A-11, Conduct of Research and Development (\$000)</b>	<b>FY 2002 Enacted</b>	<b>FY 2003 Enacted</b>	<b>FY 2004 Enacted</b>	<b>FY 2005 Enacted</b>	<b>FY 2006 Request</b>
Basic	0	0	0	0	0
Applied	2,794	1,809	758	1,107	3,340
Development (includes prototypes)	0	0	0	0	0
<b>Total</b>	<u><b>2,794</b></u>	<u><b>1,809</b></u>	<u><b>758</b></u>	<u><b>1,107</b></u>	<u><b>3,340</b></u>

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

A11f - Aircraft Catastrophic Failure Prevention Research Product and Activities	FY 2006 Request (\$000)	Program Schedule					
		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
<b>066-110 Aircraft Catastrophic Failure Prevention Research</b>							
<b>Engine Uncontainment Research</b>	<b>\$1,890</b>						
Complete AACE Grant (UCB) - Phase II "Optimization of Transport Airplane Rotor-burst Fragment Fabric Shielding"		◆					
Complete AACE Grant (ASU) - Phase II Testing of Fabric Gas Turbine Engine Containment System		◆					
Release Improved Titanium Material Models for Incorporation into the LSDYNA Model			◇				
Issue revised UEDDAM vulnerability code			◇				
Initiate Uncontained Engine Disk Crack Detection Test			◇				
Complete Containment Modeling Development for Metal/Multi-Layer Fabric Structure				◇			
Develop Prototype Engine Crack Detection System					◇		
Develop Dry Bay Mitigation Recommendations						◇	
<b>Propulsion Malfunction</b>	<b>\$847</b>						
Deliver Draft Report of Phase II Propulsion Malfunction Indications Research		◆					
Develop Demonstration of Advanced Propulsion Malfunction Indications			◇				
Develop Recommendations for Propulsion Monitoring System				◇			
Conduct Propulsion Monitoring Flight Test						◇	
<b>Personnel and Other In-House Costs</b>	<b>\$603</b>						
<b>Total Budget Authority</b>	<b>\$3,340</b>	<b>\$1,107</b>	<b>\$3,340</b>	<b>\$3,238</b>	<b>\$3,224</b>	<b>\$3,210</b>	<b>\$3,136</b>

Note: Out year numbers are for planning purposes only. Actual funding needs will be determined through the annual budget process.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
AIP	N/A	Airport Cooperative Research Program (ACRP)	\$10,000,000

### Supports FAA Strategic Goals: Increased Safety, Greater Capacity

**Program Goals and Intended Outcomes:** The Airport Cooperative Research Program (ACRP) was mandated by Congress in Vision 100-Century of Aviation Reauthorization Act. Its purpose is to carry out applied research on problems that are shared by airport operating agencies and that are not being adequately addressed by existing federal research programs.

The ACRP was authorized as a four-year pilot program. Research projects will be selected by an independent governing board of airport managers and others appointed by the Secretary of Transportation. The program will be administered by the Transportation Research Board (TRB) through a Memorandum of Agreement (MOA) with the FAA.

Research projects will be solicited annually by the TRB. Research will be conducted in areas of significant interest to airports including their operations, management and planning, environmental concerns, and capacity issues.

The research will lead to improvements in airport safety, capacity, and efficiency as well as to reductions in environmental impact from airport noise and the runoff of airport deicing and anti-icing activities.

#### Agency Outputs:

ACRP research will be conducted as relatively low cost studies lasting one to two years and will result in reports published by the TRB for use by the airport community.

#### Customer/Stakeholder Involvement:

The TRB will annually solicit research topics from airports, educational institutions, and the aviation industry. Technical panels will review the proposals and make recommendations to the ACRP regarding which research projects to fund. Other federal agencies concerned with airport research, including NASA and the Environmental Protection Agency (EPA) will serve with the FAA on the ACRP Governing Board. The airport community will be represented on the Board by airport managers and representatives from the Airports Council International (ACI), the American Association of Airport Executives (AAAE).

#### Accomplishments:

An MOA has been drafted between the FAA and the TRB to implement the ACRP. This is a new program that was first funded by \$3M in FY 2005. Actual research projects will not start until late in FY 2005.

#### R&D Partnerships:

ACRP is a cooperative partnership with airports and federal agencies to conduct airport research. The research will be conducted by universities, airports, and companies within the aviation industry.

#### MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:

The FAA has coordinated development of an MOA between itself and the TRB to implement the ACRP. The agreement has been coordinated with industry through the assistance of the ACI and the AAAE.

The TRB has solicited for research projects and received over 70 proposals.

#### FY 2006 PROGRAM REQUEST:

Vision 100 authorized \$10M per year for the ACRP. \$3M was appropriated in FY 2005. In FY 2006, the FAA has requested \$10M for the ACRP as part of the Airport Improvement Program (AIP).

Technical panels administered by the TRB will review research proposals submitted by airports, universities, and the aviation industry to select the most promising projects for funding.

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

**KEY FY 2006 PRODUCTS AND MILESTONES:**

TRB published reports documenting the airport research to be conducted.

**APPROPRIATION SUMMARY**

	<u>Amount (\$000)</u>
Appropriated (FY 1982-2004)	\$0
FY 2005 Enacted	0
FY 2006 Request	10,000
Out-Year Planning Levels (FY 2007-2010)	40,000
<b>Total</b>	<b>\$50,000</b>

Budget Authority (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Contracts:					
Airport Cooperative Research Program (ACRP)	0	0	0	0	10,000
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>10,000</b>

OMB Circular A-11, Conduct of Research and Development (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	0	0	0	0	10,000
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>10,000</b>

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

Airport Cooperative Research Program Product and Activities	FY 2006 Request (\$000)	Program Schedule					
		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
<i>Airport Cooperative Research Program</i>							
<b>Safety-Related Research</b>	<b>\$5,000</b>						
Conduct research on selected proposals			◇	◇	◇	◇	◇
Other Subtask(s) (TBD)			◇	◇	◇	◇	◇
<b>Capacity-Related Research</b>	<b>\$5,000</b>						
Conduct research on selected proposals			◇	◇	◇	◇	◇
Other Subtask(s) (TBD)			◇	◇	◇	◇	◇
<b>Total Budget Authority</b>	<b>\$10,000</b>	<b>\$</b>	<b>\$10,000</b>	<b>\$10,000</b>	<b>\$10,000</b>	<b>\$10,000</b>	<b>\$10,000</b>

◆ - Activities Accomplished      ◇ - Activities Planned

NOTES: OUT YEAR NUMBERS ARE FOR PLANNING PURPOSES ONLY. ACTUAL FUNDING NEEDS WILL BE DETERMINED THROUGH THE ANNUAL BUDGET PROCESS.

IN THE FACILITIES AND EQUIPMENT APPROPRIATIONS, PERSONNEL AND OTHER COSTS ARE BUDGETED IN ACTIVITY 5, NOT THE PROGRAM BUDGET LINE ITEM.

\* DETAILED TASKING STRUCTURE FOR THIS PROGRAM IS CURRENTLY UNDER DEVELOPMENT.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
AIP	N/A	Airports Technology Research – Capacity	\$8,525,000

### Supports FAA Strategic Goal: Greater Capacity

**Program Goals and Intended Outcomes:** The FAA is enhancing airport system capacity through better airport planning, airport design, and through improved pavement thickness design, construction, and maintenance.

**Agency Outputs:** Federal law requires the FAA to develop standards and guidance material for airport design, construction, and maintenance. The Airport Technology program provides the technical information needed to support and update these FAA outputs in a timely manner.

The airport advisory circulars (ACs) related to capacity improvements are the agency’s principal means of communicating with U.S. airport planners, designers, operators, and equipment manufacturers. These ACs apply to airport geometric design, pavement thickness design, and airport planning.

The FAA and its regional offices enforce standards and guiding material when administering the Airport Improvement Program (AIP).

**Customer/Stakeholder Involvement:** AIP grants contribute about half of the approximately \$2 billion spent each year to provide operationally safe and reliable airport pavements. Projects funded under the AIP grants must conform to the FAA ACs or designated standards. The remaining costs are borne by state and local governments.

To ensure new pavement standards will be ready to support the safe international operation of next-generation heavy aircraft, the FAA and the Boeing Company have entered into a Cooperative Research and Development Agreement. Together, these partners have built the National Airport Pavement Test Facility (NAPTF), a unique full-scale research vehicle, at the William J. Hughes Technical Center. Along with the International Civil Aviation Organization (ICAO), they are using data collected at the facility in developing the pavement design standards that airports throughout the world need to accommodate new large aircraft weighing in excess of 1,000,000 pounds.

**Accomplishments:** The Airport Technology research program has provided products to enhance airport capacity in the United States and around the world. Recent research results are published as FAA reports and ACs and made available to users worldwide. Some major accomplishments are:

- Built the NAPTF and dedicated it on April 12, 1999; began testing at the facility on June 4, 1999. In FY2004, completed reconstruction and full-scale traffic testing of three concrete pavement test items at the NAPTF.
- Issued LEDFAA version 1.3 – a new pavement design standard software based on data generated at the NAPTF – to allow the introduction of new aircraft, including the Airbus A380, into the fleet mix
- Conducted technical workshops in airport pavement design using FEDFAA and LEDFAA version 1.3
- Completed a beta test of the FEDFAA pavement design computer program incorporating 3D finite element models
- Maintained an airport pavement data base with full-scale test data collected at the NAPTF and gave on-line access to international researchers
- Established or expanded cooperative programs with non-profit research foundations [the Innovative Pavement Research Foundation (IPRF) and Auburn University] to conduct research in concrete and asphalt airport pavement technology. An IPRF report on an Ultra-Thin Whitetopping durability study at airports was completed in FY 2004
- Released software (ProFAA) for computing runway smoothness using an inertial profiler with simulations to the standard outputs from other commonly used devices

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

### R&D Partnerships:

- FAA-U.S. Army Engineer Research and Development Center\*
- FAA-U.S. Air Force, Tyndall Air Force Base\*
- FAA-University of Illinois/Northwestern University (Center of Excellence for Airport Technology)\*\*
- FAA-Boeing Company, Cooperative Research and Development Agreement (\$7 million Boeing/\$21 million total for NAPTF)\*\*\*
- FAA IPRF++
- FAA-Auburn University++
- FAA-Rowan University++

\* Interagency agreement or Memorandum of Agreement      \*\* Partnership through matching funds      \*\*\* Cost Sharing      ++ Cooperative Agreement

Through these partnerships, research results are published in scientific journals, presented at technical conferences, and discussed at workshops.

### MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:

- Continue analyzing full-scale data from the NAPTF
- Complete draft report on implementation of 3D finite element structural models in Advanced Airport Pavement Design Procedures – August 2005
- Complete draft report on sensitivity/calibration study for new airport pavement design procedures – August 2005
- Complete IPRF project on Design Guide for Stabilized and Drainable Bases – November 2004
- Develop models for airport funding strategies, and passenger surveys

### FY 2006 PROGRAM REQUEST:

The Airport Technology research program is a collaborative effort among many government organizations, universities, and industry associations. The requested funding will allow this group to continue developing standards and guidelines for maintaining and enhancing our national airport infrastructure.

### KEY FY 2006 PRODUCTS AND MILESTONES

- Continue analyzing full-scale data from the NAPTF
- Design and fabricate modules for 8-10 wheel gear loading
- Conduct full-scale pavement tests on asphalt overlaid test items at the NAPTF
- Publish new airport pavement design procedures (computer program FAARFIELD)
- Conduct technical workshops in pavement design using FAARFIELD
- Develop conceptual guidelines and computer tools for terminal building design

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

**APPROPRIATION SUMMARY**

	<u>Amount (\$000)</u>
Appropriated (FY 1982-2004)	\$23,602
FY 2005 Enacted	8,700
FY 2006 Request	8,525
Out-Year Planning Levels (FY 2007-2010)	<u>34,100</u>
<b>Total</b>	<b>\$74,927</b>

Budget Authority (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Contracts:					
Airports Technology Research - Capacity	2,675	6,586	7,750	8,700	8,525
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
<b>Total</b>	<b>2,675</b>	<b>6,586</b>	<b>7,750</b>	<b>8,700</b>	<b>8,525</b>

OMB Circular A-11, Conduct of Research and Development (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	2,675	6,586	7,750	8,700	8,525
<b>Total</b>	<b>2,675</b>	<b>6,586</b>	<b>7,750</b>	<b>8,700</b>	<b>8,525</b>

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

<b>Airports Technology Research - Capacity Product and Activities</b>	<b>FY 2006 Request (\$000)</b>	<b>Program Schedule</b>					
		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
<b><i>Airport Technology – Capacity Goal</i></b>							
<b>Airport Technology - Capacity</b>  Continue Full-Scale Testing at National Airport Pavement Test Facility (NAPTF)  Continue Analysis of Full-Scale Data from NAPTF  Advanced Airport Pavement Design Procedures (Development / Programming / Documentation / Workshops)  Develop Design Standards for General Aviation Airports  Continue Support of Airport Technology Center of Excellence  Test Non-Destructive Pavements  Support Development of MicroPaver Software  Pavement Roughness Research  Material Testing Lab  Test Machine Modification for 8-10 wheels  Mix Design for High-Pressure Tires  Test for High Inflation Pressure  Alternative Methods for NDT  Develop Gyrotory Test Method for P-401  Develop Conceptual Guidelines and Computer Tools for Terminal Building Design  Develop Models for Airport Funding Strategies, and Passenger Surveys	<b>\$7,325</b>						
<b><i>Personnel and Other In-House Costs</i></b>	<b>\$1,200</b>						
<b><i>Total Budget Authority</i></b>	<b>\$8,525</b>	<b>\$8,700</b>	<b>\$8,525</b>	<b>\$8,525</b>	<b>\$8,525</b>	<b>\$8,525</b>	<b>\$8,525</b>

◆ - Activities Accomplished      ◇ - Activities Planned

NOTES: OUT YEAR NUMBERS ARE FOR PLANNING PURPOSES ONLY. ACTUAL FUNDING NEEDS WILL BE DETERMINED THROUGH THE ANNUAL BUDGET PROCESS.

IN THE FACILITIES AND EQUIPMENT APPROPRIATIONS, PERSONNEL AND OTHER COSTS ARE BUDGETED IN ACTIVITY 5, NOT THE PROGRAM BUDGET LINE ITEM.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
AIP	N/A	Airports Technology Research – Safety	\$8,975,000

### Supports FAA Strategic Goal: Increased Safety

**Program Goals and Intended Outcomes:** The FAA intends to improve airport safety by conducting research to improve airport lighting and marking, reduce wildlife hazards, improve airport fire and rescue capability, and reduce surface accidents. The FAA will also develop and maintain standards in airport system areas to:

- Reduce aircraft accidents due to incursions, particularly in low-visibility conditions
- Reduce aircraft accidents due to slipperiness caused by ice and snow on runways
- Improve post-crash rescue and firefighting capabilities
- Reduce the negative impact of wildlife on airport safety

**Agency Outputs:** Federal law requires the FAA to develop standards and guidance material for airport design, construction, and maintenance. The Agency uses the airport advisory circular (AC) system as its principal means of to fulfill its obligation to communicate with a user community consisting of U.S. airport planners, designers, operators, and equipment manufacturers.

Achieving the overall FAA goal of reducing accidents requires improvement in airport safety as well as aircraft safety. Outputs of the program include guidance regarding: new technology for improving airport lighting and marking to help reduce surface accidents and runway incursions, improvements in aircraft rescue and fire fighting to address double decked aircraft carrying up to 800 passengers, and new techniques to modify the habitats of increasing numbers of wildlife on or near airports.

The Airport Improvement Program (AIP) provides current technical information to support and update ACs covering design of airport safety areas, visual aids, rescue and firefighting, ice and snow control, and wildlife control. The FAA and its regional offices then enforce these standards and guidance materials as part of administering the AIP.

**Customer/Stakeholder:** AIP grants contribute about half of the approximately \$2 billion spent each year to provide operationally safe and reliable airport pavements. Projects funded under the AIP grants must conform to the FAA ACs or designated standards. The remaining costs are borne by state and local governments.

**Accomplishments:** The Airport Technology research program has provided products to enhance the safety of airport operations in the United States and around the world. Research results are published as FAA ACs and made available to users worldwide. Recent program accomplishments include:

- Completed ground truthing tests for prototype bird detection radar at the Dallas/Ft. Worth International Airport
- Completed report on Light-Emitting Diode (LED) light strip for enhancing paint markings
- Completed interim report on LED application for taxiway edge lights
- Completed report on installation criteria for taxiway centerline lights
- Completed evaluation of soft ground arrestor material durability in Arctic conditions
- Completed evaluation Small Airport Firefighting Systems
- Completed demonstrations of the use of aircraft lighting to enhance the conspicuity of aircraft on the ground.
- Completed Synthetic Turf Studies
- Published final report on runway and taxiway retro-reflective markers

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

### R&D Partnerships:

- FAA-U.S. Air Force, Tyndall Air Force Base \*
- FAA-USDA, National Wildlife Research Center, Sandusky, Ohio \*
- FAA-Agencies of Canadian Government (for pavement technology and winter operations safety) \*\*
- FAA-NASA (for joint runway traction research) \*
- FAA-Port Authorities of New York and New Jersey (for design and construction of aircraft arrestor bed) \*
- FAA-industry - soft-ground arrestor materials) \*\*

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\* Inter-agency agreement or Memorandum of Agreement (MOA)

\*\* Cost Sharing

Through these partnerships, research results are published in scientific journals, presented at technical conferences, and discussed at workshops.

### MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:

- Evaluate the effectiveness of anti-icing pavement overlay at the Chicago O'Hare International Airport
- Evaluate effectiveness of prototype FOD radar at a large Airport
- Evaluate EMAS long-term durability
- Evaluate effectiveness of Polyurea alternative surface marking material

### FY 2006 PROGRAM REQUEST:

The Airport Technology FY 2004 research program is a collaborative effort among many government organizations, universities, and industry associations. The requested program funding provides contract support for an integrated, effective research program that delivers the standards and guidelines needed to maintain and enhance airport infrastructure.

### KEY FY 2006 PRODUCTS AND MILESTONES:

- Complete Design Criteria for Interior Intervention Vehicle
- Complete the Taxiway Deviation Study
- Complete Trash Transfer Station Studies
- Evaluate the Prototype Radar-based Airport Advisory System

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

**APPROPRIATION SUMMARY**

	<u>Amount (\$000)</u>
Appropriated (FY 1982-2004)	\$31,724
FY 2005 Enacted	3,700
FY 2006 Request	8,975
Out-Year Planning Levels (FY 2007-2010)	<u>35,900</u>
<b>Total</b>	<b>\$80,299</b>

Budget Authority (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Contracts:					
Airports Technology Research - Safety	2,450	7,600	9,667	3,700	8,975
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
<b>Total</b>	<b>2,450</b>	<b>7,600</b>	<b>9,667</b>	<b>3,700</b>	<b>8,975</b>

OMB Circular A-11, Conduct of Research and Development (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	2,450	7,600	9,667	3,700	8,975
<b>Total</b>	<b>2,450</b>	<b>7,600</b>	<b>9,667</b>	<b>3,700</b>	<b>8,975</b>

# 2005 FAA NATIONAL AVIATION RESEARCH PLAN

Airports Technology Research - Safety Product and Activities	FY 2006 Request (\$000)	Program Schedule					
		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
<i>Airport Technology – Safety Goal</i>							
<b>Airport Technology - Safety</b>	<b>\$7,775</b>						
Complete Testing of Proposed Heliport/Vertiport Lighting Standards		◆	◇	◇	◇		
Complete Design Criteria for Interior Intervention Vehicle		◆	◇				
Complete Design and Construction of Prototype Next Generation Elevated Waterway with Aircraft Skin Penetrating Device		◆	◇	◇	◇		
Evaluate Prototype Radar-Based Airport Advisory System			◇	◇	◇		
Conduct Trash Transfer Station Studies and Continue Wildlife Hazard Abatement Studies			◇	◇			
Conduct Taxiway Deviation Studies			◇				
Continue Development of Improved Visual Guidance Systems to Reduce Runway Incursions		◆	◇	◇	◇	◇	◇
Continue Development of Improved Rescue and Firefighting Methods		◆	◇	◇	◇	◇	◇
Continue Development of Improved Airport Design Methods and Improve Runway Friction		◆	◇	◇	◇	◇	◇
Continue Development of Improved Methods for Handling the NLA		◆	◇	◇	◇	◇	◇
Continue Development of Improved Standards for Frangibility		◆	◇	◇			
Continue Development of Improved Standards for Airport Planning		◆	◇	◇	◇	◇	◇
<i>Personnel and Other In-House Costs</i>	<b>\$1,200</b>						
<b>Total Budget Authority</b>	<b>\$8,975</b>	<b>\$3,700</b>	<b>\$8,975</b>	<b>\$8,975</b>	<b>\$8,975</b>	<b>\$8,975</b>	<b>\$8,975</b>

◆ - Activities Accomplished      ◇ - Activities Planned

NOTES: OUT YEAR NUMBERS ARE FOR PLANNING PURPOSES ONLY. ACTUAL FUNDING NEEDS WILL BE DETERMINED THROUGH THE ANNUAL BUDGET PROCESS.

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## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
F&E	1A01J	Airspace Management Laboratory	\$7,000,000

### Supports FAA Strategic Goal: Greater Capacity

**Program Goals and Intended Outcomes:** The mission of the FAA’s Air Traffic Organization (ATO) System Operations – Safety division is to meet air transportation’s demand for increased capacity, efficiency and predictability in the airspace, routes, and airports of the National Airspace System (NAS) while ensuring that safety factors and environmental regulations are diligently satisfied.

To aide the ATO in achieving its mission, the Airspace Management Laboratory provides decision support capabilities to national, regional and local airspace system management specialists. The Laboratory also develops and manages information management systems to improve the end-to-end integrity of NAS support and post-operational data.

Major categories of activities carried out by the Laboratory include:

- Identifying issues and performing analyses, with appropriate attention to potential environmental impact, in support of FAA airspace assessment and redesign activities; this activity includes the continuing development of data management and simulation tools for the evaluation of airspace design alternatives by FAA field personnel and analysts at the Federally Funded Research and Development Center
- Developing information system and decision support tools to support other FAA lines of business dependent on extensive operational data such as foreign overflight “fee for service” assessments, obstruction evaluation analyses, advanced air traffic control (ATC) tool benefits evaluation (e.g., former Free Flight Office), and Daily Measurement of Air Traffic Services
- Streamlining input, storage and output for FAA aeronautical information management systems used to create end-user products like charts and publications as well as internal FAA products such as NAS modernization/improvement plans, obstruction analyses, environmental analyses and performance metrics

Airspace Management Laboratory outcomes during the past year include:

- Acquired, stored, and distributed air traffic operational data for use in NAS performance metrics calculations and local and national NAS improvement analyses; this work included the full phase-in of a new high fidelity air traffic operational data source for all centers and large terminals
- Performed quantitative analyses of current air traffic activity, including performance measures such as reported cancellations, diversions, and delays
- Analyzed environmental factors (noise)
- Helped to develop international aeronautical data standards designed to improve the quality and timeliness of FAA aeronautical data
- Demonstrated new computer-based methodologies for constructing and publishing Temporary Flight Restriction (TFR) Notices to Airmen (NOTAMs); the prototype improved NOTAM safety and high end user acceptance by improving standardization, readability and accuracy of TFR NOTAMs
- Deployed new obstruction evaluation capabilities allowing proposed obstructions to be submitted digitally
- Continued support and fielding of the following systems:
  - Overflight “fee for service” assessments
  - The Consolidated Operations and Delay Analysis System

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

- Airspace Metrics
- Sector Design and Analysis Tool (SDAT)
- Enhanced Traffic Management System repository

**Customer/Stakeholder Involvement:** The Airspace Management Laboratory continues to focus on providing value to the FAA and its external customers. The laboratory has supported the missions of Finance and Cost Accounting, the Office of Financial Services, the Office of Aviation Policy, and the *Operational Evolution Plan*. Products and tools produced by the lab are continually used by several lines of business throughout the agency, including several ATO organizations like System Operations – Safety, System Architecture and Investment Analysis, System Capacity Air Traffic Planning and Procedures, and Air Traffic System Management. The Laboratory also has provided ongoing support for many NAS improvement projects involving staffing field analyses, performing analytical work, enabling daily access to operational data, and continuing technical support for database query programming.

### **Accomplishments:**

#### *Obstruction Evaluation and Airport Airspace Analysis*

- Deployed national infrastructure to support paper-less processing of obstruction evaluation cases
- Provided mechanism for Airports to submit airport and runway data directly to national Flight Data Center
- Deployed a new interface allowing proponents to submit proposed obstructions electronically

#### *Airspace system issue identification and operations research*

- Visualized and analyzed past and current traffic patterns
- Analyzed system performance such as work done for ATO Financial System and Performance Reporting to develop future forecasts of ATO Performance and Cost metrics
- Calculated facility utilization rates using historical and current air traffic
- Provided airspace and traffic analyses to support special requests such as the 9/11 Commission
- Developed models and scenarios to evaluate and improve NAS response to convective weather events
- Evaluated traffic volume levels for system performance and capacity studies such as a traffic volume evaluation at Standard Terminal Automation Replacement System (STARS) facilities to estimate bandwidth requirements

#### *Airspace and airport design and environmental evaluation*

- Developed alternative airspace designs and images used in examining flight track data and in evaluating airspace classification changes at major airports like Minneapolis and Detroit
- Analyzed changes to airspace design on flow, capacity, delay, workload, and other metrics as required
- Developed data needed to evaluate noise and consider pollution impacts as a part of airspace design analysis
- Enhanced the SDAT to provide advanced airspace design capabilities

#### *Aeronautical Information Management*

- Demonstrated proof of concept that the accuracy, consistency and readability of NOTAMs could be improved through use of information engineering techniques to digitally encode, transmit and distribute the notices
- Led an effort to adopt international standards for aeronautical data; the resulting adoption will lead to cost savings in aeronautical data collection, management and distribution as well as safety improvements resulting from enhanced data quality

### **MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:**

- Integrate Aviation System Standards obstruction evaluation processes into the paper-less obstruction evaluation system
- Provide analytical, decision support and operations research support to the FAA lines of business and external customers
- Continue improving aeronautical information system quality by automating and digitizing system inputs and outputs
- Leverage international aeronautical data standards and automation tools to improve aeronautical data quality, completeness and timeliness
- Add design and analysis capability into the SDAT, especially critically needed capability to automate and improve Minimum Vector Altitude sector analysis at terminals and centers
- At ATC operational data repositories with improved fidelity, focus on generating next-day reports that can be used by field facilities to refresh the web metrics system
- Continue traffic data repository collection and enhancement of high-precision aircraft position reports to support National Airspace Redesign and Environmental analysis

### **KEY FY 2006 PRODUCTS AND MILESTONES:**

- Maintain decision and analytical capabilities to support FAA lines of business and external customers
- Begin a fully integrated aeronautical information management system that leverages automation and workflow systems to provide end-to-end data integrity
- Develop additional automation systems to improve the operation of facility airspace offices
- Develop an operational concept and begin implementing new capabilities to manage temporary changes to aeronautical data (e.g., the aeronautical data content contained within a NOTAM) with the goal of improving aeronautical data accuracy and consistency for NAS users
- Deliver a new web metrics capability that utilizes high fidelity traffic data. Deploy a metrics system suitable for daily use within the air traffic facility offices
- Support the examination of technologies being acquired or alternative procedures with respect to potential for ATC efficiency and other performance-related improvements
- Continue collecting and distributing NAS support and NAS post-operational data for use by the FAA lines of business.

### **FY 2006 PROGRAM REQUEST:**

Continued investments in the Airspace Management Laboratory are needed to provide the data, tools and processes required for the FAA to meet the demands of a continually change NAS. New technologies and NAS modernization efforts (such as ERAM) require significant improvements in aeronautical data quality to achieve desired cost, efficiency and safety improvements. The Airspace Management Laboratory program plans reflect the goals of providing high quality information systems, analytical support and tool capabilities necessary for the FAA to meet performance, safety and efficiency targets.

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

**APPROPRIATION SUMMARY**

	<u>Amount (\$000)</u>
Appropriated (FY 1982-2004)	\$16,061
FY 2005 Enacted	0
FY 2006 Request	7,000
Out-Year Planning Levels (FY 2007-2010)	0
<b>Total</b>	<u>\$23,061</u>

Budget Authority (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Contracts:					
Airspace Management Laboratory	4,500	4,570	0	0	7,000
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
<b>Total</b>	<b>4,500</b>	<b>4,570</b>	<b>0</b>	<b>0</b>	<b>7,000</b>

OMB Circular A-11, Conduct of Research and Development (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	4,500	4,570	0	0	7,000
<b>Total</b>	<b>4,500</b>	<b>4,570</b>	<b>0</b>	<b>0</b>	<b>7,000</b>

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

Airspace Management Laboratory Product and Activities	FY 2006 Request (\$000)	Program Schedule					
		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
<b>Airspace Management Laboratory</b>	<b>\$7,000</b>						
<b>Analyze, Deploy, and Enhance Traffic Data &amp; Metrics Products and Projects</b>							
Enhance and Augment ATC Data Collection and Distribution System			◇				
Deliver High Fidelity Next Day Performance Metrics for Field Use			◇				
Provide Analytical and Operations Research Support to Internal and External Customers			◇				
<b>Analyze, Enhance, and Support Analysis and Decision Support Tools</b>							
Maintain and Enhance Environmental Noise Analysis Tool Capability			◇				
Deliver Airspace Office Automation Capabilities including Minimum Vector Analysis Capabilities			◇				
Integrate Terminal Procedures Component of Obstruction Evaluation into the Obstruction Evaluation Workflow System			◇				
<b>Aeronautical Information Management</b>							
<b>Create fully integrated aeronautical information management system</b>							
Automate and Standardize Aeronautical Data Inputs			◇				
Develop Transformation Engines to Automate Aeronautical Data Products and Provide Data Access to Internal and External Clients			◇				
Implement Process Improvement Strategies to Improve End-to-End Data Integrity, Timeliness and Quality			◇				
Integrate International Aeronautical Data Standards and Processes			◇				
Develop Operational Concept and Implement Processes to Support Aeronautical Data Temporality			◇				
<b>Total Budget Authority</b>	<b>\$7,000</b>	<b>\$0</b>	<b>\$7,000</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>

◆ - Activities Accomplished      ◇ - Activities Planned

NOTES: OUT YEAR NUMBERS ARE FOR PLANNING PURPOSES ONLY. ACTUAL FUNDING NEEDS WILL BE DETERMINED THROUGH THE ANNUAL BUDGET PROCESS.

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## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A11.d	Atmospheric Hazards/Digital System Safety	\$3,441,000

### Supports FAA Strategic Goal: Increased Safety

**Program Goals and Intended Outcomes:** The Atmospheric Hazards/Digital System Safety Research Program contributes to the achievement of the FAA's strategic goal in the area of aviation safety.

A major goal of the program is to reduce the vulnerability of aircraft to atmospheric hazards through ground de-icing, in-flight icing detection, and anti-icing, de-icing systems. By 2007, advisory material will be completed to certify an aircraft to fly in Supercooled Large Droplet (SLD) icing conditions. Currently, commercial airplanes certified for flight in icing conditions were certified to an icing envelope that did not include SLD icing conditions.

By FY 2008, the program will also develop and publish guidance for mitigation of electromagnetic hazards from lightning, high-intensity radiated fields, and portable electronic devices to aircraft electrical and avionic systems.

By FY 2008, conduct research needed to develop guidelines for testing, evaluation and certification of digital flight controls and avionics systems. The program develops and validates technologies, tools, methodologies, and procedures intended to:

- Detect and remove frozen contamination from aircraft at takeoff
- Develop data and technology to determine safe takeoff times and procedures in conditions of freezing precipitation
- Develop icing simulation capabilities, including SLDs
- Characterize the aircraft icing environment, including SLD and mixed-phase conditions
- Develop technology and data packages to support certification requirements and advisory material to ensure that aircraft meet performance, stability, and control safety standards during or after in-flight operation in icing conditions
- Ensure the safe operation of emerging, highly complex software-based digital flight controls and avionics systems for flight-essential and flight-critical applications
- Protect aircraft electrical and electronic systems against the damaging effects of lightning, cosmic radiation, wireless devices on board aircraft, degradation of wiring systems and all forms of High Intensity Radiated Fields (HIRF)

**Agency Outputs:** The FAA establishes rules for the operation of software, digital flight controls, and avionics systems on aircraft that encounter icing conditions and electromagnetic hazards.

The agency provides Advisory Circulars (AC) and various forms of technical information to the FAA's certification and airworthiness specialists, its inspectors, and the aircraft and avionics industry on acceptable means for meeting the rules.

The Atmospheric Hazards/Digital System Safety Research Program acts – alone and with other U.S. and international agencies – to further the development and use of technologies for detecting frozen contamination and predicting anti-icing fluid failure and for ensuring safe operations during and after flight in atmospheric icing conditions.

**Customer/Stakeholder Involvement:** The Atmospheric Hazards/Digital System Safety Research Program collaborates with a broad segment of the aviation community to improve aircraft certification, inspection, and maintenance. Highlights of this involvement include:

- FAA Free Flight Initiative – helping to perfect the highly integrated avionics, ground-based systems, complex software, and certification issues required for the success of this effort
- The Subcommittee on Aircraft Safety (SAS) of the FAA Research, Engineering and Development Advisory Committee (REDAC) – subcommittee representatives from industry, academia, and other

government agencies review the activities of the Flight Safety/Atmospheric Hazards program annually

- Technical Community Representative Groups (TCRG) – representatives from FAA headquarters and the directorates apply formal guidelines to ensure that the program’s R&D projects support new rulemaking and comply with existing rules
- Aviation Rulemaking Advisory Committee’s (ARAC) Electromagnetic Effects Harmonization Working Group (EEHWG)
- ARAC’s Ice Protection Harmonization Working Group (IPHWG) – including Super-cooled Large Droplets in the icing environment and ice detectors as a means to warn flight crews of ice accumulation on critical surfaces
- Society of Automotive Engineers (SAE) Aircraft Lightning Protection (AE-2) Committee – developing AC’s, test standards, and related users manuals to improve flight safety
- SAE G-12 Aircraft Ground Deicing Committee – updating holdover time guidelines, and establishing standards for de/anti-icing methodologies, deicing fluids, and ground ice detection
- RTCA SC-202 (Radio Technical Commission for Aeronautics-Special Committee 202) to determine the risk of using cell phones on board aircraft
- RTCA SC-200 (Modular Avionics) to promote aircraft systems design using modular avionics by developing guidance for regulatory approval of the platform and supporting components

**Accomplishments:** Since 1999, the Atmospheric Hazards/Digital System Safety Research Program has:

- Issued several AC’s, 1 technical bulletins, and a third iteration of the Aircraft Icing Handbook
- Held international conferences on aircraft ground deicing and aircraft in-flight icing
- Issued the holdover time guidelines followed by many of the world’s airlines in their use of aircraft anti-icing fluids
- Published in-service electromagnetic hazards advisory material on lightning strike characterization; a HIRF Rule, drafted through the EEHWG, is currently awaiting FAA approval
- Completed research on the effects of aging on the continued protection integrity of aircraft due to degradation of wiring and connectors
- Participated in activities of the international Certification Authorities Software Team (CAST) and Object-Oriented Technology in Aviation efforts
- Investigated standards, testing methods, and certification criteria for systems using Commercial Off-the-Shelf (COTS) real-time operating systems. Results were not favorable
- In Real-Time Scheduling Analysis, explored industry approaches to scheduling real-time tasks and developed a scheduling algorithm and temporal procedure for modeling real-time tasks
- For Ethernet as an aviation data bus: studied deterministic operations of Ethernet equipment and provided evaluation criteria for certification of Ethernet databases
- Identified issues that make COTS ground processing systems for aircraft maintenance trustworthy and secure

**R&D Partnerships:** The program has established the following cooperative relationships:

- ARAC, EEHWG international certification authority/industry forum – pertains to HIRF environment, User’s Guide for AC 20-1317
- ARAC, IPHWG – for maintenance of data on and analysis of SLD conditions in the atmosphere
- SAE–AE2 – pertains to “Lightning Protection Of Aircraft, Lightning Environment, Waveforms And Testing Standard, Aircraft Zoning Standard,” and User’s Manual for AC 20-136
- RTCA Special Committee-135 – pertains to “Environmental Conditions and Test Procedures for Airborne Equipment”

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

- Langley Research Center – based on a multiyear FAA/NASA interagency agreement for the assessment of software-based digital flight controls and avionics systems and electromagnetic hazards research
- Sandia Corporation, Army Directorate for Applied Technology, Test and Simulation, and ORION International Technologies, Incorporated – based on a letter of agreement to leverage HIRF certification research
- CAST – this group of international certification software specialists collaborates and makes recommendations to authorities on the resolution of software problems
- Aerospace Vehicle Systems Institute (AVSI) – cooperative industry and government venture for investigation of aircraft semiconductor wear out and cosmic radiation effects on avionics systems
- NASA Glenn Research Center – includes various cooperative efforts on aircraft icing activities
- Transport Canada – based on an international agreement on research on aircraft ground deicing issues
- Meteorological Service of Canada – based on an international memorandum of cooperation for research on in-flight icing conditions
- U.S. Air Force/McKinley Environmental Laboratory – based on an interagency agreement for the development of a new in-flight icing test capability
- RTCA SC-202 – FAA mandated committee to assess the risks associated with the use of cell phones aboard aircraft

### MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:

#### *Aircraft Icing*

- Continue investigation of atmospheric environment aloft, with emphasis on measurement of ice particle conditions
- Report modeling and simulation improvement of SLD icing conditions
- Determine/substantiate time of effectiveness and aerodynamic performance of modern de/anti-icing fluids
- Complete tunnel testing of characteristic features and aerodynamic effects of runback icing for thermal ice protection systems

#### *Software and Digital Systems Safety.*

- Report on analysis of aspects of COTS Component Integration (Phase 2) that are most susceptible to failures and study techniques which reduce vulnerabilities
- Complete and report on Object-Oriented Technology (OOT) in aviation, addressing the identification of language and tool-specific issues concerning the confirmation of data and control coupling
- Report on software development tools addressing the definition of tool use process and related team efficiency, and development of the evaluation criteria for verification tools
- Identify aspects of Flight Guidance and Control (FG&C) design with significant potential for safety and design effectiveness improvements and identify advanced FG&C system minimum performance standards (Subtask 1)

#### *Electromagnetic Hazards to Aircraft Systems*

- Continue collecting natural lightning strike data to further define the lightning strike environment
- Issue interim report on aircraft continued protection integrity due to degradation of wiring, connectors and insulation of transport category aircraft
- Assess risk of neutron particle effects (single event effects) on flight critical systems
- Complete testing to determine methodology to measure HIRF compliance

**FY 2006 PROGRAM REQUEST:**

*Ongoing Activities*

Laboratory methods for determination of fluid holdover times will be refined. Research in support of development of SLD engineering tools will continue. Research into atmospheric environments of special interest to aircraft icing will continue. Development of an enhanced in-flight icing simulation capability at McKinley Environmental Laboratory will continue. Investigation of acceptability of using ground ice detectors to demonstrate compliance with FAA requirements will continue.

Research will also continue on software and hardware for component integration. Work will continue the investigation in OOT, which will identify language and tool-specific issues concerning the structural coverage of OOT software at the source code and object code levels. Work will continue on databus evaluation criteria for airworthiness of newly proposed databuses and Local Area Networks (LANs) in aircraft and the protection of sensitive information on these LANs. Investigations into flight safety and certification issues identified by CAST, AVSI and RTCA subcommittee efforts will continue.

The program will continue to assess the effects of lightning on aircraft structures and systems, and assess issues affecting the continued protection integrity of transport aircraft.

*New Initiatives*

Research will begin to investigate testing, analysis, and scaling associated with use of unpressurized icing tunnels to simulate test points at altitude for hot-air ice protection systems.

New software and digital system safety research will begin on augmented manual control (fly-by-wire/light) and flight critical systems design assurance.

**KEY FY 2006 PRODUCTS AND MILESTONES:**

*Aircraft Icing*

- Determine/substantiate time of effectiveness and aerodynamic performance of modern de/anti-icing fluids
- Report on facility simulation development for SLD icing testing
- Report on runback icing for hot air ice protection systems – testing and analysis
- Report on new test standards and procedures for Type II, II, and IV anti-icing fluids and non-glycol based Type I fluids

*Electromagnetic Hazards to Aircraft Systems.*

- Report on characterization of the aircraft lightning environment
- Report on aircraft continued protection integrity due to degradation of wiring, connectors and insulation of transport category aircraft
- Report on risk assessment of cosmic radiation (Single Event Effects) on flight critical systems
- Report on methodology for HIRF compliance

*Software and Digital Systems Safety*

- Analyze concepts of Component Integration (Phase 3) related to the verification of the integration of components into a generic aviation platform
- OOT (Phase 3): Complete the identification of language and tool-specific issues concerning the structural coverage of OOT software at the source code and object code levels
- Identify design requirements, objectives, and desired design features to meet operational, safety/certification requirements and objectives for future functionally integrated FG&C systems (Subtask 2)
- Investigate safety and security aspects of LANs onboard aircraft

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

**APPROPRIATION SUMMARY**

	Amount (\$000)
Appropriated (FY 1982-2004)	\$75,478
FY 2005 Enacted	4,086
FY 2006 Request	3,441
Out-Year Planning Levels (FY 2007-2010)	13,934
<b>Total</b>	<b>\$96,939</b>

<b>Budget Authority (\$000)</b>	<b>FY 2002 Enacted</b>	<b>FY 2003 Enacted</b>	<b>FY 2004 Enacted</b>	<b>FY 2005 Enacted</b>	<b>FY 2006 Request</b>
Contracts:					
Digital System Safety	165	748	1,306	440	237
Atmospheric Hazards	4,722	3,816	1,408	1,864	1,316
Personnel Costs	1,388	1,417	1,707	1,621	1,786
Other In-house Costs	145	106	147	161	102
<b>Total</b>	<b>6,420</b>	<b>6,087</b>	<b>4,568</b>	<b>4,086</b>	<b>3,441</b>

<b>OMB Circular A-11, Conduct of Research and Development (\$000)</b>	<b>FY 2002 Enacted</b>	<b>FY 2003 Enacted</b>	<b>FY 2004 Enacted</b>	<b>FY 2005 Enacted</b>	<b>FY 2006 Request</b>
Basic	0	0	0	0	0
Applied	6,420	6,087	4,568	4,086	3,441
Development (includes prototypes)	0	0	0	0	0
<b>Total</b>	<b>6,420</b>	<b>6,087</b>	<b>4,568</b>	<b>4,086</b>	<b>3,441</b>

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

A11d – Atmospheric Hazards/Digital System Safety Product and Activities	FY 2006 Request (\$000)	Program Schedule					
		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
<b>064-110 Digital System Safety</b>							
<b>Software and Digital Systems Safety</b>	<b>\$237</b>						
Publish Report on COTS Component Integration		◆	◇				
Evaluate Object Oriented Technology in Aviation, Phases 1, 2 and 3		◆	◇				
Publish Reports on Research of Software Development & Verification Tools		◆					
Evaluate Flight Guidance and Control Systems		◆	◇	◇	◇	◇	
Evaluate Augmented Manual Control (Fly-by-Wire/Light)			◇	◇	◇	◇	◇
Evaluate Flight-Critical Systems Design Assurance			◇	◇			
Evaluate Tool Qualification of Complex Electronic Hardware				◇	◇		
Evaluate Guidance and Control Displays				◇			
Evaluate Certification and Operation of Unmanned Aerial Vehicles (UAVs)				◇	◇		
Evaluate Internet Aviation Data Transfer				◇			
Evaluate Environmental Qualification of Electronic Components				◇	◇		
Identify Criteria for Burn-In Testing				◇	◇		
Evaluate safety Engineering in Software				◇	◇		
<b>064-111 Atmospheric Hazards</b>							
<b>Aircraft Icing</b>	<b>\$1,316</b>						
Continue Investigation of Atmospheric Icing Environment Aloft		◆	◇				
Evaluate Time of Effectiveness & Aerodynamic Performance of Modern Fluids		◆	◇	◇			
Report on Runback Icing for Thermal Ice Protection Systems – Testing and Analysis			◇				
Report on New Test Standards and Procedures for Type II, III, IV and Non-Glycol Type I Fluids		◆	◇				
Report on Icing Simulation Modeling and Facility Improvements for SLD		◆	◇				
Icing Test Capability for In-flight Conditions at McKinley Environmental Laboratory				◇			
Report on Investigation and Assessment of Ice Detection				◇		◇	
Report on Airplane Takeoff Operations and Performance in Icing Conditions			◇		◇	◇	
Report on Equivalent Pressure Altitude Testing, Analysis and Scaling of hot-air ice prot. systems.							◇
<b>Electromagnetic Hazards to Aircraft Systems</b>	<b>\$0</b>						
Publish Reports on Characterization of Aircraft Lightning			◇	◇	◇		
Report on Risk Assessment on Emissions from Cell Phones and Wireless Devices				◇	◇		
Publish Protection Integrity Reports		◆	◇	◇	◇	◇	◇
Evaluate Single Event Effects		◆	◇	◇	◇	◇	◇
Report on Methodology to Measure HIRF Compliance		◆	◇	◇	◇		
<b>Personnel and Other In-House Costs</b>	<b>\$1,888</b>						
<b>Total Budget Authority</b>	<b>\$3,441</b>	<b>\$4,086</b>	<b>\$3,441</b>	<b>\$3,430</b>	<b>\$3,470</b>	<b>\$3,512</b>	<b>\$3,522</b>

Note: Out year numbers are for planning purposes only. Actual funding needs will be determined through the annual budget process.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
F&E	1A02D	Automatic Dependent Surveillance - Broadcast (ADS-B)	\$2,000,000

### Supports FAA Strategic Goals: Increased Safety, Greater Capacity, International Leadership

**Program Goals and Intended Outcomes:** This program develops system standards of Automatic Dependent Surveillance-Broadcast (ADS-B) technology for the flight domains (terminal, en route, oceanic) and the airport surface to improve aviation safety capacity, efficiency, and effectiveness. It prepares domestic and international standards to facilitate ADS-B-related avionics certification and global system interoperability, application descriptions (operational concepts), and the functional and system requirements needed to support these applications.

ADS-B technology adds a unique, near real-time ability to up-link aeronautical information – including weather, details from Notices to Airmen and Temporary Flight Restrictions – in combination with inputs from the Flight Information Services-Broadcast (FIS-B) system and the Traffic Information-Broadcast (TIS-B) system to surpass the capabilities currently offered by Air Traffic Control (ATC) surveillance radar. The system derives position and velocity of an ADS-B-equipped aircraft or vehicle by means of an onboard Global Positioning System (GPS) receiver. These data and other aircraft information are broadcast directly to ground receivers as well as to nearby aircraft. FIS and TIS information can be displayed on the aircraft’s onboard Cockpit Display of Traffic Information (CDTI) to enhance the flight crew’s situational awareness and thereby improve flight operations safety and efficiencies.

The ground receivers provide surveillance information to air traffic management facilities (whether those of the FAA or the Airline Operation Centers), air traffic controllers, and Regional Airport Authorities (RAAs). The common or shared situational awareness offered by this capability enhances overall operational safety, capacity, and efficiency. Implementation of the modular design and cooperative nature of ADS-B technology offers a low-cost alternative for surveillance coverage in areas without radars, and ADS-B further enhances the National Airspace System (NAS) overall cost structure for ATC radar surveillance in areas currently served by these radars.

The higher speed ADS-B data-link and surveillance technology could serve as a bridge to the future of enhanced air space management and operational procedures while presently providing a near-term, lower cost alternative system for monitoring:

- Aircraft on instrument approaches to closely spaced parallel runways, and
- The airport surface for runway incursion prevention/reduction (reducing both aircraft and vehicle deviations and blunders).

Safe Flight 21 is currently working with United Parcel Services Company (in cooperation with the RAA at Louisville International Airport, Kentucky) and en route facilities along the U.S. east coast to establish a terminal (and surface) domain test-bed for the operational evaluation and validation of ADS-B system applications.

The ADS-B standards and applications being developed contribute to the following goals and objectives:

- FAA Strategic Goal – Increased Safety
  - Objective 1: Reduce the commercial airline fatal accident rate
  - Objective 2: Reduce the number of fatal accidents in general aviation
  - Objective 3: Reduce accidents in Alaska
  - Objective 4: Reduce the risk of runway incursions
- FAA Strategic Goal – Greater Capacity
  - Objective 1: Increase airport capacity to meet projected demand
- FAA Strategic Goal – International Leadership

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

Objective 2: Promote seamless operations around the globe in cooperation with bilateral, regional, and multilateral aviation partners

**Agency Outputs:** Current efforts focus on developing standards for the system's avionics, application descriptions, and CDTI display system. Standardization efforts include RTCA Minimum Aviation System Performance Standards (MASPS) and Minimum Operational Performance Standards (MOPS). Analyses and evaluations will be conducted under this program to provide technical inputs to RTCA MASPS/MOPS on ADS-B links, airborne surveillance and separation assurance processing, and other surveillance system sources necessary to support ADS-B applications. Joint standards/documents with EUROCAE, EUROCONTROL and European states will be published to harmonize ADS-B system standards and applications. International standards such as the International Civil Aviation Organization's (ICAO) standards and recommended practices will also be developed. These standards must be developed and maintained for the purpose of facilitating global interoperability and implementation.

**Customer/Stakeholder Involvement:** The FAA and the user community are actively involved in the standards development activity at RTCA, specifically Special Committee 186. Some of the stakeholders include the Cargo Airline Association, Air Transport Association, Airline Pilots Association, Aircraft Owners and Pilots Association, United Airlines, Northwest Airlines, avionics manufacturers, and airframe manufacturers. EUROCAE Work Groups and EUROCONTROL have been contributing to the harmonization of MASPS and MOPS. Additionally, ICAO panels are actively engaged in the development and updating of ADS-B Standards and Recommended Practices (SARPS).

**Accomplishments:** As a result of active support from this program, a number of critical ADS-B related standards have been published by RTCA:

- Universal Access Transceiver (UAT) MOPS, DO-282
- 1090 MHz ADS-B MOPS Revision A, DO-260A
- ADS-B MASPS Revision A, DO-242A
- TIS-B MASPS, DO-286
- DO-263, Application of ACM: Detection, Prevention, & Resolution
- DO-257A MOPS for the depiction of Navigation Information on Electronic Maps
- Aircraft Surveillance Application (ASA) MASPS in final draft
- Additionally, UAT SARPS has been given approval by ICAO Air Navigation Commission to proceed with development. UAT SARPS entered into the validation phase of SARPS development

**R&D Partnerships:** The joint government/industry committee, RTCA SC 186, is tasked with achieving R&D consensus on system standards for ADS-B. The Massachusetts Institute of Technology Lincoln Laboratory, MITRE, the FAA's William J. Hughes Technical Center, and NASA are also jointly involved in the technical development and integration of ADS-B technology into the NAS. EUROCONTROL Experimental Centre is also involved with ADS-B R&D activities.

### MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:

- Complete ASA MASPS and obtain approval from RTCA PMC
- Continue development of TIS-B Rev A
- Initiate Airborne Separation Assistance System (ASAS) MOPS
- Collaborate with EUROCONTROL/EUROCAE/RTCA on development of operational and technical requirements documents for Package I (initial) ADS-B applications
- Continue to complete validation phase of ICAO UAT SARPS
- Update ICAO SARPS on 1090 MHz ADS-B

### FY 2006 PROGRAM REQUEST:

This program will continue to complete RTCA standards documents and achieve harmonization of Package I ADS-B applications with EUROCONTROL and EUROCAE. Additionally, significant progress will be made to finalize ICAO UAT SARPS. Specific FY 2005 activities will include the following:

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

- Complete TIS-B MASPS Rev. A
- Continue to draft ASAS MOPS
- Coordinate with EUROCONTROL/EUROCAE to draft operational and technical requirements documents for Package I applications
- Coordinate with ICAO panels to complete validation phase of UAT SARPS
- Update ICAO SARPS on 1090 MHz ADS-B

### APPROPRIATION SUMMARY

	<u>Amount (\$000)</u>
Appropriated (FY 1982-2004)	\$15,090
FY 2005 Enacted	1,984
FY 2006 Request	2,000
Out-Year Planning Levels (FY 2007-2010)	8,000
<b>Total</b>	<b>\$27,074</b>

Budget Authority (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Contracts:					
Automatic Dependent Surveillance - Broadcast (ADS-B)	2,800	1,500	2,000	1,984	2,000
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
<b>Total</b>	<b>2,800</b>	<b>1,500</b>	<b>2,000</b>	<b>1,984</b>	<b>2,000</b>

OMB Circular A-11, Conduct of Research and Development (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	2,800	1,500	2,000	1,984	2,000
<b>Total</b>	<b>2,800</b>	<b>1,500</b>	<b>2,000</b>	<b>1,984</b>	<b>2,000</b>

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

Automatic Dependent Surveillance – Broadcast (ADS-B) Product and Activities	FY 2006 Request (\$000)	Program Schedule					
		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
<b>ADS-B</b>	<b>\$2,000</b>						
RTCA Standards:							
TIS-B MASPS Rev. A		◆	◇	◇			
ASA MASPS		◆					
ASA MASPS Rev. A				◇	◇	◇	
ASAS MOPS		◆	◇	◇	◇		
EUROCONTROL/EUROCAE/RTCA Standards for Package I Operational and Technical Requirements		◆	◇	◇			
ICAO Standards on UAT SARPs		◆	◇	◇	◇		
Update ICAO Standards 1090 ADS-B		◆	◇	◇			
Update and Revise SARPs Standards						◇	◇
<b>Total Budget Authority</b>	<b>\$2,000</b>	<b>\$1,984</b>	<b>\$2,000</b>	<b>\$2,000</b>	<b>\$2,000</b>	<b>\$2,000</b>	<b>\$2,000</b>

◆ - Activities Accomplished      ◇ - Activities Planned

NOTES: OUT YEAR NUMBERS ARE FOR PLANNING PURPOSES ONLY. ACTUAL FUNDING NEEDS WILL BE DETERMINED THROUGH THE ANNUAL BUDGET PROCESS.

IN THE FACILITIES AND EQUIPMENT APPROPRIATIONS, PERSONNEL AND OTHER COSTS ARE BUDGETED IN ACTIVITY 5, NOT THE PROGRAM BUDGET LINE ITEM.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A11.h	Aviation Safety Risk Analysis	\$4,932,000

### Supports FAA Strategic Goal: Increased Safety

**Program Goals and Intended Outcomes:** The Aviation Safety Risk Analysis (ASRA) Program helps achieve the FAA's safety goal by developing risk management methodologies, prototype tools, technical information, procedures, and practices. The Program collaborates with industry to ensure that risk management decision support tools, including safety critical performance measures and risk indicators, are properly defined, developed, tested, and evaluated prior to implementation and to ensure changes to the regulations, advisory material and procedures are smoothly implemented.

The program is maximizing the effectiveness and efficiency of FAA's oversight of aviation system safety by developing and validating safety analysis and risk management decision support tools and methodologies to monitor and analyze aviation system operations and safety risks. By 2008, researchers will develop prototypes for enhanced risk management decision support systems to make the aviation oversight processes (certification, surveillance, investigation, and certification management) more effective, efficient, and systematic.

**Agency Outputs:** The program is making the aviation oversight processes (certification, surveillance, investigation, and certification management) more effective, efficient, systematic, and targeted to risk by reengineering the business processes and the introduction of new risk management decision support tools. The Aircraft Maintenance – Maintainability and Reliability, and Safety Analysis Methodology projects will support the development/modification of rules and advisory material. The Runway Capacity project will provide guidance material to identify a range of landing distances needed by aircraft to safely conduct Land And Hold Short Operations (LAHSO) under normal approach procedures.

**Customer/Stakeholder Involvement:** The ASA program encourages broad industry and government participation across all projects:

- The System Approach for Safety Oversight is a Flight Standards Service program that has as its primary goal the application of a systems approach, cooperative problem solving, and proactive risk management principles to operations affecting aviation safety
- The Subcommittee on Aircraft Safety (SAS) of the FAA Research, Engineering and Development Advisory Committee (REDAC) recommended that SASO, including ASRA research tasks, work closely with the air carriers Directors of Safety. The subcommittee representatives from industry, academia, and other government agencies review the activities of the ASRA Program annually
- The program and industry are developing system engineering models of air carrier operations, repair stations and training centers
- Technical Community Representative Groups (TCRG) – representatives from FAA headquarters and the directorates apply formal guidelines to ensure that the program's R&D projects support new rulemaking and comply with existing rules

**Accomplishments:** The program is focused on incorporating system safety principles into its research efforts to support the reengineering of the oversight system and research results are provided to Aircraft Certification and Flight Standards personnel for incorporation into regulations and advisory material. Recent program accomplishments include:

- The establishment of the Safety Management Focus Group, composed of directors of safety from various major and regional carriers, to review and evaluate the products of the Risk Management Decision Support project

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

- The application for a patent entitled, “Hybrid Causal Logic Model,” by the University of Maryland. The methodology will allow for the integration of fault trees and causal models that will be used to evaluate risks in the aviation system
- Research results and recommendations for an Approved Training Program for Repair Stations (Title CFR Part 145.163)
- Prototype of a Web-based information system for collecting and disseminating aircraft maintenance data
- Publication of technical reports entitled, “Assessment of Standard Probabilities in Support of FAA AC 25.1309 Phase One and Phase Two.” These technical reports provide probabilities estimated and the recommended values for standard probabilities of certain environmental and operating conditions, for example, lightning strike, high energy rejected takeoff, engine fire, etc.
- The completion of two technical reports entitled, “Flight Crew Intervention Credit Phase 1 and Phase 2.” The Phase One Study examined flight crew response to aircraft malfunctions. The Phase Two study provides design characteristics associated with descriptors for the different levels of certification credit
- System Engineering Models and associated regulations of air carrier operations, repair station operations, and training simulators that will be used to reengineer the oversight processes

**R&D Partnerships:** The ASRA Program partners with industry, academia, and other governmental agencies including:

- The Safety Management Focus Group, composed of directors of safety from various major and regional carriers, to review and evaluate the products of the Risk Management Decision Support project
- The Civil Aviation Authority of the Netherlands to jointly conduct research on aviation system safety initiatives via a Memorandum of Cooperation
- NASA to annually co-sponsor the Workshop on Risk Analysis and Safety Performance Measurement
- Wichita State University with cost sharing on a grant to develop techniques that will evaluate and improve the usability and reliability of aviation technical manuals

### **MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:**

#### *Risk Management Decision Support*

- Continue to:
  - Develop an integrated risk management tool to display the entire suite of research results built on the heritage of NASA’s Quantification Risk Analysis System (QRAS)
  - Develop an integrated framework for the identification, classification, and assessment of hazards
  - Develop a methodology to design performance measures and risk indicators based on system engineering models and an integrated hazard framework
  - Develop a methodology to identify the information requirements required to support a decision support system
- Complete:
  - Validation of a methodology to measure regulatory effectiveness
  - Development of a conceptual design of an oversight evaluation system
  - Development of systems engineering models of FAA-certificated entities, e.g. airlines, repair stations, aviation schools, etc. within the air transportation system

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

### *Aircraft Maintenance - Maintainability and Reliability*

- Continue to:
  - Develop a tool calibration program for repair stations
  - Develop and refine techniques to evaluate and improve the usability and reliability of aviation technical manuals

### *Safety Analysis Methodology*

- Start to:
  - Validate methodology to determine an appropriate certification credit level for design features intended to reduce the effect of system errors
- Continue to:
  - Analyze the airworthiness information needed to identify unsafe conditions and assess their relative impact on continued airworthiness
  - Develop methods for sorting and evaluating certification and continued airworthiness data sets to identify technical areas posing fleet-wide safety risks
  - Complete:
    - Analyzing operational information to provide probabilities estimated and the recommended values for the standard probabilities of certain environmental and operating conditions as addressed by the draft Advisory Circular 25.1309-1B, appendix 4

### *Runway Capacity Analysis*

- Start to:
  - Develop a program plan to increase the safety of terminal area operations
  - Conduct evaluations on air traffic and flight procedures related to operations of intersecting runways
  - Conduct evaluations of the effectiveness and limit of automatic LAHSO light system for terminal area operations
- Continue to:
  - Develop a systematic method to collect and analyze operational flight data for aircraft landing performance
  - Study operational aircraft landing distance performance for terminal area operations
  - Develop tools to model the safety hazards of rejected landing procedures and to identify possible training solutions
- Complete:
  - Development of visual models of parallel operations and rejected landing procedures for advanced flight simulator display
  - Preliminary development of a methodology to identify the aircraft touchdown point and stopping distances from operational landing parameters

## **FY 2006 PROGRAM REQUEST:**

### *Ongoing Activities*

Research will continue to focus on the areas listed in the GOALS section above. Government, industry, and academia aviation safety subject matter experts will be invited to participate in the research efforts. This cooperation will ensure that risk management decision support tools, including safety critical performance measures and risk indicators, are properly defined, developed, tested, and evaluated prior to implementation. The participation of these subject matter

experts will also ensure the smooth transition of new regulations and advisory materials. The program will also investigate, test, and recommend improvements, including standardization, to the quality (and quantity) of data used in risk analysis. It will also complete studies to identify and verify flight standards and aircraft certification safety information requirements.

### *New Initiatives*

No new major initiatives are planned in FY 2006.

### **KEY FY 2006 PRODUCTS AND MILESTONES:**

#### *Risk Management Decision Support*

- Continue to:
  - Develop an integrated risk management tool to display the entire suite of research results built on the heritage of NASA's QRAS
  - Develop an integrated framework for the identification, classification, and assessment of hazards
  - Develop a methodology to design performance measures and risk indicators based on system engineering models and an integrated hazard framework
  - Develop a methodology to identify the information requirements required to support a decision support system
  - Develop the conceptual design of a decision support system
- Complete:
  - Validation of the conceptual design of an oversight evaluation system

#### *Aircraft Maintenance - Maintainability and Reliability*

- Start to:
- Identify methods, techniques, etc. to improve certification and maintenance processes that are currently in place throughout the airplane's service life
- Continue to:
  - Develop a tool calibration program for aircraft maintenance
  - Develop and refine techniques to evaluate and improve the usability and reliability of aviation technical manuals

#### *Safety Analysis Methodology*

- Continue to:
  - Analyze the airworthiness information needed to identify unsafe conditions and assess their relative impact on continued airworthiness
- Complete:
  - Validation of the methodology that would provide an appropriate level of certification credit for design features intended to reduce the effects of system errors
  - Development of methods for sorting and evaluating certification and continued airworthiness data in ways that identify technical problem areas that pose a fleet-wide safety risk

#### *Runway Capacity Analysis:*

- Start to:
  - Develop evaluation plan on the use of pilot-in-the-loop flight simulators for training of advanced maneuvers related to terminal area operations
  - Study operational aircraft landing distance performance for terminal area operations

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

- Continue to:
  - Study operational aircraft landing distance performance for terminal area operations
  - Conduct evaluations on air traffic and flight procedures for terminal area operations by using pilot-in-the-loop flight simulator
  - Develop tools to model the safety hazards of rejected landing procedure and to identify possible training solutions
- Complete:
  - Evaluation of the automatic LAHSO light system for safety of terminal area operations

### APPROPRIATION SUMMARY

	Amount (\$000)
Appropriated (FY 1982-2004)	\$50,652
FY 2005 Enacted	8,571
FY 2006 Request	4,932
Out-Year Planning Levels (FY 2007-2010)	19,317
<b>Total</b>	<b>\$83,472</b>

<b>Budget Authority (\$000)</b>	<b>FY 2002 Enacted</b>	<b>FY 2003 Enacted</b>	<b>FY 2004 Enacted</b>	<b>FY 2005 Enacted</b>	<b>FY 2006 Request</b>
Contracts:					
Aviation Safety Risk Analysis	4,377	5,124	6,154	6,260	3,352
Personnel Costs	1,253	1,317	1,528	2,091	1,494
Other In-house Costs	154	98	129	220	86
<b>Total</b>	<b>5,784</b>	<b>6,539</b>	<b>7,851</b>	<b>8,571</b>	<b>4,932</b>

<b>OMB Circular A-11, Conduct of Research and Development (\$000)</b>	<b>FY 2002 Enacted</b>	<b>FY 2003 Enacted</b>	<b>FY 2004 Enacted</b>	<b>FY 2005 Enacted</b>	<b>FY 2006 Request</b>
Basic	0	0	0	0	0
Applied	5,784	6,539	7,851	8,571	4,932
Development (includes prototypes)	0	0	0	0	0
<b>Total</b>	<b>5,784</b>	<b>6,539</b>	<b>7,851</b>	<b>8,571</b>	<b>4,932</b>

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

<b>A11h - Aviation Safety Risk Analysis Product and Activities</b>	<b>FY 2006 Request (\$000)</b>	<b>Program Schedule</b>					
		<b>FY 2005</b>	<b>FY 2006</b>	<b>FY 2007</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>
<b>060-110 Aviation Safety Risk Analysis</b>							
<b>Risk Management Decision Support</b>	<b>\$861</b>						
Develop an Integrated Risk Management Tool to Display the Entire Suite of Research Results Built on the Heritage of NASA's Quantification Risk Assessment System (QRAS)		◆	◇	◇			
Develop an Integrated Framework for the Identification, Classification, and Assessment of Hazards		◆	◇	◇			
Develop a Methodology to Design Performance Measures and Risk Indicators Based on System Engineering Models and an Integrated Hazard Framework		◆	◇	◇			
Develop a Methodology to Identify the Information Requirements Required to Support a Decision Support System		◆	◇	◇			
Develop the Conceptual Design of a Decision Support System		◆	◇	◇			
Validate the Conceptual Design of an Oversight Evaluation		◆	◇	◇			
<b>Aircraft Maintenance – Maintainability &amp; Reliability</b>	<b>\$263</b>						
Identify Methods, Techniques, etc. to Improve Certification and Maintenance Processes that are Currently in Place Throughout the Airplane's Service Life			◇	◇	◇		
Develop a Tool Calibration Program for Aircraft Maintenance		◆	◇	◇			
Develop and Refine Techniques to Evaluate and Improve the Usability and Reliability of Aviation Technical Manuals		◆	◇	◇			
<b>Safety Analysis Methodology</b>	<b>\$158</b>						
Analyze the Airworthiness Information Needed to Identify Unsafe Conditions and Assess Their Relative Impact on Continued Airworthiness		◆	◇	◇	◇	◇	◇
Validate the Methodology That Would Provide an Appropriate Level of Certification Credit for Design Features Intended to Reduce the Effects of System Errors		◆	◇				
Develop Methods for Sorting and Evaluating Certification and Continued Airworthiness Data in Ways that Identify Technical Problem Areas that Pose A Fleet-Wide Safety Risk		◆	◇				
<b>Runway Capacity Analysis</b>	<b>\$2,070</b>						
Conduct Evaluation on the Use of Pilot-in-the-Loop Flight Simulators for Training of Advanced Maneuvers Related to Terminal Area Operations			◇	◇	◇		
Conduct Evaluations to Identify Constrains to Required Navigation Performance (RNP)			◇	◇	◇		
Study Operational Aircraft Landing Distance Performance for Terminal Area Operations		◆	◇	◇	◇		
Conduct Evaluations on Air Traffic and Flight Procedures for Terminal Area Operations by Using Pilot-in-the-loop flight simulator		◆	◇	◇	◇	◇	
Develop Tools to Model the Safety Hazards of Rejected Landing Procedures and to Identify Possible Training Solutions		◆	◇	◇	◇		
Evaluate the Automatic LAHSO Light System for Safety of Terminal Area Operations		◆	◇				
<b>Personnel and Other In-House Costs</b>	<b>\$1,580</b>						
<b>Total Budget Authority</b>	<b>\$4,932</b>	<b>\$8,571</b>	<b>\$4,932</b>	<b>\$4,833</b>	<b>\$4,843</b>	<b>\$4,852</b>	<b>\$4,789</b>

Note: Out year numbers are for planning purposes only. Actual funding needs will be determined through the annual budget process.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
F&E	4A10	Center for Advanced Aviation Systems Development (CAASD)	\$34,243,000

### Supports FAA Strategic Goals: Greater Capacity, Organizational Excellence

**Program Goals and Intended Outcomes:** The FAA applies knowledge and expertise developed at the Center for Advanced Aviation System Development (CAASD) to produce a safer, more efficient global air transportation system. Studies performed at CAASD comprise an essential component of FAA research, system engineering and operations research.

**Agency Outputs:** CAASD research and development identifies and tests new technologies for worldwide application to air traffic management, navigation, communication, separation assurance, security, surveillance technology, and system safety.

CAASD produces detailed reports and briefings on subjects across the entire spectrum of their work program. CAASD also develops sophisticated models and prototypes to test concepts and/or systems proposed for use in the management and control of air traffic. Presently, some of these new Air Traffic Management (ATM) products are helping to shape a next generation ATM and control system that will be safer, more efficient, and more readily available.

**Customer/Stakeholder Involvement:** The FAA responds to a constant challenge to increase safety in the nation's civil aviation system while increasing capacity and efficiency. Collaborative traffic flow management, communications, navigation and surveillance evolution are among these important issues and needs.

The CAASD effort directly contributes to the goals and activities of the RTCA Free Flight Steering Committee. This committee is the principal forum to bring industry, aircraft operators, and FAA representatives together to define the operational needs of free flight and identify an affordable NAS Architecture capable of satisfying those needs.

Additionally, the CAASD effort contributes to the goals of the International Civil Aviation Organization (ICAO) in developing worldwide navigation capabilities, including: a wide-area augmentation system; a local-area augmentation system; and a worldwide air-ground communication capability using very high frequency air-ground digital radio. ICAO is the principal venue for international standards development.

**Accomplishments:** CAASD has supported the following accomplishments:

- Conducted laboratory evaluations of prototypes of key Free Flight capabilities to define requirements and estimate potential system benefits. These include enhancements to the User Request Evaluation Tool (URET) for severe weather display, accommodating traffic flow restrictions and generating conflict resolution advisories. Enhancements to the Collaborative Routing Coordination Tool include capabilities to assess the impact of multiple traffic flow management initiatives and to generate balanced re-route solutions via automation.
- Developed and presented an end-to-end demonstration of creating and executing a traffic flow management re-route initiative
- Developed a flight plan pre-processing prototype capability – a related software client component has been provided to several U.S. airlines for operational evaluation and integration with airline flight planning tool
- Reviewed and analyzed current wake vortex data and technology to help the FAA and NASA define programs and procedures to meaningfully enhance the NAS. Specifically, CAASD conducted laboratory evaluations to establish operational feasibility of proposed near-term wake vortex procedures. CAASD also developed concepts for mid-term procedures.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

- Developed procedural changes to improve runway safety and efficiency in the en route, terminal, and oceanic domains
- Conducted analyses to develop and assess regional and national airspace design changes that improve NAS performance
- Completed four simulations of Cockpit Display of Traffic Information (CDTI) Enhanced Flight Rules (CEFR) in the CAASD Air Traffic Management Laboratory. The results of these simulations have supported the approval of the CEFR concept for the Operational Evolution Plan and, by 2004, are likely to lead to its operational use in Louisville by UPS.
- Performed research on Traffic Information Services – Broadcast (TIS-B) which is leading to initial implementation on the U.S. east coast and in Anchorage, Alaska
- Performed analysis, prototyping and laboratory evaluations of key capabilities in the en route and Traffic Flow Management domains to allow air traffic control specialists to provide a higher level of service to airspace users and to enhance the domain architectures

**R&D Partnerships:** Extensive partnerships have been forged with industry suppliers, aircraft operators, other government entities and other non-profit research institutions through the CAASD work program. These relationships include:

- Interdisciplinary Center for Economic Science at George Mason University – related to economic analyses
- NASA Langley on Wake Vortex and surface issues – related to capacity improvement
- EUROCONTROL – related to future ATM developments
- NASA Ames – related to Multi-Center Traffic Management Advisor
- NASA Langley’s Small Aircraft Transportation System (SATS) program, Johns Hopkins Laboratory, and the states of North Carolina, Maryland and Virginia – related to broadcast services
- Cargo Airlines Association, Embry-Riddle Aeronautical University, on ADS-B and its use – related to situational awareness (traffic and weather information in the cockpit) and self-spacing
- MIT Lincoln Laboratory – related to wake vortex technologies and surveillance requirements and solutions resulting from evolving FAA security requirements
- The Volpe National Transportation Systems Center – related to operational evaluation of Air Traffic Management research topics

CAASD is partnering with Georgia Tech to develop a modeling and simulation curriculum, and with the Santa Fe Institute on agent-based modeling. CAASD also is working with Catholic University on human factors stress monitoring techniques. CAASD specialists collaborate with their counterparts at the Volpe National Transportation Systems Center on evolving TFM operational capabilities and infrastructure modernization.

### **MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:**

- Conduct further laboratory evaluations of enhancements to URET for severe weather display. This work will include field evaluations on URET enhancements to accommodate traffic flow restrictions and the integration of air-ground data link with URET.
- Develop and conduct laboratory evaluations of an expanded capability to assess the impact of multiple traffic flow management initiatives. These evaluations will be used to develop requirements for and to prioritize enhancements to the Traffic Flow Management infrastructure.
- Prototype and evaluate automated decision support capabilities for developing Traffic Flow Management initiatives that consider the uncertainty in actual en route sector aircraft counts. This work will specifically address both the underlying algorithms and the visual representation of the data to traffic management specialists.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

- Develop and conduct laboratory evaluations of a set of capabilities to enhance Area Supervisor situational awareness and predict the operational impact of Air Traffic Management initiatives.
- Conduct analyses in support of gaining approval for near-term wake vortex procedures. Further develop a detailed operational concept for mid-term procedures.
- Perform prototype development and assessment of flight data processing capabilities for rapid system requirements validation.
- Evaluate enhanced vision systems in conjunction with LAAS Category I to achieve Category III capabilities.
- Evaluate the feasibility of using Automatic Dependent Surveillance – Broadcast (ADS-B) for radar-like services in the Gulf of Mexico.

### APPROPRIATION SUMMARY

	<u>Amount (\$000)</u>
Appropriated (FY 1982-2004)	\$74,836
FY 2005 Enacted	46,794
FY 2006 Request	34,243
Out-Year Planning Levels (FY 2007-2010)	<u>162,360</u>
<b>Total</b>	<b>\$318,233</b>

Budget Authority (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Contracts:					
Center for Advanced Aviation System Development (CAASD)	5,143	45,268	47,108	46,794	34,243
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
<b>Total</b>	<b>5,143</b>	<b>45,268</b>	<b>47,108</b>	<b>46,794</b>	<b>34,243</b>

OMB Circular A-11, Research and Development (\$000)	Conduct of	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Basic		0	0	0	0	0
Applied		5,143	45,268	47,108	46,794	34,243
Development (includes prototypes)		0	0	0	0	0
<b>Total</b>		<b>5,143</b>	<b>45,268</b>	<b>47,108</b>	<b>46,794</b>	<b>34,243</b>

Notes: By OMB direction, beginning FY 03, CAASD is a part of the F&E line item of the same name. The numbers above represent the research portion only.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

Center for Advanced Aviation System Development (CAASD) Product and Activities	FY 2006 Request (\$000)	Program Schedule					
		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
<b>Center for Advanced Aviation System Development (CAASD)</b>							
<b>Research, Engineering and Development</b>	<b>\$11,985</b>						
Develop and Integrate Detailed Next Generation Air/Ground Communications System Program Plan		◆	◇	◇			
Define Relationships Among Safety, Separation Standards, and Operational Capability to Enhance Safety Management		◆	◇	◇	◇	◇	
Investigate the Expand use of GPS and Advanced Navigation Systems		◆	◇	◇	◇	◇	◇
Continue Investigating Procedures, User Needs, System Requirements, and Architecture Implications for Enhanced Information Systems		◆	◇	◇	◇	◇	◇
<b>Air Traffic Operational Research</b>	<b>\$14,040</b>						
Conducted Evaluations of Airspace Redesign Enhancements in all Operational Domains to Improve System Performance and Utilization of Resources		◆	◇	◇	◇		
Research New Air Traffic Management and Control Operating Concepts Evaluation and/or Infrastructure Replacements		◆	◇	◇	◇	◇	◇
Incorporate GPS Technology into Ongoing Work in Area of Low Cost Avionics to Make Full Use of Traffic Alert and Collision Avoidance System (TCAS)		◆	◇	◇	◇	◇	◇
<b>Special Situation Support</b>	<b>\$8,218</b>						
Define and Develop Requirements for Advanced Free Flight Concepts and Capabilities that will be Needed Beyond Free Flight Phase 1		◆	◇	◇	◇	◇	◇
Deliver and Evaluate a Core Set of Operational Capabilities (SMA, CDM, CTAS and URET) at a Limited Number of Sites		◆	◇				
Develop Alternative Methods for Using GPS Technology Inclusion of Free Flight Concepts in Domestic Airspace		◆	◇	◇	◇	◇	◇
Integrate Decision Support System Requirements with FAA and Industry Technology		◆	◇	◇	◇	◇	◇
<b>Total Budget Authority</b>	<b>\$34,243</b>	<b>\$46,794</b>	<b>\$34,243</b>	<b>\$36,900</b>	<b>\$39,360</b>	<b>\$41,820</b>	<b>\$44,280</b>

◆ - Activities Accomplished      ◇ - Activities Planned

NOTES: OUT YEAR NUMBERS ARE FOR PLANNING PURPOSES ONLY. ACTUAL FUNDING NEEDS WILL BE DETERMINED THROUGH THE ANNUAL BUDGET PROCESS.

IN THE FACILITIES AND EQUIPMENT APPROPRIATIONS, PERSONNEL AND OTHER COSTS ARE BUDGETED IN ACTIVITY 5, NOT THE PROGRAM BUDGET LINE ITEM.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
Ops	N/A	Commercial Space Transportation Safety	\$125,000

### Supports FAA Strategic Goal: Increased Safety

**Program Goals and Intended Outcomes:** The mission of the Commercial Space Transportation Safety Program is to ensure protection of the public, property, national security and foreign policy interests of the United States during a commercial launch or re-entry activity and to encourage, facilitate, and promote U.S. commercial space transportation. To achieve its mission, the program undertakes research projects intended to:

- Evaluate the results of the human consequence models used by the Office of the FAA’s Associate Administrator for Commercial Space Transportation (AST) to assess, based on the best available empirical data, public risk from launch and re-entry debris
- Develop recommendations to mitigate the risk of radio frequency blackouts caused by the high electron concentration that occurs in the plasma surrounding a re-entering reusable launch vehicle (RLV)
- Determine the feasibility of deriving a hierarchical control allocation and reconfiguration architecture that extends the safe ascent and descent operational envelopes of RLVs
- Determine the design and intended qualification and integration of NASA’s autonomous flight safety system (FSS) and apply the generalized verification methodology recommended in previous AST FSS research to the NASA system
- Determine the major reasons for weather delays and/or postponements of launches of expendable launch vehicles (ELVs) at federal and commercial launch ranges

### Agency Outputs:

The research program completes or provides inputs for the development of regulations, advisory circulars, and/or guidelines that identify the requirements for safe ELV and RLV operations. These outputs include:

- A comparison of the results of empirical tests and historical events involving explosions with AST computational models to determine the vulnerability of humans to be seriously injured by launch and re-entry debris
- An improved understanding of methods for mitigating communications outages during re-entry and enabling controller communications for RLV operation in the National Airspace System and in near space
- Recommended techniques for reducing the radio frequency (RF) reception errors that re-entry craft experience with the Global Positioning System (GPS) and other navigation signals
- Recommendations on requisite frequency bands to facilitate an AST decision on whether to request that the Federal Communications Commission (FCC) reserve selected band(s)
- A summary of available reconfigurable control methodologies applicable to RLVs, and general guidelines for applying these technologies to enhance the safety of RLV operations
- Criteria and/or methodologies for determining how non-traditional, autonomous flight safety systems can be safely applied to RLV concepts on a case-by-case basis
- Insights from a detailed comparison of attested weather delays and postponements at different ranges that can suggest ways to decrease delays and/or postponements during future ELV operations

### **Customer/Stakeholder Involvement:**

The research on debris risk analysis was recommended by the FAA Commercial Space Transportation Advisory Committee (COMSTAC) Reusable Launch Vehicle Working Group (RLVWG). The results of this research will be presented to the RLVWG for comments and suggestions for further investigations.

The beneficiaries of the research on RF blackout during re-entry are: the RLV industry, for a reliable means of communication during the reentry and ascent phases of the flight under the Space and Air Traffic Management System; the FAA in providing a safe means for controllers to communicate with the reentering craft; and the safety of the occupants in the RLVs and the general public by ensuring a safe mode of operation during a high speed reentry.

The research on reconfigurable control allocations will be of primary benefit to the emerging RLV industry and the public by ensuring a safe mode of entry during a high-speed re-entry.

The research initiative concerning autonomous FSS was recommended by the COMSTAC RLVWG. This non-traditional FSS research is intended to produce guidelines for safety standards that will provide the public with a sufficient level of safety during launch and re-entry activities of vehicles utilizing these systems. The resulting guidelines will be prepared with the intent to provide industry with a less burdensome but equally effective approach to the regulation of the launch and reentry of vehicles utilizing these systems.

The study on weather delays and/or postponements will help the ELV launch operator make sound decisions regarding launch operations and planning. Taking meteorological constraints into consideration during the design phase could improve the weather related launch delay/postponement probability of the vehicle.

### **Accomplishments:**

During fiscal year 2003, the FAA produced a report on non-traditional flight safety systems and integrated vehicle health monitoring that: described existing and proposed designs of these systems; identified technologies intended to enable regulatory approval of these systems; and presented a draft plan for verifying these systems. Also, initial agreements were reached to establish the expected scope and schedule of the work to be accomplished on this follow-on effort.

Aerospace Corporation provided an initial report to AST covering: understanding of methods to mitigate communications outages during reentry; recommended techniques for reduced RF reception errors on reentry craft for GPS; and recommended methods for uninterrupted communications through plasma sheaths.

FY2005 is the first year of funding for: Debris Risk Analysis, Reconfigurable Control Allocations for RLVs, and Evaluating ELV Weather Delays.

### **R&D Partnerships:**

AST will partner with several launch ranges to fund the evaluation of computational vulnerability models for humans in buildings by comparing test data with data from historical accidents. The project will be carried out by AST and its contractor, ACTA Inc.

Various tasks associated with the research on non-traditional flight safety systems and integrated vehicle health monitoring and on weather delays and/or postponements may be accomplished in conjunction with ongoing NASA, Department of Defense (DoD), and U.S. Air Force efforts in this field.

### **MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:**

For the debris risk analysis project, the AST contractor will evaluate computational vulnerability models for humans in buildings in comparison with empirical data from tests and historical events. Specifically, the contractor will compare and document sub-model results from AST tools for explosion-induced casualties with data from historical events, such as the Oklahoma City and Khobar Towers bombings. The contractor will also compare and document AST sub-model results for building penetration from empirical data such as tests conducted by the DoD. The contractor will draft and submit a report that details the specifics of the evaluation, including a discussion of the issues that arose during these comparisons and the methods by which those issues were addressed. The contractor also will suggest revisions to the methodology and identify any unresolved issues.

## **2005 FAA NATIONAL AVIATION RESEARCH PLAN**

For research concerning RF blackout during reentry, a final report will be generated detailing: 1) understanding of methods to mitigate communications outages during reentry, 2) recommendations on techniques for reduced RF reception errors on reentry craft for GPS, and 3) recommendations on methods for uninterrupted communications through plasma sheaths.

A report will be developed on current technology of reconfigurable control methods applicable to RLVs and general guidelines for application of reconfigurability to RLVs to enhance safety.

For non-traditional flight safety systems and integrated vehicle health monitoring research, the effectiveness of the verification methodology previously developed by AST will be evaluated.

A report will be generated on research findings on the major weather delays and/or postponements for ELVs at federal and/or commercial ranges.

### **FY 2006 PROGRAM REQUEST:**

For all projects, authorized commercial space transportation research is currently included in the Operations budget.

### **KEY FY 2006 PRODUCTS AND MILESTONES:**

For RF blackout during re-entry, there may be additional research conducted leading to frequency band identification and development of an FCC application to reserve relevant frequency bands.

Follow-on tasks in FY 2006 may be proposed if unresolved issues involving non-traditional flight safety systems and integrated vehicle health monitoring are identified during FY 2005 efforts.

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

**APPROPRIATION SUMMARY**

	<u>Amount (\$000)</u>
Appropriated (FY 1982-2004)	\$0
FY 2005 Enacted	110
FY 2006 Request	125
Out-Year Planning Levels (FY 2007-2010)	<u>500</u>
<b>Total</b>	<b>\$735</b>

Budget Authority (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Contracts:					
Commercial Space Transportation Safety	0	0	0	110	125
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>110</b>	<b>125</b>

OMB Circular A-11, Conduct of Research and Development (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	0	0	0	110	125
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>110</b>	<b>125</b>

# 2005 FAA NATIONAL AVIATION RESEARCH PLAN

Commercial Space Transportation Safety Product and Activities	FY 2006 Request (\$000)	Program Schedule					
		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
<b>Commercial Space Transportation Safety</b>	<b>\$125</b>						
<b>Non-Traditional Flight Safety Systems and Integrated Vehicle Health Monitoring</b> Evaluate verification methodology for determining FSS safety on a case-by-case basis		◆					
<b>Debris Risk Analysis</b> Report on comparison study of human vulnerability to launch/re-entry debris		◆					
<b>Reconfigurable Control Allocations for RLVs</b> Report on current technologies suitable for safely applying reconfigurable control methods to RLV operations; provide general guidelines for such applications		◆					
<b>Evaluating ELV Weather Delays</b> Report on a detailed comparison of weather delays/postponements for ELV launches at federal and commercial ranges		◆					
<b>Radio Frequency Blackout During Reentry</b> Report on methods to mitigate effects of RF blackout during reentry of RLVs		◆ ◆ ◆ ◆					
<b>Total Budget Authority</b>	<b>\$125</b>	<b>\$110</b>	<b>\$125</b>	<b>\$125</b>	<b>\$125</b>	<b>\$125</b>	<b>\$125</b>

◆ - Activities Accomplished      ◇ - Activities Planned

NOTES: OUT YEAR NUMBERS ARE FOR PLANNING PURPOSES ONLY. ACTUAL FUNDING NEEDS WILL BE DETERMINED THROUGH THE ANNUAL BUDGET PROCESS.  
IN THE FACILITIES AND EQUIPMENT APPROPRIATIONS, PERSONNEL AND OTHER COSTS ARE BUDGETED IN ACTIVITY 5, NOT THE PROGRAM BUDGET LINE ITEM.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A13.a	Environment and Energy	\$16,008,000

### Supports FAA Strategic Goals: Greater Capacity, International Leadership, Organizational Excellence

**Program Goals and Intended Outcomes:** The Environment and Energy Program helps achieve FAA’s environmental compatibility goal and supports the FAA *Flight Plan* and the Joint Planning and Development Office (JPDO) Next Generation Air Transportation System (NGATS) plan. This program is reducing the environmental impacts of aircraft and airport operations to a level that eliminates or minimizes constraints on the operations of the global aviation system.

The program is developing and validating methodologies, models, and tools to assess the effect of aircraft noise and aviation emissions in a manner that balances the interrelationships between emissions and noise and includes economic consequences. To achieve this goal the program will:

- By FY 2007, develop and distribute a first generation of integrated noise and emission prediction and modeling tools
- By FY 2008, develop airline and technology environmental cost module
- By FY 2010, develop and disseminate a planning version of Aviation Environmental Design Tool that will allow integrated assessment of noise and emissions impact at the local and global levels
- By FY 2013, develop and field Aviation Environmental Portfolio Management Tool, which will allow cost benefit analyses

The program is also developing, applying, and disseminating knowledge and tools to support international harmonization and optimization of emissions and noise related aircraft certification standards, operational procedures and abatement technology. The program is:

- (a) Developing data, requirements, standards, rules, and technical guidance addressing certification of new and modified designs for reduction of aircraft noise and emissions. By FY 2008, researchers will develop technical guidance for certification.
- (b) Through the government-industry Center of Excellence (PARTNER - Partnership for Air Transportation Noise and Emissions Reduction), conducting research to identify and better measure the issues and impacts associated with aircraft noise and aviation emissions, and generate improved solutions to deal with these problems. By FY 2008, researchers will develop and disseminate standards and methodologies to quantify and assess the impact of aircraft noise and aviation emissions for use by industry, government, and the public).
- (c) Preparing technical documentation and training materials for use by aircraft manufacturers and others. By FY 2007, researchers will develop methods and models to analyze aircraft and ground support equipment emissions and their impact on air quality. By FY 2008, they will develop noise and emissions exposure models for airspace management activities.
- (d) Providing computer models and impact criteria for use by civil aviation authorities in environmental assessments. By FY 2013, researchers will use hazardous air pollutants and particulate matter direct measurements from engines to replace factors used in modeling tools.

The program is also developing tools and data to support development of flight procedures and airspace design that reduce environmental impacts. By FY 2008, researchers will implement a new continuous-descent approach noise and emission abatement procedure.

The program intends to provide an Internet capability to educate and inform the public about aviation and the environment and to enable the community to participate actively in public processes. By FY 2010, the program will test and deploy first elements of the website.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

### The Program:

- Improves analytic and planning tools that reveal aviation's impacts upon the environment (by themselves and compared to pollutants from other sources) and the consequences of alternative courses of action
- Works with the international aviation community to reduce aviation noise – actions include: improving aircraft certification standards and operational procedures; promoting compatible land use; and applying abatement technologies around populations exposed to aircraft operations
- Minimizes the impact of aircraft emissions – actions include: advancing the state of science/knowledge concerning atmospheric/health effects of aviation emissions; improving aircraft certification standards and operational procedures; and implementing improved control technologies and mitigation measures
- Develops comprehensive environmental analytical tools that address the interrelationships between noise and emissions and among environmentally beneficial actions affecting various emissions

### Agency Outputs: Aviation environmental research outputs include:

- Computer models and impact criteria for use by civil aviation authorities in assessing proposed actions
- Standards for the certification of new and modified designs to reduce aircraft noise and engine exhaust emissions
- Technical reports, handbooks, Advisory Circulars, training courses, and procedures for use by the aviation community and the public

**Customer/Stakeholder Involvement:** The FAA works closely with other federal agencies, industry, academia, and international governments and organizations to design R&D efforts to mitigate the environmental impact of aviation. This unified regulatory approach to research identifies and influences technologies, models, regulations, and certification criteria that can improve our present and future global environment.

The FAA established the Aviation Rulemaking Advisory Committee (ARAC) as a formal standing committee composed of representatives from aviation associations and industry. The committee conveys its recommendations, advice, and information to the FAA for consideration in rulemaking activities. ARAC harmonization working groups ensure that domestic and international aircraft noise certification regulations impose uniform standards upon the aircraft of all countries.

Along with representatives of other civil aviation authorities and observers from the aviation industry, the FAA represents the United States on the International Civil Aviation Organization's (ICAO) Committee on Aviation Environmental Protection (CAEP). This committee establishes and continually assesses the adequacy of international aviation environmental standards for aircraft noise and engine exhaust emissions.

The FAA and other interested federal agencies established the Federal Interagency Committee on Aviation Noise (FICAN) to encourage debate and agreement over needs for future aviation noise abatement and resulting new research efforts. FICAN conducts annual public forums in different geographic regions with the intent to better align noise abatement research with local public concerns.

The FAA and other government agencies, industry, academia, and the public have developed an aviation Particulate Matter (PM) Roadmap to coordinate research and regulatory activities. The objective of this long-range action plan is to gain the necessary understanding of particle formation, composition, and growth and transport mechanisms for assessing aviation's particulate emissions, understanding their impact on human health and the environment, and ultimately, if warranted, guide the development of aviation-related technology that results in reduced particulate emissions.

**Accomplishments:** The number of people exposed to significant noise levels was reduced by about 90% between 1975 and 2000. Today's aircraft are also 70 percent more fuel-efficient-per-passenger-mile than jet aircraft of the

1960s. Reduced fuel consumption has also led to a 90 percent reduction in carbon monoxide, smoke, and other aircraft emissions.

- Reported to Congress regarding:
  - A comprehensive national study of ways to reduce aircraft noise and emissions
  - Quiet technology for air tour aircraft operating in Grand Canyon National Park
  - The annual progress of the FAA/NASA subsonic jet noise research program from FY 1994 to FY 2003
- Established a new Center of Excellence, Partnership for AIR Transportation Noise and Emissions Reduction (PARTNER), to allow partnerships with universities, research institutions, and industry to conduct exploratory research to identify and better measure the issues and impacts associated with aircraft noise and aviation emissions, and generate improved solutions to deal with these problems
- In collaboration with NASA, initiated a long-term, strategic effort to develop analytical tools to address the relationship between noise and emissions and different types of emissions. The long-term aim is a comprehensive approach to address all aspects of noise and emissions. The tools will facilitate better informed decisions which can cost in excess of 10 billion dollars to government and industry.
- Developed highly influential advanced computer models for airport and heliport noise analysis – users number over 850 in over 40 countries. Models used in over 160 U.S. airport studies involving more than \$1.8 billion in airport noise compatibility grants; they have provided the basis for an aircraft overflight noise exposure prediction model for Grand Canyon National Park
- Published special reports and findings:
  - Annual reports of FICAN activities since 1994
  - A compendium on federal aviation noise research projects
  - Federal findings on: (1) the relationship between aircraft noise and sleep awakenings, (2) research on natural quiet, (3) effects of aircraft noise on classroom learning, (4) value of supplemental noise metrics in aircraft noise analysis, and (5) effects of low frequency on residences
- Developed new Continuous Descent Approach noise abatement procedures in collaboration with NASA, Academia, manufacturers, and airline and airport operators
- Developed and enhanced the computer model that is used extensively by over 300 domestic and international users in airport air quality analyses and has won the Environmental Protection Agency's (EPA) highest endorsement
- Developed a handbook on performing civil and military airport air quality analyses that promises to improve the quality of environmental assessments reviewed by the Federal Government
- Developed a modeling capability that will be used to produce annual inventories of aircraft greenhouse gas emissions and to assess aviation's forecasted global emissions

**R&D Partnerships:** Through a series of Memorandums of Agreement, the FAA works closely with NASA to identify source abatement technologies for noise and emissions. Together, the agencies also work with industry and academia to assess the possible global impact of aircraft engine exhaust emissions. The FAA is also pursuing collaborative agreements with DoD, DoE, and EPA to leverage resources to address aviation's environmental impact.

The Volpe National Transportation Systems Center (VNTSC) continues, in collaboration with the Environment and Energy Program, to provide substantial technical assistance in the areas of aircraft noise and engine emissions measurement and assessment.

FICAN also offers a forum for partnership, as the Committee comprises all Federal agencies concerned with aviation noise. The FAA works with this committee to foster greater, more cost-effective partnering in aviation noise research among all agencies.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

### MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:

#### *Aircraft noise*

- Promulgate new federal noise certification standard for subsonic jet and large transport airplanes
- Continue developing methods and techniques to improve use of supplemental noise metrics through the COE
- With the “Aviation emissions activity”, conducted a Center of Excellence noise and emissions conference
- Plan for an interactive website/software development effort to communicate complex noise technical information in a manner suitable for public distribution (NoiseQuest)
- Complete an assessment of the benefits of introducing NASA developed noise abatement technologies into the fleet

#### *Aviation emissions*

- Develop and publish:
  - Procedures and technical guidance materials for affordable engine exhaust emissions testing and certification that are both harmonized and simplified
  - Protocol for assessing hazardous air pollutants in the aviation environment
- Continue to:
  - Assess potential benefits of using NASA-developed emissions reduction technologies; identified technology goals for long term reduction of aircraft engine emissions
  - Assess the atmospheric and health effects of aviation related emissions through the COE
- Test and analyze particulate matter emissions from aircraft engines to support further development of SAE E31 aerospace recommended practices
- With the “Aviation emissions activity”, conduct a Center of Excellence noise and emissions conference
- Complete assessment of the state of knowledge on the atmospheric impact of commercial and other aircraft operating at cruise altitudes since the Intergovernmental Panel on Climate Change (IPCC) report “Aviation and the Global Atmosphere,” published in 1999

#### *Noise and Emissions Analyses and interrelationships*

- Continue examining and validating methodologies used to assess aircraft noise exposure and impact [Integrated Noise Model (INM), Area Equivalent Method (AEM)]
- Release new INM software and database of aircraft (including helicopters) noise and performance values/parameters
- Complete:
  - System for Assessing Global Emissions (SAGE) model, version 1.1 development and validation
  - Annual inventory of national and global emissions
- Continue to:
  - Examine and validate methodologies used to assess aviation emissions and their impact on air quality; identify and implement enhancements to the Emissions And Dispersion Modeling System (EDMS)
  - Develop and enhance the Screening Model for Airport Air Quality (SMAAQ)
- Initiate efforts to develop the elements of Aviation Environmental Design Tool (AEDT):
  - Formulated Environmental Design Space (EDS) module

- Created breadboard AEDT to identify the building blocks and determine the correct architecture and interfaces for linking these together
- Harmonized database architecture
- Perform a study to determine an acceptable architecture
- Initiate efforts to develop the elements of the Aviation Portfolio Management Tool (APMT):
- Complete feasibility study of Aviation Environmental Portfolio Management Tool (APMT) to allow cost/benefit analyses of environmental policy options
- Formulate economic elements of EDS

### **FY 2006 PROGRAM REQUEST:**

In accordance with the National Environmental Policy Act, the FAA must consider and mitigate the environmental consequences of its actions. The FAA will continue to work with NASA, the manufacturing industry, and international authorities to support the development and implementation of aircraft environmental certification regulations through proactive response to changes in airplane and engine technology, measurement/analysis technology, regulatory policy, and international regulatory initiatives.

The FAA will continue to work with NASA in the Quiet Aircraft Technology research program identifying noise reduction technologies that may enter the marketplace within the next 10-15 years. The agency will use these research findings to consider new environmental certification standards and procedures for the next generation of transport aircraft.

#### *Ongoing Activities*

Aerospace systems have historically been designed – and regulations for their certification and use have been written – as though aviation noise and various emissions had nothing to do with one another. But aviation noise and emissions are actually highly interdependent phenomena. Future environmentally responsible aviation policy and rulemaking has to be based on a new, interdisciplinary approach. Furthermore, this approach must be made as affordable as it is effective.

Existing analytical tools are inadequate to assess interdependencies between noise and emissions or analyze the cost/benefit of proposed actions. Accordingly, the FAA is developing a robust new comprehensive framework of aviation environmental analytical tools and methodologies to perform these functions. The long-term aim is provide a seamless, comprehensive set of tools to address all aspects of noise and emissions.

The elements of the this framework include:

- Environmental Design Space (EDS) capability to provide integrated analysis of noise and emissions at the aircraft level
- Aviation Environmental Design Tool (AEDT) comprises EDS and other integrated aviation noise and emissions modules – will provide integrated capability of generating interrelationships between noise and emissions and amongst emissions at the local and global levels
- Aviation Environmental Portfolio Management Tool (APMT) comprises AEDT and other modules – will provide the common, transparent cost/benefit methodology needed to optimize national aviation policy in harmony with environmental policy

These framework of tools will allow:

- Government agencies to understand how proposed actions and policy decisions impact and are impacted by aviation noise and emissions
- Industry to understand how operational decisions impact and are impacted by proposed projects affecting aviation noise and emissions
- The public to understand how actions by government and industry impact and are impacted by aviation noise and emissions

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Anticipated benefits of this initiative include:

- Optimize environmental benefits of proposed actions and investments
- Improved data and analysis on airport/airspace capacity projects
- Increased capability to address noise and emissions interdependencies in the resolution of community concerns
- More effective R&D portfolio management
- Removal of environmental roadblocks to capacity growth
- Continued global leadership for the United States in environmentally responsible aviation

Other activities:

- Continue activities through the COE to identify and better measure the issues and impacts associated with aircraft noise and aviation emissions, and generate improved solutions to deal with these problems
- Continue updating and enhancing existing analytical tool modules (e.g., INM, EDMS, SAGE, Modeling System for Assessing Global Noise Exposure (MAGENTA)) as necessary to support existing customers and transition to AEDT
- Support the FAA role in the ICAO CAEP working groups for assessing the technological, scientific, operational, and economic aspects associated with maintaining international standards and recommended practices for aircraft noise and engine exhaust emissions
- Continue efforts to maintain the currency of the regulation and technical guidance materials concerning aircraft noise and engine exhaust emissions certification requirements

### KEY FY 2006 PRODUCTS AND MILESTONES:

#### *Aircraft noise*

- Promulgate new federal noise certification standard for subsonic jet and large transport airplanes
- Develop methods and techniques to improve use of supplemental noise metrics through the COE
- Complete aircraft low frequency noise study; obtain measurements, annoyance data, develop impact metrics and mitigation techniques
- Continue evaluating the effectiveness of sound insulation, assess encroachment issues, and examine land use versus airport controls to provide information to enhance land use practices around airports through the COE
- With the “Aviation emissions activity”, conduct a COE conference
- Conduct study to analyze the four elements of the Balanced Approach to noise abatement and their relationships
- Continue development of the interactive website/software to communicate complex noise technical information in a manner suitable for public distribution (NoiseQuest)
- Continue to assess applicability of existing noise metrics to sonic boom and determine annoyance of low boom waveforms to inform future decision making regarding supersonic flight over land

#### *Aviation emissions*

- Continue to develop and publish:
  - Procedures and technical guidance materials for affordable engine exhaust emissions testing and certification that are both harmonized and simplified
  - Protocol for assessing hazardous air pollutants in the aviation environment
- Continue to:

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

- Assess potential benefits of using NASA-developed emissions reduction technologies; identify technology goals for long term reduction of aircraft engine emissions
- Assess the atmospheric and health effects of aviation related emissions through the COE
- Test and analyze particulate matter emissions from aircraft engines to support further development of SAE E31 aerospace recommended practices
- Complete study to collect particulate matter data using Light Detection and Ranging (LIDAR) to enhance dispersion analytical models
- Continue to advance measurements, develop aviation emissions metrics, and assess aviation emissions contributions to health impacts through the COE
- With the “Aircraft noise activity”, conduct a COE conference

### *Noise and Emissions Analyses and interrelationships*

- Complete annual assessment of noise exposure
- Complete annual inventory of national and global emissions
- Continue to develop the elements of AEDT:
  - With NASA, validate EDS 1.0 module
  - Harmonized AEDT modules codes and database management
- Complete AEDT Version 1.0 for CAEP/7 Introduction (Initial validation, which includes noise + emissions + aircraft design (EDS 1.0) + global fleet modeling – but not a seamless model)
  - Continue examining and validating methodologies used to assess aircraft noise exposure and impact [Integrated Noise Model (INM), Area Equivalent Method (AEM)] for incorporation into AEDT
  - Continue updating and enhancing MAGENTA for incorporation into AEDT
  - Continue upgrades to EDMS, SAGE, and SMAAQ modules for incorporation into AEDT
- Continue efforts to develop the elements of APMT:
  - Initiate effort to create a breadboard APMT
  - Initiate study to develop architecture for integrating AEDT and APMT
  - Continue collection of airline and technology cost data
  - Continue valuating aviation environmental costs and assess relationship between policies and environmental impact
  - Initiate technology cost module design

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

**APPROPRIATION SUMMARY**

	Amount (\$000)
Appropriated (FY 1982-2004)	\$109,348
FY 2005 Enacted	11,795
FY 2006 Request	16,008
Out-Year Planning Levels (FY 2007-2010)	60,941
Total	<u>\$198,092</u>

<b>Budget Authority (\$000)</b>	<b>FY 2002 Enacted</b>	<b>FY 2003 Enacted</b>	<b>FY 2004 Enacted</b>	<b>FY 2005 Enacted</b>	<b>FY 2006 Request</b>
Contracts:					
Aircraft Noise	19,822	18,192	3,921	1,164	1,383
Engine Emissions	989	1,941	2,340	467	1,615
Noise & Emissions Analyses				8,436	10,880
Personnel Costs	1,086	1,383	1,580	1,575	1,985
Other In-house Costs	184	97	87	153	145
<b>Total</b>	<b><u>22,081</u></b>	<b><u>21,613</u></b>	<b><u>7,928</u></b>	<b><u>11,795</u></b>	<b><u>16,008</u></b>

<b>OMB Circular A-11, Conduct of Research and Development (\$000)</b>	<b>FY 2002 Enacted</b>	<b>FY 2003 Enacted</b>	<b>FY 2004 Enacted</b>	<b>FY 2005 Enacted</b>	<b>FY 2006 Request</b>
Basic	0	0	0	0	0
Applied	22,081	21,613	<b>7,928</b>	11,795	16,008
Development (includes prototypes)	0	0	0	0	0
<b>Total</b>	<b><u>22,081</u></b>	<b><u>21,613</u></b>	<b><u>7,928</u></b>	<b><u>11,795</u></b>	<b><u>16,008</u></b>

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

<b>A13.a- Environment and Energy Product and Activities</b>	<b>FY 2006 Request (\$000)</b>	<b>Program Schedule</b>					
		<b>FY 2005</b>	<b>FY 2006</b>	<b>FY 2007</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>
<b>091-110 Aircraft Noise</b>	<b>\$1,383</b>						
Assessment of FAA/NASA Aircraft Noise Reduction Technology Research		◆	◇	◇	◇	◇	◇
Noise COE reports, conferences, findings, and other activities		◆	◇	◇	◇	◇	◇
Publish Advisory Circular 36-4 (and updates)		◆		◇		◇	
New noise standard for subsonic jets and large airplanes			◇			◇	
New noise standard for helicopters					◇		
Validation of the Methodologies Used to Assess Aircraft Noise Exposure and Impact (INM, AEM)		◆		◇		◇	
COE reports, findings, and other activities			◇	◇	◇	◇	◇
<b>091-111 Engine Emissions</b>	<b>\$1,615</b>						
Assessment of Technological and Scientific Bases to Support Future ICAO Engine Emission Standards		◆		◇		◇	
Alternative, Simplified Engine Exhaust Emissions Certification Test Procedures				◇	◇		◇
Updated Advisory Circular 34-1		◆			◇		◇
Measurement/sampling Protocol for Particulate Matter (PM) Emissions from Aircraft Engines		◆			◇		◇
Measurement/sampling Protocol for Particulate Matter (PM) Emissions from Aircraft Engines		◆			◇	◇	
COE reports, findings, and other activities			◇	◇	◇	◇	◇
<b>091-016 Noise and Emissions Analysis</b>	<b>\$10,880</b>						
Architecture for noise/emissions modules communication		◆		◇			◇
Development of Model for Assessing Global Exposure to Noise from Transport Aircraft		◆		◇			◇
Validation of the Methodologies Used to Assess Aircraft Noise Exposure and Impact (INM, AEM)		◆		◇		◇	
Release Integrated Noise Model (INM) Updates			◇		◇	◇	
Enhanced aircraft noise modeling for airspace management activities				◇	◇		◇
Release Emissions and Dispersion Modeling System (EDMS) Updates		◆		◇			
Forecast future global emissions and complete updates to the SAGE model		◆		◇			
Release Screening Model for Airport Air Quality (SMAAQ), Version 1, and Updates		◆			◇		
Validation of Methodologies Used to Assess Aviation Emissions and Their Impact on Air Quality		◆	◇	◇			
First-order Approximation Method for Aircraft Engine PM Emissions		◆		◇			
Publish handbook for Airport Air Quality Analysis and Updates				◇	◇	◇	

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A13.a- Environment and Energy Product and Activities	FY 2006 Request (\$000)	Program Schedule					
		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
Guidance Document for Estimating and Reducing Emissions from Ground Support Equipment		◆					
Resource and Guidance Materials, and Assessment Protocol Concerning Hazardous Air Pollutants		◆	◇	◇		◇	
Development of Aviation Environmental Design Tool (AEDT)			◆	◇	◇	◇	
Development of Aviation Environmental Portfolio Management Tool (AEPMT)			◆	◇		◇	
Harmonize AEDT and APMT databases and code Management protocols			◆		◇		◇
Integration of Cost and socioeconomic data			◆		◇		◇
<i>Personnel and Other In-House Costs</i>	\$2,130						
<b>Total Budget Authority</b>	<b>\$16,008</b>	<b>\$11,795</b>	<b>\$16,008</b>	<b>\$15,464</b>	<b>\$15,364</b>	<b>\$15,258</b>	<b>\$14,855</b>

Note: Out year numbers are for planning purposes only. Actual funding needs will be determined through the annual budget process.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A11.a	Fire Research and Safety	\$6,244,000

### Supports FAA Strategic Goal: Increased Safety

**Program Goals and Intended Outcomes:** The Fire Research and Safety Program helps to achieve the FAA’s aviation safety goal by developing technologies, procedures, test methods, and criteria to prevent accidents caused by hidden in-flight fires and fuel tank explosions and to improve survivability during a post-crash fire. The research focuses on near-term improvements in aircraft fuel tank explosion protection, fire detection and suppression systems, and interior materials fire test methods and criteria, as well as long-range research to develop the enabling technology for ultra-fire resistant cabin materials.

To reduce the number and severity of accidents associated with in-flight aircraft fires, the program is developing and assessing ways to prevent ignition and flame propagation of cabin materials. By FY 2008, researchers will have developed improved fire test criteria for hidden materials, such as insulation, wiring and HVAC ducting. In addition, the program is working to develop and assess means to detect in-flight fires. By FY 2008, researchers will develop detection criteria to locate hidden fires rapidly and reliably. This program is developing and assessing means to extinguish in-flight fires. By FY 2008, researchers will develop criteria for effective use of hand-held or fixed extinguishing systems against hidden fires.

To prevent accidents caused by fuel tank explosions, the program is developing a practical and cost effective inerting system. By FY 2008, researchers will conduct research and tests in support of the new rule mandating use of fuel tank inerting systems.

The program is also conducting tests to determine if composite transport aircraft, such as the Boeing 7E7, can provide the same level of in-flight and post-crash fire safety as current aircraft constructed of metallic materials. By FY2008, researchers will develop fire test criteria for structural composites to ensure the same level of fire safety as currently exists in aircraft with metallic structure.

**Agency Outputs:** The FAA establishes rules for aircraft fire safety affecting material selection, design criteria, and operational procedures. New test methods, reports, and journal publications produced by the fire research and safety program provide the major source of technical information used in developing these regulations and offer advice on how to comply with them. Through this long-term research, which is resulting in new materials and formulations and government-owned patents, the FAA provides industry with critical new safety products.

**Customer/Stakeholder Involvement:** The Fire Research and Safety Program has worked with the following industry and government groups:

- The Aircraft Safety Subcommittee of the FAA Research, Engineering and Development Advisory Committee (REDAC) – subcommittee representatives from industry, academia, and other government agencies annually review the activities of the Fire Research and Safety Program
- Technical Community Representative Groups (TCRB) – representatives from FAA headquarters and the directorates apply formal guidelines to ensure that the program’s R&D projects support new rulemaking and comply with existing rules
- The Aviation Rulemaking Advisory Committee (ARAC), the Boeing Company and Airbus Industries – focused on fuel tank inerting
- Aircraft manufacturers (U.S. and foreign), airlines, foreign airworthiness authorities, chemical companies, material suppliers, and aircraft fire safety equipment manufacturers – focused on interior material fire tests and improvement of fire detection and suppression systems
- National Transportation Safety Board (NTSB) – focused on in-flight fire incidents, on-site accident investigations, and related testing

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

**Accomplishments:** The FAA operates the world's most extensive aircraft fire test facilities. FAA certification engineers receive training in these facilities each year and, at the request of the NTSB, program personnel participate in major fire accident and incident investigations. The Fire Research and Safety Program annually publishes over two-dozen reports and papers.

Outstanding program accomplishments include:

- Demonstrating the effectiveness of the FAA-developed fuel tank inerting system during flight tests in a A320 operated by Airbus and in a 747 operated by NASA
- Developing thermal protection test criteria for oxygen container carrying cases, designed to prevent the release of oxygen from cargo fire heating causing overpressurization (proposed RSPA regulation)
- Designing, building, and demonstrating an on-board inerting system to prevent fuel tank explosions, persuading Boeing to seek FAA certification of this system for 737 and 747 aircraft
- Determining the minimum concentration of oxygen required to inert a fuel tank to prevent explosions
- Developing improved fire test criteria for thermal acoustic insulation including in-flight fire resistance and post-crash fire burn-through resistance, mandated by FAA in 2003
- Completing tests and publishing the results, which led to an FAA airworthiness directive, requiring the removal of metalized Mylar insulation in over 700 aircraft because of its vulnerability to ignition by an electrical arc
- Completing cargo fire hazard tests, resulting in the retrofit of 3400 transport aircraft with fire detection and suppression systems
- Developing and publishing minimum performance standards for halon replacement fire extinguishing agents in cargo compartments, lavatories and hand-held extinguishers
- Transferring Microscale Combustion Calorimeter technology to DOW Chemical Company in first-ever licensing of FAA/DOT patented technology
- Developing and patenting a hand-held extinguisher nozzle that discharges carbon dioxide as dry ice, increasing the agent effectiveness

**R&D Partnerships:** Fire Research and Safety Program R&D partners include:

- FAA-sponsored international systems fire protection working group – R&D involves fuel tank protection, hidden fire safety, fire/smoke detectors and halon replacement
- FAA-sponsored international aircraft materials fire test working group – R&D involves development and standardization of improved material fire tests
- Integrated FAA and NASA program – R&D involves research on gas generation systems for fuel tank protection, advanced fire/smoke detectors and explosion/fire resistant composite structure
- Inter-agency working group on fire and materials – promotes technology exchange among U.S. Government agencies and prevents unwarranted duplication of work
- Inter-agency agreement with the National Institute of Standards and Technology (NIST) – develops fire retardant mechanisms and rapid screening tools for flammability
- Memorandum of cooperation with the British Civil Aviation Administration (CAA) – R&D involves a variety of fire safety research efforts
- Cabin safety research technical group – cooperates in and coordinates cabin safety research conducted and/or sponsored by the international regulatory authorities
- Grant programs with educational institutions and consortia
- Arrangements with Fortune 100 companies to share development costs for new fire resistant materials

**MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:**

*Fire Safety Improvements*

- Evaluate advanced fuel tank inerting system developed by NASA in the FAA's ground-based 737 test aircraft
- Publish report describing fuel tank flammability and inerting system performance during 747 flight tests
- Determine the potential impact of a 7E7 composite fuselage on occupant postcrash fire survivability based on a sensitivity analysis of world-wide past accidents
- Complete standardization of improved fire test method for electrical wiring
- Produce hidden in-flight fire fighting video for awareness training of airline cabin crew members
- Fire Resistant Materials
- Develop and demonstrate a thermoplastic for use in making passenger service units, seat trays and other molded cabin components with an order of magnitude reduction in heat release rate
- Fabricate and test samples of low heat release thermoset resin composites for mechanical strength, and physical and chemical properties

**FY 2006 PROGRAM REQUEST:**

*Ongoing Activities*

Research to prevent fuel tank explosions will primarily support an anticipated proposed FAA regulation to require a fuel tank inerting system in all large transport aircraft with heated center wing tanks. Testing will be completed to determine the impact of an auxiliary fuel tank on the design of a center wing tank inerting system. Also, research will be undertaken to measure and predict fuel vapor flammability in center wing tanks, where there have been 3 fatal explosions, and in wing tanks which have been explosion free. Reducing center wing tank flammability to a level experienced in wing tanks is a potential inerting system design criteria.

Research to prevent uncontrollable in-flight fires originating in hidden areas will include both improved fire test criteria for materials and improved fire fighting. Improved fire test criteria will be developed for HVAC ducting, raising the fire resistance of ducting to a significantly higher level accomplished by past research for thermal acoustic insulation and electrical wiring. Firefighting research will focus on a built-in extinguishing system for the attic space above the cabin ceiling, based on prior testing which found that hand-held extinguishers would likely not be effective in wide body aircraft because of the large volume. Nitrogen will be the first extinguishing agent examined because of its favorable cost effectiveness with the advent of fuel tank inerting.

The new all composite Boeing 7E7 transport airplane raises concerns regarding in-flight and post-crash fire safety. Simulated flight tests will be conducted to determine the impact of a composite fuselage on the progression of a hidden in-flight fire. Also, large scale fire tests will be conducted to determine the hazards caused by outgassing into the cabin when a composite fuselage is exposed to an external postcrash fuel fire. The output from this research will be fire test criteria for structural composites.

Long range, applied research will continue to develop the enabling technology for ultra-fire resistant aircraft interior materials. An elastomer will be demonstrated for use in seat cushions, pillows and flexible sealants with an order of magnitude reduction in heat release rate compared to current requirements. Also, previously demonstrated low heat release thermoplastics will be fabricated into small coupons and tested for in-service requirements, such as mechanical strength, and physical and chemical properties.

*New Initiatives*

No new initiatives are planned in FY 2006.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

### KEY FY 2006 PRODUCTS AND MILESTONES:

#### *Fire Safety Improvements*

- Evaluate the impact of the operation of an auxiliary fuel tank on the design of a center wing tank inerting system
- Determine the lower flammability limit of jet vapors as a function of altitude
- Develop an improved fire test for HVAC ducting
- Evaluate the effectiveness and safety of nitrogen enriched air in extinguishing a fire in the cabin attic area
- Determine the impact of a composite fuselage on the progression of a hidden in-flight fire
- Evaluate the cabin hazards caused by outgassing from a composite fuselage exposed to a postcrash external fuel fire

#### *Fire Resistant Materials*

- Develop and demonstrate an elastomer for use in making seat cushions, pillows and flexible sealants with an order of magnitude reduction in heat release rate
- Fabricate and test samples of low heat release thermoplastics for mechanical strength, and physical and chemical properties

### APPROPRIATION SUMMARY

	Amount (\$000)
Appropriated (FY 1982-2004)	\$121,653
FY 2005 Enacted	6,525
FY 2006 Request	6,244
Out-Year Planning Levels (FY 2007-2010)	25,399
<b>Total</b>	<b>\$159,821</b>

<b>Budget Authority (\$000)</b>	<b>FY 2002 Enacted</b>	<b>FY 2003 Enacted</b>	<b>FY 2004 Enacted</b>	<b>FY 2005 Enacted</b>	<b>FY 2006 Request</b>
Contracts:					
Fire Research and Safety	2,340	2,903	6,311	3,263	2,632
Personnel Costs	2,621	2,796	3,043	2,890	3,379
Other In-house Costs	281	252	314	372	233
<b>Total</b>	<b>5,242</b>	<b>5,951</b>	<b>9,668</b>	<b>6,525</b>	<b>6,244</b>

<b>OMB Circular A-11, Conduct of Research and Development (\$000)</b>	<b>FY 2002 Enacted</b>	<b>FY 2003 Enacted</b>	<b>FY 2004 Enacted</b>	<b>FY 2005 Enacted</b>	<b>FY 2006 Request</b>
Basic	0	0	0	0	0
Applied	5,242	5,951	9,668	6,525	6,244
Development (includes prototypes)	0	0	0	0	0
<b>Total</b>	<b>5,242</b>	<b>5,951</b>	<b>9,668</b>	<b>6,525</b>	<b>6,244</b>

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

<b>A11a - Fire Research and Safety Product and Activities</b>	<b>FY 2006 Request (\$000)</b>	<b>Program Schedule</b>					
		<b>FY 2005</b>	<b>FY 2006</b>	<b>FY 2007</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>
<b>061-110 Fire Research &amp; Safety</b>							
<b>Fire Resistant Materials</b>	<b>\$0</b>						
Demonstrate Resins, Thermoplastic, Elastomer and Fiber with Order of Magnitude Reduction in Heat Release		◆	◇	◇			
Complete Property Tests of Ultra-Fire Resistant Resins, Thermoplastic, Elastomer, and Fiber Specimens.		◆	◇	◇	◇		
Evaluate Improvement in Postcrash Fire Survivability Provided by Ultra-Fire Resistant Materials During Full-Scale Fire Tests							◇
<b>Fire Safety Improvement</b>	<b>\$2,632</b>						
Publish Report Describing Fuel Tank Flammability and Inerting System Performance During 747 Flight Tests		◆					
Evaluate Advanced Fuel Tank Inerting System Developed by NASA in FAA's Ground-Based 737 Test		◆					
Evaluate the Impact of an Auxiliary Fuel Tank on the Design of a Center Wing Tank Inerting System			◇				
Determine the Lower Flammability Limit of Jet Fuel Vapor as a Function of Altitude			◇				
Conduct Flight Tests on Advanced Fuel Tank Inerting System					◇		
Complete Standardization of Improved Fire Test Method for Electrical Wiring		◆					
Produce Hidden In-Flight Firefighting Video for Awareness Training for Airline Cabin Crew		◆					
Develop an Improved Fire Test for KVAC Ducting			◇				
Determine the Impact of a Composite Fuselage on the Progression of a Hidden In-Flight Fire			◇				
Evaluate the Effectiveness and Safety of Nitrogen Enriched Air in Extinguishing a Fire in the Cabin Attic			◇				
Assess Postcrash Fire Safety Impact of 7E7 Composite Aircraft		◆					
Develop 7E7 Composite Aircraft Fire Safety Requirements/Guidelines				◇			
Characterize Cabin & Fuselage Fires in VLTA				◇			
Define VLTA Fire Protection Methodology							◇
Improve Oxygen System Design Guidelines/ Requirements						◇	
Examine Aircraft Vulnerability to Hydraulic Fluid Fires							◇
<b>Personnel and Other In-House Costs</b>	<b>\$3,612</b>						
<b>Total Budget Authority</b>	<b>\$6,244</b>	<b>\$6,525</b>	<b>\$6,244</b>	<b>\$6,239</b>	<b>\$6,321</b>	<b>\$6,404</b>	<b>\$6,435</b>

Note: Out year numbers are for planning purposes only. Actual funding needs will be determined through the annual budget process.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A11.g	Flightdeck/Maintenance/System Integration Human Factors	\$8,181,000

### Supports FAA Strategic Goals: Increased Safety, Greater Capacity

**Program Goals and Intended Outcomes:** The Flightdeck/Maintenance/System Integration Human Factors Program helps achieve the FAA's safety strategic goal by:

- Developing more effective methods for pilot, inspector, and maintenance technician training
- Enhancing the understanding and application of error management strategies in flight and maintenance operations
- Increasing human factors considerations in certifying new aircraft and in equipment design and modification
- Improving pilot, inspector, and maintenance technician task performance

This program is increasing aviation community knowledge and understanding of current operations and potential accident causes. The program is developing methodologies to identify and mitigate risk factors in automation-related operator errors. By FY 2007, researchers will evaluate methods for assessing causal factors of human error in flight deck operations and aviation maintenance to mitigate the potential for incidents and accidents.

The program is also reducing accidents associated with the performance of pilots, maintainers, inspectors, and others who fill roles important to the safety of the national airspace system. Researchers are developing tools, knowledge, guidance, and standards to assess and improve the performance of flight crews, maintainers, and others. By FY 2007, researchers will initiate development of guidance on how advanced technology can be used for inspection training and reducing errors in general aviation maintenance.

In addition, the program is developing requirements, knowledge, guidance, and standards for design, certification, and use of automation-based technologies, tools, and support systems. By FY 2007, the program will complete development of the Human Factors Certification Job Aid Version 8 for Parts 25 (Airworthiness Standards for Transport Category Airplanes) and 23 (Airworthiness Standards including Commuter Category Airplanes) to support FAA certification personnel, aircraft designers, and researchers in addressing possible human factors concerns related to displays, controls, flight deck systems, pilot tasks, and procedures; equipment, and testing assumptions.

The program is designing and developing a system safety approach to provide a better understanding of the causes of human error, and developing training and other actions to reduce those errors. By FY 2008, researchers will assess error patterns of pilots, maintenance personnel, and inspectors, and identify precursors to those errors.

Researchers are developing tools, knowledge, guidance, requirements, models, and standards for information management and display systems. By FY 2008, they will develop certification guidelines and human factors standards for integrating advanced technologies. The researchers will also develop knowledge, guidance, requirements, and standards for selection and training of pilots and maintenance technicians. By FY 2008, they will develop training guidelines for flight deck error management.

**Agency Outputs:** The Human Factors Research and Engineering Division provides the research foundation for FAA guidelines, handbooks, advisory circulars, rules, and regulations that help to ensure the safety and efficiency of aircraft operations. The division also develops human performance information which the agency provides to the aviation industry for use in designing and operating aircraft and training personnel.

The 1995 *National Plan for Civil Aviation Human Factors: An Initiative for Research and Application* provides a technical framework for the research program. Research categories and associated emphases include:

- Information Management and Display – improving design of computer-human interfaces to reduce information overload and resulting errors

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- Human-Centered Automation – improving and maintaining the operator’s situational awareness, and providing corrective mechanisms to compensate for operator skills degradation or automation failure
- Human Performance Assessment – assessing cognitive and contextual factors to improve operator performance and reduce errors
- Selection and Training – applying program-generated knowledge of human factors to improve selection and training of aviation system personnel

**Customer/Stakeholder Involvement:** The Human Factors Research Program complies with Public Law 100-591. The program works directly with colleagues in the FAA, government, and industry to support the following R&D programs and initiatives:

- NASA’s Aviation Safety Program
- The FAA’s Voluntary Safety Program Office initiatives including Advanced Qualification Program (AQP), Flight Operations Quality Assurance (FOQA), and Aviation Safety Action Program (ASAP)
- The FAA/Industry Safer Skies initiative – analyzes U.S. and global data to find the root causes of accidents and proposes the means to prevent their occurrence

**Accomplishments:** The program’s output of scientific and technical human performance information includes:

### *Information Management and Display*

- Developed a manual that addresses appropriate human factors considerations in designing flight deck operating documents that was adopted for use by International Civil Aviation Organization (ICAO)
- Produced human factors design and evaluation considerations for aviation applications such as electronic flight bags and head-up displays in air transports

### *Human-Centered Automation*

- Completed job aids and checklists ensuring human factors considerations in the certification of technologies such as flight deck displays and global positioning system receivers
- Developed initial performance models for automation usage in air carrier cockpits

### *Human Performance Assessment*

- Developed an alternative method to measure night vision goggle cockpit lighting compatibility that is as valid, reliable, and significantly cheaper than the accepted military methodology
- Provided guidance for precision visual flight rules and simultaneous non-interfering routes that will allow rotorcraft with global positioning system navigation capabilities to stay within narrow, defined horizontal airspace limits while operating under visual flight rules
- Completed detailed general aviation fatal accident human error analysis, using Human Factors Analysis and Classification System, to determine how often is each error type the “initiating” error in the causal chain of events and what are the exact types of errors committed that lead to a fatal accident
- Completed initial mapping of flight data parameters onto AQP qualification standards

### *Selection and Training*

- Recommended mitigation strategies in reducing maintenance related language errors, verbal and written, which are predominately committed by non-native English speakers
- Provided guidance on an acceptable vision standard for personnel involved in nondestructive inspection and testing (NDI/NDT) and visual inspection of aircraft and aircraft components.
- Provided guidance on the effectiveness and reliability of a personal computer aviation training device and a flight-training device in conducting an instrument proficiency check
- Developed and validated a proceduralized pilot crew resource management (CRM) training and assessment system

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- Improved line operations safety audit (LOSA) methodology adopted by ICAO to help air carriers to identify human-centered safety vulnerabilities

**R&D Partnerships:** The Flightdeck/Maintenance/System Integration Human Factors Program collaborates with industry and other government programs through the following partnering vehicles and forums for information exchange:

- Joint Safety Analysis Teams (JSATs) and Joint Safety Implementation Teams (JSITs) within the Safer Skies Agenda – coordinated with NASA and industry, these efforts stress human factors issues in developing intervention strategies for the reduction of air carrier and general aviation accidents
- DOD Human Factors Engineering Technical Advisory Group – the FAA participates in this group to promote a joint vision for automation and related technical areas
- Domestic and international aviation maintenance partnerships with industry – the emphasis is on achieving research results that can be applied to real-world problems
- Society of Automotive Engineers G-10 subcommittees – the FAA participates on all of the Society's subcommittees involving human factors to adapt their findings to aviation standards, guidelines, etc.
- Twenty-one FAA grants to universities support research on air carrier training, flight deck automation, aviation accident analysis, general aviation, and aviation maintenance technician and inspector training

### MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:

#### *Information Management and Display*

- Identify human factors issues in instrument procedures design
- Define a standardized format for data collection, reduction, and analysis to identify proactively contributing factors of improper maintenance

#### *Human-Centered Automation*

- Expand human factors Certification Job Aid for FAR Part 25 flight decks and initiate work for FAR Part 23 Flight Decks

#### *Human Performance Assessment*

- Determine the optimum amount of time an inspector can perform nondestructive testing inspections before human performance decrements can be expected
- Complete industry survey identifying the challenges in implementing maintenance Aviation Safety Action Program (ASAP) programs and factors that influence success and failure of the program
- Quantify helicopter pilots Precision Visual Flight Rules (PVFR) navigation performance without the aid of global positioning system display

#### *Selection and Training*

- Enhance Rapidly Reconfigurable Line Oriented Evaluations (RRLOE) scenario generation software and expanded collection of air carrier user data
- Develop methodologies for integrating ASAP, FOQA and AQP data
- Expand methodologies to link performance data to curriculum modification procedures in AQP programs
- Develop training guidelines for error management in air carrier cockpits
- Complete an industry-wide benchmark for aviation maintenance inspection; this computer based inspection training program will standardize the inspection training process in the general aviation industry
- Develop research and educational materials that will help reduce general aviation accidents

- Provide guidance on the revision of FAR Part 61-141 by specifying the number of credit hours for which various flight training devices and personal computer aviation training devices may be used in lieu of actual flight time

### **FY 2006 PROGRAM REQUEST:**

The program will continue to focus on providing technical information and advice to improve aircrew, inspector, maintenance technician, and aviation system performance. The emphasis will remain on developing guidelines, tools, and training to enhance error capturing and mitigation capabilities in the flight deck and maintenance environments, and on developing human factors tools to ensure that human performance considerations are adequately addressed in the design and certification of flightdecks and equipment.

#### *Ongoing Activities*

##### *Information Management and Display*

- Develop human factors guidance for instrument procedures design
- Develop human factors guidance for multiple weather sources on a multi-function display
- Develop certification guidelines for integrated technology in general aviation cockpits

##### *Human-Centered Automation*

- Evaluate human factors issues regarding Required Navigation Procedures (RNP) information on navigation displays
- Examine best approaches for effective training for automated cockpits
- Validate advanced knowledge assessment software tool for automated aircraft
- Develop the human factors Certification Job Aid for FAR Part 23 flight decks

##### *Human Performance Assessment*

- Identify intervention strategies to either prevent or mitigate general aviation accidents.
- Refine flight and simulator data analysis tools
- Examine unique methods to improve pilot assessment
- Examine advanced methods to link FOQA, ASAP, and AQP data
- Provide guidance on the transition from instrument flight rules to precision visual flight rules for helicopters

##### *Selection and Training*

- Examine advanced methods to allow air carriers to trend ASAP data
- Validate training guidelines for unexpected events
- Expand software enhancements to rapidly reconfigurable line oriented evaluations scenario generation tools; collect air carrier user data
- Expand the development of LOSA
- Develop guidance on appropriate simulator requirements for both initial and recurrent pilot training
- Identify factors that will maximize the likelihood of successful implementation of Aviation Safety Action Program (ASAP) for aircraft maintenance programs
- Provide guidance on a risk assessment tool that will identify contributing factors of improper maintenance

##### *New Initiatives*

No new initiatives are planned in FY 2006.

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### KEY FY 2006 PRODUCTS AND MILESTONES:

#### *Information Management and Display*

Complete the development of:

- Guidance on communicating maintenance Aviation Safety Action Program (ASAP) derived actions and recommendations using the web-based ASAP safety-information and program-tracking (WASP) tool
- Initial human factors guidelines for instrument procedure design
- Guidelines regarding multiple weather sources on a multi-function display

#### *Human-Centered Automation*

- Expand development of Certification Job Aid to FAR Part 23 flight decks
- Provide certification guidelines for integrated technology in general aviation cockpits
- Distribute refined training guidelines for automated cockpits
- Report on the validation study of the advanced knowledge assessment tool

#### *Human Performance Assessment*

- Distribute advanced flight and simulator data analysis tools to air carriers
- Provide initial report on methods to improve pilot assessment
- Provide initial report on advanced methods to link FOQA, ASAP, and AQP data
- Complete trend and data analysis tool to identify contributing factors of improper maintenance
- Provide guidance as to whether commercially available flight simulation products such as Microsoft's Flight Simulator have actual training value comparable to FAA approved generic simulation devices

#### *Selection and Training*

- Provide guidance on training helicopter Visual Flight Rules (VFR) pilots to operate on Precision Visual Flight Rules (PVFR) routes
- Provide ASAP enhancements for reporting factors contributing to aviation incidents
- Provide initial report on advanced methods to allow air carriers to trend ASAP data
- Distribute training guidelines for unexpected cockpit events
- Distribute to, and train air carriers in the use of the new Rapidly Reconfigurable Line Oriented Evaluations (RRLOE) scenario generation tools
- Provide methods to transition enhanced Line-Oriented Safety Audit to ICAO carriers
- Report on the appropriate requirements for simulator use in initial and recurrent pilot training

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

**APPROPRIATION SUMMARY**

	Amount (\$000)
Appropriated (FY 1982-2004)	\$176,065
FY 2005 Enacted	11,700
FY 2006 Request	8,181
Out-Year Planning Levels (FY 2007-2010)	32,125
<b>Total</b>	<b>\$228,071</b>

<b>Budget Authority (\$000)</b>	<b>FY 2002 Enacted</b>	<b>FY 2003 Enacted</b>	<b>FY 2004 Enacted</b>	<b>FY 2005 Enacted</b>	<b>FY 2006 Request</b>
Contracts:					
Flightdeck/Maintenance/System	6,617	6,330	4,647	8,157	5,420
Intecration Human Factors					
Personnel Costs	2,398	2,582	2,856	2,664	2,626
Other In-house Costs	891	845	841	879	135
<b>Total</b>	<b>9,906</b>	<b>9,757</b>	<b>8,344</b>	<b>11,700</b>	<b>8,181</b>

<b>OMB Circular A-11, Conduct of Research and Development (\$000)</b>	<b>FY 2002 Enacted</b>	<b>FY 2003 Enacted</b>	<b>FY 2004 Enacted</b>	<b>FY 2005 Enacted</b>	<b>FY 2006 Request</b>
Basic	0	0	0	0	0
Applied	9,906	9,757	8,344	11,700	8,181
Development (includes prototypes)	0	0	0	0	0
<b>Total</b>	<b>9,906</b>	<b>9,757</b>	<b>8,344</b>	<b>11,700</b>	<b>8,181</b>

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

A11g – Flight Deck/Maintenance/System Integration Human Factors Product and Activities	FY 2006 Request (\$000)	Program Schedule					
		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
<b>081-110 Flightdeck/Maintenance/System Integration Human Factors</b>							
<b>Selection and Training</b>							
<b>\$2,182</b>							
Develop Reconfigurable Event Sets	◆	◇	◇				
Provide Guidance for Simulator Motion Requirements	◆	◇	◇				
Develop/Distribute Advanced Data Analysis Methods Linking FOQA and Simulator Data	◆	◇	◇				
Develop Training Guidelines for Flight Deck Error Management	◆	◇	◇	◇	◇	◇	
Develop Guidance on Information Required to Revise FAR 61.141 that Specifies Credit Hours for which FTDs and PCATDs May Be Used in Lieu of Actual Flight	◆	◇	◇	◇			
Initiate Development of Guidance on How Advanced Technology Can Be Used for Inspection Training and Reducing Errors in General Aviation Maintenance	◆	◇	◇				
<b>Human Performance Assessment</b>							
<b>\$367</b>							
Provide Expanded APMS Methodologies and Analysis Capabilities	◆	◇					
Examine Advanced Methods to Link FOQA, ASAP, and AQP Data	◆	◇	◇	◇			
Continue Examination on Acceptable Vision Standards and Procedures for Personnel Involved in NDT/NDI and Visual Inspection of Aircraft and Aircraft Components	◆	◇					
Demonstrate Precision Visual Flight Rules (PVFR) Routes That Use Global Positioning System	◆	◇					
<b>Human Centered Automation</b>							
<b>\$1,598</b>							
Provide Industry and FAA Guidance Addressing Training for Automated Cockpits	◆	◇					
Complete Certification Job Aid for FAR Part 25 Flight Decks and Other FAR Parts (e.g. 23,27,29) as Determined by FAA Sponsor	◆	◇	◇				
Develop Certification Guidelines for Integrated Technology in General Aviation Cockpits	◆	◇	◇	◇	◇	◇	
<b>Information Management and Display</b>							
<b>\$1,273</b>							
Develop Guidelines for Instrument Procedures Design	◆	◇	◇	◇	◇	◇	
Develop Guidelines for the Display of Weather on Multi-Function Displays	◆	◇					
Provide Guidance on Whether Digitizing Maintenance Data Affects Maintenance Performance	◆	◇	◇				
Identify Factors That Can Maximize the Likelihood of Successful Implementation of ASAP for Aircraft Maintenance Programs	◆	◇	◇				
<b>Personnel and Other In-House Costs</b>	<b>\$2,761</b>						
<b>Total Budget Authority</b>	<b>\$8,181</b>	<b>\$11,700</b>	<b>\$8,181</b>	<b>\$8,028</b>	<b>\$8,049</b>	<b>\$8,071</b>	<b>\$7,977</b>

Note: Out year numbers are for planning purposes only. Actual funding needs will be determined through the annual budget process.

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FAA Budget Appropriation	Budget Item	Program Title	Budget Request
F&E	1A01E	General Aviation and Vertical Flight Technology (GA&VF)	\$1,500,000

### Supports FAA Strategic Goals: Increased Safety, International Leadership

**Program Goals and Intended Outcomes:** The General Aviation and Vertical Flight (GA&VF) Technology Program directly supports goals and programs delineated in the FAA’s *Flight Plan 2005-2009*, the *Aviation Safety Action Plan*, the *RTCA Free Flight Action Plan*, the *Operational Evolution Plan*, the Performance-Based Operations Aviation Rulemaking Committee, and the ongoing National Airspace System (NAS) architecture development effort. The program emphasizes direct needs of light general aviation airplanes, helicopters and tiltrotor aircraft.

The program contributes to achieving three strategic goals and associated objectives of *Flight Plan 2005-2009*. It supports the strategic goal of *Increased Safety*, with application to general aviation, by providing visual flight rules (VFR) pilots with instrument flight rules (IFR)-like environments and conducting research to increase the situational awareness of the pilots of small general aviation (GA) aircraft. It also supports the strategic goal of *Greater Capacity* through initiatives that increase GA access to high-demand metropolitan areas by adding new routes, and by improving landing and departure capabilities for helicopters during low visibility weather conditions. And it supports the strategic goal of *International Leadership* through its recommendations to incorporate standards and procedures developed by the GA&VF Technology Program into International Civil Aviation Organization (ICAO) Standards and Practices.

The applied research and development activities of the GA&VF Technology Program support GA requirements for communications, navigation, and surveillance (CNS) services, and improved avionics technologies. Program products are integral to NAS modernization. Advanced CNS technology not only provides for precise navigation of aircraft and aircraft position determination for Air Traffic Management (ATM), but it also enables these services at locations that are currently unavailable to GA users. New and improved standards and regulations associated with this program help to improve the safety, cost-effectiveness, and efficiency of air traffic services, and by so doing safely expand the capacity of the NAS.

The GA&VF Technology Program supports research and development across all GA operations. Its research areas align with the most critical components for GA participation in NAS terminal and en route operations: landing facilities, airmen and controller training, and low-cost avionics. The program also supports the development of procedures and standards that enable simultaneous non-interfering (SNI) operations between fixed-wing and vertical flight aircraft.

The program’s new Terminal Instrument Procedures (TERPS) criteria for GA and vertical flight aircraft are based on specific aircraft and avionics performance characteristics within the context of new CNS capabilities. This approach promises to make better aviation services safely and efficiently available in new locations. For example, low-altitude CNS research is helping to evaluate the future low-altitude en route infrastructure needed for Free Flight.

**Agency Outputs:** The GA&VF Technology Program helps generate design criteria, provides technical data for advisory circulars and training documents, and supports collaborative technology integration with the current and future NAS. The program also provides technical and management expertise to establish successful partnerships with industry.

Efforts that rely upon GA&VF Technology Program products and services include:

*Terminal Airspace Infrastructure* – Criteria and design parameters for instrument approaches to hospital, corporate, and business district heliports. These results support TERPS criteria, aircraft and avionics certification standards, IFR operations, emergency medical service (EMS) procedures and training guidance, as well as minimum aviation system performance standards, minimum operational performance standards, and technical standard orders.

*Low Altitude Air Routes* – Procedures and test protocols designed in an operational environment to work with Global Positioning System (GPS) navigation, new surveillance capabilities, terrain-avoidance and situational awareness

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technology developed by other projects. These results help to integrate newer, safer, and more efficient rotorcraft routings into the NAS, and can be useful to other GA aircraft operating at low altitudes.

*Avionics and Cockpit Technology* – Avionics, auxiliary equipment, procedures, and related testing to enable the safe, efficient integration of GA and vertical flight aircraft into the NAS. These results support the introduction of GPS-based navigation, landing and surveillance systems, and related work under the Free Flight initiative, and the Safer Skies initiative.

*Low Altitude CNS Infrastructure and Pilot Situational Awareness Capability*– Route system guidelines, cockpit display guidelines, noise abatement procedures, and terminal and en route system integration plans for low altitude CNS operations. Establishment of test beds to foster efficient use of airspace and improved situational awareness for GA pilots.

*Homeland Security* – Feasibility assessments of concepts and procedures related to GA aircraft operations, related avionics and security equipment requirements. Encourage use of test beds established in high security areas as elements of comprehensive homeland security initiatives.

### **Customer/Stakeholder Involvement:**

Customers Include:

- Helicopter Association International
- Eastern Region Helicopter Council
- Aircraft Owners and Pilots Association
- National Association of State Aviation Officials
- Association of Aeronautical Medical Services
- National Emergency Medical Services Pilots Association
- Airborne Law Enforcement Association

Stakeholders include:

- American Helicopter Society
- National Business Aircraft Association
- Experimental Aircraft Association
- General Aviation Manufacturers Association
- Small Aircraft Manufacturers Association

### **Accomplishments:**

- Evaluated current technology to support precision IFR approaches to heliports and vertiports
- Developed vertical flight Satellite Navigation road map
- Developed operations concept plan to provide enhanced weather data and flight information services to helicopter operations in the Gulf of Mexico as part of the next generation CNS technology
- Developed strategic plan and operations concept for vertical flight operations using advanced technology
- Established criteria to publish mountain pass waypoints on VFR charts
- Completed a report on a simulation utilizing industry pilots to determine the adequacy of Instrument Landing System (ILS) Category I lighting systems to support helicopter instrument landing system approaches to lower minimum weather conditions
- Reported on procedures for providing enhanced services for time-critical (e.g., law enforcement or emergency medical services) VFR vertical flight operations
- Amended the Aeronautical Information Manual to provide guidance on special practices and techniques for helicopters in off-shore environments

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- Completed a first phase report on maximum safe descent angle for helicopters during the visual segment of an instrument approach to a heliport
- Completed a report, with recommendations for new research, on current and developing heliport lighting and marking technologies
- Conducted tests, collected data, and initiated work on reports on human factors affecting how precision VFR [or Precision Vertical Flight Rules (PVFR)] routes are flown and the precision that pilots can maintain on routes
- Completed work on enabling helicopters to utilize ILS Category II facilities for safe approaches in lower than the present minimal weather conditions
- Completed a simulation report on potential helicopter routes that could be operated with minimal interference to fixed-wing traffic in the New York terminal area
- Completed holding pattern TERPS data analysis

**R&D Partnerships:** The GA&VF Technology Program collaborates with the Centers of Excellence for General Aviation for research initiatives and with industrial partners on projects involving various types of aircraft and pilot experience levels. Experts from aviation industries review test specifications with program personnel, and companies provide qualified pilots to participate in experiments. This spirit of cooperation helps the program to develop standards and criteria that accurately reflect industry's performance capabilities.

### MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:

- Complete simulation, testing and evaluation of helicopter ILS Category I approaches for safe use in lower than the present minimal weather conditions
- Reports on human factors issues affecting how PVFR routes are flown and the precision that pilots can maintain on the routes
- Establish a test bed in the New York terminal area to test and measure the benefits of SNI routes and improved situational awareness services
- Report on helicopter performance and instrumentation required for heliport instrument approaches
- Establish Industry/FAA partnership with Eastern Region Helicopter Council for SNI routes and improved situational awareness capability in the New York terminal area
- Initiate testing and data collection GPS Wide Area Augmentation System precision lateral guidance for approaches and departures at airports and heliports
- Initiate research on new lighting concepts and technology for IFR and VFR operations at heliports
- Complete final flight testing (utilizing industry pilots) and data analysis on maximum safe descent angle for helicopters during the visual segment of an instrument approach to a heliport

### FY 2006 PROGRAM REQUEST:

The requested funding will allow the program to continue to focus on the areas listed in the GOALS section of this narrative. Specific R&D areas will include SNI operations in the terminal area, precision approaches to heliports, heliport lighting, and reduction of Controlled Flight into Terrain (CFIT) for light general aviation aircraft and vertical flight aircraft.

### KEY FY 2006 PRODUCTS AND MILESTONES:

- Continue testing and demonstration of vertical flight and light general aviation SNI routes in the New York Terminal area utilizing GPS navigation capabilities and new non-precision approaches to New York City heliports
- Initiate demonstration of PVFR operations

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- Initiate design of reduced-width SNI routes in the New York terminal area based on optimized C/N/S capabilities, the results of simulation, and air traffic controller feedback
- Develop heliport IFR steep angle approach, missed approach, and departure standards for helicopters utilizing GPS WAAS capabilities
- Initiate design of complex helicopter and tiltrotor approaches and departures
- Complete research on new lighting technologies for IFR and VFR operations
- Evaluate potential for reduced helicopter minimums using synthetic vision technology

### APPROPRIATION SUMMARY

	<u>Amount (\$000)</u>
Appropriated (FY 1982-2004)	\$7,702
FY 2005 Enacted	1,488
FY 2006 Request	1,500
Out-Year Planning Levels (FY 2007-2010)	8,000
<b>Total</b>	<b>\$18,690</b>

Budget Authority (\$000)	FY 2002 Enacted	FY 2003 Request	FY 2004 Request	FY 2005 Enacted	FY 2006 Request
Contracts:					
General Aviation and Vertical Flight Technology	1,000	1,000	1,400	1,488	1,500
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
<b>Total</b>	<b>1,000</b>	<b>1,000</b>	<b>1,400</b>	<b>1,488</b>	<b>1,500</b>

OMB Circular A-11, Conduct of Research and Development (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	1,000	1,000	1,400	1,488	1,500
<b>Total</b>	<b>1,000</b>	<b>1,000</b>	<b>1,400</b>	<b>1,488</b>	<b>1,500</b>

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General Aviation and Vertical Flight Technology Product and Activities	FY 2006 Request (\$000)	Program Schedule					
		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
<b>General Aviation and Vertical Flight Technology</b>							
<b>Simultaneous Non Interfering Operations</b>	<b>\$600</b>						
Precision VFR Route Testing and Analysis		◆	◇	◇			
New York Terminal Area (NYTA) SNI GPS/ADS-B Test Bed Using Existing Standards		◆	◇	◇			
Establish FAA/Industry Partnership for NYTA test bed		◆			◇		
NYTA Simulation/Modeling for Separation Standards Reduction			◇				
NYTA Simulation/Modeling for WAAS/LAAS Standards				◇	◇		
NYTA Demonstration with WAAS/LAAS Standards					◇	◇	◇
Recommendation for WAAS/LAAS SNI National Development					◇		
<b>Instrument Operations at Heliports/Vertiports</b>	<b>\$800</b>						
Copter ILS Cat I Lighting Simulation, Test and Evaluation		◆					
Heliport IFR/VFR Lighting Research, Design, Test and Demonstration		◆	◇	◇	◇		
Helicopter Performance/Instrumentation for Heliport Approaches		◆	◇				
Helicopter/Tiltrotor criteria for Lateral Guidance and Steep Angle Approaches			◇	◇	◇		
Helicopter/Tiltrotor criteria for Complex Approaches				◇	◇	◇	◇
<b>Advanced Technology and Procedures Applications</b>	<b>\$100</b>						
Surveillance Options for Light GA Aircraft Pilot Guidance				◇	◇		
Enhanced Vision for Light GA Aircraft Pilot and Inspector Guidance				◇	◇		
Copter/Light GA Synthetic Vision Displays Pilot and Inspector Guidance			◇	◇	◇	◇	
Improve Weather Distribution in the Gulf of Mexico					◇	◇	
<b>Homeland Security</b>							
Analyze Options for GAVF Support of Homeland Security				◇	◇	◇	◇
<b>Total Budget Authority</b>	<b>\$1,500</b>	<b>\$1,488</b>	<b>\$1,500</b>	<b>\$2,000</b>	<b>\$2,000</b>	<b>\$2,000</b>	<b>\$2,000</b>

◆ - Activities Accomplished      ◇ - Activities Planned

NOTES: OUT YEAR NUMBERS ARE FOR PLANNING PURPOSES ONLY. ACTUAL FUNDING NEEDS WILL BE DETERMINED THROUGH THE ANNUAL BUDGET PROCESS.

IN THE FACILITIES AND EQUIPMENT APPROPRIATIONS, PERSONNEL AND OTHER COSTS ARE BUDGETED IN ACTIVITY 5, NOT THE PROGRAM BUDGET LINE ITEM.

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FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A12.a	Joint Planning and Development Office (JPDO)	\$18,100,000

### Supports FAA Strategic Goal: Greater Capacity

#### Rationale:

##### IMPACT OF AVIATION ON THE U.S. ECONOMY

- The economic stakes of maintaining U.S. leadership in aviation are high. Civil aviation is the great engine of economic growth. Its products and services generate a significant surplus for U.S. trade accounts and contribute to the \$100 billion a year in tourism from abroad. It creates high-skilled, high-paying jobs.
- Most forecasts show a three-fold increase in air traffic, passengers and cargo over the next 25 years; however, the present system cannot keep up with this torrid pace of growth. New aircraft such as very light jets and uninhabited aerial vehicles and services such as air taxis will also place new strains on the system.
- A lack of capacity threatens continued growth. Gridlock is a real possibility. Consumers stand to lose \$30 billion annually due to people and products not reaching their destinations within time periods we expect today. The Commission on the Future of the United States Aerospace Industry concluded that without improvement, the combined economic cost of delays from 2000-2012 will be an estimated \$170 billion.
- Threatened by stiff competition from European nations and other countries, the U.S. leadership position in aviation/aerospace is also at serious risk. The U.S. could become a second-tier aviation supplier in the second century of aviation.
- Security remains a concern for the National Airspace System. As the President noted earlier this year, “Our country is safer than we were three years ago, but we are not safe yet.”

##### NEED TO INCREASE THE SECURITY, SAFETY, CAPACITY AND EFFICIENCY OF THE U.S. AIR TRANSPORTATION SYSTEM

- The changes that are coming are too big and too fundamental for incremental adaptations of the current infrastructure. We must modernize and transform our air transportation system starting today.
- Through system transformation, we will triple current capacity to meet these demands; reduce curb-to-curb transit time by 30 percent and minimize the impact of weather and other disruptions to provide for 95 percent on-time arrivals and departures. This process will take us to the year 2025 and beyond.
- We will deliver a system with the capacity to allow travelers to choose how, where and when they travel while making the experience as safe, secure and hassle free as possible. The system must also be flexible enough to encourage the exploration of new business models and a more dynamic set of services for air travelers.
- We will integrate capabilities across Federal agencies to meet defense, commerce and homeland security requirements. Network enabled operations will provide a shared situational picture of aircraft and will help to prevent a recurrence of a 9/11-type terrorist attack.
- To secure America’s place as a global leader in aviation’s second century, we need an air transportation system that supports a strong commercial capability, facilitates private sector expansion and creates jobs.
- In a time of tight budgets, we must also align resources across agencies to eliminate duplication of effort and make the best use of the taxpayer’s dollar.

### Goals:

To deal with this national priority, the Commission on the Future of the United States Aerospace Industry and National Research Council reports called for an integrated approach that would create a unified vision of what our air transportation system can and should deliver, for the next generation, and beyond what is contained in the FAA's Flight Plan and Operational Evolution Plan.

The VISION 100 FAA Reauthorization Act (PL 108-176) established the multi-agency Joint Planning and Development Office (JPDO) and authorized up to \$50M per year for the next six years for its work (FY 2004-FY 2010). This unique coalition of government agencies is made up of DOT, FAA, NASA, DOD, DOC, DHS and OSTP. The Office will serve as a model of what can be accomplished when Federal agencies work in concert with one another and leverage private sector expertise to pursue a common objective.

To create and carry out an Integrated National Plan for the Next Generation Air Transportation System (NGATS) while aligning resources.

- In December 2004, the JPDO delivered to Congress the Integrated National Plan for the NGATS, and in a partnership with the private sector will now manage the work associated with it. The Integrated National Plan is a long-term strategic business plan that lays out goals and objectives and requirements for transformation in eight specific areas, each individually significant yet interdependent on the others. They are: airport infrastructure development, security, the air traffic system, information technology, safety management, environmental stewardship, weather forecasting and global collaboration.
- The Integrated National Plan will deliver short-term benefits on the road to achieving the larger transformed year 2025 vision.
- The Integrated National Plan is premised on the belief that Government cannot solve all the problems facing aviation. The goal is not to pick winning technologies but instead to provide a framework to utilize the creative forces of the market.
- Of great importance, Government's role under this plan will shift to allow industry to provide the most cost-effective solutions within a performance-based set of security and environmental rules.
- As we move forward, we will draw on private-sector ingenuity and a key component of the entire effort will be the development of innovative public-private partnerships.
- To succeed, we must maximize and leverage scarce public/private resources and align research resources and synchronize capital investments.
- Market forces will play a role wherever possible.

### JPDO Outputs:

Working in close collaboration with the private sector, the JPDO is ensuring that planning and execution of the NGATS are coordinated across government and industry. Integrated Product Teams (IPTs) are already hard at work developing strategies and action plans to implement the NGATS.

The IPTs will initially refine the options for future solutions, assess existing programs and plans, leverage what is available, and identify gaps and key questions for further research and development. System engineering/integration work will begin in earnest to support the architecture and IPT planning. These more detailed plans will be reflected as annexes to the second edition of the Integrated National Plan to be delivered to Congress in December 2005. In FY 2005-2006, the JPDO will conduct the following activities and produce the indicated outputs/deliverables for the eight transformation strategies:

- Develop airport infrastructure to meet future needs – assess regional and national needs
- Establish an effective security system – explore threat assessment & devise policies
- Establish an agile air traffic system – develop system performance standards, communications, navigation, surveillance/air traffic management concept of operations and architecture

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- Establish user-specific situational awareness – develop policies and decision architecture, and a network-enabled operations demonstration project with FAA, NASA, DOD and DHS
- Establish a comprehensive proactive safety management program – create safety doctrine, standards & framework
- Develop environmental protection that allows sustained economic growth – establish environmental doctrine and draft environmental research plan
- Develop a system-wide capability to reduce weather impacts – R&D alignment, R&D requirements, and an applied research center for weather
- Harmonize equipage and operations globally – identify needs, streamline efforts, unify U.S. positions and partner with industry

### **Customer/Stakeholder Involvement:**

The Administration has stressed the need for collaboration between all interested parties in creating the NGATS. A major policy challenge is to understand the role of all stakeholders and the mechanisms for shared decision making in a more integrated public-private operation. Given JPDO's unique structure and mission, the Administration proposes employing a blend of traditional and non-traditional mechanisms to help foster and expand the JPDO's "engage and then decide" outreach process.

As appropriate, federal advisory committees will be used to ensure all plans and decisions receive broad review and public comment. These committees will include senior-level executives from across industry who are empowered to provide advice on strategy and transition issues. Furthermore, the participants will be able to gauge industry reaction and support for system developments and to develop and gain industry support for major decisions.

JPDO will also establish mechanisms for direct input and participation from experts in the private sector. It has already employed a series of workshops designed for gathering input on future planning scenarios, and will continue this means for direct expert involvement. At times, the JPDO may also make use of broad area announcements and other tools to solicit ideas or tangible contributions from the community at large. This input will be augmented through a system of engineering and integration acquisition with the use of an industry team approach. Each IPT will identify specific means for private sector involvement through formal advisory committees, working groups, collaborative research agreements, and other available appropriate means.

Combining these efforts will ensure the establishment of a collective enterprise among the key stakeholders to achieve the transformation, as well as make certain we fulfill our critical obligation to create a process that is fully open to public scrutiny. Moreover, the agencies retain statutory responsibility to manage their programs, making use of acquisition strategies that provide the government the best value and ensure the implementation of the solutions developed through joint effort. Implicit in this transformation approach is the mechanism for accelerating the pace at which industry innovations are applied into the NGATS.

- Coordination across government agencies: To date, DOT/FAA and JPDO have briefed members and staff of some of the key House and Senate Committees on the Integrated National Plan. The staff will continue the ongoing dialogue with DHS/TSA, DOD, DOC, NASA, OST, OSTP, DOT and other relevant Federal, State and local government agencies.
- Coordination with industry: To date, the JPDO has met with or briefed organizations/businesses including AOPA, ATA, ATCA, ACI, AIA, Boeing, MBAA, NATA, NASAO, Raytheon, Lockheed, RAA, REDAC, and RTCA. As noted above, many have participated in workshops that provided invaluable input into the drafting of the Integrated National Plan and will now take on an even greater role as the JPDO draws on their expertise for the IPTs.
- The Integrated National Plan is updated and coordinated annually with input from all stakeholders.

### **Accomplishments:**

#### **Refined Operational Concepts:**

Established the framework that will guide the operational, systems and technical architecture development process.

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- Air Traffic Management where service is delivered independent of geography; automation simplifies operations such as sequencing; noise management of arrivals and departures; migration to control of specific exception cases; decisions are distributed between the public and private sectors, air and ground; and procedures are tailored to an aircraft's capabilities and performance.
- Security is embedded and seamless with multi-layered measures for prevention, detection and resolution that go well beyond airport boundaries; measures are interwoven throughout the system; established command and control protocols are backed with real time data (e.g. Auto-land); and there is a real-time threat analysis.
- Airports have a balanced use of capacity with a greater use of inherent capacity, including expanded capacity for new operations.
- Aircraft operations have performance-based services tailored to the more diverse range operations enabled through introduction of advanced capabilities.

### **Established Future System Characteristics that:**

- Are able to adapt to new and unanticipated changes in transport needs, evolving safety and security concerns and a more information-driven national and global economy;
- Are flexible and able to quickly adapt to changes by leveraging new technologies and procedures;
- Are heavily reliant on automation for routine tasks enabling people to focus on higher-priority tasks;
- Use increased automation with procedures to help boost system capacity. Automation aids will augment the role of decision makers and new operational procedures will leverage aircraft performance with fewer ties to geographical airspace;
- Rely on human performance and efficiency enhancements that enable decision makers to accommodate a larger and more diverse number of operations;
- Ensure threats to the system are mitigated by an integrated multi-layered approach and that there is ubiquitous access to operational information to provide for shared situational awareness and immediate responses;
- Are based on new business models that increase flight options for travelers and shippers; and
- Coordinate aviation and aeronautics research programs to achieve the goal of more effective and directed programs that result in applicable research and identification of specific R&D requirements that are not currently being addressed.

### **R&D Partnerships:**

- The National Plan includes a coordinated R&D plan across DOT/FAA, NASA, DHS/TSA, DOD, OST, OSTP and DOC for those elements required for defining and transforming the future air transportation system
- The IPTs will analyze changes currently underway, identifying gaps and establish the government and/or industry R&D activities to close them
- The IPTs will coordinate with government and private industry on R&D resources
- The IPTs will collaborate with industry on research and implementation of the initiatives

### **MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:**

#### *Ongoing Activities*

- Begin to implement the Integrated National Plan has been as developed and delivered to Congress.
- Continue to address issues of the JPDO's Senior Policy Committee for the purpose of addressing legislative and policy issues and foster the operation of federal advisory committees and other mechanisms to coordinate industry and stakeholder input, (such as seminars and working groups.) through the Senior Policy Committee

## **2005 FAA NATIONAL AVIATION RESEARCH PLAN**

- Annually update, validate, and coordinate the Integrated National Plan, to include:
  - National Vision for 2025
  - Socio-Economic Demands
  - National Goals, Objectives and Policies
  - Operational Concepts and Transition Roadmap
  - Coordinated Research Plan
- Conduct detailed planning for several demonstrations that will test potential operational concepts and protocols; demonstrate how technologies can be applied to address the major technical challenges; and provide alternatives for communications/navigation and surveillance architecture tradeoffs
- Perform system-of-system modeling and simulation to ensure benefits, costs, and trade-offs are understood across the full range of Integrated National Plan goals and metrics
- Establish the systems engineering process that will ensure an integrated approach to implementing the future system

### **KEY FY 2006 ACTIVITIES AND MILESTONES:**

#### **Planning and Agency/Industry Alignment:**

As required by Vision 100 Act, the Joint Planning and Development Office will:

- Update, validate, coordinate and begin implementing the Integrated National Plan for the Next Generation Air Transportation System
  - Coordinate aviation and aeronautics research programs to achieve the goal of more effective and directed programs that will result in applicable research
  - Set goals and priorities and coordinate research activities within JPDO member agencies and with U.S. aviation and aeronautical firms
- Facilitate the transfer of technology from research programs (e.g. NASA and DOD Advanced Research Projects Agency program) to the Federal agencies with operational responsibilities to the private sector

#### **Systems Integration and Transformation Analysis:**

To accomplish the coordination necessary to create and carry out the Integrated National Plan, the JPDO must establish the basis for system integration. It must:

- Refine the Integrated Product Team Action Plans and the overarching Transformation Roadmap, and coordinate them with the implementing agencies, the user community and industry
- Begin to execute the IPT Action Plans
- Begin development of the enterprise architecture to facilitate the development, management and implementation of the Next Generation Air Transformation System
- Model the planned system improvements called for in the Transformation Roadmap to validate their efficacy in accomplishing the goals identified in the Integrated National Plan
- Conduct the analysis, trade studies, and demonstrations to select the best approaches/alternatives for transforming the current air transportation system

This basis will allow transformation analysis beginning in FY 2007 to:

- Develop integrated transformation approach for defense, homeland security, and civil aviation based on IPT plans
- Refine a transformation roadmap that integrates IPT roadmaps. (This roadmap will develop plans for required avionics and for policy decisions implementation, and will focus on FAA National Airspace System architecture, FAA modernization plans – including the Flight Plan and Operational Evolution

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Plan – homeland security plans, and an assessment of DoD impact. This activity will be closely coordinated through the IPTs with planners in DHS, DoD, U.S industry and international partners.)

- Analyze the transition strategies that will integrate individual IPT plans. (These analyses will develop alternative transition strategies for potential transformational changes and analysis of transition implications – including costs, equipage, safety, training, labor issues, and international harmonization.)
- Budget for, schedule, integrate, and analyze IPT plans.

### APPROPRIATION SUMMARY

	Amount (\$000)
Appropriated (FY 1982-2004)	\$0
FY 2005 Enacted	5,059
FY 2006 Request	18,100
Out-Year Planning Levels (FY 2007-2010)	68,307
<b>Total</b>	<b>\$91,466</b>

Budget Authority (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Contracts:					
Joint Planning & Development Office				3,659	16,720
Personnel Costs	0	0	0	1,200	1,313
Other In-house Costs	0	0	0	200	67
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>5,059</b>	<b>18,100</b>

OMB Circular A-11, Conduct of Research and Development (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Basic	0	0	0	0	0
Applied	0	0	0	5,059	18,100
Development (includes prototypes)	0	0	0	0	0
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>5,059</b>	<b>18,100</b>

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A12a – Joint Planning & Development Office (JPDO) Product and Activities	FY 2006 Request (\$000)	Program Schedule					
		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
<p><i>Joint Agency Planning and Development</i></p> <p><b>Planning and Agency/Industry Alignment:</b></p> <p><b>Update and Carry Out an Integrated Plan for a Next Generation Air Transportation System</b></p> <p style="margin-left: 20px;">Coordinate Aviation and Aeronautical Research Programs – Directed toward Applicable Research</p> <p style="margin-left: 20px;">Coordinate Goals, Priorities, and Research Activities - among FAA and U.S. Aviation and Aeronautical Firms</p> <p><b>Systems Integration and Transformation Analysis:</b></p> <p><b>Establish the Basis for System Integration (Prerequisite to Research)</b></p> <p style="margin-left: 20px;">Develop Enterprise Architecture to Provide Basis for a Robust System-of-Systems Engineering Process</p> <p style="margin-left: 20px;">Evaluate and Validate Cross-IPT, Integrated System-Wide Concepts, Procedures, Policies, Business Cases, etc.*</p> <p style="margin-left: 20px;">Establish Guiding Policies and Principles (Based on Early Decisions) to Direct the Transformation</p> <p style="margin-left: 40px;">* These Constructs Must Include Defense and Homeland Security Needs and Provide Alternatives Capable of Meeting All National Plan Objectives Simultaneously.</p>	\$16,720						
<i>Personnel and Other In-House Costs</i>	\$1,380						
<b>Total Budget Authority</b>	<b>\$18,100</b>	<b>\$5,059</b>	<b>\$18,100</b>	<b>\$17,409</b>	<b>\$17,251</b>	<b>\$17,086</b>	<b>\$16,561</b>

Note: Out year numbers are for planning purposes only. Actual funding needs will be determined through the annual budget process.

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
F&E	1A01H	NAS Requirements (Office of Aerospace Weather Policy and Standards)	\$800,000

**Supports FAA Strategic Goal: Greater Capacity**

**Program Goals and Intended Outcomes:** Weather has a significant impact on safety and efficiency. Avoidable weather delays are estimated to cost airlines, air cargo operators and other users approximately \$4B annually. Accidents and injuries from icing, turbulence cost approximately \$300M per year. The FAA’s Aerospace Weather Policy and Standards office manages aviation weather requirements at the NAS level and aims to reduce accidents caused by weather plus decrease avoidable weather delays. The staff manages mostly non-capital requirements met by both the FAA and the National Weather Service (NWS), principally through three efforts: U.S. representation to the International Civil Aviation Organization (ICAO); leadership in the FAA Safer Skies initiative in the weather arena; and management of the Aviation Weather Technology Transfer (AWTT) process, which sets priorities for aviation weather research and facilitates the implementation of maturing products and services resulting from Research and Development (R&D).

This budget line item provides an established but flexible means for the FAA to direct attention and resources to concerns affecting system efficiency and safety of the present and future National Airspace System (NAS). Its focus changes as needs develop, and it operates independently of vendor to provide timely evaluations of selected services or technologies. The program’s continuing goal is to ensure that the most effective technical strategies are being pursued to ensure the success of the Agency’s mission: to provide a safe, secure and efficient aerospace system. The thrust of the program for the near future is to ensure the ongoing success of projects intended to reduce accidents caused by adverse weather and to decrease avoidable weather delays through implementation of new R&D weather products.

Deliverables supported by the NAS Requirements line item will provide a near-term means to off-set decreases in in-house resources.. These deliverables will help: (1) pilots avoid areas of current and forecast icing; (2) pilots and dispatchers to select routes to avoid areas of potentially hazardous turbulence; (3) pilots and dispatchers to select more efficient, safer routes around convective weather, including the oceanic environment; (4) forecasters to better predict areas of convection, turbulence and low ceilings and visibilities in the Continental U.S. (CONUS) and Alaska; (5) meteorologists to better forecast volcanic ash dispersion, and (6) users to select routes that take advantage of forecast winds. The deliverables will replace four labor-intensive textual weather products with equivalent graphics and will establish a baseline for how all future graphical products may be developed.

**Agency Outputs:** This line item enables the development of technical requirements documents affecting:

- Continuing implementation of weather solutions developed collaboratively by the FAA and the NWS
- Reconciliation of aviation weather domestic practices with International Standards and Recommended Practices
- Management of the AWTT Process
- Ongoing liaison with the FAA’s internal and external customers of weather products to ensure their requirements and priorities are reflected in the evolution of weather products and services

This documentation is accomplished through a combination of analysis and staff work resulting in:

- Formal Requirements Statements
- Impact Assessments
- Concepts of Use for various new products and services
- Performance Assessments and Business Case development
- Strategy formulations

## **2005 FAA NATIONAL AVIATION RESEARCH PLAN**

### **Customer/Stakeholder Involvement:**

This program's customers and stakeholders include:

- External FAA users including pilots, dispatchers, airline operations centers, airport operators, and aviation meteorologists, all of whom are represented by entities that include ATA, NBAA, AOPA, ALPA, APA, RAA, SAMA, GAMA, IATA as well as individual airlines and others (see Appendix E for clarification of unfamiliar acronyms)
- Internal FAA Service units representing controllers service providers in Terminal, En route/Oceanic, Flight Service, Systems Operations, Operations Planning, and Technical Operations Services
- FAA Regulatory arm (aircraft certification and flight standards personnel)
- The weather and satellite services in the Department of Commerce, National Oceanic and Atmospheric Administration
- International Civil Aviation Organization (ICAO) and the World Meteorological Organization
- The Office of the Federal Coordinator for Meteorology
- The National Aeronautics and Space Administration

### **Accomplishments:**

The following summarizes major accomplishments to date:

- Completed technology transfer into NAS operations of several new R&D products including the Current and Forecast Icing Potential Products, Graphical Turbulence Guidance Products, and National Convective Weather Forecast (1 Hour)
- Transferred other products into the final R&D phase (experimental): Ceiling and Visibility, Oceanic weather products, and improved capabilities associated with icing and turbulence products
- Implemented Collaborative Convective Forecast Product
- Completed the Turbulence Joint Safety Implementation Team (JSIT) final report detailing strategies to mitigate accidents and incidents caused by turbulence
- Identified accident causes and developed standard interventions to avoid icing related accidents and incidents as part of the Joint Safety Analysis Team (JSAT) Residual Risk activity
- Represented U.S. aviation interest at ICAO to minimize operating costs for U.S. carriers
- Provided requirements of service as contracting state to support the operation of Washington World Area Forecast Center and Anchorage/Washington Volcanic Ash Advisory Centers

### **Partnerships:**

The Office of Operations Planning Aerospace Weather Policy and Standards, within the FAA's Air Traffic Organization (ATO), partners with the Agency's Aviation Weather Research program, other ATO offices, Flight Standards, Aircraft Certification, and NWS offices as a part of the AWTT process. The office partners with the Flight Standards and NWS personnel on a full range of aviation weather development activities. In the international arena, the office closely partners with ICAO and its contracting members.

### **MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:**

- Continue the AWTT process; it is anticipated that an extended Graphical Turbulence Guidance product (FL100- FL200) will be implemented in the NAS this year, and several products enter their last R&D phase (experimental)
- Complete the JSIT final report detailing strategies to mitigate accidents and incidents caused by icing
- Initiate the development of international standards for graphic products for icing and turbulence
- Develop guidance material for an international standard for in-situ aircraft turbulence reporting
- Develop a comprehensive set of FAA weather requirements for products and services, and support NWS implementation team to fulfill these requirements

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- Assess development of a Quality Assurance scheme for Automatic Dependent Surveillance Meteorological messages for the World Area Forecast System
- Evaluate the effectiveness of FAA and NWS weather information in reducing weather delays (this is a three year FAA Flight Plan Initiative under Capacity Goal – first year FY 2005)
- Initiate proof-of-concept experiments on utility of Probability Forecasts in reducing airline fuel carriage related to alternate airport requirements

### **FY 2006 PROGRAM REQUEST:**

The requested funding will allow the program to continue to focus on the areas listed in the GOALS section of this narrative. Specific areas will include continued activities associated with the AWTT process, ICAO representation, and weather impact assessments.

### **KEY FY 2006 PRODUCTS AND MILESTONES:**

- Continue the AWTT process to implement the Current Icing Potential for Alaska and National Convective Weather Forecast (Two Hour) and promote several other products into last R&D phase (experimental) including Forecast Icing Potential and Severity, Convective Cloud Top Height product associated with Oceanic environment, and a National Ceiling and Visibility product for CONUS
- Continue the second year effort on evaluation of the effectiveness of FAA and NWS weather information in reducing weather delays
- Complete proof-of-concept experiments on utility of Probability Forecasts in reducing airline fuel costs related to alternate airport requirements
- Represent U.S. aviation interests at ICAO Regional Air Navigation meteorological Group Meetings
- Complete a Plan for the Broadcast of Aeronautical Information Services on the World Area Forecast System
- Provide support to NWS in the design of aviation weather products and services in response to FAA requirements

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

**APPROPRIATION SUMMARY**

	<u>Amount (\$000)</u>
Appropriated (FY 1982-2004)	\$8,900
FY 2005 Enacted	1,488
FY 2006 Request	800
Out-Year Planning Levels (FY 2007-2010)	<u>9,200</u>
Total	\$20,388

Budget Authority (\$000)	FY 2002 Enacted	FY 2003 Request	FY 2004 Request	FY 2005 Enacted	FY 2006 Request
Contracts:					
NAS Requirements (Office of Aerospace Weather Policy and Standards)	3,000	0	3,000	1,488	800
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
Total	3,000	0	3,000	1,488	800

OMB Circular A-11, and Development (\$000)	Conduct of Research	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Basic		0	0	0	0	0
Applied		0	0	0	0	0
Development (includes prototypes)		3,000	0	3,000	1,488	800
Total		3,000	0	3,000	1,488	800

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

<b>NAS Requirements (Office of Aerospace Weather Policy and Standards) Product and Activities</b>	<b>FY 2006 Request (\$000)</b>	<b>Program Schedule</b>					
		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
<b>NAS Requirements (Office of Aerospace Weather Policy and Standards)</b>  <b>AWTT Process</b>  Implement Graphical Turbulence Guidance FL100-200  Implement Alaska CIP  Implement NCWF-2  Continue implementation of R&D products  <b>JSIT/JSAT</b>  Complete the JSIT final report detailing strategies to mitigate accidents and incidents caused by icing.  <b>ICAO</b>  Initiate the development of International standards for graphic products for icing and turbulence Develop guidance material for International standard for in-situ aircraft turbulence reporting Initiate development of Quality Assurance scheme for Automatic Dependent Surveillance Meteorological messages for the World Area Forecast System Represent US at Regional Air Navigation meteorological Group Meetings as a part of the International activities Complete a Plan for the Broadcast of Aeronautical Information Services on the World Area Forecast System Provide US policy positions to 12 ICAO operations, study and planning groups  <b>FAA Flight Plan Initiative</b>  Evaluate effectiveness of FAA and NWS weather information in reducing weather delays  <b>Aviation Weather Requirements Development</b>  Develop a comprehensive set of FAA weather requirements for NWS products and services and support to NWS implementation team on strategies to fulfill these requirements Proof-of-concept experiments on utility of Probability Forecasts in reducing airline fuel costs related to alternate airport requirements	<b>\$800</b>						
<b>Total Budget Authority</b>	<b>\$800</b>	<b>\$1,488</b>	<b>\$800</b>	<b>\$2,000</b>	<b>\$2,000</b>	<b>\$2,000</b>	<b>\$3,200</b>

◆ - Activities Accomplished      ◇ - Activities Planned

NOTES: OUT YEAR NUMBERS ARE FOR PLANNING PURPOSES ONLY. ACTUAL FUNDING NEEDS WILL BE DETERMINED THROUGH THE ANNUAL BUDGET PROCESS.

IN THE FACILITIES AND EQUIPMENT APPROPRIATIONS, PERSONNEL AND OTHER COSTS ARE BUDGETED IN ACTIVITY 5, NOT THE PROGRAM BUDGET LINE ITEM.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
F&E	1A01G	NAS Safety Assessment	\$1,500,000

### Supports FAA Strategic Goal: Increased Safety

**Program Goals and Intended Outcomes:** The Safety Risk Assessment program aims to bring the FAA's acquisitions for the National Airspace System (NAS) into compliance with the Safety Management System (SMS) requirements defined by the International Civil Aviation Organization (ICAO). The program will modify the Acquisition Management System (AMS) Safety Management Program to meet or exceed internal FAA and external ICAO requirements for an SMS. In addition, the program will continue to support NAS modernization efforts by managing the safety assessments required to meet AMS guidance. Part of this effort includes operating the NAS Modernization System Safety Working Group, which ensures the quality of NAS safety products and provides tools and assistance to programs in executing their individual and integrated safety program plans.

**Agency Outputs:** By ensuring that the FAA has an operational SMS for system acquisitions that is integrated with, and a part of, the FAA's overall SMS program, this program contributes to the FAA's performance target of "apply[ing] SMS to all significant changes to the NAS." The program will directly affect the FAA's ability to manage the safety risk inherent in operating and modernizing the NAS as required by FAA orders and ICAO requirements.

#### Customer/Stakeholder Involvement:

Safety Analysis and Assessment supports internal FAA operations service units such as: En Route, Terminal, System Operations, Technical Operations, etc. It does not directly interface with external customers.

#### FY 2004 Program Accomplishments:

- Modified the AMS to comply with FAA and ICAO SMS requirements.
- Modified AMS and Configuration Control Board policy and process to comply with SMS requirements relative to NAS changes

#### R&D Partnerships:

Safety Analysis and Assessment does not have R&D partnerships. It supports internal FAA operations service units such as: En Route, Terminal, System Operations, Technical Operations, etc. It does not directly interface with external customers.

#### MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:

- Maintain an Acquisition Management System (and supporting processes) that is compliant with the FAA Safety Management System
- Track and report on safety significant changes made to the NAS
- Deliver safety risk management training to acquisition teams responsible for the conduct of safety assessments

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**FY 2006 PROGRAM REQUEST:**

The requested funding will allow the program to:

- Design, develop, and deliver tool modules to be used to conduct safety risk management
- Provide guidance and expertise to acquisition teams in the conduct of safety risk management

**KEY FY 2006 PRODUCTS AND MILESTONES:**

- Design, develop, and deliver tool modules to be used to conduct safety risk management
- Develop and disseminate additional SMS/SRM guidance materials, tools, and lessons learned across ATO/FAA

**APPROPRIATION SUMMARY**

	<u>Amount (\$000)</u>
Appropriated (FY 1982-2004)	\$1,000
FY 2005 Enacted	992
FY 2006 Request	1,500
Out-Year Planning Levels (FY 2007-2010)	4,600
<b>Total</b>	<b>\$8,092</b>

Budget Authority (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Contracts:					
NAS Safety Assessment	0	0	1,000	992	1,500
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
<b>Total</b>	<b>0</b>	<b>0</b>	<b>1,000</b>	<b>992</b>	<b>1,500</b>

OMB Circular A-11, Conduct of Research and Development (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	0	0	1,000	992	1,500
<b>Total</b>	<b>0</b>	<b>0</b>	<b>1,000</b>	<b>992</b>	<b>1,500</b>

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NAS Safety Assessment Product and Activities	FY 2006 Request (\$000)	Program Schedule					
		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
<b>NAS Safety Assessment</b>							
<b>Integrated Safety Engineering Environment (ISEE)</b>							
Incorporate Ground-Based Safety Analysis Descriptions	\$100	◆	◇	◇	◇	◇	◇
Incorporate Airborne-Based Safety Analysis Descriptions		◆	◇	◇	◇	◇	◇
Develop Computer-Based Training Capability		◆	◇	◇	◇	◇	◇
Maintain ISEE Tool		◆	◇	◇	◇	◇	◇
<b>Safety Tools</b>							
<b>Integrated Safety Engineering Environment (ISEE)</b>							
Incorporate Ground-Based Safety Analysis Descriptions		◆	◇	◇	◇	◇	◇
Incorporate Airborne-Based Safety Analysis Descriptions		◆	◇	◇	◇	◇	◇
Develop a Computer-Based Training Capability		◆	◇	◇	◇	◇	◇
Maintain ISEE Tool		◆	◇	◇	◇	◇	◇
<b>Hazard Tracking and Risk Resolution</b>							
Achieve a Fully-Oriented System		◆	◇	◇	◇	◇	◇
Capture Incident Data and Convert to Hazards		◆	◇	◇	◇	◇	◇
Align HTTR with SMS Requirements		◆	◇	◇	◇	◇	◇
<b>Safety Risk Management Training</b>							
Deliver safety risk management training to acquisition teams	\$850	◆	◇	◇	◇	◇	◇
<b>Safety Risk Management Expertise</b>							
Provide guidance and expertise to acquisition teams	\$300	◆	◇	◇	◇	◇	◇
Develop and disseminate additional SMS/SRM guidance materials, tools, and lessons learned		◆	◇	◇	◇	◇	◇
<b>Total Budget Authority</b>	<b>\$1,500</b>	<b>\$992</b>	<b>\$1,500</b>	<b>\$1,000</b>	<b>\$1,200</b>	<b>\$1,200</b>	<b>\$1,200</b>

◆ - Activities Accomplished      ◇ - Activities Planned

NOTES OUT YEAR NUMBERS ARE FOR PLANNING PURPOSES ONLY. ACTUAL FUNDING NEEDS WILL BE DETERMINED THROUGH THE ANNUAL BUDGET PROCESS.

IN THE FACILITIES AND EQUIPMENT APPROPRIATIONS, PERSONNEL AND OTHER COSTS ARE BUDGETED IN ACTIVITY 5, NOT THE PROGRAM BUDGET LINE ITEM.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
F&E	1A01D	Operations Concept Validation	\$3,000,000

### Supports FAA Strategic Goal: Greater Capacity

**Program Goals and Intended Outcomes:** Operational concept validation will challenge the validity of common situational awareness assumptions behind new mechanized systems for distributing weather and traffic information and will provide the high-quality performance requirements needed to ensure that the next generation of National Airspace System (NAS) ground and airborne support systems succeed. Tactical and strategic assumptions behind decision support tools in general – as well as requirements affecting information type, update rate, and display within the systems – will all be brought under strict scrutiny and redirected, and needed, for the mutual benefit of the public and the aviation community.

**Agency Outputs:** This process of identifying and refining a valid structure for operating the next generation NAS requires the development of many planning documents and work products, including:

- Documentation of a validated overall concept, or “target system,” for the future management and control of NAS operations – the documents are well-defined and understandable, and the validations are based on credible systems modeling and simulation
- Requirements for the subsystems of the new target system – these integrated, configuration-managed research criteria are individually and collectively validated to provide a coherent, comprehensive framework to guide anticipated research and development activities
- Top-level designs for the major new Air Traffic Management (ATM) capabilities associated with the modernized operational concept – the subsystems enabling these capabilities include new ground-based and airborne information infrastructures needed to allow air traffic controllers to tailor their airspace responsibility dynamically to accommodate changing traffic demands more efficiently
- A system-level safety assessment of the operational concept and associated new capabilities
- A risk-mitigation plan to guide development activities for new capabilities
- A human factors validation plan that provides a comprehensive roadmap of activities to ensure that new functionality will be operationally acceptable to flight crews and controllers

**Customer/Stakeholder Involvement:** The RTCA Select Committee for Free Flight Implementation has been a strong external influence upon the FAA in many aspects of operational concept development and validation. The Agency also has conducted a detailed survey of major stakeholders to obtain their ranking of future concept sub-elements to support modernization. This level of stakeholder participation ensures that the evolving concept is fully mindful of aviation user community requirements – an essential prerequisite to validating the concept of a modern NAS based on a shared, integrated infrastructure.

**Accomplishments:** The vision for the modern NAS has been developed and published in the *Government/Industry Operational Concept for Free Flight* (RTCA, August 1997), *A Concept of Operations for the NAS Airspace System in 2005* (Air Traffic Services, September 1997), and *RTCA NAS Concept of Operations and Vision of Future Aviation* (RTCA, December 2002). These documents have provided guidance to the development of the NAS Architecture Version 5. Additional details appear in the appendices to the NAS Architecture document itself.

Starting in FY 1999, the program initiated the following activities to ensure high standards of top-level design, risk-mitigation planning, and attention to the influence of human factors in arriving at a validation plan:

#### *Operational concept development*

- Developed concepts for NAS Common Reference and the management of airspace resources information needed to facilitate improved flight planning and impact assessment

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

- Developed a framework for individual service enhancement and domains to support the development of system-level requirements for modernization
- Developed a NAS performance model for evaluating the impact of proposed concepts on operational performance; developed quantitative measures and goals for mid-term concept capabilities
- Developed concepts for individual service enhancement and domains to support the specification of system-level requirements for modernization (in particular, to support development of a Concept of Use for integrated Decision Support Tools within the 2003-2005 timeframe)

### *Concept validation*

- Compared U.S. Eastern Triangle operations to European core airspace
- Established a validation data repository for the reuse of experimental data and results
- Developed a capability for the fast-time analysis of new concepts such as multi-sector planning and dynamic resectorization
- Developed detailed scenarios of operational changes in support of architecture and research requirements
- Conducted joint FAA/NASA/user concept validation activities, including human-in-the-loop simulations

### *Concept system design*

- Analyzed core factors related to common trajectory
- Analyzed the effects of dynamic boundaries on operational and controller performance in preparation for the implementation of dynamic sectorization
- Analyzed en route sectorization strategies to support the mid-term design for the Eastern Triangle
- Assessed controller workload in various U.S. traffic situations for use in validating density concepts and alerts for Collaborative Decision-Making (CDM) and Traffic Flow Management (TFM) products
- Developed and analyzed the separation normalization concept referred to as “three miles everywhere”

**R&D Partnerships:** This work directly relates to the FAA/NASA Memorandum of Understanding on ATM research and development. Work under this program is coordinated through the joint Integrated Product Team Plan to ensure NASA's efforts both complement and are integrated into the NAS Operational Concept. As agreed to in the memorandum, NASA contributes regularly to the long-term development of ATM systems and to the validation of flight deck concepts.

The concept development and concept validation effort described here is also coordinated with the European community via agreements with EUROCONTROL. This cooperation ensures that unique solutions and transitions are not developed in different quadrants of the globe, a situation which would impose an undue burden on all carriers and manufacturers participating in the global airspace system.

## **MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:**

### *Operational concept development*

- Deliver concept of operations for a high/low airspace split of ATC en route operations for increased productivity and reduced training requirements
- Expand the concept of operations to consider the impact of splitting operational rooms from the infrastructure backroom on cost, performance and increased flexibility
- Develop detailed concepts of operations for the interaction of tactical, multi-sector planners and strategic flow service providers in en route, terminal and command center to support the validation of the FAA's Airspace Management Concept

### *Concept validation*

- Develop a modernization testbed
- Conduct end-to-end analysis of changes in the provider roles and responsibilities for increased productivity and system efficiency
- Deliver guidance on team size and dynamics for changes in controller roles and responsibilities

### *Concept system design*

- Populate the information model of advanced concepts into NAS interface requirements
- Identify information and system design requirements for multi-sector planner position

### **FY 2006 PROGRAM REQUEST:**

The FY 2006 request continues to evolve the NAS operations concept. From its initial broad perspective and early validation emphasis the concept is transitioning toward internal investigations of opportunities for increased productivity and reduced dependency on geographic location.

Further demonstration and validation are required to show if this concept can support the integration of the entire NAS infrastructure with all airspace definitions within the proposed En Route Automation Modernization methodology.

Opportunities to exploit changes in technology and communications for productivity and flexibility are investigated including the legacy requirements for local knowledge, changes in work methods to make high altitude airspace more “generic”, exploiting performance based procedures for infrastructure and customer cost efficiencies.

Leveraging work is being performed by: (1) EUROCONTROL on the European Air Traffic Management System Concept and the associated ATM 2000+ strategy, and (2) the FAA in support of the International Civil Aviation Organization Air Traffic Management Concept Panel.

### **KEY FY 2006 PRODUCTS AND MILESTONES:**

#### *Operational concept development*

- Expand the concept of splitting en route operations into a high airspace/low airspace split for productivity and training efficiency through the analysis of cognitive and situational awareness issues, such as the local knowledge requirements and decision support
- Conduct an analysis and develop the concept to support deemphasizing geographic dependency in facilities including splitting of front and back rooms and the related impact on cross facility coordination (terminal and en route)
- Deliver a Concept of Use for future flight data management in a System Wide Information Environment including the Flight Object
- Apply the performance framework for concepts including Required ATM System Performance and Real-Time Streaming Protocol (RTSP)
- Update the RTCA NAS Concept of Operations

#### *Concept validation*

- Continue to populate the Validation Data Repository to capture all FAA activities and results associated with concept and concept-of-use validation. Establish metrics to allow comparability of results across program validation efforts in the U.S. and Europe
- Validate the Flight Object Concept of Use and its relation to Common Trajectory Management to ensure completeness and harmonization of the definition for integration into ground and airborne decision support systems in the U.S. and Europe
- Expand the performance framework for Required ATM System Performance and RTSP by incorporating and expanding next level metrics such as Required Navigation Performance, Required Surveillance Performance, and Required Communications performance to support the move from technology based procedures to a Performance based NAS

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

### *Concept system design*

- Extend closed-loop system dynamic modeling of decisions and demand dynamics related to scheduling and management of aircraft in congested en route airspace
- Leverage human factors research work, and human factors and operational validations experimentation, to define the information type, update rate, and display requirements needed to support agreed-to operational improvements of the NAS Concept of Operations through 2010
- Apply the performance framework for concepts including Required ATM System Performance and RTSP

### APPROPRIATION SUMMARY

	<u>Amount (\$000)</u>
Appropriated (FY 1982-2004)	\$16,868
FY 2005 Enacted	1,984
FY 2006 Request	3,000
Out-Year Planning Levels (FY 2007-2010)	<u>12,000</u>
Total	\$33,852

Budget Authority (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Contracts:					
Operations Concept Validation	2,500	1,250	2,700	1,984	3,000
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
Total	2,500	1,250	2,700	1,984	3,000

OMB Circular A-11, Conduct of Research and Development (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	2,500	1,250	2,700	1,984	3,000
Total	2,500	1,250	2,700	1,984	3,000

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

<b>Operations Concept Validation Product and Activities</b>	<b>FY 2006 Request (\$000)</b>	<b>Program Schedule</b>					
		<b>FY 2005</b>	<b>FY 2006</b>	<b>FY 2007</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>
<b>Operations Concept Validation</b>							
<b>Operational Concept Development</b>							
<b>\$800</b>							
Expand the Concept of Splitting Enroute Operations into a High Airspace/Low Airspace Split for Productivity and Training Efficiency Through the Analysis of Cognitive and Situational Awareness Issues	◆	◇	◇	◇	◇		
Develop a Detailed Concept of Use for Future Flight Data Management in Swim and Flight Object	◆	◇	◇	◇	◇		◇
Apply the Performance Framework for Concepts Including Required ATM System Performance and Real-Time Streaming Protocol (RTSP)	◆	◇	◇	◇	◇		◇
Based on Analysis, Develop Concept for De-Emphasis of Geographic Dependency in Facilities (Splitting of Front and Back Rooms and Its Related Impact on Terminal and En Route Cross-Facility Coordination)	◆	◇	◇	◇	◇		◇
Update The RTCA NAS Concept of Operations	◆	◇	◇				
<b>Concept Validation</b>							
<b>\$1,000</b>							
Continue to Populate the Validation Data Repository to Capture All FAA Activities and Results Associated With Concept and Concept-of-Use Validation; Establish Metrics to Allow Comparability of Results Across Program Validation Efforts in the U.S. and Europe	◆	◇	◇				
Validate the Flight Object Concept of Use and Its Relation to Common Trajectory Management to Ensure Completeness and Harmonization of the Definition for Integration into Ground and Airborne Decision Support Systems in the U.S. and Europe	◆	◇	◇	◇	◇		◇
Expand the Performance Framework for Required ATM System Performance and Real-Time Streaming Protocol (RTSP); Incorporate and Expand Selected Next Level Metrics to Support the Move from Technology-Based Procedures to a Performance-Based NAS	◆	◇	◇	◇	◇		◇
<b>Concept System Design</b>							
<b>\$800</b>							
Extend Closed-Loop System Dynamic Modeling of Decisions and Demand Dynamics Related to Scheduling and Management of Aircraft in Congested En Route Airspace	◆	◇	◇	◇	◇	◇	◇
Leverage Human Factors Research Work, and Human Factors and Operational Validations Experimentation, to Define Requirements Needed to Support Agreed-to Operational Improvements of the NAS Concept of Operations through 2010	◆	◇	◇	◇	◇	◇	◇
Apply the Performance Framework for Concepts Including Required ATM System Performance and Real-Time Streaming Protocol (RTSP)	◆	◇	◇	◇	◇	◇	◇
<b>RTCA</b>							
<b>\$400</b>							
Develop Aviation Community to MASPS, MOPS and Integrated Plans to Support Future Concepts and Modernization	◆	◇	◇	◇	◇	◇	◇
<b>Total Budget Authority</b>	<b>\$3,000</b>	<b>\$1,984</b>	<b>\$3,000</b>	<b>\$3,000</b>	<b>\$3,000</b>	<b>\$3,000</b>	<b>\$3,000</b>

◆ - Activities Accomplished      ◇ - Activities Planned

NOTES: OUT YEAR NUMBERS ARE FOR PLANNING PURPOSES ONLY. ACTUAL FUNDING NEEDS WILL BE DETERMINED THROUGH THE ANNUAL BUDGET PROCESS.

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## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A11.b	Propulsion and Fuel Systems	\$4,049,000

### Supports FAA Strategic Goal: Increased Safety

**Program Goals and Intended Outcomes:** The Propulsion and Fuel Systems Program helps achieve the FAA’s aviation safety strategic goal by enhancing the airworthiness, reliability, and performance of civil turbine and piston engines, propellers, fuels, and fuel management systems. The program is reducing the number of accidents associated with the failure of aircraft structures, components, and systems.

Through this research, the FAA is improving processing and manufacturing techniques for critical engine components to eliminate engine failures. By FY 2008, the program will conduct research needed to develop recommendations related to the prevention of engine failures and recommend ways to improve the melt processes to prevent defects from being formed. In addition, by FY 2008, the program will continue to work with fuel, airframe, and engine manufacturers to test new unleaded fuels as they become available.

The program is developing and validating technologies, tools, methodologies, and materials that will:

- Transition safely to a new high octane unleaded aviation gasoline that can ensure the continued reliability and safety of general aviation operations
- Improve the structural integrity and durability of rotating turbine engine parts throughout their service life
- Improve design and life management standards for turbine engine rotors
- Improve the melt process standards for premium quality aerospace alloys used in the manufacture of turbine rotor components
- Evaluate other factors and defects that can shorten the fatigue life of turbine rotor disks
- Evaluate any safety impact for the use of compression ignition (diesel) engines for general aviation use
- Determine the impact of Jet A fuel in very low temperature operations
- Evaluate the possible use of molecular markers in Jet A fuel

**Agency Outputs:** The FAA issues certification and advisory standards, and it endorses the specifications and practices recommended by recognized technical societies to maintain the airworthiness of aircraft engines, fuels, and airframe fuel management systems. The agency also publishes information in the public domain and sponsors technology workshops, demonstrations, and other means of training and technology transfer. The Propulsion and Fuel Systems Program provides the resources and oversight to deliver the propulsion, fuel, and fuel transfer system technologies needed to implement these agency outputs.

**Customer/Stakeholder Involvement:** The Propulsion and Fuel Systems Program works with the following industry and government groups:

- The Subcommittee on Aircraft Safety of the FAA Research, Engineering and Development Advisory Committee (REDAC) – subcommittee representatives from industry, academia, and other government agencies review the activities of the Propulsion and Fuel Systems Program annually
- Technical Community Representative Groups (TCRG) – representatives from FAA headquarters and the directorates apply formal guidelines to ensure that the program’s R&D projects support new rulemaking and comply with existing rules
- The Coordinating Research Council (CRC) Unleaded Aviation Gasoline Development Group
- The Aerospace Industries Association (AIA) working subcommittees; Materials and Structures, Rotor Integrity, Rotor Manufacturing and Jet Engine Titanium Quality

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

- The National Transportation Safety Board (NTSB), particularly with regard to recommendations A-90-89 and A-90-90
- CRC ad hoc group on the effect of red dye contamination of Jet A fuel
- CRC ad hoc group on the effect of molecular markers in jet fuel

### **Accomplishments:**

- Demonstrated the integrated probabilistic rotor design and life management code (Design Assessment for Reliability with Inspection - DARWIN™) for titanium alloys to provide commercial aircraft turbine engine manufacturers an approved certification tool to augment the current “safe life” management approach
- Conducted a DARWIN™ Code FAA/Industry training workshop
- Sponsored five joint FAA/Air Force/Navy/NASA workshops on the application of probabilistic design methodology to gas turbine rotating components; published proceedings
- Demonstrated the DEFORM™ defect deformation micro code for analysis of titanium alloy defects during the turbine disk forging process
- Demonstrated a DARWIN™ code version for surface anomalies
- Completed vacuum fatigue crack growth tests on nickel rotor disk super alloys
- Demonstrated portable industrial process monitor for vacuum arc remelting
- Demonstrated an advanced vacuum arc remelting controller for the production of premium quality aerospace alloys
- Demonstrated the feasibility of safety net unleaded fuel
- Proved that the fleet octane requirement is the single most critical parameter for development of high-octane unleaded aviation gasoline
- Established matrix components for developing candidate fuel formulations
- Tested motor octane and engine endurance associated with candidate fuel formulations
- Defined detonation detection procedures for use by the American Society for Testing and Materials (ASTM D6424) on potential unleaded replacement fuels
- Determined and issued final fleet octane requirements (greater than 100 octane) for unleaded fuel replacement in high performance piston engines
- Drafted report documenting the impact of red dye contamination in Jet A fuel for continuous engine operation
- Drafted report documenting compression ignition (diesel) engines for general aviation use
- Proposed final report documenting an investigation of turbine Jet A fuel operating at very low temperatures (near freeze point)

### **R&D Partnerships:**

- Turbine Rotor Material Design Program - Southwest Research Institute (SwRI) has teamed with Pratt & Whitney, General Electric, Honeywell, and Rolls Royce in R&D to provide a probabilistic-based rotor life and risk management certification tool (DARWIN™)
- Specialty Metals Processing Consortium – based at Sandia National Laboratory, this consortium includes the Sandia Liquid Metals Processing Laboratory, Allvac, Oremet Titanium Co., RMI Titanium Co., Timet Co., General Electric Aircraft Engines, Rolls-Royce, and Pratt & Whitney
- SwRI research to determine the acceptable level of fuel dye contamination allowable for the safe, continuous operation of turbine engines; the Defense Energy Support Center, Internal Revenue Service, Air Transport Association, American Petroleum Institute, General Electric Aircraft Engines, Pratt & Whitney, Rolls Royce, Honeywell and Boeing also contributed funding to this effort

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

- CRC Unleaded Aviation Gasoline Development Group – includes Texaco, Exxon Mobil, Phillips Petroleum, Chevron, British Petroleum, Cessna, Raytheon (Beech), Teledyne Continental, and Textron Lycoming; this group facilitates two-way transfer of technology between government and industry to benefit all participants
- The Cessna Aircraft Company – partnered R&D has demonstrated the feasibility of a temporary (safety net) unleaded 100 octane general aviation fuel
- The FAA Airworthiness Assurance Center of Excellence (AACE) – this partnering within the FAA leverages monetary and intellectual contributions of university researchers; an AACE-initiated academic partnership with the University of Dayton Research Institute has investigated the performance of Jet A fuel in very low temperature flight operations
- The FAA General Aviation Center of Excellence in conjunction with direct grants with the University of North Dakota, South Dakota State University and Baylor University – these relationships have produced feasibility studies for the use of ethanol fuel blends as a possible unleaded piston fuel replacement for 100 octane low lead avgas

### MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:

- Expand research on blended fuels containing ethanol for general aviation piston engines
- Complete draft report on dwell time fatigue in titanium alloys
- Demonstrate advanced controllers for vacuum arc and electroslag remelting for the production of premium quality aerospace alloys
- Continue lab characterization and engine ground testing of candidate unleaded fuels to replace 100 octane low-lead gasoline
- Continue enhancement of the probabilistic rotor design code (DARWIN™)
- Evaluate the effect of molecular marker in Jet A Fuel

### FY 2006 PROGRAM REQUEST:

#### *Ongoing Activities*

The program will continue research on industry-provided lead free fuel formulation candidates including petrochemical and ethanol based fuels to replace the low lead aviation gasoline currently in use. In-house testing will continue to evaluate industry-supplied formulations. In addition the requirement started in FY 2004 by congress to investigate the effects of molecular markers in Jet A fuel will be ongoing.

Advancement of the probabilistically based turbine engine rotor design and life risk assessment code (DARWIN™) will continue. This code is an FAA approved means to support a damage tolerant based certification enhancement to the current safe life design approach.

Research will continue into criteria for use in commercial manufacturing standards for premium quality rotor grade materials. This research will concentrate on rotor disk alloy material melt process improvements.

Research into metallurgical factors that can shorten fatigue life of titanium rotor disk alloys will be continued.

#### *New Initiatives*

No new initiatives are planned in FY 2006.

### KEY FY 2006 PRODUCTS AND MILESTONES:

- Complete enhancement of the probabilistic rotor design code (DARWIN™) for nickel super alloys that contain multiple anomalies
- Continue developing advanced melt process controllers and diagnostics for premium quality aerospace alloys
- Continue enhancement of the probabilistic rotor design code (DARWIN™)

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

- Continue developing an understanding of the relationship between cold dwell fatigue and the microstructure of titanium as well as the fatigue life debit
- Continue developing a design methodology for use by industry to prevent cold dwell fatigue
- Conduct fatigue testing of nickel material samples containing naturally occurring defects
- Continue laboratory characterization and engine ground testing of industry-supplied candidate unleaded fuels to replace 100 octane low lead avgas including ethanol and ethanol blends
- Draft report on the effects of molecular markers in Jet A fuel

### APPROPRIATION SUMMARY

	Amount (\$000)
Appropriated (FY 1982-2004)	\$76,926
FY 2005 Enacted	7,115
FY 2006 Request	4,049
Out-Year Planning Levels (FY 2007-2010)	15,824
<b>Total</b>	<b>\$103,914</b>

<b>Budget Authority (\$000)</b>	<b>FY 2002 Enacted</b>	<b>FY 2003 Enacted</b>	<b>FY 2004 Enacted</b>	<b>FY 2005 Enacted</b>	<b>FY 2006 Request</b>
Contracts:					
Propulsion Systems Research	7,344	6,046	5,461	6,089	2,816
Personnel Costs	1,079	1,224	1,052	922	1,155
Other In-house Costs	145	87	94	104	78
<b>Total</b>	<b>8,568</b>	<b>7,357</b>	<b>6,607</b>	<b>7,115</b>	<b>4,049</b>

<b>OMB Circular A-11, Conduct of Research and Development (\$000)</b>	<b>FY 2002 Enacted</b>	<b>FY 2003 Enacted</b>	<b>FY 2004 Enacted</b>	<b>FY 2005 Enacted</b>	<b>FY 2006 Request</b>
Basic	0	0	0	0	0
Applied	8,568	7,357	6,607	7,115	4,049
Development (includes prototypes)	0	0	0	0	0
<b>Total</b>	<b>8,568</b>	<b>7,357</b>	<b>6,607</b>	<b>7,115</b>	<b>4,049</b>

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

A11b - Propulsion and Fuel Systems Product and Activities	FY 2006 Request (\$000)	Program Schedule					
		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
<b>063-110 Propulsion and Fuel Systems Research</b>							
<b>Turbine Engine Research</b>							
	<b>\$2,079</b>						
Complete the Enhancement of the Probabilistic Rotor Design Code (DARWIN™) for Nickel Super-Alloys That Contain Multiple Anomalies			◇				
Complete Draft Report on Dwell Time Fatigue in Titanium Alloys		◆					
Continue Developing Advanced Melt Process Controllers and Diagnostics for Aerospace Alloys		◆	◇	◇	◇	◇	
Continue Enhancement of the Probabilistic Rotor Design Code (DARWIN™)		◆	◇	◇	◇	◇	◇
Continue Developing a Design Methodology to Prevent Cold Dwell Fatigue			◇	◇			
<b>Unleaded Fuels and Fuel System Safety Research</b>							
	<b>\$737</b>						
Continue Lab Characterization and Engine Ground Testing of Candidate Unleaded Fuels to Replace 100 Octane Low-Lead Gasoline		◆	◇	◇	◇	◇	◇
Evaluate ethanol based piston fuel		◆	◇	◇			
Evaluate the Effect of Molecular Markers in Jet A Fuel		◆	◇	◇			
<b>Personnel and Other In-House Costs</b>	<b>\$1,233</b>						
<b>Total Budget Authority</b>	<b>\$4,049</b>	<b>\$7,115</b>	<b>\$4,049</b>	<b>\$3,964</b>	<b>\$3,968</b>	<b>\$3,974</b>	<b>\$3,918</b>

Note: Out year numbers are for planning purposes only. Actual funding needs will be determined through the annual budget process.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
F&E	1A01B	Runway Incursion Reduction	\$6,500,000

### Supports FAA Strategic Goal: Increased Safety

**Program Goals and Intended Outcomes:** The FAA has undertaken the Runway Incursion Reduction Program (RIRP) to minimize the chance of injury, death and damage, or loss of property caused by runway accidents or incidents within the civil aviation system. The program selects and evaluates runway incursion reduction technologies to validate their technical performance and operational suitability. Based on these evaluations, a business case for program implementation is developed to support Agency investment decisions. Current program initiatives are aimed at evaluating pilot situational awareness tools.

The Program directly contributes to achieving Objective 4, “reduce the risk of runway incursions,” of the FAA’s *Flight Plan 2005–2009* strategic goal of *Increased Safety*.

Airports referred to in this program description include:

- DFW Dallas/Ft. Worth International Airport
- VGT North Las Vegas Airport
- LGB Long Beech – Daugherty Field
- GEG Great Circle Airport – Spokane, Washington

### Agency Outputs:

- Operational concepts, system prototypes, field test data, technical specifications and life cycle cost estimates for selected technology solutions
- Non-technology solutions, such as improved airport markings/signage, education, training, and advisory circulars

**Customer/Stakeholder Involvement:** Operational concepts, technical specifications and system evaluations for runway incursion reduction initiatives are fully coordinated with stakeholders within the air traffic service provider, pilot and airport operator communities. Reducing runway incursion incidents remains a top FAA priority – as reflected in Safety Objective 4 of the FAA Flight Plan.

### Accomplishments:

- Completed developmental and shadow operations testing for the Runway Status Lights (RWSL) system at DFW
- Installed RWSL airfield lighting system on DFW runway 18/36
- Installed Enhanced Airport Lighting (EAL) system at VGT
- Conducted market survey to identify potential offerors of a Low-Cost Surface Surveillance (LCSS) system suitable for low to medium-sized airports

### R&D Partnerships:

Partnerships for RIRP technology initiatives exist with industry (several), Federally Funded Research and Development Consortia (e.g. MIT Lincoln Laboratory, MITRE), selected airport operators (e.g. DFW, VGT, LGB, GEG), and other government agencies (e.g. the Volpe National Transportation Systems Center).

## **2005 FAA NATIONAL AVIATION RESEARCH PLAN**

### **MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:**

- Evaluate operation of RWSL at DFW
- Develop (initial) RWSL Take-Off Hold Light (THL) enhancements
- Install LCSS, System 1 at GEG
- Evaluate operation of LCSS at GEG
- Conduct Final Approach Runway Occupancy Signal (FAROS) Shadow Operations Test
- Prepare EAL evaluation report

### **FY 2006 PROGRAM REQUEST:**

The requested funding will allow the program to:

- Develop business case for RWSL
- Develop and evaluate THL enhancement to RWSL system
- Conduct evaluation of LCSS, System 2 at GEG
- Conduct FAROS field evaluation
- Conduct education, training, and awareness programs

### **KEY FY 2006 PRODUCTS AND MILESTONES**

- Continue researching potential technology solutions for small-to-medium-sized airports
- Continue developing performance standards/requirements for selected runway incursion reduction technologies
- Complete evaluation and business case development for RWSL
- Develop evaluation reports, technical specifications, and life cycle cost estimates for selected products

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

**APPROPRIATION SUMMARY**

	<u>Amount (\$000)</u>
Appropriated (FY 1982-2004)	\$37,268
FY 2005 Enacted	9,027
FY 2006 Request	6,500
Out-Year Planning Levels (FY 2007-2010)	<u>20,000</u>
Total	\$72,795

Budget Authority (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Contracts:					
Runway Incursion Reduction	5,700	6,700	8,200	9,027	6,500
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
Total	5,700	6,700	8,200	9,027	6,500

OMB Circular A-11, Conduct of Research and Development (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	5,700	6,700	8,200	9,027	6,500
Total	5,700	6,700	8,200	9,027	6,500

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

Runway Incursion Reduction Product and Activities	FY 2006 Request (\$000)	Program Schedule					
		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
<b>Runway Incursion Reduction</b>	<b>\$6,500</b>						
<b>Runway Status lights (RWSL)</b>							
Conduct Operational Evaluations		◆					
Resolve OpEval Issues			◇				
Prepare ½ JRC		◆	◇				
Develop THL		◆	◇	◇			
Perform THL Operational Evaluation			◇	◇	◇		
System Enhancements					◇	◇	◇
<b>Enhanced lighting</b>							
Prepare EAL Evaluation Report		◆					
<b>Low-Cost Surface Surveillance</b>							
Install System 1		◆					
Evaluate System 1		◆					
Install/Evaluate System 2			◇	◇	◇		
<b>Final Approach Runway Occupancy System (FAROS)/Flashing PAPI</b>							
Conduct Shadow Operations		◆	◇				
Perform Field Evaluation			◇				
<b>Total Budget Authority</b>	<b>\$6,500</b>	<b>\$9,027</b>	<b>\$6,500</b>	<b>\$5,000</b>	<b>\$5,000</b>	<b>\$5,000</b>	<b>\$5,000</b>

◆ - Activities Accomplished      ◇ - Activities Planned

\*Assume Positive JRC Decisions

\*\*Supports Flight Plan Objective 4

\*\*\*CIP Increase Required

Notes: OUT YEAR NUMBERS ARE FOR PLANNING PURPOSES ONLY. ACTUAL NEEDS WILL BE DETERMINED THROUGH THE ANNUAL BUDGET PROCESS.

IN THE FACILITIES AND EQUIPMENT APPROPRIATIONS, PERSONNEL AND OTHER COSTS ARE BUDGETED IN ACTIVITY 5, NOT THE PROGRAM BUDGET LINE ITEM.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
F&E	1A02A	Safe Flight 21 – Alaska Capstone	\$14,500,000

### Supports FAA Strategic Goal: Increased Safety

**Program Goals and Intended Outcomes:** Capstone is a technology focused safety program in Alaska that seeks near term safety and efficiency gains in aviation by accelerating implementation and use of modern technology. It links multiple programs and initiatives under a common umbrella for planning, coordination, focus and direction. The Capstone initiative is a visible program providing tangible benefits that include: weather, terrain, and traffic information; flight following and locating capabilities; global positioning system (GPS) en route instrument flight rules (IFR) infrastructure and non-precision instrument approaches; and training for pilots with Capstone avionics equipment. The program is building an infrastructure that is consistent with NAS modernization plans while it identifies the transition path for procedure development and technology implementation and provides near-term safety benefits.

The initiative's first priority is to improve aviation-system safety in Alaska through the introduction of new Communications, Navigation, and Surveillance (CNS) technologies. Capstone enabling technologies are Automatic Dependent Surveillance-Broadcast (ADS-B), Flight Information Services-Broadcast (FIS-B), and Traffic Information Service-Broadcast (TIS-B).

The Capstone initiative directly contributes to achieving Objective 3, "reduce accidents in Alaska," of the FAA's *Flight Plan 2005 – 2009* strategic goal of *Increased Safety*. It will expand through a three-phased approach from Bethel and Southeast Alaska to the entire state. The strategy is to *expand* and *accelerate* the implementation of safety and air navigation improvement programs in Alaska. The Capstone Program Office has recently finalized the Capstone Statewide Strategic Plan that provides for statewide implementation of ADS-B. "Bundled" capabilities/technologies such as ADS-B, FIS-B, Automated Weather Sensor Systems, and GPS/WAAS approaches have improved safety and access to remote locations in the Bethel/YK Delta and Southeast Alaska. By FY 2008, Capstone and related initiatives are expected to reduce accidents involving general aviation and Part 135 operators by 20% throughout Alaska.

**Agency Outputs:** The Capstone Program is essential to risk mitigation in the evolutionary process of bringing emerging technologies into the NAS. Its objectives will be achieved as follows:

- Making the Universal Access Transceiver (UAT) datalink and the GPS/WAAS navigation available to pilots statewide
- Installing a ground infrastructure that provides
  - FIS-B, weather, wind-shear, Notices to Airmen, and Pilot Reports;
  - Cost-effective Controlled Flight into Terrain avoidance through graphical position display;
  - Surveillance using ADS-B in non-radar airspace;
  - TIS-B; and
  - Operator flight monitoring
- Removing legacy navigation infrastructure

Developmental work will continue on the following:

- Multilateration for runway safety and terminal surveillance
- Use of 1090 MGz data link in addition to UAT
- Use of satellites for relay of voice and ADS-B information

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

**Customer/Stakeholder Involvement:** The Safe Flight 21 – Alaska Capstone Program grew from the FAA’s Safer Skies initiative. The program is strongly endorsed by the Alaska Industry Council, the Aircraft Owners and Pilots Association, the Airline Pilots Association, the Alaska Aviation Safety Foundation, the Alaska Airmen’s Association, the Department of Defense, the State of Alaska Department of Transportation and Public Facilities, the Air Traffic Control Association, the Cargo Airline Association, the MITRE Corporation, U.S. airlines, and the Alaska Capstone Program Office.

### **Accomplishments:**

The following has been accomplished in Alaska under the Safe Flight 21 – Capstone Program:

- An Alaska Capstone program initial study documents state 40% reduction in accidents for Capstone-equipped aircraft in the Y-K delta
- Installed Ground Based Transceivers in the Bethel area to provide critical information to controllers, dispatchers, and pilots
- Installed Certified Capstone avionics in approximately 200 commercial aircraft operating in the Bethel area
- Installed Certified Capstone avionics in approximately 70 commercial aircraft operating in the Southeast Alaska
- Installed and commissioned thirteen automated weather observation systems with weather cameras in the Bethel area and one in Southeast Alaska
- Commissioned two communications sites
- Published 19 first-time GPS approaches for 10 airports
- Trained over 140 pilots and associated personnel on Capstone avionics through the University of Alaska
- Initiated use of the world’s first GPS/WAAS receiver as the sole means for en route navigation in Alaska
- Complete a strategic plan for expanding Capstone statewide

**R&D Partnerships:** The Capstone program is based on the principle that government and industry must share in developing and implementing new communications, navigation, and surveillance technologies as the nation enters the free flight era.

The FAA works closely with the aviation industry in supporting Safe Flight 21 – Alaska Capstone. This partnership allows the community to share the funding of avionics and ground systems and to build on ongoing industry initiatives. Safe Flight 21 will build on Alaska Capstone activities by:

- Identifying and resolving ADS-B technology issues
- Developing ADS-B operational concepts
- Focusing data collection activities to answer as many operational and avionics certification issues as practical
- Focusing on cockpit human factors issues
- Exploring the use of TIS-B and FIS-B data link messages to receive traffic, weather, and other information in the cockpit
- Developing an integrated cockpit display of terrain, traffic, and weather information
- Ensuring that organizations representing controllers and commercial and general aviation pilots are included in Alaska Capstone planning and in the evaluation of operational enhancements and data link alternatives

**MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:**

In FY 2005, the FAA expects to complete the following activities in support of Capstone in Alaska:

- Replace developmental Ground Based Transceivers in the Bethel area with production-level systems for Air Traffic Surveillance. Upgrade avionics to meet recently approved industry standards
- Continue installing primary flight displays and navigation displays and ADS-B avionics in up to 200 aircraft Southeast Alaska Capstone-participating aircraft
- Expand use of RNAV Arrival/Departure Procedures in Alaska
- Install and commission Ground Based Transceivers in the Southeast area
- Install and test the use of displays of ADS-B data in the Juneau control tower and flight service station
- Test surveillance of mixed-equipped (transponder and ADS-B) aircraft via multilateration in the Juneau area
- Develop and demonstrate a prototype satellite communications system to complement the Capstone Ground Based Transceivers

**FY 2006 PROGRAM REQUEST:**

The requested funding will provide:

- Ongoing test and evaluation, procedures development, certification tasks, and simulation activities for the activities described above
- Initiate approach control service for aircraft in the Bethel area
- Initial expansion of Capstone avionics and ground infrastructure for Alaska statewide

**KEY FY 2006 PRODUCTS AND MILESTONES:**

Key FY 2006 products and milestones involve activities related to the implementation of ADS-B applications in Alaska that prove beneficial in achieving these program outcomes:

- Install avionics and Ground Based Transceivers in Southeast Alaska and
- Provide Approach Control services for aircraft in the Bethel area

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

**APPROPRIATION SUMMARY**

	<u>Amount (\$000)</u>
Appropriated (FY 1982-2004)	\$89,800
FY 2005 Enacted	28,768
FY 2006 Request	14,500
Out-Year Planning Levels (FY 2007-2010)	16,600
<b>Total</b>	<b>\$149,668</b>

Budget Authority (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Contracts:					
Safe Flight 21 - Alaska Capstone	20,000	19,600	21,000	28,768	14,500
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
<b>Total</b>	<b>20,000</b>	<b>19,600</b>	<b>21,000</b>	<b>28,768</b>	<b>14,500</b>

OMB Circular A-11, Conduct of Research and Development (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	20,000	19,600	21,000	28,768	14,500
<b>Total</b>	<b>20,000</b>	<b>19,600</b>	<b>21,000</b>	<b>28,768</b>	<b>14,500</b>

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

Safe Flight 21 – Alaska Capstone Product and Activities	FY 2006 Request (\$000)	Program Schedule					
		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
<i>Safe Flight 21 – Alaska Capstone</i>							
<b>Optional Enhancements</b>	<b>\$ 14,500</b>						
Commission Additional Ground Based Transceivers in the Bethel area for Air Traffic Surveillance		◆	◇	◇			
Upgrade Avionics and Ground Based Transceivers to Meet Recently Approved Industry Standards		◆	◇	◇			
Install Primary Flight Displays and navigation Displays and ADS-B Avionics in up to 200 Aircraft Southeast Alaska Capstone Participating Aircraft		◆	◇	◇			
Expand Use of RNAV Arrival/Departure Procedures in Southeast Alaska		◆	◇	◇			
Commission Two Communications Sites		◆	◇	◇			
Install and Commission Ground Based Transceivers in the Southeast Area		◆	◇	◇			
Test Surveillance of Mixed-Equipped (Transponder and ADS-B) Aircraft Via Multilateration in the Juneau Area		◆	◇	◇			
Develop and Demonstrate a Prototype Satellite Communications System that will Complement Capstone Ground Based Transceivers		◆	◇	◇			
Complete a Strategic Plan for Expanding Capstone Statewide		◆	◇	◇			
Continue Test and Evaluation, Procedures Development, Certification Tasks, and Simulation Activities for the Activities Initiated in 2004 in Southeast Alaska			◇				
Begin Expansion of Capstone Ground Infrastructure for Alaska Statewide			◇				
<b>Total Budget Authority</b>	<b>\$14,500</b>	<b>\$28,768</b>	<b>\$14,500</b>	<b>\$16,600</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>

◆ - Activities Accomplished      ◇ - Activities Planned

NOTES: OUT YEAR NUMBERS ARE FOR PLANNING PURPOSES ONLY. ACTUAL FUNDING NEEDS WILL BE DETERMINED THROUGH THE ANNUAL BUDGET PROCESS.

IN THE FACILITIES AND EQUIPMENT APPROPRIATIONS, PERSONNEL AND OTHER COSTS ARE BUDGETED IN ACTIVITY 5, NOT THE PROGRAM BUDGET LINE ITEM.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
F&E	1A02B/C	Safe Flight 21 – Ohio River Valley/ Surface Moving Maps	\$10,000,000

### Supports FAA Strategic Goals: Increased Safety, Greater Capacity

**Program Goals and Intended Outcomes:** The Ohio River Valley portion of the Safe Flight 21 Program is an initial step in implementing important aviation capabilities. The project is also initiating other pockets of service implementation in response to customer requirement for technology evaluation in the lower 48 states. This project combines the efforts of government and industry to demonstrate the potential of new air traffic procedures to increase National Airspace System (NAS) safety, capacity, effectiveness, and efficiency. It concentrates on validating advanced communications, navigation, surveillance and automation capabilities in a challenging operational environment.

Project focus:

- Addresses pilot and controller human factors issues
- Develops and assesses new operational procedures and associated training
- Streamlines certification processes and procedures
- Develops a cost-effective avionics and NAS infrastructure
- Defines a realistic NAS transition path supported by the user community

The Safe Flight 21 activities contribute to following goals and objectives:

- FAA Strategic Goal – Increased Safety
  - Objective 1, Reduce the commercial airline fatal accident rate
  - Objective 2, Reduce the number of fatal accidents in general aviation
  - Objective 3, Reduce accidents in Alaska
  - Objective 4, Reduce the risk of runway incursions
- FAA Strategic Goal – Greater Capacity
  - Objective 1, Increase airport capacity to meet projected demand

**Agency Outputs:** Safe Flight 21 – Ohio River Valley is essential to risk mitigation related to the process of bringing emerging technologies into the NAS. The program addresses the risks and challenges of fielding advanced communications, navigation, surveillance and automation systems, such as Automatic Dependent Surveillance – Broadcast (ADS-B), Controlled Flight Into Terrain (CFIT) avoidance, Flight Information Services – Broadcast (FIS-B), and the Traffic Information Service – Broadcast (TIS-B).

These objectives will be achieved through:

- Implementing the ADS-B link decision [i.e., 1090 MHz and Universal Access Transceiver]
- Conducting operational tests of the nine operational enhancements identified by RTCA:
  - FIS-B for Special Use Airspace status, weather, wind-shear, Notices To Airmen, and Pilot Reports
  - Cost-effective CFIT avoidance through graphical position display
  - Improved Terminal operations in low-visibility conditions
  - Enhanced see-and-avoid
  - Enhanced en route air-to-air operations
  - Improved Surface surveillance and navigation for pilots

- Enhanced airport Surface surveillance for controllers
- ADS-B surveillance in non-radar airspace
- ADS-B-based separation standards

**Customer/Stakeholder Involvement:** The Safe Flight 21 Program resulted from inputs that the FAA Administrator requested from the RTCA Select Committee on Free Flight Implementation and is strongly endorsed by the RTCA Free Flight Steering Committee. The Safe Flight 21 Steering Committee (with representatives from the RTCA Select Committee, the FAA, the Aircraft Owners and Pilots Association, the Airline Pilots Association, the Air Traffic Control Association, the Cargo Airline Association, the MITRE Corporation, and U.S. airlines) coordinates between stakeholders and the Safe Flight 21 program.

**Accomplishments:**

- Published the Operational Evaluation (OpEval) final report from the first operational evaluation OpEval in Wilmington, Ohio, conducted in FY 1999
- Established or modified operational concepts and procedures required to support the Safe Flight 21 – Ohio River Valley applications evaluated in OpEval-2, including:
  - Approach spacing
  - Departure spacing
  - Runway and final approach occupancy awareness
  - Airport Surface situational awareness
- Acquired and installed a “single stack” Common ARTS automation system and displays, at the Louisville Terminal Radar (TRACON) facility, for evaluation by air traffic controllers in their work with for airborne ADS-B applications
- Coordinated avionics requirements with manufacturers and awarded four contracts to develop prototype avionics systems
- Installed a multilateration/ADS-B Surface surveillance system at Memphis in preparation for an FY 2001 OpEval focused on Surface management
- Hosted Air Traffic Modernization Day at Memphis in the third quarter of FY 2001 focused on Surface safety applications and system integration of the multilateration system
- Updated nine ADS-B Operational Safety Assessments, one each for the nine operational enhancements being evaluated in the context of Safe Flight 21 – Ohio River Valley ADS-B applications
- Installed a multilateration system at the Louisville test bed
- Conducted:
  - OpEval-2 at Louisville, in the first quarter of FY 2001, to demonstrate applications and gather data on approach spacing, departure spacing, runway and final approach occupancy awareness, and airport Surface situational awareness
  - Detailed OpEval-2 data analysis, and published the final report
  - Comparative Safety Assessment of a future NAS with and without the use of ADS-B
  - Comparative Safety Assessment of Airborne Conflict Management criteria
  - Preliminary Hazard Assessment of ADS-B technology in accordance with NAS Modernization System Safety Program Plan requirements
- Completed:
  - ADS-B technical work assessment as input to an ADS-B link decision
  - Preliminary analysis, begun in FY 2000, for NAS-wide implementation of ADS-B

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- Developed and received approval for:
  - Concepts of operation for Terminal and Surface applications
  - Call sign procedure and phraseology for testing in FY 2003
- Continued:
  - Developing procedures affecting air traffic in the Terminal environment
  - Developing requirements and specifications for TIS-B and FIS-B
  - Responding to customer requirements to achieve early ADS-B benefits

**R&D Partnerships:** The Safe Flight 21 – Ohio River Valley program is based on the principle that government and industry will share in the development and implementation of new communications, navigation, and surveillance technologies as the nation moves toward full commitment to free flight.

The FAA, State governments and the aviation industry will share in the funding of Safe Flight 21 program avionics and ground systems, and together the partners will build upon ongoing initiatives that include:

- Identifying and resolving ADS-B technology issues
- Developing ADS-B operational concepts
- Focusing data collection activities during OpEvals and test events to answer as many operational and avionics certification issues as practical
- Focusing on cockpit human factors issues
- Exploring the use of TIS-B and FIS-B data link messages to receive traffic, weather, and other information in the cockpit
- Developing, in conjunction with industry partners, an integrated cockpit display of terrain, traffic, and weather information
- Ensuring that organizations representing controllers and commercial and general aviation pilots are included in Safe Flight 21 program planning and in the evaluation of operational enhancements

### **MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:**

In FY 2005, the FAA anticipates accomplishing the following activities in support of Safe Flight 21:

- Continue air traffic procedure development for Terminal environment with ATM-lab evaluations
- Develop TIS-B and FIS-B requirements and specifications; plan testing in the small airport test bed at Prescott, AZ
- Execute ADS-B installation agreements with the states of North Carolina and Virginia, and with university research labs at Embry Riddle Aeronautical University and in Maryland, Arizona and Florida
- Develop Small Airport Architecture in support of Safe Flight 21 General Aviation requirements and applications
- Continue airport surface moving map prototype database certification and update procedure development
- Conduct data collection activities and metrics development using the call sign procedure at the Louisville test bed

### **FY 2006 PROGRAM REQUEST:**

For FY 2006, the SF-21 program will continue to evaluate nine high-priority communication /navigation/surveillance operational enhancements using global positioning system (GPS)-based ADS-B and other information services. The nine operational enhancements are:

- 1) Weather and Other Information in the Cockpit
- 2) Improvement of CFIT Avoidance

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

- 3) Improved Terminal Operations in Low Visibility Conditions
- 4) Enhanced See and Avoid
- 5) Enhanced En Route Air to Air Operations
- 6) Improved Surface Operations
- 7) Airport Surface Display for the Controller
- 8) ADS-B for Surveillance in non-radar airspace
- 9) ADS-B separation standards establishment

In FY 2006, the \$10,000,000 requested will continue the maintenance of the ground infrastructure in the Ohio River Valley and East Coast, and continue the assessment of SF-21 applications associated with ADS-B and broadcast service technology. The SF-21 program will be migrating service capabilities such as “radar like services” to the lower 48 states to take advantage of efforts being undertaken in Alaska to improve safety in non-radar areas. Safe Flight 21 program would continue integrating ADS-B onto the Standard Terminal Automation Replacement System (STARS) automation system. The surface moving map database will be updated to reflect the latest standards.

### KEY FY 2006 PRODUCTS AND MILESTONES:

Key FY 2006 products and milestones involve activities related to the limited implementation of ADS-B applications that prove beneficial in meeting the intended outcomes of increasing the safety and capacity of the NAS.

#### *Avionics and ground systems*

- Coordinate within the FAA to integrate ADS-B into the STARS baseline
- Continue testing and demonstrating prototype avionics with airport surface moving maps, and with TIS-B and FIS-B products

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

**APPROPRIATION SUMMARY**

	<u>Amount (\$000)</u>
Appropriated (FY 1982-2004)	\$70,800
FY 2005 Enacted	3,972
FY 2006 Request	10,000
Out-Year Planning Levels (FY 2007-2010)	3,400
<b>Total</b>	<b>\$88,172</b>

Budget Authority (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Contracts:					
SF21 - Ohio River Valley /Surface Moving Maps	12,700	16,300	4,100	3,972	10,000
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
<b>Total</b>	<b>12,700</b>	<b>16,300</b>	<b>4,100</b>	<b>3,972</b>	<b>10,000</b>

OMB Circular A-11, Conduct of Research and Development (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	12,700	16,300	4,100	3,972	10,000
<b>Total</b>	<b>12,700</b>	<b>16,300</b>	<b>4,100</b>	<b>3,972</b>	<b>10,000</b>

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

Safe Flight 21 – Ohio River Valley Product and Activities	FY 2006 Request (\$000)	Program Schedule					
		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
<i>Safe Flight 21 – Ohio River Valley</i>							
<b>Optional Enhancements</b>	<b>\$8,000</b>						
Provide Weather and Other Information in the Cockpit		◆	◇	◇			
Improve Controlled Flight into Terrain (CFIT) Avoidance		◆	◇	◇			
Improve Terminal Operations in Low Visibility Conditions		◆	◇	◇			
Enhance See and Avoid		◆	◇	◇			
Enhance En Route Air to Air Operations		◆	◇	◇			
Improve Surface Operations		◆	◇	◇			
Provide Airport Surface Display for the Controller		◆	◇	◇			
Perform Surveillance with ADS-B in Non-Radar Airspace		◆	◇	◇			
Establish ADS-B Separation Standards		◆	◇	◇			
Continue Air Traffic Procedure Development for Terminal Environment with ATM-Lab Evaluations		◆					
Develop TIS-B and FIS-B Requirements and Specifications; Plan Testing in the Small Airport Test Bed at Prescott, AZ		◆					
Execute ADS-B Installation Agreements with the State of North Carolina, University Research Lab in Maryland and Embry Riddle Aeronautical University (ERAU) Arizona and Florida		◆	◇				
Develop Small Airport Architecture in Support of Safe Flight 21 General Aviation Requirements and Applications		◆	◇				
Continue Airport Surface Moving Map Prototype Database Development and Maintenance and Update Procedure Development		◆	◇	◇			
Conduct Data Collection Activities and Metrics Development Using Call Sign Procedure at Louisville Test Bed		◆	◇				
Continue Evaluating SF-21 Applications, Including Avionics and Vehicle Tracking, at the Louisville and Memphis Test Beds		◆					
<b>Total Budget Authority</b>	<b>\$8,000</b>	<b>\$3,972</b>	<b>\$8,000</b>	<b>\$3,400</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>

◆ - Activities Accomplished      ◇ - Activities Planned

NOTES: OUT YEAR NUMBERS ARE FOR PLANNING PURPOSES ONLY. ACTUAL FUNDING NEEDS WILL BE DETERMINED THROUGH THE ANNUAL BUDGET PROCESS.

IN THE FACILITIES AND EQUIPMENT APPROPRIATIONS, PERSONNEL AND OTHER COSTS ARE BUDGETED IN ACTIVITY 5, NOT THE PROGRAM BUDGET LINE ITEM.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
F&E	1A01F	Safer Skies	\$3,400,000

### Supports FAA Strategic Goal: Increased Safety

**Program Goals and Intended Outcomes:** The FAA, other government agencies, and industry launched Safer Skies in April of 1998 in direct response to a White House Commission on Safety and Security goal of sharply reducing fatal aviation accidents within ten years.

**Agency Outputs:** The implementation of the Safer Skies initiative is resulting in the development of guidance materials and/or revisions to Advisory Circulars (ACs), Aeronautical Information Manuals, Handbook Bulletins for Air Transportation, and Notices to Airmen.

#### Customer/Stakeholder Involvement:

The FAA, NASA, and the Department of Defense are working jointly with industry participants to analyze causes of accidents and to develop and implement new intervention technologies and strategies to prevent or reduce the leading causes of aviation accidents.

The Commercial Aviation Safety Team (CAST) provides the leadership for identifying causes of accidents and intervening to reduce the commercial accident rate. Their focus is on reducing commercial aviation accidents attributed to uncontained engine failure, Controlled Flight into Terrain (CFIT), approach and landing, loss of control, runway incursions, and weather.

Similarly, General Aviation Joint Steering Committee researchers are committed to reducing the numbers, and increase the survivability, of general aviation accidents caused by CFIT, weather, runway incursions, pilot decision-making, and loss of control.

Other industry members include the Aerospace Industries Association, Airbus Industries, Air Transport Association, Aircraft Owners and Pilots Association, Boeing, Experimental Aircraft Association, Flight Safety Foundation, General Aviation Manufacturers Association, Helicopter Association International, National Air Carrier Association, National Air Transport Association, National Business Aviation Association, Pratt & Whitney (also representing General Electric and Rolls-Royce), and the Regional Airline Association. Employee groups include the Allied Pilots Association, Air Line Pilots Association, International Federation of Air Line Pilots, and the National Air Traffic Controllers Association.

#### Accomplishments:

CAST is well on its way toward implementing safety interventions for two leading causes of commercial accidents, CFIT and uncontained engine failures. CAST has approved intervention strategies affecting approach and landing accidents and is beginning the implementation phase. Government and industry CAST participants continue to develop intervention strategies for runway incursions, loss of control, and weather. A collision avoidance evaluation has been initiated to determine if logic changes are required to reduce approach and landing related accidents.

The General Aviation Joint Steering Committee has completed analyses for CFIT and weather-related accidents. Areas under analysis are pilot decision-making, loss of control, survivability, and runway incursions. 30 mountain passes have been completed providing guidance to pilots to assist their navigating and flying through specific mountain passes.

### MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:

- Collision Avoidance Evaluation – Conduct analyses to investigate display configurations and aural alerts for traffic alert and collision avoidance system resolution advisories; analysis will be used to determine if collision avoidance logic should be changed to reduce approach and landing related accidents

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

- Continue to assess existing and emerging weather-related technologies that affect commercial and GA operations
- Continue developing and implementing Safer Skies interventions for commercial and general aviation in areas of CFIT, runway incursion, approach and landing, loss of control, and weather focus areas
- Develop mountain pass guidance to assist GA pilots in safety navigating and in flying both through and within specific mountain passes – twenty five mountain passes are scheduled for completion
- Conduct modeling scenarios and develop guidance/implementation materials relevant to the evolution to a performance based national airspace system using Required Navigation Performance, Required Communication Performance, Required Surveillance Performance. and Global Navigation Satellite Systems
- Complete evaluation of safety enhancements of head mounted displays. Complete program to establish helicopter approach procedures using current technologies
- Complete the Moving Map Integration program to evaluate multifunction displays and avionics by comparing the effectiveness of various equipment packages and procedures
- Support development of certification processes and standards for Uninhabited Aerial Vehicle (UAV) operations within the NAS

### **FY 2006 PROGRAM REQUEST:**

FY 2006 funding will support implementation of Safer Skies interventions that have been identified by the FAA in collaboration with other government agencies, industry representatives, and employee groups. This request will focus primarily on accident causes related to Runway Incursion, Controlled Flight Into Terrain, approach and landing, and Weather focus areas for commercial and general aviation. Key programs funded will be the development of guidance for the use of general aviation for flying mountain passes and the implementation of logic recommendations from the collision avoidance evaluation.

### **KEY FY 2006 PRODUCTS AND MILESTONES:**

During FY 2006 the program will:

- Complete collision avoidance system evaluation and begin implementation of logic recommendations
- Continue developing and implementing Safer Skies interventions for commercial and general aviation in areas of CFIT, runway incursion, approach and landing, loss of control, and weather focus areas
- Continue development of policy, regulations and certification guidelines and standards for UAV operations within the NAS
- Continue to develop mountain pass guidance to assist GA pilots in safety navigating and flying through and in specific mountain passes – completion of 25 mountain passes scheduled
- Continue to assess existing and emerging weather-related technologies that affect commercial and GA operations

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

**APPROPRIATION SUMMARY**

	<u>Amount (\$000)</u>
Appropriated (FY 1982-2004)	\$5,400
FY 2005 Enacted	3,373
FY 2006 Request	3,400
Out-Year Planning Levels (FY 2007-2010)	<u>12,000</u>
Total	\$24,173

Budget Authority (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Contracts:					
Safer Skies	0	2,000	3,400	3,373	3,400
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
Total	0	2,000	3,400	3,373	3,400

OMB Circular A-11, Conduct of Research and Development (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	0	2,000	3,400	3,373	3,400
Total	0	2,000	3,400	3,373	3,400

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

<b>Safer Skies Product and Activities</b>	FY 2006 Request (\$000)	Program Schedule					
		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
<i>Safer Skies</i>							
<b>Safer Skies Implementation</b>	<b>\$3,400</b>						
Identify Operational Requirements for Mountainous and Remote Operating Area Communication Links		◆	◇	◇	◇	◇	◇
Develop Test Plans			◇	◇			
Conduct Evaluations		◆	◇	◇	◇		
Develop Course Materials			◇		◇	◇	◇
Identify AIM and AC Guidance Appropriate for Inclusion in FAA Handbooks			◇	◇	◇	◇	◇
Develop Handbook Materials			◇	◇	◇	◇	◇
<b>Total Budget Authority</b>	<b>\$3,400</b>	<b>\$3,373</b>	<b>\$3,400</b>	<b>\$3,000</b>	<b>\$3,000</b>	<b>\$3,000</b>	<b>\$3,000</b>

◆ - Activities Accomplished      ◇ - Activities Planned

Notes: OUT YEAR NUMBERS ARE FOR PLANNING PURPOSES ONLY. ACTUAL NEEDS WILL BE DETERMINED THROUGH THE ANNUAL BUDGET PROCESS.

IN THE FACILITIES AND EQUIPMENT APPROPRIATIONS, PERSONNEL AND OTHER COSTS ARE BUDGETED IN ACTIVITY 5, NOT THE PROGRAM BUDGET LINE ITEM.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
F&E	1A01A	Separation Standards	\$2,500,000

### Supports FAA Strategic Goals: Greater Capacity, International Leadership

**Program Goals and Intended Outcomes:** The Separation Standards Program supports meeting the “Greater Capacity” goal of the FAA Flight Plan 2005-2009, Objective 3, “Increase on-time performance of scheduled carriers.” The Program also supports meeting the “International Leadership” goal of the Flight Plan, specifically Objective 2, “Promote seamless operations around the globe in cooperation with bilateral, regional and multilateral aviation partners.” The Separation Standards Program reduces separation standard values within international airspace, resulting in the following benefits to providers and users of oceanic air traffic control systems:

- Increased system efficiency – measured by reduced aircraft fuel-burn and transit times
- Increased theoretical system capacity – measured by numbers of routes and flight levels controllers can safely support within the same volume of airspace
- Enhanced international standardization of separation criteria and resultant increase in system safety

**Agency Outputs:** The FAA’s “Strategic Plan for Oceanic Enhancements and Separation Reductions” describes a prioritized, systematic process for revising international separation values. To document and evaluate each separation change, the FAA produces a series of supporting products:

- Operational assessment of the value that the change brings to Air Traffic Control (ATC) system providers and users
- Benefit-cost analyses
- Safety assessment of the system before and after application of the change
- Publication of FAA regulatory material
- Completion of required new rulemaking
- Development of ATC-required procedures
- Development of new or changed International Civil Aviation Organization (ICAO) guidance material, annexes, or regional supplementary procedures required to standardize and make the reduced separation value safe for international operations
- Establishment and maintenance of long-term safety oversight functions required for the implementation and continued safe use of the reduced separation value

**Customer/Stakeholder Involvement:** The Separation Standards Program establishes ICAO-government-industry forums to draw all parties concerned with changing separation standards into a common process. State Civil Aviation Authorities, ICAO Regional and Headquarters elements, ATS providers, ATC system users, industry trade organizations, aircraft and avionics manufacturers, and unions representing controllers and pilots often attend these meetings.

Participants in the various change processes include:

- Asia Pacific separation standards — changes occur with the coordination and endorsement of the (North Pacific) Oceanic Work Group, Informal (North) Pacific ATC Coordinating Group, and Informal South Pacific ATS Coordinating Group, as well as specialist bodies established by the ICAO regional planning group, the Asia Pacific Air Navigation Planning and Implementation Regional Group
- North Atlantic separation standards — changes are carried out through the ICAO Regional Planning Group, the North Atlantic Systems Planning Group

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

- West Atlantic Route System Separation Standards — changes involve participation of the New York Oceanic Capacity Enhancement Task Force
- Caribbean and South American Separation Standards — changes involve participation of specialist bodies of the ICAO Caribbean/South American Regional Planning and Implementation Group

The program also provides FAA representation on ICAO's Separation and Airspace Safety Panel (SASP) — the focal point for development of the technical justification for new separation minima, as well as the global and regional forum for assessing application of recommended ICAO separation practices.

**Accomplishments:** Through the Separation Standards Program, the FAA has made major reductions in the separation standards affecting international airspace. These include:

- Introduced Northern Pacific 50-nm lateral separation standard based on operator compliance with Required Navigation Performance (RNP)-10 requirements (April 1998; December 1998; and February 2000)
- Introduced North Atlantic Implementation Management Group Cost Effectiveness (Nice) Program (October 1999)
- Introduced Pacific Reduced Vertical Separation Minima (RVSM) (February 2000)
- Expanded Pacific RVSM from Flight Level (FL) 390 to FL 410 throughout the Pacific (October 2000)
- Introduced RVSM into West Atlantic Route System portion of international airspace over North Atlantic (November 2001)
- Developed requirements for 30-nm lateral separation standard based on automatic dependent surveillance in oceanic and remote airspace (May 2001)
- Introduced RVSM into most of Western Pacific/ South China Sea portion of Asia Pacific Region (February 2002)
- Introduced NICE simulation methodology into northern Pacific air traffic system planning and analysis (April 2002)
- Prepared draft ICAO manual to introduce global standardization of RVSM regional monitoring agency practices, procedures and data sharing (August 2003)
- Sponsored introduction of comprehensive airspace safety monitoring oversight function in the ICAO Asia Pacific Region through establishment of Asia Pacific Airspace Safety Monitoring Advisory Group (April 2004)
- Led ICAO Caribbean/South American RVSM Task Force to reach positive decision to introduce RVSM into ICAO Caribbean and South American Regions in January 2005 (November 2004)

**R&D Partnerships:** The Separation Standards Program provides FAA representation to ICAO's SASP, the principal global forum for moving ahead with the development of new separation minima. The FAA and other state-based civil aviation authorities typically cooperate in such work, and all participants share research results. The program maintains close research ties with academia through a contractual relationship with Rutgers University, sponsoring development of large fast-time simulation models of oceanic airspace. It also has a direct link with international separation research activities in which the FAA's GPS Monitoring System supports EUROCONTROL's RVSM safety oversight activities. EUROCONTROL, in turn, provides access to the products of its RVSM research.

### MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:

- Implement the RVSM within ICAO Caribbean/South American Regions' airspace on January 20, 2005
- Develop detailed plans and conduct data collections related to application of 30-nm lateral and longitudinal separation standards in FAA-administered South Pacific oceanic airspace using satellite navigation and data link technologies

## **2005 FAA NATIONAL AVIATION RESEARCH PLAN**

- Provide fast-time simulation model assistance to airspace planners in formulating separation-standard improvement options within Pacific airspace
- Establish safety oversight function through Asia Pacific Airspace Safety Monitoring Advisory Group
- Provide technical assistance to China in establishment and operation of RVSM regional monitoring agency

### **FY 2006 PROGRAM REQUEST:**

The requested funding will allow the Separation Standards Program to:

- Conduct operational trial of 30-nm horizontal-plane separation minima in a portion of FAA-administered South Pacific oceanic airspace based on satellite and data link technologies
- Complete support of safety assessments related implementation of the RVSM in the ICAO Caribbean and South American Regions
- Complete recommendations for northern Pacific airspace improvement options
- Continue RVSM safety oversight in portions of ICAO Asia Pacific and North Atlantic and Pacific regions
- Assume responsibility for one-year follow-up safety assessment and ongoing safety-related support to planned January 2005 U.S. Domestic and North American RVSM implementation

### **KEY FY 2006 PRODUCTS AND MILESTONES:**

- Initiate Fourth Quarter calendar year 2005 operational-trial introduction of 30-nm lateral and 30-nm longitudinal separation standards in South Pacific airspace administered by the FAA
- Publish ATC procedures and operator approval criteria to support application of 30-nm lateral/30-nm longitudinal separation standards in the South Pacific
- Support one-year follow-up safety assessment of planned January 2005 introduction of RVSM into ICAO Caribbean/South American Regions
- Continue providing RVSM safety oversight in portions of ICAO Asia Pacific and North Atlantic Regions
- Publish results of the cost-effectiveness study of cost-effectiveness of candidate improvement options for northern Pacific airspace
- Complete required one-year follow-up safety assessments of U.S. Domestic RVSM and North American RVSM implementations in May 2006
- Conduct required ongoing airspace safety monitoring in connection with U.S. Domestic and North American RVSM implementations throughout FY 2006

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

**APPROPRIATION SUMMARY**

	<u>Amount (\$000)</u>
Appropriated (FY 1982-2004)	\$11,645
FY 2005 Enacted	2,480
FY 2005 Request	2,500
Out-Year Planning Levels (FY 2007-2010)	<u>10,000</u>
<b>Total</b>	<b>\$26,625</b>

Budget Authority (\$000)	FY 2002 Enacted	FY 2003 Request	FY 2004 Request	FY 2005 Enacted	FY 2006 Request
Contracts:					
Separation Standards	2,200	2,200	2,500	2,480	2,500
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
<b>Total</b>	<b>2,200</b>	<b>2,200</b>	<b>2,500</b>	<b>2,480</b>	<b>2,500</b>

OMB Circular A-11, Conduct of Research and Development (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	2,200	2,200	2,500	2,480	2,500
<b>Total</b>	<b>2,200</b>	<b>2,200</b>	<b>2,500</b>	<b>2,480</b>	<b>2,500</b>

# 2005 FAA NATIONAL AVIATION RESEARCH PLAN

Separation Standards Product and Activities	FY 2006 Request (\$000)	Program Schedule					
		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
<b>Separation Standards</b>							
<b>30-nm Lateral/30-nm Longitudinal Separation Standard in FAA-Administered Oceanic Airspace</b>	\$1,200						
Develop ICAO Documentation and Specifications		◆					
Develop Implementation Requirements, Operational Concept, and Procedures		◆	◇				
Conduct Trials		◆	◇	◇			
Implement			◇				
Conduct Safety Oversight			◇	◇	◇	◇	◇
<b>Asia Pacific and North Atlantic RVSM</b>	\$ 200						
Conduct Safety Oversight - Pacific		◆	◇	◇	◇	◇	◇
<b>Asia Pacific and Global Standardization of RVSM and Other Airspace Safety Functions</b>	\$200						
Develop Common Principles and Practices		◆					
Develop Long-Term Monitoring Requirements		◆	◇				
<b>Reduced Vertical Separation Minimum in ICAO Caribbean and South America</b>	\$100						
Develop Planning Through Task Force		◆	◇				
Conduct Data Collection and Analysis		◆	◇	◇	◇		
Implement		◆	◇				
Assist in Safety Oversight			◇	◇			
<b>Investigation of Northern Pacific Airspace Improvement Options Using North Atlantic Cost Effectiveness Methodology</b>	\$300						
Provided Initial Report		◆					
Identify Promising Options; Conduct Simulation and Analysis; Identify Best Options; Make Final Reports		◆	◇				
<b>Conduct ongoing safety monitoring in connection with U.S. Domestic and North American RVSM</b>	\$500						
Conduct required on-year follow-on safety assessment		◆	◇				
Conduct required airspace safety monitoring		◆	◇	◇	◇	◇	◇
<b>Total Budget Authority</b>	\$2,500	\$2,480	\$2,500	\$2,500	\$2,500	\$2,500	\$2,500

◆ - Activities Accomplished      ◇ - Activities Planned

NOTES: OUT YEAR NUMBERS ARE FOR PLANNING PURPOSES ONLY. ACTUAL FUNDING NEEDS WILL BE DETERMINED THROUGH THE ANNUAL BUDGET PROCESS.

IN THE FACILITIES AND EQUIPMENT APPROPRIATIONS, PERSONNEL AND OTHER COSTS ARE BUDGETED IN ACTIVITY 5, NOT THE PROGRAM BUDGET LINE ITEM.

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
F&E	1A01C	System Capacity, Planning and Improvement	\$6,500,000

**Supports FAA Strategic Goal: Greater Capacity**

**Program Goals and Intended Outcomes:** The System Capacity, Planning, and Improvement program provides measurement tools, procedural recommendations, capacity related technologies, and problem solving methodologies to measure and improve the National Airspace System (NAS) operational structure. This program encompasses a series of projects and activities that deliver capacity enhancements to alleviate incidents of traffic congestion, system delays, and operational inefficiencies within the aviation system. These initiatives seek to develop long-term responses to capacity demands that will promote system accessibility and flexibility resulting in improved on-time performance.

The ASCI program supports the Agency’s efforts to adopt a performance-based organization by initiating the following tasks:

- Implementing a performance measurement tool that translates the organization’s vision/mission and strategies into a set of performance indicators that are linked to activities and initiatives
- Developing and expanding a computer-based tool that will collect, process, compute, and analyze data so users can measure and report system performance on a routine basis
- Providing timely and accurate performance metrics designed to measure current FAA goals and customer needs

The Capacity Office complies with mandates levied by Congress through the Government Performance and Results Act (GPRA) of 1993 and by the White House through an executive order controlling infrastructure investment. These vehicles require the Agency to produce and report on airport improvement plans that advance the aviation industry’s high-priority initiatives for increased capacity and to implement the recommendations of the Presidential Commission on Improved Airline Competitiveness.

**Agency Outputs:** The ASCI program strives to deliver high-quality, cost-effective services to meet the needs of its customers, the users of the air transportation system, on a continuing basis. The Performance Data and Analysis Reporting System (PDARS) will provide a new tool for capturing real time performance data at all field facilities. Various Airport design studies will continue to provide problem identification and solution sets at specific targeted airports. Performance metrics required by the Air Traffic Organization (ATO) and captured through that organization’s Strategic Management Process tool will continue to provide a framework for assessing operational performance against Agency goals and targets. ASCI sponsors a wide range of tasks designed to measure, assess, and improve aviation capacity. The following programs are critical to the refinement of the aviation system:

Airport Capacity Enhancement Studies

Investigate capacity and delay issues at the major airports within the NAS. Drawing upon the capabilities of computer simulation modeling, the Agency works with airports and other aviation industry stakeholders to conduct studies that recommend improvements for the operating efficiency of the infrastructure.

International Terminal Benchmarking

Measures the cost and performance of air traffic terminal facilities through a series of bilateral comparisons of U.S. terminal facilities with similar facilities worldwide.

ATO Strategic Management Process

Designs, develops, and implements a communications management tool within regional, en route, and terminal businesses to improve the efficiency and effectiveness of strategy implementation within the Air Traffic Services regional environment.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

### Aviation Capacity Enhancement Plan

Identifies new and ongoing agency initiatives to increase airport and airspace capacity. Additionally, compiles useful data on operations, emplacements and airport project development plans for the top 100 U.S. airports.

### Performance Data and Analysis Reporting System

Supports the development of facility level metrics that tie Agency level goals to actions at the point-of-service delivery and quantify specific outcomes. The system will facilitate baselining and trend monitoring of various operations such as travel times, traffic density, and aircraft interval/acceptance rates.

**Customer/Stakeholder Involvement:** The success of the FAA is largely due to effective capacity programs led by all facets of the Agency, its customers, and its stakeholders alike. Field experts from the affected disciplines – concerned airports, air carrier representatives, aviation interest groups, and FAA regional and local air traffic control – collaborate on diversified airspace and airport capacity task force or projects.

The Capacity Office is an active participant in formal advisory committees, informal seminars, and individual meetings with relevant industry elements regarding the NAS infrastructure.

### **Accomplishments:**

- Completed the Future Airport Capacity Task (FACT) – Phase I
- Completed the JFK International Airport New Large Aircraft (NLA) Ground Movement Study
- Completed the NLA Taxiway Deviation Study
- Awarded the A380 Design Group 6 Waivers Agreement to prototype the aircraft
- Prototyped web-based software application infrastructure to provide ATO Executive Council with centralized access to ATO cost and performance information
- Completed PDARS installation at all domestic Air Route Traffic Control Centers
- Completed Portland International Airport Study – Presentation of the recommended improvements and completion of the final report
- Participated in the International Terminal Benchmarking Study to: finalize airport pairs; determine required operations, staffing, and cost data elements; and collect and summarize preliminary data from the six international and six U.S. air traffic control facilities

### **R&D Partnerships:**

In a shared effort, the Capacity Office facilitates FAA and EUROCONTROL agreements on airspace technologies and initiatives that modernize international aviation. The goal of this effort is to ensure that the United States is compatible with the rest of the aviation world in areas such as Free Flight, the Global Positioning System, the Flight Management System, the Precision Runway Monitor, and other emerging technologies. The FAA also collaborates with major air carriers and the operators of business aviation aircraft in developing financial management systems approaches.

The PDARS program was designed, developed and prototyped in coordination with NASA's Office of Aerospace Technologies. PDARS provides the tools, data and input NASA officials need to respond to the goals and objectives of their Aviation Safety Program and their Aviation System Monitoring and Modeling program. From an FAA perspective, the system contributes to the Agency's ability to meet the requirements of the GPRA of 1993, the ATS Performance Plan, and ATS Performance Initiatives.

The Capacity Office partners with aircraft manufacturers Boeing and Airbus Industries, avionics manufacturers, Municipal Airport Authorities, Airports Council International – North America (ACI-NA), Air Transport Association, and the Airlines Pilots Association for proposed new large aircraft. Work undertaken by these partnerships has included the Wide Area Augmentation System/Local Area Augmentation System for Minimum Vectoring Altitude and Automatic Dependent Surveillance – Broadcast for closely-spaced parallel runway analysis for ACI-NA.

**MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:**

- Initiate FACT – Phase II
- Complete the Indianapolis International Airport Design Team Study
- Initiate the San Francisco International Airport NLA Ground Movement Study
- Complete the Los Angeles International Airport NLA ground movement study
- Develop the Airfield Delay Simulation Model (ADSIM) performance metrics inputs
- Complete the final draft of the 2004 Aviation Capacity Enhancement Plan
- Develop the Performance Measures Model
- Complete development criteria, gather data, and present initial analysis for the International Terminal Benchmarking Study
- Initiate PDARS installation at the ten Terminal Radar Approach Control (TRACON) centers specified in the FAA *Operational Evolution Plan* (OEP)
- As part of the ATO Strategic Management Process:
  - Identify data sources, collect baseline data, conduct gap analysis and establish performance targets for the En Route and Oceanic Service Unit
  - Develop a web-based software application infrastructure to provide ATO Corporate and En Route & Oceanic Management teams with centralized access to ATO and Service Unit cost and performance analysis, forecasting, reporting and initiative tracking capabilities

**KEY FY 2006 PRODUCTS AND MILESTONES:**

- Complete the ADSIM model outputs
- Conduct operational simulation at the Airways Facilities Tower Integration Lab for New York’s JFK International Airport
- Draft the operational procedures for the A380
- Provide modeling, computer simulation, and reporting capabilities at Portland and Cleveland Airports
- Complete PDARS installation at ten OEP TRACONs
- As part of the ATO Strategic Management Process:
  - Identify data sources, collect baseline data, conduct gap analysis and establish performance targets for the En Route and Oceanic Service Unit
  - Develop a web-based software application infrastructure to provide ATO Corporate and En Route & Oceanic Management teams with centralized access to ATO and Service Unit cost and performance analysis, forecasting, reporting and initiative tracking capabilities

**FY 2006 PROGRAM REQUEST:**

The requested funding will support the Agency goals documented in the FAA Flight Plan by continuing to focus on maximizing airport capacity through improvements in runways, taxiways, navigational/guidance aids, and operational procedures that can result in increased capacity and reduced delays. The Capacity program will effectively design data systems to measure and analyze operational performance for the assessment of system improvements. The program will also produce capacity studies and analysis for the nations most congested airports to improve operational activity.

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

**APPROPRIATION SUMMARY**

	<u>Amount (\$000)</u>
Appropriated (FY 1982-2004)	\$25,255
FY 2005 Enacted	3,968
FY 2006 Request	6,500
Out-Year Planning Levels (FY 2007-2010)	<u>26,000</u>
<b>Total</b>	<b>\$61,723</b>

Budget Authority (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Contracts:					
System Capacity, Planning and Improvement	5,300	5,100	6,500	3,968	6,500
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
<b>Total</b>	<b>5,300</b>	<b>5,100</b>	<b>6,500</b>	<b>3,968</b>	<b>6,500</b>

OMB Circular A-11, Conduct of Research and Development (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	5,300	5,100	6,500	3,968	6,500
<b>Total</b>	<b>5,300</b>	<b>5,100</b>	<b>6,500</b>	<b>3,968</b>	<b>6,500</b>

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

<b>System Capacity, Planning and Improvement Product and Activities</b>	FY 2006 Request (\$000)	Program Schedule					
		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
<b><i>System Capacity, Planning and Improvement</i></b>							
<b>NAS Performance Measurement</b>							
	<b>\$5,500</b>						
Develop En Route & Oceanic Svc Unit SMP			◇	◇			
Develop Terminal Svc Unit SMP		◆	◇	◇			
Develop Flight Services Svc Unit SMP		◆	◇	◇			
Installation of PDARS at 12 OEP Airports		◆	◇	◇			
<b>Airport Development</b>							
	<b>\$500</b>						
Update Capacity Benchmarks Study		◆	◇	◇	◇	◇	◇
International Terminal Benchmarking Study							
Model & Simulate NLA Ground Movements		◆	◇	◇	◇		
Develop Metrics for 35 OEP Airports		◆					
Complete and Distribute 2004 ACE Plan		◆					
Begin Data Gathering for 2005 ACE Plan		◆	◇				
Initiate the Future Airport Capacity Task II				◇	◇	◇	◇
Indianapolis Design Team Study							
Airfield Delay Simulation National Goal Forecasting							
SIMMOD Performance Model Outputs							
<b>Capacity Improvement Initiatives</b>							
	<b>\$500</b>						
Model Airspace Redesign at Houston		◆	◇				
SFO NLA Ground Movement Study							
A380 Design Group 6 Waivers							
Performance Measures Model (RDSIM)							
Airways Facilities Tower Integration Lab for JFK							
<b><i>Total Budget Authority</i></b>	<b>\$6,500</b>	<b>\$3,968</b>	<b>\$6,500</b>	<b>\$6,500</b>	<b>\$6,500</b>	<b>\$6,500</b>	<b>\$6,500</b>

◆ - Activities Accomplished      ◇ - Activities Planned

NOTES: OUT YEAR NUMBERS ARE FOR PLANNING PURPOSES ONLY. ACTUAL FUNDING NEEDS WILL BE DETERMINED THROUGH THE ANNUAL BUDGET PROCESS.

IN THE FACILITIES AND EQUIPMENT APPROPRIATIONS, PERSONNEL AND OTHER COSTS ARE BUDGETED IN ACTIVITY 5, NOT THE PROGRAM BUDGET LINE ITEM.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A14.a	System Planning and Resource Management	\$1,271,000

### Supports FAA Strategic Goals: International Leadership, Organizational Excellence

**Program Goals and Intended Outcomes:** The FAA is meeting customer needs, increasing program efficiency, and reducing management and operating costs. The FAA will increase customer and stakeholder involvement in its programs and foster greater proliferation of U.S. standards and technology to meet global aviation needs. The FAA carefully manages these activities, to ensure that costs are contained. This includes both in-house and contracted efforts.

In FY2006 through FY 2010, the FAA will maintain a R&D management workforce comprising no more than 10% of our overall R&D workforce and will sustain the System Planning and Resource Management budget at 2% or less of the total R,E&D budget.

**Agency Outputs:** In FY 2006 the FAA will:

- Host two Research, Engineering and Development Advisory Committee (REDAC) meetings and, at least, 12 subcommittee meetings, including support of the new Joint Planning and Development Office Subcommittee, which advised the Administrator regarding the work of the Joint Planning and Development Office and the national initiative to transform the U.S. air traffic control system for 2025. The Committee produces periodic and special reports providing advice and recommendations to the FAA on its R,E&D program
- Co-host, with EUROCONTROL, four quarterly EUROCONTROL R&D Committee meetings
- Host the 6th USA-Europe Air Traffic Management Seminar, which is the only such symposium held specifically to discuss air traffic management research worldwide
- Update and publish, on the Internet, the FAA Research and Development Strategy
- Prepare the annual R,E&D budget submission
- Publish the annual National Aviation Research Plan (NARP)
- Continue to coordinate research activities with NASA through FAA's R&D Field Offices
- Produce coordinated research plans with NASA supporting both the efficiency and safety strategic goals of the FAA

### Customer/Stakeholder Involvement:

The REDAC reviews FAA research commitments annually and provides guidance for future R,E&D investments. The members of this committee and its associated subcommittees are subject matter experts drawn from various associations, user groups, corporations, government agencies, as well as universities and research centers. Their combined presence in the REDAC fulfills a congressional requirement for FAA R&D to be mindful of aviation community and stakeholder input.

**Accomplishments:** Each year, the Agency provides R,E&D program status information through the *NARP* and submits the R,E&D budget requests to the Office of Management and Budget (OMB) and Congress. REDAC has provided the FAA with an independent strategic view on the Agency's research commitments. The committee reviewed and offered recommendations on the FAA's planned FY 2006 R,E&D Investments (April 2003). The National Aviation Research Plan, which is submitted annually to the Congress concurrent with the President's Budget submission, is available to the public on the FAA's web site.

**R&D Partnerships:** The FAA's R&D partnerships are described in each budget line item.

**MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:**

*R,E&D plans and programs*

- Published the National Aviation Research Plan (February 2005)
- Published the FAA Research and Development Strategy Performance Goals and Measures Addendum (September 2005)

*R,E&D advisory committee*

- Submitted Committee review of and recommendations for FY 2007 R,E&D Program
- Submitted Committee guidance for FY 2007 R,E&D Program
- Participated in joint meetings with NASA's Aero-Space Technology Advisory Committee

**FY 2006 PROGRAM REQUEST:**

This request will be used to further FAA's R,E&D program strategic management of its R&D activities.

Specifically, the Agency will evaluate the Research and Development Strategy against the Agency's R&D Program and Agency goals. This will be done to ensure that the strategy remains viable in a changing world and that the program itself continues to support the most pressing needs of the Agency. Results of this evaluation will be used in the update of the strategy planned and the program.

The agency will continue to support the work of the REDAC in its task to advise the Administrator about the FAA R&D Program. In particular, the agency will seek the counsel and guidance of the committee for the FY 2008 program, review the proposed FY 2008 program prior to submission of the budget requirements to the Department of Transportation, and seek the committee's guidance during the execution of our R&D program.

The agency will continue to publish, as required by Congress, the *National Aviation Research Plan* and submit it annually to Congress concurrent with the President's Budget Request.

The agency will continue to provide cross- functional management team support for the *FAA R&D Strategic Plan*, ensure that programs planned in response to that plan are balanced across FAA strategic objectives, and ensure the most important and beneficial work is accomplished within the available resources.

The Agency will continue to maintain its field offices at NASA's Ames and Langley Research Centers as a vital part of our efforts to coordinate and integrate the research and development programs of the two organizations. Additionally, we will continue to support, along with NASA, the Joint University Program. This program continues to be an important incubator of new ideas, which in the past have made significant contributions in advancing aviation safety and efficiency of operations in the National Airspace System.

*Ongoing Activities*

Ongoing activities include:

- Update the R&D Strategic Plan
- Publish the National Aviation Research Plan
- Sustain R,E&D Advisory Committee Activities
- Publish the National Aviation Research Plan

*New Initiatives*

No new initiatives are planned in FY 2006.

**KEY FY 2006 PRODUCTS AND MILESTONES:**

*R,E&D plans and programs*

- Publish the National Aviation Research Plan
- Conduct FAA R&D Strategy assessment

## **2005 FAA NATIONAL AVIATION RESEARCH PLAN**

### *R,E&D advisory committee*

- Prepare recommendations on planned R,E&D investments for FY 2008
- Prepare other reports as requested by the Administrator
- Participate in joint meetings with NASA's Aero-Space Technology Advisory Committee

### *NASA Field Offices*

- Continue developing and implementing Free Flight Phase 1 and 2 Tools
- Continue participating in the Joint Aviation System Transformation Program design effort and related development of the FAA Flight Plan 2020 Initiative
- Continue developing and implementing aircraft structural safety programs
- Support the FAA/NASA Virtual Airspace Modeling System (VAMS) project goal of developing and airspace system modeling, simulation and evaluation environment
- Support the NASA Human Measured and Performance Project, which improves the design of human centered automation and interfaces
- Support the NASA Efficient Flight Path Management Project, which develops ATM decision support tools to facilitate the modernization of the NAS
- Support the NASA Strategic Airspace Usage Project, which develops technologies to improve traffic flow management within the NAS
- Support the NASA Efficient Aircraft Spacing Project, which develops new operational concepts and technologies that allow aircraft to travel in closer proximity to one another
- Support the NASA Space Based Technologies Project, which initiates the transition of today's CNS into a network centric digital infrastructure

### *Joint University Program*

- Publish and disseminate research results reported on at the quarterly reviews

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

**APPROPRIATION SUMMARY**

	Amount (\$000)
Appropriated (FY 1982-2004)	<u>\$36,226</u>
FY 2005 Enacted	516
FY 2006 Request	1,271
Out-Year Planning Levels (FY 2007-2010)	4,781
Total	<u>\$42,794</u>

<b>Budget Authority (\$000)</b>	<b>FY 2002 Enacted</b>	<b>FY 2003 Enacted</b>	<b>FY 2004 Enacted</b>	<b>FY 2005 Enacted</b>	<b>FY 2006 Request</b>
Contracts:					
R,E&D Plans and Programs	1,130	902	436	455	1,225
Personnel Costs	49	43	56	53	43
Other In-house Costs	21	2	5	8	3
<b>Total</b>	<u><b>1,200</b></u>	<u><b>947</b></u>	<u><b>497</b></u>	<u><b>516</b></u>	<u><b>1,271</b></u>

<b>OMB Circular A-11, Conduct of Research and Development (\$000)</b>	<b>FY 2003 Enacted</b>	<b>FY 2003 Enacted</b>	<b>FY 2004 Enacted</b>	<b>FY 2005 Enacted</b>	<b>FY 2006 Request</b>
Basic	0	0	0	0	0
Applied	1,200	947	497	516	1,271
Development (includes prototypes)	0	0	0	0	0
<b>Total</b>	<u><b>1,200</b></u>	<u><b>947</b></u>	<u><b>497</b></u>	<u><b>516</b></u>	<u><b>1,271</b></u>



## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
F&E	1A01K	Wake Turbulence	\$2,000,000

### Supports FAA Strategic Goal: Greater Capacity

**Program Goals and Intended Outcomes:** The Air Traffic Control (ATC) wake turbulence hazard mitigation procedures currently regulating departing aircraft reduce an airport's overall operational capacity. Also affecting arrival rates, wake turbulence is a major indirect contributor to terminal delays, especially when bad weather conditions do not permit visual operations. The Wake Turbulence Program seeks to achieve a reduction of wait time between departures on closely spaced parallel runways (by definition, those that are adjacent to each other and separated by less than 2500 feet). The resulting increased numbers of departures per airport runway are expected to enhance overall ATC service capabilities considerably within the National Airspace System (NAS).

The Wake Turbulence Research Program was tied both to the FAA *Flight Plan 2004-2008* and the Operation Evolution Plan (OEP). Objective One for the Greater Capacity Goal of that year's Plan, "Increase Airport Capacity to Meet Projected Demand," anticipated an initiative that would "develop technology and procedures to increase the use of parallel runways in adverse weather conditions." A result of collaboration between the FAA and the aviation industry, the current OEP further defines the program component for the new *Flight Plan 2005-2009* parallel runway initiative as: "OEP AW-5.2, Wake turbulence Research and Development Effort to Enhance Operations for Closely Spaced Parallel Runways (CSPRs)."

To help realize the objectives of the new Flight Plan and its associated OEP AW-5.2, the new Wake Turbulence Program will examine the feasibility of changing how existing procedures for the continued use of CSPR could better be applied in conditions requiring instrument approaches. Initial stages of this work were undertaken with FY 2004 Wake Turbulence program funding from the FAA Facilities and Equipment (F&E) Budget Appropriation. The approach procedures component will be continued in FY 2005 and subsequent years using program funding from the FAA Research, Engineering and Development (R,E&D) Budget Appropriation.

The desired outcome of the F&E component Wake Turbulence Program will be a ground-based capability to space aircraft airport departures with shorter times for wake turbulence mitigation than are allowable today. Beginning in FY 2006, the FAA will evaluate the prototype ground-based departure spacing system developed by NASA and will initiate the systems engineering required to integrate the capabilities of this prototype into the NAS. Future funding will allow the NASA system to be added to existing terminal automation platforms and enable procurement of the specialized wind/wake sensors it requires.

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### Agency Outputs:

If NASA succeeds in mounting a viable prototype that demonstrates significant benefit to airport departure operations, the FAA will develop, deploy and operate the following:

- Modified air traffic control wake mitigation procedures for aircraft departing on airport CSPRs
- Enhancements to FAA airport/TRACON automation systems and additional weather/wake sensors at affected airports

Funding requested in FY 2006 allows for the evaluation of the NASA technology prototypes in a particular airport environment, but does not yet support its integrated into the NAS. Subsequent development by the FAA is pending the results of the NASA prototype demonstration and the availability of FAA resources needed to introduce a major new capability into the NAS.

### Customer/Stakeholder Involvement:

Development of a ground-based departure spacing system is being jointly undertaken by the FAA and NASA as a single component of an overall joint FAA/NASA Wake Turbulence Program. A key stratagem of the joint program is

## **2005 FAA NATIONAL AVIATION RESEARCH PLAN**

the requirement of periodic (semi-annual) program status meetings with key stakeholders. To involve an even broader audience to review the work being accomplished by the program, the joint leads hold forums (WakeNet USA) twice a year to make wake turbulence research results public. Program staff also coordinate their efforts with those of their European counterparts so that both may accelerate this important work.

Customers and stakeholders within the FAA who directly participate in or advise the joint Wake Turbulence Program are: the Air Traffic Organization - Terminal Services, the s Service, and the Office of System Safety. Collaborators outside of the Agency include: the Boeing Company, the Lockheed Martin Corporation, the United Parcel Service, United Airlines, the Air Line Pilots Association, and the National Air Traffic Controllers Association.

### **Accomplishments:**

These FY 2004 accomplishments directly relate to and will contribute to the success of the approach to the development of wake turbulence aircraft procedures work being continued as part of the FAA R,E&D Program in FY 2005:

- Upgraded the FAA's wake turbulence risk assessment tool – utilizing analyzed wake turbulence data from the closely spaced parallel runways at the San Francisco International Airport
- Collected wake turbulence data for a full year from closely spaced parallel runways (12R and 12L) at the Lambert – St. Louis International Airport
- Analyzed a ten-month portion (thus far) of the Lambert – St. Louis International Airport data
- Increased the wake turbulence detection and tracking rate of the prototype pulsed Light Detection and Ranging (LIDAR) sensor to 85 percent
- Installed a second pulsed LIDAR sensor at the Lambert – St. Louis International Airport to investigate alternative wake turbulence detection and tracking processes
- Determined that wake turbulence generated by arriving transport aircraft can be predicted reliably
- Continued benefit and safety risk assessments

### **R&D Partnerships:**

As described under Customer/Stakeholder Involvement, the FAA/NASA Wake Turbulence Program is constructed as a joint/collaborative program of researchers across the FAA, NASA, EUROCONTROL and supporting organizations. The following entities participate in the program:

- NASA, Efficient Aircraft Spacing Projects
- FAA, Air Traffic Organization – Planning
- DOT, Volpe National Transportation Systems Center
- MITRE/Center for Advanced Aviation Systems Development
- George Mason University
- Titan Corporation
- MIT Lincoln Laboratory
- Computer Sciences Corporation
- NorthWest Research Associates
- ASE Inc.
- Coherent Technologies Inc
- CSSI, Incorporated
- Air Traffic Simulation, Inc.
- ICF Consulting
- Logistics Management Institute

### **MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:**

Not Applicable. The Wake Turbulence Program was funded in the FY 2005 R,E&D Appropriation to accomplish research enabling changes in the air traffic control wake mitigation procedures for arrivals on CSPR. "Major Activities and Anticipated FY 2005 Accomplishments" for the R,E&D portion of the Wake Turbulence Program can be found in the R,E&D portion of this National Aviation Research Plan. This Facilities and Equipment component of the Wake Turbulence Program (development of ground-based air traffic control capability to wake space aircraft departures with less delay time than applied by today's standards) had not requested, nor did it receive, FY2005 F&E Appropriation funding. Work in this program area will resume in FY 2006.

### **FY 2006 PROGRAM REQUEST:**

In FY 2006, the NASA departure spacing prototype is projected to be completed and funding will be needed to provide for an FAA evaluation of the feasibility of adapting the prototype, and its associated operational procedures, as an additional NAS service capability. The requested funding will also provide for the initial system engineering tasks of integrating the NASA prototype capability into the FAA airport service infrastructure. Subsequent FAA investment decisions will determine the extent to which the capability will be implemented in the NAS and funding requirements for FY 2007 and beyond.

### **KEY FY 2006 PRODUCTS AND MILESTONES:**

- Assessment of the winds in the airport area as a predictor of the transport of a departing aircraft's wake turbulence
- Evaluation of NASA's initial air traffic control decision support tool prototype (and associated sensor suite) for separating the wakes of departing aircraft
- Development of the computer-human interface for the NASA ATC decision support tool prototype
- Support for development of pulsed LIDAR to detect and track wake turbulence from departing aircraft

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

**APPROPRIATION SUMMARY**

	<u>Amount (\$000)</u>
Appropriated (FY 1982-2004)	\$4,000
FY 2005 Enacted	0
FY 2006 Request	2,000
Out-Year Planning Levels (FY 2007-2010)	0
<b>Total</b>	<u>\$6,000</u>

Budget Authority (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Contracts:					
Wake Turbulence	0	0	4,000	0	2,000
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
<b>Total</b>	<b>0</b>	<b>0</b>	<b>4,000</b>	<b>0</b>	<b>2,000</b>

OMB Circular A-11, Conduct of Research and Development (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	0	0	4,000	0	2,000
<b>Total</b>	<b>0</b>	<b>0</b>	<b>4,000</b>	<b>0</b>	<b>2,000</b>

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Wake Turbulence Product and Activities	FY 2006 Request (\$000)	Program Schedule					
		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
<i>Wake Turbulence</i>	\$2,000						
Assessment of Airport Winds			◇				
Evaluation of NASA Prototype			◇				
Development of Computer-Human Interface for Integrated Capability			◇				
Support of Wake Detecting LIDAR Systems			◇				
<b>Total Budget Authority</b>	\$2,000	\$0	\$2,000	\$0	\$0	\$0	\$0

◆ - Activities Accomplished      ◇ - Activities Planned

NOTES: OUT YEAR NUMBERS ARE FOR PLANNING PURPOSES ONLY. ACTUAL FUNDING NEEDS WILL BE DETERMINED THROUGH THE ANNUAL BUDGET PROCESS.  
IN THE FACILITIES AND EQUIPMENT APPROPRIATIONS, PERSONNEL AND OTHER COSTS ARE BUDGETED IN ACTIVITY 5, NOT THE PROGRAM BUDGET LINE ITEM.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A12.b	Wake Turbulence	\$2,296,000

### Supports FAA Strategic Goal: Greater Capacity

**Program Goals and Intended Outcomes:** The Wake Turbulence Program addresses the FAA goal for capacity as well as the DOT Mobility Strategic Objective: “Advance accessible, efficient, intermodal transportation for the movement of people and goods.” The Program is working to increase trip time reliability by adding aviation system capacity at airports, so that on-time arrival performance improves by one percentage point per year.

The program is increasing the capacity of terminal airspace by developing operational concepts for wake avoidance under various weather conditions. By FY 2009, the program will complete International Civil Aviation Organization-level wake vortex standards performance assessment.

Program outcomes include:

- Implementation of new wake turbulence standards and procedures that will improve flight efficiency along with airport arrival and departure rates, thus an increase in the National Airspace System (NAS) productivity and capacity
- Reduction in delays during less than Visual Flight Rules (VFR) conditions

**Agency Outputs:** The Wake Turbulence Program conducts applied research to solve operational problems through the development of improved wake avoidance procedures and weather dependent wake avoidance solutions for closely spaced parallel runways. During periods of less than ideal weather and visibility conditions that presently constrain the use of an airport’s closely spaced parallel runways, implementation of these procedures and solutions will allow increased utilization of the parallel runways. These procedures and solutions will permit air traffic control to operate the airports closer to their design capacity during less than ideal weather and visibility conditions.

**Customer/Stakeholder Involvement:** The wake research priorities and plans are consistent with user needs. The program addresses the stated needs of Air Traffic Organization and works in concert with the Flight Standards Services to ensure the developed procedures and solutions are safe and target airports are those critical to reducing air traffic delays. The program works with controllers, airlines and pilots to ensure that user recommendations are included and that training and implementation issues are addressed from the start. The program also works with NASA to support their mid-term and long-term research activities in wake turbulence and to ensure that their solutions will focus on remaining wake constraints and effectively integrating into the NAS.

**Accomplishments\*:** The following represent major accomplishments of the wake turbulence program:

- Updated the Airspace Simulation and Analysis for TERPS (Vertical Flight Terminal Instrument Procedures) wake turbulence safety assessment capability operated by Flight Standards Services. Information for the update obtained from the program’s data collection efforts in San Francisco
- Completed Simultaneous Offset Instrument Approach/precision Runway Monitor safety assessment of wake at the San Francisco International Airport
- Linked data from newly installed St. Louis Lambert Field multilateration system into St. Louis Lambert Field wake turbulence data collection network to provide higher resolution information on aircraft lateral positions on landings
- Established cooperative data exchange with European wake turbulence data collection efforts
- Established second prototype Light Detection and Ranging (LIDAR) based wake tracking system at St. Louis Lambert Field for collecting wake turbulence data on departing aircraft and on the approach path of landing aircraft.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

\* Supported by FY 2004 funds enacted F&E Appropriation for Aviation Weather Services Improvement.

**R&D Partnerships:** In addition to its partnership with the FAA's Flight Standards Services, the airlines, and the controller's and pilot's labor organizations, the wake turbulence research activities are closely coordinated and leveraged with industry, academia, and other government agencies. This coordination is done directly through interagency agreements, university grants and Memorandums of Agreement. Principal partners include the Volpe National Transportation Center, Mitre/CAASD, Massachusetts Institute of Technology's Lincoln Laboratory; and NASA's Ames and Langley Research Centers. The wake turbulence program also partners with EUROCONTROL and the European aviation research community to share results of the international wake research activities.

### **MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:**

- Utilize St. Louis analyzed data to update the Airspace Simulation and Analysis for TERPS (Vertical Flight Terminal Instrument Procedures) wake turbulence safety assessment capability operated by Flight Standards Services
- Complete safety assessment on the potential modified wake turbulence procedure application for the closely spaced parallel runways at St. Louis Lambert Field
- Modify Air Traffic Control Order 7110.65 as it affects closely spaced parallel runways (2500 ft rule) at the initially selected airport. St. Louis Lambert Field
- Complete plan for developing and validating modifications to wake turbulence mitigation procedures for closely spaced parallel runways during less than ideal conditions at six of the top-35-delayed airports

### **FY 2006 PROGRAM REQUEST:**

#### *Ongoing Activities*

- Continue wake data collection and analysis at additional airports to support national and airport specific changes to 2500 ft rule
- Continue development of wind dependent wake turbulence mitigation procedures for departing aircraft – based on data collection and analysis efforts

#### *New Initiatives*

No new initiatives are planned in FY 2006.

### **KEY FY 2006 PRODUCTS AND MILESTONES:**

- Complete sensor installation and initiate wake turbulence data collection effort at Cleveland Hopkins Airport
  - Complete post implementation evaluation of modified wake turbulence mitigation procedure application at St. Louis Lambert Field
  - Develop national change to Air Traffic Order 7110.65 as it applies to closely spaced parallel runways
- Complete concept definition for wind dependent wake turbulence mitigation procedure for aircraft departing on closely spaced parallel runways

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

**APPROPRIATION SUMMARY**

	Amount (\$000)
Appropriated (FY 1982-2004)	\$12,622
FY 2005 Enacted	4,262
FY 2006 Request	2,296
Out-Year Planning Levels (FY 2007-2010)	8,701
<b>Total</b>	<b>\$27,881</b>

<b>Budget Authority (\$000)</b>	<b>FY 2002 Enacted</b>	<b>FY 2003 Enacted</b>	<b>FY 2004 Enacted</b>	<b>FY 2005 Enacted</b>	<b>FY 2006 Request</b>
Contracts:					
Wake Turbulence	3,577	7,580	0	3,966	2,059
Personnel Costs	352	315	0	163	225
Other In-house Costs	71	28	0	133	12
<b>Total</b>	<b>4,000</b>	<b>7,923</b>	<b>0</b>	<b>4,262</b>	<b>2,296</b>

<b>OMB Circular A-11, Conduct of Research and Development (\$000)</b>	<b>FY 2002 Enacted</b>	<b>FY 2003 Enacted</b>	<b>FY 2004 Enacted</b>	<b>FY 2005 Enacted</b>	<b>FY 2006 Request</b>
Basic	0	0	0	0	0
Applied	4,000	7,923	0	4,262	2,296
Development (includes prototypes)	0	0	0	0	0
<b>Total</b>	<b>4,000</b>	<b>7,923</b>	<b>0</b>	<b>4,262</b>	<b>2,296</b>



## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A11.k	Weather Program	\$20,582,000

### Supports FAA Strategic Goals: Increased Safety, Greater Capacity

**Program Goals and Intended Outcomes:** The Weather Program helps achieve the FAA’s strategic goals of increasing aviation safety and providing greater capacity by reducing the number of accidents associated with weather. Furthermore, this program supports the Flight Plan goal to improve mobility by minimizing the impacts of adverse weather events on National Airspace operational capacity.

This program also supports the goals outlined in the National Aviation Research Plan. In collaboration with National Weather Service (NWS) and National Aeronautic and Space Administration (NASA) programs, this program produces weather algorithms, more accurate and rapid forecasting and dissemination of forecasts, and enhanced intuitive capability for aviation decision makers. It also supports the development of aviation weather instructional material.

This program improves FAA’s ability to provide short-term and mid-term forecasts of naturally occurring atmospheric hazards, such as turbulence, severe convective activity, icing, and restricted visibility. Additional research is on-going to provide weather observations, warnings, and forecasts that are more accurate, accessible, efficient, and that meet current and planned regulatory requirements. These resulting upgrades enhance flight safety, reduce air traffic controller and pilot workload, improve flight planning, increase productivity, and enhance common situational awareness. By 2009, the weather program will develop a 6 to 12 hour freezing precipitation forecast capability. By 2015, high-glance-value weather products with longer forecast lead times and increased accuracy, for the atmospheric hazards listed above, will be developed and available electronically to all aviation users.

**Agency Outputs:** The weather program develops new and improved weather algorithms that help to solve operational problems that have always challenged aviation. National Airspace System (NAS) research platforms for the program’s research include the weather and radar processor, the integrated terminal weather system and the operational and supportability implementation system. NWS platforms are also used.

The program participates in technology transfer that allows private weather service companies that support the NAS to share in the following benefits from the improved algorithms and other weather products developed by the FAA:

- Depiction of current and forecasted in-flight icing areas – enhances safety and aircraft utilization
- Interactive data assimilation, editing and forecast tools – improves aviation advisories and forecasts issued by the NWS
- Depiction of current and forecasted precipitation type and rate – enhances safety in the terminal area
- Short-term forecasts and prediction of ceiling and visibility in the national area – enhances national area safety
- In-situ and remote detection and forecast of en route turbulence including clear air turbulence – enhances en route safety

**Customer/Stakeholder Involvement:** The weather research priorities and plans are consistent with user needs. The program works in concert with the Aerospace Weather Policy and Standards Staff, and with Flight Standards Services.

It derives research projects and priorities from the interagency National Aviation Weather Initiatives (1999). These initiatives are strongly influenced by other NAS drivers, such as “Safer Skies,” free-flight implementation, Aviation Weather Mission Need Statement (2002), Traffic Management Unit Weather Needs Document (1999), Flight Plan Safety Objectives, and NAS operational concept documents. The weather program continually revalidates these merged priorities and plans by giving briefings in public forums such as the annual National Business Aircraft Association conference and the Friends/Partners in Aviation Weather Forum.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

The program is responsive to the aviation weather service user needs and requirements stated in the Aviation Safety Action Plan. Additionally, it has addressed recommendations and requirements found in several industry-produced documents and publications.

**Accomplishments:** Major accomplishments and associated benefits of the Weather Program include:

- Provided more accurate, higher-resolution data on upper winds, temperature, and moisture through rapid-update-cycle analyses and forecasts – enhanced safety
- Forecast freezing precipitation aloft and supported rulemaking that prevents turboprops from flying into conditions conducive to in-flight icing – enhanced safety and improved airspace efficiency, aircraft utilization, and safety, especially for commuter aircraft
- Upgraded Next-Generation Weather Radar (NEXRAD) algorithms, storm cell identification and tracking, hail detection, and mesocyclone and tornado detection (leveraged with NWS) – enhanced flight safety through better definition of location, timing, and severity of convective weather hazards
- Transferred the Weather Support to Decision Making system technology to a commercial weather provider – enhanced safety by providing ground deicing decision making information to airlines, airports and cities, and resulted in significant cost savings (received the 1999 Government Technology Leadership Award)
- Enhanced the Aviation Digital Data Service via the implementation of a flight path tool depicting vertical cross sections of weather along user-specified flight routes – enhanced safety and system efficiency (received the 2000 Government Technology Leadership Award)
- Delivered data through four recently-operationally implemented weather products with strong potential to impact the future safety and efficiency of NAS operations; respectively, these products provide new capabilities of:
  - Current and up to one hour forecast of convective weather
  - Current and up to twelve hour forecasts of in-flight icing conditions
  - Current and up to twelve hour forecasts of clear-air turbulence
  - Current and up to twelve hour forecasts of marine stratus burnoff at San Francisco International Airport
- Completed convective storm growth and decay field tests in Dallas, Orlando and Memphis and New York. This research is resulting in the accurate short-term prediction of the initiation, growth, and decay of storm cells as it is providing operational benefit at the above four sites. It is enhancing safety and capacity by improving aircraft avoidance of hazardous weather, resulting in enhanced strategic and tactical flow management planning, allowing more effective routing of traffic to/from airports and runways
- Awarded the FAA’s 2002 Excellence in Aviation Award
- Awarded the National Weather Association’s 2002 Aviation Meteorology Award
- Awarded the FAA Office of Research and Acquisitions 2003 Mission Excellence Award

**R&D Partnerships:** As required by the Federal Aviation Act of 1958, as amended, the FAA cooperates with the Department of Commerce in promoting and developing meteorological science, and in fostering support of research projects through the use of private and governmental research facilities. The scope of these duties is broadened by recommendations published by the Office of the Federal Coordinator for Meteorology (1999), the Weather Joint Safety Implementation Team (2000), and the FAA Aviation Weather Mission Needs Statement (2002).

The Weather Program collaborates with the FAA’s Aviation Weather Policy and Standards Staff and with Flight Standards Services. It also leverages research activities with members of industry, academia, and other government agencies through interagency agreements, university grants, and Memorandums of Agreement (MOAs).

The program’s partners include: the National Center for Atmospheric Research; NOAA laboratories; Massachusetts Institute of Technology’s Lincoln Laboratory; NWS’s Aviation Weather Center and Environmental Modeling Center;

## **2005 FAA NATIONAL AVIATION RESEARCH PLAN**

NASA Dryden, Langley and Glenn; the Naval Research Laboratory; UPS; universities; airlines; port authorities; and cities.

Research results are transferred to the private sector via cooperative research and development agreements with WSI, Harris, Sonalyst, Freese-Notis, Jeppesen, and Parochus.

### **MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:**

- Approval by the FAA of in-flight icing forecast product including severity for experimental use
- Tested 3-6 hour national convective forecast product
- Acceptance by NWS Technical Advisory Committee of turbulence detection product for NEXRAD
- Developed 12-hour frost forecast capability
- Tested operational utility of enhanced tactical convective hazard product at Dallas-Ft. Worth ARTCC
- FAA approval of mid-level turbulence forecast product for experimental use
- Implemented baseline Northeast ceiling & visibility product on web-based platform
- Approval by the FAA of oceanic cloud-top height product for experimental use
- Approval by the FAA of CONUS ceiling, visibility, and flight category analysis products for experimental use
- Implemented enhanced resolution Rapid Update Cycle model into operations at NWS
- Conducted quality assessment evaluations of in-flight icing, turbulence, convective weather, national ceiling and visibility, and oceanic convective nowcast products to support the aviation weather technology transfer process

### **FY 2006 PROGRAM REQUEST:**

#### *Ongoing Activities*

- Develop algorithms for forecasts of freezing drizzle aloft
- Integrate terminal, regional, and national convective weather forecast capability
- Develop oceanic hazard diagnostic and forecast products
- Develop ceiling and visibility now-cast products as part of northeast corridor efforts for Terminal Ceiling and Visibility (C&V) program
- Transition weather research products to operations in the NWS, the FAA, and industry automation and weather systems
- Continue to develop automated data analysis and assimilation techniques

#### *New Initiatives*

No new initiatives are planned in FY 2006.

### **KEY FY 2006 PRODUCTS AND MILESTONES:**

- Approval by the FAA of current icing potential product for Alaska for operational use
- Approval by the FAA of two-hour national convective weather forecast product for operational use
- Implement mesocyclone detection product onto NEXRAD
- Develop six hour winter weather precipitation forecast
- Implement experimental volcanic ash coordination tool at the Washington, DC Volcanic Ash Advisory Center
- Availability of Weather Research & Forecasting model with rapid refresh for experimental use
- Implement mid-level turbulence forecast product into operations
- Approval by the FAA of CONUS ceiling, visibility & flight category forecast products for experimental use

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

- Approval by the FAA of oceanic convective diagnosis product for experimental use
- Develop model-based ceiling and visibility outlook forecast product
- Conduct quality assessment evaluations of in-flight icing, turbulence, convective weather, national ceiling and visibility, oceanic cloud-top height products to support the aviation weather technology transfer process

### APPROPRIATION SUMMARY

	Amount (\$000)
Appropriated (FY 1982-2004)	\$294,133
FY 2005 Enacted	20,671
FY 2006 Request	20,582
Out-Year Planning Levels (FY 2007-2010)	77,439
<b>Total</b>	<b>\$412,825</b>

Budget Authority (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Contracts:					
Weather Program - Safety	18,129	19,249	19,073	19,248	19,418
Weather Program - Efficiency	0	4,176	2,981	0	0
Personnel Costs	1,155	1,145	1,523	1,224	1,074
Other In-house Costs	384	113	134	199	90
<b>Total</b>	<b>19,668</b>	<b>24,683</b>	<b>23,711</b>	<b>20,671</b>	<b>20,582</b>

OMB Circular A-11, Conduct of Research and Development (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Basic	0	0	0	0	0
Applied	19,668	24,683	<b>23,711</b>	20,671	20,582
Development (includes prototypes)	0	0	0	0	0
<b>Total</b>	<b>19,668</b>	<b>24,683</b>	<b>23,711</b>	<b>20,671</b>	<b>20,582</b>

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A11k - Weather Program – Safety Product and Activities	FY 2006 Request (\$000)	Program Schedule					
		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
<b><i>041-110 Aviation Weather Analysis and Forecasting</i></b>							
<b>In-flight Icing</b>	<b>\$2,775</b>						
Approval of operational current icing potential product for AK			◇				
Approval of operational forecast icing potential product		◆					
FAA Approval of terminal-scale product for operational use						◇	
Implement forecast product for Alaska operation					◆		
<b>Advanced Weather Radar Techniques</b>	<b>\$864</b>						
Implement mesocyclone detection product into NEXRAD			◇				
3D Mosaics for CIWS Operational				◇			
<b>Aviation Forecasts</b>	<b>\$2,750</b>						
Test operational utility of enhanced Tactical Convective Hazard Product at Dallas-Ft. Worth ARTCC		◆					
Implement Experimental Volcanic Ash Coordination Tool at the Volcanic Ash Advisory Center			◇				
<b>Model Development and Enhancement</b>	<b>\$2,450</b>						
Implement Enhanced Resolution RUC model into Operations at NWS		◆					
WRF with Rapid Refresh Available for Experimental Use			◇				
<b>Winter Weather Research</b>	<b>\$645</b>						
Develop 6-hour Precipitation Forecast			◇				
Complete Development of 6-12 hr. Freezing Precip Forecast						◇	
<b>Turbulence</b>	<b>\$1,162</b>						
FAA Approval of Mid-Level Turbulence Product for Experimental Use		◆					
FAA Approval of Mid-Level Turbulence Forecasting Product for Operational Use			◇				
Complete Operational Implementation of Convectively-Induced Turbulence Product							◇
<b>National Ceiling &amp; Visibility</b>	<b>\$1,112</b>						
FAA Approval of CONUS C&V/flt cat analysis prod (exper use)		◆					
FAA Approval of CONUS C&V/flt cat fc prod (exper use)			◇				
Complete operational impl of C&V/flt cat fc products for AK						◇	
<b>Convective Weather</b>	<b>\$2,893</b>						
Test 3-6 hr National Convective Forecast Product		◆					
Approval by FAA of National Convective Wx 2-hour forecast for operational use			◇				
Implement High-Resolution National Convective Forecast into operations							◇
<b>Terminal Ceiling and Visibility</b>	<b>\$1,265</b>						
Implement Baseline Northeast C&V product on Web-Based Platform		◆					
Develop Model-Based Ceiling & Visibility Outlook fc Product			◇				
Demonstrate Winter C&V products at DCA & IAD						◇	
<b>Oceanic Weather</b>	<b>\$1,054</b>						
Approval of Cloud Top Height Product for Experimental Use		◆					
Approval of Oceanic Conv. Diag. Prod for Experimental Use			◇				
Completed Operational Implem. of Conv. nowcast Product							◇
<b>Quality Assessment</b>	<b>\$2,448</b>						
Conduct Eval to Support AWTT Process			◇				
Devel Verif. Tech. & conduct evaluations for AWTT						◇	
<b>Personnel and Other In-House Costs</b>	<b>\$1,164</b>						
<b>Total Budget Authority</b>	<b>\$20,582</b>	<b>\$20,671</b>	<b>\$20,582</b>	<b>\$19,767</b>	<b>\$19,569</b>	<b>\$19,364</b>	<b>\$18,739</b>

Note: Out year numbers are for planning purposes only. Actual funding needs will be determined through the annual budget process.

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A14.b	William J. Hughes Technical Center Laboratory Facility	\$3,393,00

**Supports FAA Strategic Goal: Organizational Excellence**

**Program Goals and Intended Outcomes:** The FAA sustains Agency research facilities located at the William J. Hughes Technical Center (WJHTC) in support of R,E&D program goals to:

Reduce the number of accidents and accident risk

- Perform airspace studies and improve airspace design
- Increase airport capacity
- Reduce delays due to weather and system outages
- Reduce user costs

These centralized facilities consist of NAS systems, aircraft, simulation facilities, communication systems laboratory, and a Human Factors laboratory.

**Agency Outputs:** R,E&D programs require various well equipped, routinely available facilities to emulate and evaluate field conditions. Human factors projects require laboratories to perform human-in-the-loop simulations, measure human performance, and evaluate human factors issues. Airborne and navigation projects require “flying laboratories” that are specially instrumented and reconfigurable to support different projects.

**Customer/Stakeholder Involvement:** The facilities directly support agency projects and integrated product teams in the following areas:

- Capacity and air traffic management technology
- Communications, Navigation, And Surveillance (CNS)
- *Operational Evolution Plan (OEP)* concept validation
- Free Flight Phase 1 and 2
- Weather
- Airport technology
- Aircraft safety technology
- Human Factors
- Information Security
- Environment and Energy
- Automated Dependent Surveillance-Broadcast (ADS-B)
- Terminal Instrumentation Procedures (TERPS)
- Wide/Local Area Augmentation System (WAAS/LAAS)
- Safe Flight 21

**Accomplishments:** The technical laboratory facilities provide the reliable test bed infrastructure to support R,E&D program goals and outputs.

**R&D Partnerships:** In addition to the R,E&D programs listed, WJHTC laboratories cooperate with the Canadian Ministry of Transport, NASA, U.S. Air Force, Aircraft Owners and Pilots Association, International Civil Aviation Association, academia and industry.

## **2005 FAA NATIONAL AVIATION RESEARCH PLAN**

### **MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:**

The following programs, are supported by the laboratories:

- Runway Incursion
- Information Security
- Separation Standards
- GPS/WAAS/LAAS
- TERPS
- Satellite Communication
- Data Link
- Acquisition Human Factors
- Delay Reduction
- Safe Flight 21
- STARS Operational Testing
- Dynamic Vertical Reduced Separation Minima (DRVSM)
- Operational Evolution Plan (OEP)
- Airspace Resectorization Studies

### **FY 2006 PROGRAM REQUEST:**

- The WJHTC will sustain technical laboratories/facilities that support R,E&D programs

#### *Ongoing Activities*

- Free Flight Phase 2
- Capacity Initiatives (Airspace, Procedures)
- Information Security
- Satellite Communication and Navigation Programs
- Separation Standards
- GPS WAAS/LAAS
- TERPS
- Runway Incursion
- Aircraft Safety
- ATC/AF Human Factors
- OEP Concept Validation
- Dynamic Vertical Reduced Separation Minima (DRVSM)

#### *New Initiatives*

No new initiatives are planned in FY 2006.

### **KEY FY 2006 PRODUCTS AND MILESTONES:**

The test beds at the WJH Technical Center provide the necessary infrastructure for R,E&D programs to achieve their goals. Specific milestones and products are contained within individual programs.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

### APPROPRIATION SUMMARY

	Amount (\$000)
Appropriated (FY 1982-2004)	\$93,324
FY 2005 Enacted	3,362
FY 2006 Request	3,393
Out-Year Planning Levels (FY 2007-2010)	14,284
<b>Total</b>	<b>\$114,363</b>

Budget Authority (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Contracts:					
WJHTC Laboratory Facility	3,540	3,683	979	983	606
Personnel Costs	8,046	2,281	2,401	2,293	2,712
Other In-house Costs	664	33	25	86	75
<b>Total</b>	<b>12,250</b>	<b>5,997</b>	<b>3,405</b>	<b>3,362</b>	<b>3,393</b>

OMB Circular A-11, Conduct of Research and Development (\$000)	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
Basic	0	0	0	0	0
Applied	12,250	5,997	3,405	3,362	3,393
Development (includes prototypes)	0	0	0	0	0
<b>Total</b>	<b>12,250</b>	<b>5,997</b>	<b>3,405</b>	<b>3,362</b>	<b>3,393</b>

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

A14b – WJHTC Laboratory Facility Product and Activities	FY 2006 Request (\$000)	Program Schedule					
		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
<i>011-140 WJHTC Laboratory Facility</i>							
<b>Systems Support Laboratory (En Route, Terminal, Automated Flight Station, Communications, and Scan Radars)</b>	<b>\$151</b>						
Free Flight Phase 2		◆	◇	◇			
Operational Evolution Plan Concept Validation		◆	◇	◇	◇	◇	◇
Capacity Initiatives (Airspace, Procedures)		◆	◇	◇	◇	◇	◇
Information Security		◆	◇	◇	◇	◇	◇
<b>Research &amp; Development Laboratory (Target Generator Facility, Cockpit Simulator, Auto Tracking, Tech Center Data)</b>	<b>\$152</b>						
Approach Procedures (SOIA)		◆	◇	◇	◇		
Free Flight Phase 2		◆	◇	◇	◇	◇	◇
Airspace Design		◆	◇	◇	◇	◇	◇
Operational Evolution Plan Concept Validation		◆	◇	◇	◇	◇	◇
Dynamic Vertical Reduced Separation Minima (DRVSM)		◆	◇	◇	◇	◇	◇
STARS Operational Testing		◆	◇	◇	◇		
<b>Aviation Support Laboratory (Aircraft)</b>	<b>\$152</b>						
Satellite Communications and Navigation Programs		◆	◇	◇	◇	◇	◇
Separation Standards		◆	◇	◇	◇		
GPS WAAS/LAAS		◆	◇	◇	◇	◇	◇
TERPS		◆	◇	◇	◇	◇	◇
Aircraft Safety		◆	◇	◇	◇	◇	◇
Runway Incursion		◆	◇	◇	◇	◇	◇
<b>Human Factors Laboratory</b>	<b>\$151</b>						
Air Traffic Control Human Factors		◆	◇	◇	◇	◇	◇
Airway Facilities Human Factors		◆	◇	◇	◇	◇	◇
Operational Evolution Plan Concept Validation		◆	◇	◇	◇		
<b>Personnel and Other In-House Costs</b>	<b>\$2,787</b>						
<b>Total Budget Authority</b>	<b>\$3,393</b>	<b>\$3,362</b>	<b>\$3,393</b>	<b>\$3,451</b>	<b>\$3,532</b>	<b>\$3,615</b>	<b>\$3,686</b>

Note: Out year numbers are for planning purposes only. Actual funding needs will be determined through the annual budget process.

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
F&E	1A011	Wind Profiling and Weather Research, Juneau	\$3,160,000

### Supports FAA Strategic Goal: Increased Safety

**Program Goals and Intended Outcomes:** The Juneau Airport Wind System (JAWS) Program directly supports goals delineated in the FAA's *Flight Plan 2004-2008*. The program emphasizes direct needs of commercial and general aviation airplanes and helicopters in the Juneau, Alaska area, where the only modes of transportation in and out of the state capital are by air or sea.

The program contributes to achieving two strategic goals and objectives of *Flight Plan 2004-2008*. It supports the strategic goal of *Increased Safety* by providing critical wind information to enable commercial and general aviation RNP operations in Juneau, and it disseminates timely turbulence information to pilots to reduce cabin injuries caused by turbulence. JAWS also supports the strategic goal of *Greater Capacity* by improving landing and departure capabilities for aircraft during hazardous wind conditions.

#### Agency Outputs:

The JAWS program generates turbulence advisories and wind information that are used by commercial and general aviation pilots in the Juneau area. Commercial (in particular, Alaska Airlines) and general aviation pilots rely on the wind information generated by JAWS to allow Required Navigation Precision (RNP) procedures to be utilized.

#### Customer/Stakeholder Involvement:

Customers include the National Weather Service (NWS) and General Aviation pilots. Alaska Airlines is the principal stakeholder.

#### Accomplishments:

- Investigated the feasibility of developing a turbulence warning system in Juneau as a result of aircraft incidents in Juneau
- Installed anemometers and wind profilers in the Juneau area
- Developed correlations between hazards encountered by aircraft and measurements from JAWS sensors
- Installed early prototype to provide FAA and Alaska Airlines with wind information from JAWS sensors
- Refined correlations by undergoing additional field programs using Doppler radar, large (737) and small aircraft
- Developed and installed an operational prototype to provide JAWS advisories to the FAA

#### R&D Partnerships:

The JAWS program was initiated as a research effort and later matured into an F&E program. The principal developer, NCAR, is primarily an aviation weather R&D organization.

#### MAJOR ACTIVITIES AND ANTICIPATED FY 2005 ACCOMPLISHMENTS:

- Implement the JAWS operational prototype in Juneau
- Complete an Operational Evaluation of the prototype system
- Obtain human factors and user feedback on the prototype system
- Develop the end-state JAWS on a COTS hardware platform
- Complete safety mitigation efforts at the JAWS mountaintop anemometer sites

## 2005 FAA NATIONAL AVIATION RESEARCH PLAN

- Install the end-state JAWS system to allow for operational testing

### FY 2006 PROGRAM REQUEST:

The requested funding will allow the program to complete the development of the end-state JAWS, and to start testing the system.

### KEY FY 2006 PRODUCTS AND MILESTONES:

- Complete the development and installation of the end-state JAWS
- Initiate and complete operational testing of the end-state system
- Develop training courses and materials (Air Traffic and Airways Facilities)
- Develop required system documentation (e.g. system specification, Technical Instruction Book)
- Complete the safety mitigation efforts at the JAWS wind profiler locations
- System certification and commissioning

### APPROPRIATION SUMMARY

	<u>Amount (\$000)</u>
Appropriated (FY 1982-2004)	\$18,129
FY 2005 Enacted	4,861
FY 2006 Request	3,160
Out-Year Planning Levels (FY 2007-2010)	0
<b>Total</b>	<b>\$26,150</b>

	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
<b>Budget Authority (\$000)</b>					
Contracts:					
Wind Profiling and Weather Research, Juneau	6,700	5,464	5,965	4,861	3,160
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
<b>Total</b>	<b>6,700</b>	<b>5,464</b>	<b>5,965</b>	<b>4,861</b>	<b>3,160</b>

	FY 2002 Enacted	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Request
<b>OMB Circular A-11, Conduct of Research and Development (\$000)</b>					
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	6,700	5,464	5,965	4,861	3,160
<b>Total</b>	<b>6,700</b>	<b>5,464</b>	<b>5,965</b>	<b>4,861</b>	<b>3,160</b>

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**

Wind Profiling and Weather Research, Juneau Product and Activities	FY 2006 Request (\$000)	Program Schedule					
		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010
<i>Juneau Airport Wind System</i>							
<b>Development of End-State System</b>	<b>\$500</b>						
Hardware Development		◆	◇				
Software Development		◆	◇				
Documentation		◆	◇				
<b>Operational Testing</b>	<b>\$800</b>						
Develop Test Plan & Procedures		◆					
Conduct Test		◆					
Develop Test Report		◆					
<b>Training</b>	<b>\$500</b>						
Develop Training Courses		◆	◇				
Develop Training Materials		◆	◇				
Conduct Training			◇				
Conduct Refresher & Attrition Training							
<b>Safety Mitigation</b>	<b>\$1,000</b>						
Develop Anemometer Site Design Drawings		◆					
Develop Wind Profiler Site Design Drawings		◆					
Upgrade Anemometer Sites		◆					
Upgrade Wind Profiler Sites		◆					
<b>Certification and Commissioning</b>	<b>\$200</b>						
JAWS Certification			◇				
Conduct Joint Acceptance Inspection			◇				
JAWS Commissioning			◇				
<b>Operations and Maintenance (O&amp;M)</b>	<b>\$0</b>						
JAWS O&M							
<b>Total Budget Authority</b>	<b>\$3,160*</b>	<b>\$4,861</b>	<b>\$3,160*</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>

◆ - Activities Accomplished      ◇ - Activities Planned

NOTES: OUT YEAR NUMBERS ARE FOR PLANNING PURPOSES ONLY. ACTUAL FUNDING NEEDS WILL BE DETERMINED THROUGH THE ANNUAL BUDGET PROCESS.  
 IN THE FACILITIES AND EQUIPMENT APPROPRIATIONS, PERSONNEL AND OTHER COSTS ARE BUDGETED IN ACTIVITY 5, NOT THE PROGRAM BUDGET LINE ITEM.

**2005 FAA NATIONAL AVIATION RESEARCH PLAN**