Federal Aviation Administration

2007 National Aviation Research Plan (NARP)

Appendices

A - Program Descriptions
B - Partnership Activities
C - Advisory Committee
D - Acronyms and Abbreviations

February 5, 2007

Report of the Federal Aviation Administration
to the United States Congress
pursuant to 49 U.S. Code 44501(c)

Blank Page

APPENDIX A

Program Descriptions
Listed Alphabetically

*Budget line item numbers are not used for these programs within the Safety and Operations (S&O) and Airport Improvement Program (AIP) appropriations.

Listed by FAA Appropriation and Budget Item

* Budget line item numbers are not used for these programs within the S&O and AIP appropriations.

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A11.c.	Advanced Materials/Structural Safety	$2,713,000

Supports FAA Strategic Goal: Increased Safety

Intended Outcomes: The Advanced Materials/Structural Safety Program helps FAA achieve its strategic goal of increasing aviation safety by preventing accidents that would occur as a result of structural failure. The Advanced Materials/Structural Safety Program assesses the safety implications of new and present day composites, alloys, and other materials, and associated structures and fabrication techniques that can help to reduce aviation fatalities. The program is also enhancing aircraft crashworthiness.

Agency Outputs: The Advanced Materials/Structural Safety Program provides technical support for rule making and develops guidance to help the aviation industry 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 structures, 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 Chief Scientist/Technical Advisor 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, seat and restraint systems, and human tolerance injury criteria. The FAA is developing alternative methods to streamline the certification process (i.e., certification by analysis and component tests in lieu of full-scale tests).

Research Goals: To prevent accidents associated with the airframe and to improve the crashworthiness of airframes in the event of accidents, the Advanced Materials/Structural Safety research focuses on developing analytical and testing methods for standardization; understanding how design, loading, and damage 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; enhancing occupant survivability and reducing personal injury from accidents; improving crash characteristics of aircraft structures, cabin interiors, auxiliary fuel tanks, fuel systems, and occupant seat and restraint systems; and improving the efficiency of aircraft certification through the use of better analytical modeling of crash events.

- By FY 2009, generate composite material dynamic properties.
- By FY 2009, develop analytical modeling techniques of aircraft structures.
- By FY 2010, generate data using full-scale structure with a goal of uniform, accepted certification methodology for damage tolerance and fatigue of composite airframe.
- By FY 2010, develop test and analysis protocols for repeated loads and damage threats.

- By FY 2011, identify required data and test methods for high temperature materials to assure safety of new constructions.
- By FY 2012, initiate study of ceramics as they are used in engine components.

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

- 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) – this FAA committee and its subcommittees help to ensure the effectiveness of the agency's rule making by identifying R&D requirements and priorities, providing guidance for the update of documents, such as AC20-107A, and encouraging industry's full participation in implementing new rules.
- Aircraft Safety Subcommittee of the FAA Research, Engineering and Development Advisory Committee – representatives from industry, academia, and other government agencies annually review the program's activities.
- Technical Community Representative Groups – FAA representatives apply formal guidelines to ensure that the program's research projects support new rule making and development of alternate means of compliance for existing rules.

R&D Partnerships: The Advanced Materials/Structural Safety Program benefits from a close working relationship with the FAA Center of Excellence led by Wichita State University's National Institute of Aviation Research and the University of Washington. The research performed under this program is leveraged by the monetary and intellectual contributions of its core universities.

Advanced Materials

With the cooperation of other government agencies, FAA sponsors a primary, authoritative handbook (MIL-HDBK-17) facilitating 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 are 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 Drexel University to develop dynamic crash computer modeling codes for transport airplane structures.

Accomplishments: The Advanced Materials/Structural Safety Program provides technical reports (available on-line at http//actlibrary.tc.faa.gov), handbooks, ACs, and certification guidance to aircraft manufacturers, maintainers, and operators. Outstanding program accomplishments include:

FY 2006

- Developed software for analyzing bonded joints that can be used by the general aviation industry.

- Developed a web-based course on maintenance of composite airframe structures.
- Developed analytical models that predict durability of braided materials.
- Generated data on human neck injury criteria for side-facing aircraft seats that may be used to develop safety criteria for business jets with side-facing seats. Currently, no criteria exist for these seats.

FY 2005

- Developed an aircraft seat cushion replacement methodology that may have the potential to replace future requirements for full-scale sled tests currently required when replacing aircraft seat cushions.
- Established common practices for bonded joints in composites structures that served as a basis for an AC.

FY 2004

- Developed data on the procurement and processing of composites that resulted in a published AC.
- Analyzed data from ATR42-300 drop test to help establish crashworthiness criteria for commuter aircraft.

Previous years

- Developed an economical data reduction method, characterizing statistically composite materials through shared databases that is now used worldwide by the general aviation industry.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

Advanced Materials

- Complete the validation of analytical methodology to predict residual strength of a composite sandwich structures following an impact event.
- Establish feasibility of embedded sensors to track damage in composite structures.
- Evaluate aging composite aircraft by a destructive evaluation and testing.

Structural Safety

- Develop an updated ATR 42-300 model to analyze critical fuselage frame failure observed in the vertical drop test.
- Develop occupant protection criteria for side facing seats commonly used in business jets. Currently, no criteria exist.
- Evaluate the use of reticulated foam to mitigate post-crash fires using full-scale sled tests.

FY 2008 PROGRAM REQUEST:

Ongoing Activities

The program will continue to focus on aging composite control surfaces on transport airplanes and will link to aircraft safety issues involved with control surface performance. Bonded joints will also be studied as to their damage tolerance and durability. Researchers will also explore savings in maintenance costs, of using embedded sensors to monitor in-service damage, and will investigate the long-term safety friction stir-welded parts and fiber/metal laminates proposed for use in new aircraft. In addition, they will collect data for new materials and applications, such as ceramics and high temperatures.

Research will continue to develop analytical models of aircraft crash events.

New Initiatives

No new initiatives are planned in FY 2008.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

Advanced Materials

- Assess the severity of control surface stiffness degradation and its effect on dynamic characteristics.
- Develop chemical characterization tests to ensure adequate surface preparation for bonded joints.
- Develop safety criteria for damage tolerance of fiber/metal laminates and friction stir welded joints.

Structural Safety

- Develop analytical models of aircraft crash events to reduce the number of full-scale tests and thus reduce the cost of certification.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	88,155
FY 2007 Request	2,843
FY 2008 Request	2,713
Out-Year Planning Levels (FY 2009-2012)	10,913
Total	104,624

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Contracts:					
Advanced Materials	5,676	5,087	4,383	1,211	1,684
Structural Safety	202	96	174	165	0
Personnel Costs	1,234	1,345	1,247	1,394	945
Other In-house Costs	111	115	77	73	84
Total	**7,223**	**6,643**	**5,881**	**2,843**	**2,713**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	7,223	6,643	5,881	2,843	2,713
Development (includes prototypes)	0	0	0	0	0
Total	**7,223**	**6,643**	**5,881**	**2,843**	**2,713**

A11.c. – Advanced Materials/Structural Safety Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
062-111 Advanced Materials Structures							
Advanced Materials	**$1,684**						
Validate analysis to predict residual strength after impact		♦					
Conduct teardown and destructive testing of aging composite aircraft		♦					
Establish feasibility of embedded sensors to track damage		♦					
Ascertain the effect of stiffness loss due to damage for dynamic characteristics			◊				
Develop safety criteria as they concern damage tolerance of fiber/metal laminates and friction stir welded joints			◊				
Develop chemical characterization tests to assure adequate surface preparation for bonded joints			◊				
Generate composite materials dynamic properties				◊			
Verify accepted certification methodology for damage tolerance and fatigue using full-scale test data.					◊		
Develop test and analysis protocols for repeated loads and damage threats					◊		
Identify data and test for materials at elevated temperatures						◊	
Initiate research in ceramic composites							◊
062-110 Structural Safety							
Structural Safety	**$0**						
Develop an updated ATR 42-300 analytical model		♦					
Evaluate the use of reticulated foam to mitigate post-crash fires		♦					
Develop occupant protection criteria for side facing seats		♦					
Develop analytical models of aircraft crash events			◊				
Develop analytical modeling techniques of aircraft structures				◊			
Personnel and Other In-House Costs	**$1,029**						
Total Budget Authority	**$2,713**	**$2,843**	**$2,713**	**$2,686**	**$2,700**	**$2,747**	**$2,780**

♦ - Activities Accomplished ◊ - Activities Planned

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

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A11.j.	Aeromedical Research	$6,780,000

Supports FAA Strategic Goals: Increased Safety, Greater Capacity, International Leadership, and Organizational Excellence.

Intended Outcomes: The Aeromedical Research Program supports FAA's Flight Plan Goal for Increased Safety by:

- Investigating and analyzing injury and death patterns in civilian flight accidents and incidents to determine the 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 humans from aerospace craft.
  - Dynamic protection and safety of humans on aerospace craft.
  - Safety, security and health of humans on aerospace craft.

Research program outcomes include improved safety, security, protection, survivability and health of aerospace craft passengers and aircrews. The Aeromedical Research Program supports FAA's Flight Plan goals to reduce the commercial fatal accident rate and the number of general aviation fatal accidents by:

- Exploiting new and evaluating existing bioaeronautical guidelines, standards, and models for aerospace craft cabin equipment, procedures and environments.
- Providing research data to serve as the basis for new regulatory action in evaluation of existing regulations to continuously optimize human performance and safety at a minimum cost to the aviation industry.
- Analyzing 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.
- Evaluating the complex mix of pilot, flight attendant and passenger activities in a wide range of environmental, behavioral, and physiological situations to propose standards and guidelines that will enhance the health, safety, and security of all aerospace travelers.

Agency Outputs: The Civil Aerospace Medical Institute (CAMI) is uniquely positioned 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 a 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 situations is evaluated to propose standards and guidelines that will enhance the health, safety, and security of all aerospace travelers.

Research Goals:

- By FY 2008, publish an assessment of the clarity and utility of signs and symbols used in passenger safety information. Research directly supports certification and harmonization.
- By FY 2009, 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.
- By FY 2010, establish fact-based criteria for the design of occupant restraint systems that will support occupant crash protection that is equivalent to the aircraft structure.
- By FY 2012, accomplish experimental projects in support of the following regulatory and certification operations:
  - Integrate analysis of biomedical, toxicological and molecular biological factors and stressors in uneventful flight and in aerospace craft incidents and accidents.
- Other research goals include:
  - Developing quantitative bioengineering criteria related to:
    - Optimum aerospace craft seat and restraint system certification.
    - Enhanced egress, flotation and onboard life support/rescue equipment certification.
  - Developing quantitative bioaeronautical data associated with:
    - Regulatory oversight of health, safety and security risks for flight deck, cabin crew, and other occupants.
    - Aerospace radiation and environmental factors and their threat to all aerospace craft occupants.
    - Bioaeronautical, bioengineering and performance factors required to support cabin evacuation certification.
  - Developing 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:

- Directly supports the bioaeronautics agenda set forth in the 2006 National Aviation Research Plan.
- Provides research for FAA, European Aviation Safety Authority and Transport Canada under the Aircraft Cabin Safety Research Plan established in 1995. This is a coordinated, living plan to maximize the cost/benefit of aerospace craft cabin safety research nationally and internationally.
- Supports multi-year collaborative studies by FAA and other government and industrial entities to evaluate flight crew and passenger symptomatology, disease, and impairment.
- Supports the FAA Air Transportation Center of Excellence for Airliner Cabin Environment that conducts partnership research with academia, industry, and other governmental agencies in accordance with Congressional directives to evaluate cabin environmental safety, security and health.

R&D Partnerships: Staff members collaborate with and hold memberships, fellowships, and leadership positions in the following scientific, medical, and bioengineering societies associated with aerospace medicine and safety:

- Cabin Safety Harmonization Working Group.
- Seat Certification Streamlining Effort.
- Airbus 380 Cabin Safety Working Group.
- The National Safety Council.
- Society of Automotive Engineers committee addressing safety research related to the work of this program.
- Aerospace Medical Association.
- Civil Aviation Medical Association.
- Professional Aeromedical Transport Association.
- American Society of Mechanical Engineers.
- American Opthomological Society.
- Direct collaboration with the DoD and NASA on crashworthiness, in-flight turbulence, aerospace medicine, ocular injury from lasers, and exposure to cosmic radiation.
- Participates in NATO aerospace medical advisory groups, the European Union, and many independent scientific organizations and academic institutions.
- Develops Cooperative Research and Development Agreements with industry to ensure collaborative projects benefiting both FAA and the aviation industry.
- Established National Research Council (NRC) postdoctoral associates to conduct research in molecular biology and space environmental physiology.
- Established a cooperative grant program with Wright State University to support the development of an aircraft injury database and analysis system.
- Maintained academic collaboration with more than 30 students/faculty annually participating in aeromedical research.

Accomplishments: Program highlights include:

FY 2006

- Completed gene expression research review to identify fatigue in collaboration with the U.S. Air Force.
- Conducted biodynamic evaluations to assess the head/neck injury potential relative to head impact with various aircraft interior structures. Research included initial evaluations of lap belt and shoulder strap mounted airbags to determine their potential for head/neck injury mitigation.
- Developed mathematical techniques to assess the performance of the above-mentioned test devices and aid the development of advanced modeling capability. Development of computer-modeling methods will provide faster, safer, more cost-effective aircraft certification decisions.
- Provided advisory materials for enhancing human health relative to in-flight cosmic and solar radiation exposures and cabin air quality via the Internet and through other widely available media for all participants in aerospace flight. The solar radiation alert system provided near real-time warning of solar events, with recommendations for reduced aircraft flight altitudes and potential diversions for polar routes.

FY 2005

- Continuously provided integrated toxicological and biomedical data on all aerospace accidents and significant incidents. Current findings indicate that about one in five pilots fatally injured in a civilian aircraft accident shows evidence of using a prescription drug; one in six has taken an over-the-counter drug; one in twenty has alcohol in excess of FAA regulations; and one of twelve is using a significant controlled dangerous substance. State-of-the-art techniques and methodology are continuously maintained in this world-class research program.
- Developed a research program to evaluate the potential use of centrifuge-based simulators for aircraft upset recovery training. Established a cooperative research grant with Embry-Riddle University to conduct background research relative to the use of centrifuge based simulators in upset recovery and to evaluate the effectiveness of simulator training in actual aircraft upset recovery situations. Established a contract with an industrial manufacturer to develop and demonstrate basic simulator methodology to perform upset recovery training using a short arm centrifuge based training device.
- Initiated development of cabin evacuation computer modeling to evaluate aircraft evacuation from current transport aircraft. Transport aircraft are currently certified by manned testing to determine if the aircraft evacuation capability meets requirements. Certification tests are expensive, can result in injured test subjects, and generally evaluate specific scenarios that may not be representative of actual evacuation requirements. Advancements in bioinformatics and the high costs of human subject testing have driven the development of cabin evacuation models to replace and/or streamline portions of manned tests.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Assess flight crew health risks during a flying career.
- Analyze the suitability for component tests and mathematical modeling as an alternative for showing regulatory compliance with crashworthiness standards for aircraft.
- Assess impact protection performance of aircraft seating systems.
- Evaluate performance-based 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.
- Assess guidelines to reduce in-flight sudden/subtle incapacitation.
- Evaluate autopsy data from fatal aviation accidents to determine protective equipment and design practices.
- Optimize life support equipment, emergency medical equipment, and operational procedures certification.
- Develop processes to ensure laboratory accreditation and ISO-9000 competency.
- Continue epidemiological assessments of biochemical, toxicological and molecular biological factors associated with fatal civilian aviation accidents.
- Develop advanced molecular biochemical techniques to enhance aviation forensic toxicology.
- Complete recommendations for life support equipment and medical requirements in civilian spacecraft.
- Complete technical and customer reports on the physiological evaluation of pulse oxygen systems for general aviation aircraft.

- Evaluate potential for airbag and advanced occupant restraint systems to reduce injury and allow unassisted aircraft evacuation.
- Develop advanced database technology to provide statistical and graphical analysis to evaluate medical certification criteria and mechanisms of injury in aircraft accidents/incidents.
- Support research conducted by industrial organizations to develop/analyze methods to detect/mitigate aircraft cabin contamination.
- Evaluate performance and protection characteristics of aircrew eye/respiratory protective equipment, including protection from chemical/biological agents.
- Develop research recommendations for Aviation Rule Making Advisory Committee reviews of cabin air quality and altitude safety rules.
- Complete guidelines for maintaining aircraft cabin occupant health to include re-evaluation of the effectiveness of Automatic External Defibrillators (AEDs) and the use of medical kit components in the flight environment.
- Evaluate physiological effect of hypoxia at altitudes that, under current regulations, do not require the use of supplemental oxygen.
- 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.
- Conduct advanced aeromedical accident and pilot certification data analyses.
- Develop research program on crew and passenger safety requirements for very high altitude air or spacecraft.

FY 2008 PROGRAM REQUEST:

Complex medical decisions, based on epidemiological assessments, accompany initial and follow-up medical assessments of airmen who request special medical certification to allow continued flying despite clinical abnormalities. Cabin safety, health, and security for all human occupants of civilian aerospace craft require careful, cost-effective certification and regulation. To ensure fact-based scientific decisions concerning these issues, the following research will ensure optimal human safety, security, and health by providing a 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 bioinformatic analytical systems.
  - Effectiveness of programs dedicated to the enhancement of passenger safety, health, security, and performance in emergencies and uneventful flight.
  - Risk posed by pilots with special medical issuances.
  - Sensor systems to provide real time warning and support actions to mitigate the effects of intentional or unintentional chemical or biological aircraft contaminants.
- 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 to improve evacuation capability and improve certification procedures.
  - Develop functional genomics technology to support accident investigation and fatigue identification in aircrew aerospace stress response analysis.
- Initiatives:
  - Implement molecular biological techniques in forensic toxicological investigations of aircraft accidents.
  - Collaborative research linking medical aircraft accident investigation with biodynamic and cabin evacuation research programs to develop bioaeronautical safety criteria.
  - Expand biodynamic mathematical modeling and model validation to allow partial or full certification of aircraft restraint systems to include complex occupant protection systems.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Integrate analysis of biomedical, toxicological and molecular biological factors and stressors in uneventful flight and in aerospace craft incidents and accidents:
  - Analyze accuracy of pilot-reported medication usage compared with actual toxicology findings.
  - Perform epidemiological assessment of toxicology factors from fatal civilian aviation accidents.
  - Analyze use of molecular biological laboratory methods to enhance forensic toxicological investigation of aircraft accidents/incidents.
  - Analyze 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.
  - Analyze application of gene expression technology in prevention of fatigue related accidents.
  - Develop instructional material on the radiation (cosmic and visual) environment during air travel.
  - Develop guidelines to reduce in-flight sudden/subtle incapacitation.
  - Establish an aircraft accident medical database.
  - Conduct advanced aeromedical accident and pilot certification data analyses.
  - Evaluate autopsy data from fatal aviation accidents to determine protective equipment and design practices.
- Develop quantitative bioengineering criteria:
  - Develop a 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.
  - Assess impact protection performance of aircraft seating systems.
  - Develop performance-based 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.

- Develop quantitative bioaeronautical data:
  - Enhance guidelines for maintaining aircraft cabin occupant health, including the CARI-6 radiobiological computer program covering large solar particle events.
  - Support research conducted by industrial organizations to develop/analyze methods to detect/mitigate aircraft cabin contamination.
  - Assess flight crew health risks during a flying career.
  - Develop quantitative biomedical and performance criteria and recommendations.
  - Analyze effectiveness of oxygen systems at very high altitudes.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	117,626
FY 2007 Request	6,962
FY 2008 Request	6,780
Out-Year Planning Levels (FY 2009-2012)	29,101
Total	160,469

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Contracts:					
Aeromedical Research	2,801	3,776	3,569	1,504	732
Personnel Costs	4,611	4,761	5,091	5,313	5,893
Other In-house Costs	1,418	1,542	140	145	155
Total	**8,830**	**10,079**	**8,800**	**6,962**	**6,780**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	8,830	10,079	8,800	6,962	6,780
Development (includes prototypes)	0	0	0	0	0
Total	**8,830**	**10,079**	**8,800**	**6,962**	**6,780**

A11.j. – Aeromedical Research Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
086-110 Aeromedical Research							
Quantitative bioaeronautical data	**$50**						
Assess flight crew health risks during a flying career		◆	◊	◊	◊	◊	◊
Support research conducted by industrial organizations to develop / analyze methods to detect / mitigate aircraft cabin contamination		◆	◊	◊	◊		
Quantitative bioengineering criteria	**$225**						
Analyze the suitability for component tests and mathematical modeling as an alternative for showing regulatory compliance with crashworthiness standard for aircraft		◆	◊	◊	◊	◊	
Assess impact protection performance of aircraft seating systems		◆	◊	◊	◊	◊	◊
Develop performance-based 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		◆	◊	◊	◊	◊	◊
Integrate analysis of biomedical, toxicological and molecular biological factors and stressors in uneventful flight and in aerospace craft incidents and accidents	**$390**						
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		◆					
Conduct advanced accident and pilot certification data analyses		◆	◊	◊	◊	◊	◊
Quantitative biomedical and performance criteria and recommendations	**$67**						
Analyze effectiveness of oxygen systems		◆	◊	◊	◊	◊	◊
Personnel and Other In-House Costs	**$6,048**						
Total Budget Authority	**$6,780**	**$6,962**	**$6,780**	**$6,932**	**$7,149**	**$7,390**	**$7,630**

◆ - Activities Accomplished ◇ - Activities Planned

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

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A11.e.	Aging Aircraft	$14,931,000

Supports FAA Strategic Goal: Increased Safety.

Intended Outcomes: The Aging Aircraft Research Program contributes to FAA's strategic goal of increasing aviation safety by reducing the number of accidents associated with failure of aircraft structure, engines, and systems. The program supports FAA's aviation safety goal by developing technologies, procedures, technical data, and performance models to prevent accidents and mitigate accident severity related to airframe, engine, and system failures as a function of the age and usage of civil aircraft. The program is focused on the structural integrity of fixed wing aircraft and rotorcraft, continued airworthiness of aircraft engines, development of aircraft inspection technologies, and the safety of electrical wiring interconnect systems (EWIS), mechanical systems, and flight controls.

Agency Outputs: The FAA issues rules and advisory materials for regulating aircraft design, construction, operation, modification, inspection, maintenance, repair, and safety. Technologies, procedures, technical data, and analytical models produced by the Aging Aircraft Research Program provide a major source of technical information used in developing these regulations and related advisories. Through this research, which results in new technologies, FAA also provides the aviation community with critical new safety technologies and data.

Research Goals: The goal of the Aging Aircraft Research Program is to understand how the airworthiness and safety of aircraft are affected by the age and operation of an aircraft over its lifetime, including the potential effects of modifications and repairs. The program conducts research and develops methods to eliminate and mitigate the potential failures related to aircraft aging processes, resulting in a reduction in the number and severity of accidents associated with aging aircraft.

To satisfy these goals the program conducts research to assess causes and consequences of airplane structural fatigue, corrosion, and other structural failures, and develop effective analytical tools to understand the behavior of these conditions. This includes development of nondestructive inspection technologies to detect these conditions. Similar research is conducted on aircraft engines and rotorcraft. Aircraft systems research to understand the causes and consequences of EWIS and mechanical systems failures, and the relationship of these failures to other aircraft systems and safety completes the program.

By FY 2009:

- Develop a fatigue loads handbook for FAR Part 25 transport category aircraft. The data in the handbook is used to determine safe fatigue and damage tolerance loads for aircraft modifications and repairs.
- Complete studies to determine quantitatively how process variables impact the performance of fluorescent penetrant inspections (FPI) and integrate results into industry inspection standards. Improvements to the FPI inspection performance ensure that cracks in safety critical components are found before reaching critical length.

By FY 2010:

- Develop EWIS segregation and separation advisory guidance. This research supports development of guidelines used in the design and modifications of aircraft EWIS and

improves safety by ensuring that adequate clearances for EWIS separation and segregation are provided in the EWIS installation.

- Develop and validate a model-assisted probability of detection (MAPoD) methodology to determine quantitative inspection reliability data, eliminating the need to conduct expensive and time consuming tests currently required to establish inspection reliability. Accurate probability of detection data is critical to determining the life of safety critical components.

By FY 2011:

- Complete a study of risk-based fleet management for small-airplane continued operational safety.
- Assess performance of various in-situ damage detection technologies for inspection of remote and inaccessible areas in aircraft. In-situ monitoring provides the means for regular monitoring of structural behavior and identification of damage not normally found between major maintenance checks.

By FY 2012:

- Develop damage tolerance methodologies and standards for rotorcraft to establish guidance for certification.
- Assess performance of traditional and advanced inspection systems necessary for evaluating the strength of bonded aircraft structures. The continued airworthiness of bonded aircraft structures, the use of which is increasing, will require technologies to find hidden damage in these joints.

Customer/Stakeholder Involvement: The Aging Aircraft Research Program coordinates with an extensive network of government and industry groups, including:

- Subcommittee on Aircraft Safety of the FAA Research, Engineering and Development Advisory Committee – representatives from industry, academia, and other government agencies annually review program activity, progress, and plans.
- Technical Community Representative Groups – FAA representatives apply formal guidelines to ensure that the program's research projects support new rule making and the development of alternate means of compliance with existing rules.
- The Aviation Rulemaking Advisory Committee – Industry representatives propose cost-effective rulemaking and research to address aircraft safety issues.
- Aircraft manufacturers, operators, foreign airworthiness authorities, academia, and industry trade groups - Consult on a wide range of current and future aging aircraft and continued airworthiness issues.

R&D Partnerships: Aging Aircraft Research Program activities are closely coordinated with industry, the National Aeronautics and Space Administration (NASA), and the Department of Defense (DoD). The FAA maintains interagency agreements with NASA, the U.S. Navy, the U.S. Air Force, and the Department of Energy (DOE). The FAA, DoD, and NASA have co-sponsored nine joint aging aircraft conferences.

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

- The Joint Council on Aging Aircraft – leverages resources and coordinates the efforts of all DoD service organizations for common aging aircraft issues.
- The FAA Airworthiness Assurance Center of Excellence – a consortium of university and industry partners who conduct R&D for FAA on a cost-matching basis

- The National Rotorcraft Technology Center – comprised of the U.S. Army, U.S. Navy, FAA, and NASA.
- Metallic Materials Properties Development and Standardization (MMPDS) Government/Industry Steering Group – a joint government and industry working group that funds and develops the metallic materials properties handbook.

Accomplishments: The FAA Aging Aircraft Research Program conducts a broad array of projects to meet the goals described above. Technical reports documenting the accomplishments of most projects are available on-line at:

http://aar400.tc.faa.gov/Programs/AgingAircraft/index.htm.

Outstanding program accomplishments include:

FY 2006

- Completed development of the MMPDS Handbook of FAA accepted material properties, which replaces MIL-HDBK-5 previously cancelled by the DoD. The MMPDS Handbook is an essential reference for aircraft manufacturer design engineers and is used by FAA for aircraft certification.
- Completed aircraft wire degradation research that evaluated the degradation of common types of aircraft electrical wire as a function of laboratory controlled aging processes. Data generated by the study are being used to evaluate the potential of methods for monitoring wire performance in aircraft and in wire reliability assessment methods.
- Completed research on the use of composite doublers as a safer, more cost-effective means for repair of damaged metallic aircraft structure.
- Completed development of a low cost, field prototype, generic scanning and imaging system that can be readily coupled to existing aircraft inspection devices, thereby improving flaw detection in metal and composite structure.
- Completed development and demonstration of an enhanced prototype of a magnetic carpet probe for rapid and wide-area inspection of aircraft engine critical rotating components. This technology is a potential replacement of fluorescent penetrant inspection.

FY 2005

- Completed airworthiness evaluations of two aging Cessna airplanes, a 402A and 402C, and a teardown evaluation of a T-34A accident aircraft.
- Evaluated and verified methods to assess multiple site damage (MSD).
- Developed the fatigue crack growth database that is used in support of damage tolerance assessments of airframe structure.
- Developed and demonstrated a prototype micro-energy, high-voltage nondestructive test method for inspecting aircraft wiring.
- Completed research to determine the interrelationship of landing gear lateral loads on the body and wing gear during ground turns of FAA's multiple main gear B-747SP aircraft. Results of this research support development of landing gear certification standard.

FY 2004

- Established the FAA Arc Fault Evaluation Laboratory and initiated the evaluation of advanced circuit protection technologies and experiments to quantify damage created by arc fault conditions.
- In cooperation with the industry, developed, validated, and facilitated the adoption of improved inspection procedures for detecting cracks and corrosion in rotorcraft.

- Demonstrated phased array inspection technology for critical engine titanium forgings. Phased array technology reliably detects smaller material flaws in forgings that are used to manufacture critical turbine engine rotating components.

Previous Years

- Developed rotorcraft component damaged part database that will be used to determine the origin and causal factor of rotorcraft structures and component failures.
- Developed and flight-tested aircraft arc-fault circuit breaker (AFCB) prototypes; AFCBs will mitigate the hazardous effects of potentially catastrophic arc-faults.
- Completed several test programs addressing aircraft structural integrity using the Full-Scale Aircraft Structural Test Evaluation and Research Facility. The tests confirmed the ability of advanced computational models developed by FAA and NASA to simulate crack growth and residual strength in panels that have sustained MSD.
- Completed development of Supplemental Structural Inspection Documents for two typical small aircraft, demonstrating the feasibility of maintaining older aircraft to damage-tolerance standards.
- In collaboration with the engine industry, developed and tested new and enhanced inspection technologies for nickel and titanium billet and titanium forgings used in critical engine components.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Evaluate the airworthiness of an aging Raytheon Beech 1900D aircraft.
- Complete destructive and extended fatigue testing of fuselage sections taken from a retired Boeing 727. Analysis and results will support formulation of policy regarding the use and interpretation of the teardown data in applications for continued airworthiness certification.
- Develop and test second-generation (115Volt/3-phase and 28Volt DC) arc-fault circuit breakers; arc-fault circuit breakers reduce the possibility of electrically ignited fires on aircraft.
- Complete a second-phase prototype of magnetic carpet probe for rapid and wide area inspection of aircraft engine critical rotating components and perform a field evaluation.
- Investigate the suitability of NDI inspection technologies for high reliability detection of small cracks and corrosion in propeller systems.

FY 2008 PROGRAM REQUEST:

Ongoing Activities

The FY 2008 funding request will support FAA aging aircraft research requirements that contribute to FAA's aviation safety goal. The program will continue its focus on developing technologies, technical information, procedures, and practices that help ensure the safety of aircraft structures and systems in the civil aircraft fleet. Research will continue for the development of damage tolerance methods and health and usage monitoring systems for rotorcraft. Research will continue on the development and evaluation of risk assessment and risk management methods for the continued operational safety of commuter aircraft. Researchers will also continue efforts on engine airworthiness, propeller damage tolerance, and safety of flight controls.

The focus will shift toward composite structures in the structural integrity and nondestructive inspection research projects. Large-scale usage of composite structures is growing and the FY 2008 request will support the research and development of data, analysis methods, and technologies to assure the long-term safety of these structures.

New Initiatives

The program will begin new research to investigate issues related to the application of damage tolerance to emerging structural technologies, such as unitized structures, castings, and welded joints.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Initiate research on the long-term airworthiness of emerging materials, fabrication and repair techniques for these materials, and advanced design concepts of next generation aircraft structures.
- Complete the Advanced Risk Assessment Tool for conducting hazard analysis of aircraft electrical interconnect systems. The risk assessment tool uses a probabilistic method of EWIS risk assessment supporting compliance with FAR 25.1309 risk assessment requirements.
- Complete installation of arc-fault circuit breakers on all aircraft participating in the arc-fault circuit breaker implementation and evaluation research project.
- Continue to assess certification process of HUMS ground-based station system and validate flight regime recognition using AC-29-2C, Section MG-15. Develop or revise HUMS advisory circular guidance in accordance with research results.
- Complete operational loads characterization of the B-737/700 (transports) and B-767 (cargo) airplanes in typical operations including profiles of altitudes, airspeeds, accelerations, ground-air-ground cycles, and kinematics of flight and ground operations. Data from this research will be used to assess the currency of certification and design assumptions used in aircraft certification.
- Assess the performance of traditional and emerging inspection systems to determine the limits of damage detection in thick, laminated aircraft structure.
- Evaluate thermal acoustic technology as potential replacement for fluorescent penetrant inspection (FPI) for critical engine components.
- Develop standard propeller load spectrum to support propeller damage tolerant design methodologies.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	356,388
FY 2007 Request	18,621
FY 2008 Request	14,931
Out-Year Planning Levels (FY 2009-2012)	59,287
Total	449,227

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Contracts:					
Aging Aircraft	15,633	13,852	14,881	14,211	10,665
Personnel Costs	4,478	4,609	4,631	4,159	3,946
Other In-house Costs	387	537	295	251	320
Total	**20,498**	**18,998**	**19,807**	**18,621**	**14,931**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	20,498	18,998	19,807	18,621	14,931
Development (includes prototypes)	0	0	0	0	0
Total	**20,498**	**18,998**	**19,807**	**18,621**	**14,931**

A11.e. - Aging Aircraft Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
065-110 Aging Aircraft							
Structural Integrity and Inspection Systems Research	**$2,724**						
Develop a fatigue loads handbook for FAR Part 25 transport category aircraft		◆	◇	◇			
Complete extended fatigue testing of fuselage sections from a retired Boeing 727		◆					
Initiate research on application of damage tolerance methods to emerging structural technologies			◇	◇			
Evaluate the airworthiness a Raytheon Beech 1900D of commuter aircraft		◆					
Evaluate risk-based fleet management methods for small-airplane continued operational assessment		◆	◇	◇	◇	◇	
Assess operational loads characteristics of Boeing 737/700 and 767 aircraft		◆	◇				
Assess damage detection of traditional and advanced inspection for thick, aircraft laminates		◆	◇				
Assess the effect of FPI process variables on inspection performance and reliability				◇			
Develop and validate a model-assisted methodology to predict inspection reliability data					◇		
Assess performance of in-situ damage detection technologies for inspection of remote and inaccessible areas in aircraft		◆	◇	◇	◇	◇	
Assess performance of advanced inspection systems to determine strength of bonded aircraft structures		◆	◇	◇	◇	◇	◇
Rotorcraft Structural Integrity and Safety	**$4,105**						
Develop rotorcraft damage tolerance methodologies and standards to establish guidance for certification		◆	◇	◇	◇	◇	◇
Assess certification process for HUMS ground-based station and validate flight-regime recognition		◆	◇	◇	◇	◇	◇
Continued Airworthiness of Aircraft Engines	**$2,942**						
Evaluate thermal acoustic technology as a potential replacement of FPI for critical engine components		◆	◇	◇			
Develop prototype magnetic carpet probe for inspection of critical rotating engine components		◆					
Investigate suitability of NDI technologies for detection of small cracks and corrosion in propeller systems		◆	◇	◇			
Develop standard propeller load spectrum for damage tolerant design methodologies		◆	◇				
Continued Airworthiness of Aircraft Systems	**$894**						
Develop and test 2nd generation arc-fault circuit breakers and continue aircraft installation and test		◆					
Install arc fault circuit breakers on participating aircraft			◇				
Complete advanced risk assessment tool for aircraft electrical systems		◆	◇				
Assess EWIS separation and segregation standards and develop advisory guidance		◆	◇	◇	◇		
Personnel and Other In-House Costs	**$4,266**						
Total Budget Authority	**$14,931**	**$18,621**	**$14,931**	**$14,683**	**$14,688**	**$14,903**	**$15,013**

◆ - Activities Accomplished ◇ - Activities Planned

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

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A11.i.	Air Traffic Control/Technical Operations Human Factors	$10,254,000

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

Intended Outcomes: The Air Traffic Control/Technical Operations (ATC/TO) Human Factors Program supports FAA strategic goals for increased safety, greater capacity, and organizational excellence by developing research products and promoting the use of those products to meet the future demands of the aviation system. The program also addresses operational improvements in JPDO Segments 2-4 slated for development and implementation in 2010-17. This research will examine the roles of controllers and maintainers at increased capacity levels and how those roles are best supported by allocation of functions between human operators and automation. The ATC/TO program generates requirements for human interface characteristics of the next generation of air traffic workstations. It is enhancing our understanding of the role that ATC supervisors play in mitigating operational errors. The program is also providing material to reduce incidents associated with the performance of controllers, system maintainers, and others who fill important safety roles. In addition, researchers are determining effective methods to present weather information to air traffic specialists for severe weather avoidance, developing methods to select controllers so that the applicant screening process is valid, reliable, and fair, and improving human-system integration in a manner that allows controllers to manage an increased number of aircraft in a sector while reducing task loading.

The research program works to improve system safety by:

- Developing:
  - System safety tools for use by human factors practitioners and safety analysts to proactively identify human error hazards during early stages of acquisition and procedure development.
  - New methods to identify complex airspace that may contribute to operational errors.
  - Organizational changes to transform the Technical Operations ATO safety culture.
  - Effective methods to present weather information to air traffic specialists for severe weather avoidance.
- Improving:
  - Supervisory best practices so that first-line supervisors can implement effective methods that suppress the rate of operational errors and reduce the severity of errors that do occur.
  - Methods to select controllers so that the applicant screening process is valid, reliable, and fair.

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

- Developing:
  - Integrated workstations that allow the air traffic service provider to meet the increased demand for services with a reduced staffing level.
  - Methods to assess the value of proposed changes to workstations to determine if human-in-the-loop performance is enhanced to the required level.

  - Advanced workstation concepts for virtual towers (introduced by the NextGen Concept of Operations) as a method to use automation to increase services, increase capacity, and decrease the cost of air traffic services.
- Improving:
  - Human-system workstation integration in a manner that allows air traffic service providers and pilots to effectively manage traffic loads to efficiently move air traffic in the NAS.
  - Roles and responsibilities between air traffic service providers and pilots as technology evolves to meet future demands.

Agency Outputs: The Air Traffic Control/Technical Operations Human Factors Research Program provides leadership and products to motivate the evolution of the NAS to assure that the human component of the system will reliably perform to meet the needs of the flying public.

Outputs include:

- Air traffic workstations and concepts that increase productivity of the workforce by identifying key workload factors that must be mitigated to enable the humans in the system to manage the traffic flow in the future NAS.
- Evaluations of candidate technologies that purport to provide a specified human-in-the-loop performance level or safety benefit when used by the ATO workforce.
- Transformation of the ATO safety culture through research in the Technical Operations community to identify the effective interventions that are needed to move the ATO toward a Just Culture.
- Personnel selection criteria to enhance the efficiency and effectiveness of the screening process for air traffic controllers.

Research Goals:

- By FY 2009, complete the first stage of development of a future en route workstation to increase controller productivity and sector capacity.
- By FY 2009, identify the efficient use of automation and the sharing of responsibilities with users of the NAS, such as pilots and dispatchers.
- By FY 2012, improve the design of computer-human interfaces to reduce information overload and resulting errors.
- By FY 2012, assess cognitive and contextual factors to improve operator performance and reduce errors.
- By FY 2012, apply program-generated knowledge of human factors to improve selection and training of aviation system personnel.

Customer/Stakeholder Involvement: The ATC/TO Human Factors research program receives requirements from its internal FAA sponsoring organizations, primarily from the following FAA Air Traffic Organization Air Traffic/Technical Operations research groups:

- *Advanced Air Traffic Systems Requirements Group* – operational personnel and systems developers from the En Route and Terminal Service units as well as System Engineering in Operations Planning articulate human factors research requirements for measuring the benefits of proposed technologies to controllers and maintainers. Beginning in FY 2006 the Flight Standards and Aircraft Certification organizations in FAA were invited to participate in the definition of research requirements associated with air-ground integration as FAA moves toward a future vision of the NAS.

- *Individual and Team Performance Requirements Group* – The Safety, En Route, Terminal, Technical Operations and System Engineering functions participate to identify human performance research needs involving safety culture, human error hazard identification, age, operational errors, runway incursion prevention, and employee attitudes. The Safety Integrated Product Team of the JPDO participated in this requirements group in 2006.
- *Technical Operations Research Group* – The Technical Operations, En Route, and Terminal service areas recommend research for operation and maintenance of the NAS infrastructure including specification of displays, controls, and maintainability features of ATC systems.
- *Personnel Selection Research Group* – Human Resources, Workforce Services, Workforce Development, and the financial services groups address personnel selection and retention including the ability to successfully screen applicants for controller positions, and the need to reduce training cost and time.

R&D Partnerships:

- Collaborative research with NASA includes the identification of human factors air-ground integration research issues in the future NAS as technology brings changes to capabilities in the flight deck.
- Collaboration with EUROCONTROL includes participation in semi-annual Air Traffic Management (ATM) Seminars and participation in ATM Safety Research symposiums.
- Program personnel represent the agency in the Normal Operations Safety Survey Study Group of the International Civil Aviation Organization.
- Grants are in place with Massachusetts Institute of Technology (MIT), St. Louis University, and the University of Texas.

Accomplishments: Program highlights include:

FY 2006

- Explored the limitations in human performance during routine air traffic control scenarios to find the workload limits of controllers using current technology and procedures to determine when traffic growth will exceed human factors limits.
- Completed an initial effort to transform safety culture in the ATO work force.
- Initiated data collection to update the anthropometric database to guide the ergonomic design of maintenance workstation.
- Developed a human factors design standard for alerts and alarms in the maintenance domain.
- Initiated development of an alternative form of pre-screening for air traffic controller job applicants that are selected to take the Air Traffic Selection and Training (AT-SAT) test battery.
- Initiated a task analysis of the tower controller duties and functions to enhance the method of selecting candidates for the terminal training option.

FY 2005

- Completed performance analyses of proposed en route display systems to determine if projected savings in controller time and errors was achievable.
- Performed a simulation that assessed the benefits of improved weather displays in the terminal environment for severe weather avoidance and demonstrated a potential 6 percent to 10 percent capacity enhancement.
- Developed a method for human error hazard analysis for use in the early investment analysis stages to include the risk of human error in the early requirement and decision process.

- Developed a safety audit method for air traffic controllers to manage risk during normal operations.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Conduct an analysis of human performance benefits in terms of safety and capacity when using enhanced weather products, such as storm movement and turbulence, at the en route controller's workstation.
- Conduct an advanced integrated workstation assessment.
- Develop initial requirements for an advanced TRACON workstation that will increase capacity by at least 30 percent.
- Assess human factors aspects of tower electronic flight data handling to reduce tower staffing and workload.
- Assess changes to oceanic automation and procedures to meet increased traffic demands of 2015.
- Complete the development of supervisory best practices to reduce operational errors.
- Complete the first stage of transforming the safety culture of the Technical Operations organization and assess the effectiveness of interventions.
- Develop a tool for human error safety risk management during the early stages of system development, investment analysis, and requirements development.
- Continue data collection for the database of anthropometric measurements of the ATO work force.
- Complete a human factors design specifications/standard applicable to Technical Operations workstations.
- Initiate research to identify and mitigate human factors issues intrinsic to reliability centered maintenance practices.
- Develop human factors aspects of ATC system outage and human error reporting.
- Complete the validation of a method to assign applicants to tower versus radar training.
- Develop successful ATCS applicant profile.
- Conduct AT-SAT longitudinal validation.
- Assess impact of new technology on selection and training.
- Analyze training data to determine the effectiveness of AT-SAT for the initial block of controller applicants and graduates of the Collegiate Training Initiative.

FY 2008 PROGRAM REQUEST:

The program will continue to provide research that addresses human performance issues in the acquisition, design, operation, and maintenance of ATC systems over the next several years. The development of human factors concepts for future air traffic workstations and proactive analysis of human error causal factors continue to be the focus of a substantial portion of this research program.

Advanced Air Traffic Systems

- Defining the characteristics of methods to reduce controller workload to eliminate performing tasks that are essential, but do not contribute to the central mission of controlling air traffic to achieve near-term gains in productivity and capacity.
- Exploring methods to achieve mid-term gains in capacity by simulating traffic loads predicted for the 2015 period and assessing how automation methods contribute to the capacity goal.

Individual and Team Performance

- Continue work in human error analysis and reporting by expanding the application of research in the transformation of the ATO safety culture.

Advanced Technical Operations (TO) Systems

- Assessing methods to reduce the potential for human error in system operations.
- Design, develop, and implement training systems and job aids that reduce the amount of time that technicians spend away from their job in training.

Personnel Selection and Training

- Continue to refine air traffic selection processes using the results of the updated Job Task Analysis activities to derive measures of controller performance for use in selection, training, and system development.
- Provide guidelines so that instructional strategies used match task demands.
- Provide principles and guidelines for the design, development and delivery of e-learning training.
- Perform a strategic job task analysis based on the NextGen Concept of Operations to determine the knowledge, skills and abilities that will be needed by service providers in the future NAS.
- Determine the required changes to the selection process to screen air traffic service provider applicants.

Initiatives

For NextGen new technologies, this research will focus on the terminal portions of the system particularly the Tower domain. The NextGen Concept of Operations introduces Automated Virtual Towers (AVT) and Staffed Virtual Towers (SVT) as a method to use automation to increase services, increase capacity in response to changes in demand, and decrease the cost of air traffic services. The research will address virtual towers:

- Perform an analysis to determine the level of service needed at airports served by virtual towers.
- Determine the air-ground integration issues to assure that aircraft and airmen can operate successfully and safely in the airport environment when virtual towers are providing services.
- Develop the advanced workstation concept for virtual towers (AVT and SVT) to assure that the service provider has the appropriate information to provide the required level of service and safety at the remote airport. In particular, determine the surveillance and visual display requirements to manage the safety risk of runway incursions and provide separation services.
- Plan and prepare for simulations of virtual tower concepts to determine the displays, controls, communication needs, surveillance information, and flight data information required to provide the services and assure safety at airports served by a SVT.
- For all terminal service providers, determine the weather information requirements and display needs to assure that aircraft avoid hazards such as storms, icing, and low ceilings and visibility when the aircraft or airmen are not properly equipped to encounter these conditions.
- Perform a human error safety risk analysis (HESRA) of the hazards associated with the pilot and service provider interaction with the AVT.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

Advanced Air Traffic Systems

- Initiate assessment of an advanced integrated single-person en route workstation with the automation characteristics that are appropriate for the traffic loads and characteristics of the future NAS including unmanned aircraft and autonomous flights.
- Assess the potential for grouping aircraft in a sector to reduce communications and visual workload as a means to advance toward the goal of increased capacity and safety compatible with performance-based ATM concepts.
- Complete a study of the use of advanced weather products for tactical use at the en route controller workstation to determine the effects on capacity and safety including aircraft accidents.
- Complete initial human factors aspects of virtual tower integrated tower displays to reduce costs and increase services to airports in the NAS.
- Complete a plan to evaluate the virtual tower concept for various levels of service for small, medium and large airports.
- Conduct investigations of human factors concepts for standard automation platforms usable by controllers in converging TRACON and en route domains.

Individual and Team Performance

- Assess the effects of interventions at facilities applying techniques to improve and transform safety culture in the TO work force.
- Develop a tool for human error safety risk management during the early stages of system development, investment analysis, and requirements development.

Advanced Technical Operations (TO) Systems

- Deliver a human factors specification/standard for the design of TO workstations.
- Develop criteria for TO system design to reduce the probability of human error.
- Complete study on reliability-centered maintenance.
- Develop human factors aspects of outage and human error reporting.

Personnel Selection

- Deliver a set of ATCS performance metrics for terminal controllers to be used in development of the controller training and evaluation process.
- Deliver the results of the strategic job task analysis to determine if changes to technology and operation of the NAS will demand a change to the selection and training of air traffic service providers.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	152,451
FY 2007 Request	9,654
FY 2008 Request	10,254
Out-Year Planning Levels (FY 2009-2012)	42,429
Total	214,788

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Contracts:					
Air Traffic Control/Airway Facilities Human Factors	2,747	2,756	4,234	4,130	4,587
Personnel Costs	4,445	4,765	5,079	5,285	5,443
Other In-house Costs	1,654	1,870	245	239	224
Total	**8,846**	**9,391**	**9,558**	**9,654**	**10,254**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	8,846	9,391	9,558	9,654	10,254
Development (includes prototypes)	0	0	0	0	0
Total	**8,846**	**9,391**	**9,558**	**9,654**	**10,254**

A11.i. – Air Traffic Control/Technical Operations Human Factors Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
082-110 Air Traffic Control/Technical Operations Human Factors							
Advanced Air Traffic Systems	**$1,842**						
Conduct an advanced integrated workstation assessment		◆	◊	◊	◊	◊	
Develop workstation concept for staffed and automated virtual towers			◊	◊	◊	◊	
Develop weather information requirements for en route		◆	◊				
Assess HF aspects of tower electronic flight data handling		◆	◊				
Develop HF display concepts for converging en route and terminal		◆	◊	◊	◊	◊	◊
Individual and Team Performance	**$1,309**						
Develop human error safety risk tool		◆	◊	◊			
Increase the number of facilities applying techniques to transform safety cultures in the work force		◆	◊	◊			
Technical Operations	**$760**						
Complete the human factors study of reliability-centered maintenance		◆	◊	◊	◊	◊	
Develop TO HF design specifications		◆	◊				
Develop HF aspects of outage and human error reporting		◆	◊	◊			
Personnel Selection	**$676**						
Assess personnel selection and training requirements for the future NAS			◊	◊	◊	◊	
Develop successful ATCS applicant profile		◆	◊	◊			
Conduct AT/SAT longitudinal validation		◆	◊	◊	◊	◊	◊
Assess impact of new technology on near-term selection and training		◆	◊	◊			
Personnel and Other In-House Costs	**$5,667**						
Total Budget Authority	**$10,254**	**$9,654**	**$10,254**	**$10,324**	**$10,471**	**$10,715**	**$10,919**

◆ - Activities Accomplished ◇ - Activities Planned

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

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A11.f.	Aircraft Catastrophic Failure Prevention Research	$2,202,000

Supports FAA Strategic Goal: Increased Safety.

Intended Outcomes: The Aircraft Catastrophic Failure Prevention Program supports FAA's strategic goal of increasing aviation safety by reducing the number of fatal accidents from uncontained engine failures and engine malfunctions. The program supports FAA's 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. Its researchers assess the use of advanced materials to protect aircraft critical systems and passengers in the event of catastrophic engine failures. The program also uses historical accident data and National Transportation Safety Board recommendations to examine and investigate:

- Turbine engine uncontainment events, including the mitigation and modeling of aircraft vulnerability to uncontainment parameters stated in Advisory Circular (AC) 20-128, Phase II.
- Propulsion malfunction indications in response to Aerospace Industries Association (AIA) recommendations and proposed solutions.

Agency Outputs: With technical data from the Aircraft Catastrophic Failure Prevention Program, FAA establishes certification criteria for aircraft and revises regulations to certify new technologies. The agency also publishes ACs to outline acceptable means for meeting these rules. The program's objective is to ensure safe aircraft operation in the public domain.

Research Goals: To reduce the number of fatal accidents from uncontained engine failures, the program develops data and methods for evaluating aircraft vulnerability to uncontained engine failures and provides analytical tools for protecting identified critical systems that may need shielding from uncontained engine debris. Through the LSDYNA Aerospace Users Group, FAA is working with industry to establish standards for finite element analysis and guidance for use in support of certification.

- By 2010, develop a modular Uncontained Engine Debris Damage Assessment Model (UEDDAM) (version 4) to be compatible with Department of Defense code upgrades for supportability and incorporate industry recommended improvements.
- By 2012, develop revised guidance for fuselage protection from uncontained engine failure fragments that includes multiple fragment analysis.

In the area of propulsion malfunctions, the program develops guidance on the symptoms that can be expected when malfunctions occur and evaluates the ability of available technologies to detect and annunciate the malfunctions to the flight crew. An important factor is to identify which engine is malfunctioning so that in the event of a commanded engine shutdown, the crew will not mistakenly shut down a good engine.

- By 2009, conduct a propulsion indication system demonstration bench test that will combine the sustained thrust anomaly recommendations with the engine damage recommendations into a complete indication system.
- By 2011, conduct propulsion indication system simulator flight evaluation to provide a visualization of the cockpit indication in the flight environment.

Customer/Stakeholder Involvement: The program collaborates with a broad cross section of the aviation community, including:

- Subcommittee on Aircraft Safety of the FAA Research, Engineering and Development Advisory Committee – representatives from industry, academia, and other government agencies annually review the program's activities.
- Technical Community Representative Groups – FAA representatives apply formal guidelines to ensure that the program's research projects support new rule making and development of alternate means of compliance with existing rules.
- The Aviation Rulemaking Advisory Committee (ARAC) – helps to ensure the effectiveness of the Agency's rule making. Members of the subcommittee and full committee identify research requirements, priorities, and provide guidance for the update of documents such as AC20-128, and encourage 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.

R,E&D Partnerships: The Aircraft Catastrophic Failure Prevention Program partners with industry and other government agencies including:

- The National Aeronautics and Space Administration (NASA) and industry in support of the development and validation of explicit finite element analysis. The industry participates in the LSDYNA Aerospace Users group to support quality control reviews of the code and also critique research objectives in material testing, model development and verification. NASA and FAA are teamed to develop high quality test data and analytical models that support the Aerospace Users Group efforts. The end goal is to develop guidance for the use of LS-DYNA in the certification process.
- The AIA Transport Committee, with participation of FAA and industry, has examined propulsion system malfunctions, identified inappropriate crew response, and recommended development of specific regulations and advisory materials to correct safety hazards. AIA has completed some preliminary efforts on propulsion issues with implications for follow-on ARAC work on FAR 25.1305.

Accomplishments: Results of Aircraft Catastrophic Failure Prevention Program research provide the technical basis for FAA rule changes and new or modified ACs. Researcher results are also provided to airframe and engine manufacturers and designers.

Engine Uncontainment Research

FY 2006

- Delivered the UEDDAM, version 3.0, for evaluation of uncontained engine debris hazards to aircraft. UEDDAM uses a Monte Carlo approach to perform the vulnerability analysis in design cases where the released multiple fragments are analyzed.
- Conducted a workshop for the Department of Defense and ARAC on UEDDAM in November 2005.

FY 2005

- Developed fabric attachment data and designs for fuselage shielding. Fabric material models were used to design full-scale shields to be tested in an aircraft fuselage.
- Completed full-scale fabric shielding demonstration test of various fabric attachment designs in a retired commercial airplane at Naval Air Warfare Center (NAWC), China Lake.

FY 2004

- Developed test data using spherical projectiles on aluminum, Lexan and composites, then evaluated material model ability to accurately predict the results.
- Conducted a workshop for engine certification engineers on non-linear finite element modeling of turbine engine containment systems at the Los Angeles Aircraft Certification Office (ACO).

Previous Years

- 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.
- Developed test data and improved analytical modeling of fabric shielding with revision to the fabric material model.
- Conducted a workshop for engine certification engineers on non-linear finite element modeling of turbine engine containment systems at the Boston ACO.
- Developed a significant database of small and full-scale test data to understand the interaction of multiple ballistic fabric layers in engine fan blade out containment systems.
- Completed a mitigation test for debris damage to pressurized fuel lines inside the aircraft due to an uncontained engine failure; prototype power panels showed promise.

Propulsion Malfunction

In FY 2005

- Completed detailed study of propulsion malfunctions classified as Sustained Thrust Anomalies. Research developed a set of indications that can be added to the flight deck as indications and annunciations to inform the crew that a malfunction exists on a specific engine.

In FY 2003

- Completed an in-depth analysis of 80 in-service propulsion system malfunctions and developed recommendations for potential propulsion indication improvement.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

Engine Uncontainment Research

- Continue FAA/NASA/industry sponsored quality control program for modeling aircraft problems in the manufacturer's supported finite element code (LSDYNA).
- Complete testing and modeling of fabrics used in gas turbine engine containment systems. Test results will be compared with analytical results from fabric model version three.
- Complete testing and material model development for aluminum using the Johnson-Cook formula. Continue development of material model for titanium and composites.
- Develop an oversight process for LSDYNA that ensures consistent results as computers and programs continue to evolve.

Propulsion Malfunction

- Complete study on engine mechanical damage, identify what propulsion malfunction indications are possible, and develop recommendations for evaluation of future cockpit displays.

FY 2008 PROGRAM REQUEST:

Ongoing Activities

Uncontained engine failure mitigation research will continue to develop vulnerability models. The FY 2008 effort will evaluate improved penetration equation constants for aircraft structure and develop a tutorial for how to use the suite of tools developed for uncontained engine failure mitigation. Research will continue on the NASA/FAA quality control program for modeling aircraft engine failures in LSDYNA. George Washington University will support development of guidelines and validated generic aerospace models that verify various portions of the code with sample problems. This effort is also developing a workshop series for aerospace users as part of the bi-annual LSDYNA users conference.

Propulsion Indications work in FY 2008 will develop the combined requirements from the previous studies and begin to develop a demonstration system. This work will combine the sustained thrust anomaly engine malfunction study results with the mechanical engine damage study results into a comprehensive demonstration.

New Initiatives

No new initiatives are planned in FY 2008.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

Engine Uncontained Research

- Continue FAA/NASA/industry sponsored quality control program for modeling aircraft problems in the manufacturer's supported finite element code (LSDYNA).
- Improve material models for incorporation into the LSDYNA model that are verified and accepted by the aerospace users group as standardized models.

Propulsion Malfunction

- Combine propulsion malfunction indication recommendations from previous studies and begin design of the demonstration bench test system that will evaluate system level performance of the indication strategies.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	32,360
FY 2007 Request	1,512
FY 2008 Request	2,202
Out-Year Planning Levels (FY 2009-2012)	8,684
Total	44,758

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Contracts:					
Aircraft Catastrophic Failure Prevention Research	259	833	2,703	947	1,684
Personnel Costs	468	241	566	533	482
Other In-house Costs	31	33	37	32	36
Total	**758**	**1,107**	**3,306**	**1,512**	**2,202**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	758	1,107	3,306	1,512	2,202
Development (includes prototypes)	0	0	0	0	0
Total	**758**	**1,107**	**3,306**	**1,512**	**2,202**

A11.f. - Aircraft Catastrophic Failure Prevention Research Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
066-110 Aircraft Catastrophic Failure Prevention Research							
Engine Uncontainment Research	**$842**						
Continue FAA/NASA/industry sponsored quality control program for modeling aircraft problems in the manufacturer's supported finite element code (LSDYNA)		◆	◊	◊	◊	◊	◊
Complete testing and modeling of fabrics used in gas turbine engine containment systems		◆					
Complete testing and material model development for aluminum using Johnson Cook formula		◆					
Develop an oversight process for LSDYNA that ensures consistent results as computers and programs continue to evolve		◆					
Develop improved material models for use in LSDYNA model that are verified and accepted as standardized models			◊				
Develop modular UEDDAM Code (version 4)					◊		
Develop revised guidance for protection from uncontained engine failure with multiple fragment analysis							◊
Propulsion Malfunction	**$842**						
Develop propulsion malfunction indications for engines with mechanical damage		◆					
Begin design of the demonstration bench test system			◊				
Develop propulsion indication system demonstration bench test				◊			
Conduct propulsion indication simulator flight evaluation						◊	
Personnel and Other In-House Costs	**$518**						
Total Budget Authority	**$2,202**	**$1,512**	**$2,202**	**$2,158**	**$2,153**	**$2,181**	**$2,192**

◆ - Activities Accomplished ◇ - Activities Planned

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

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

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

Intended Outcomes: The Airport Cooperative Research Program (ACRP) was mandated by Congress in the 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 began operations on September 26, 2005, after a Memorandum of Agreement (MOA) was signed between the FAA, which funds the program, and the National Academy of Sciences, acting through its Transportation Research Board (TRB), which administers the program. The ACRP Oversight Committee (AOC), an independent governing board composed of airport managers and other aviation officials appointed by the Secretary of Transportation, selects all of the program's research projects. The ACRP undertakes research and other technical activities in a variety of significant airport issues involving operations, design, construction, engineering, maintenance, human resources, administration, policy, planning, environment, safety, and security. This research will lead to continual improvements in airport safety, capacity, and efficiency.

Agency Outputs: The nature of airport problems requires ACRP research to have products specifically tailored to obtain maximum effectiveness.

Standard research projects are relatively low cost studies lasting one to two years resulting in original research that can be published as a report, guidebook, multimedia disk (CDs and DVDs), computer software, informational pamphlet, and/or a presentation.

Special research projects are conducted in areas of specific interest to the airport community, of which there are currently three main areas: Legal aspects of airport programs; Quick response studies for special needs; and Synthesis of information related to airport problems. The products of this special research will generally be in the form of legal briefs or short reports (40-60 pages) intended to capture and consolidate information or practices currently in use by the airport industry.

All ACRP research products are published and distributed through the National Academies and TRB.

Customer/Stakeholder Involvement: The ACRP benefits from the cooperation and participation of airport professionals, air carriers, shippers, state and local government officials, equipment and service suppliers, airport users, educational institutions, and other research organizations. These groups are solicited annually by the TRB for research topics and industry concerns. Representatives from these organizations also serve on the AOC where they help select ACRP research projects. Federal representation on the AOC is comprised of the FAA, along with NASA and the Environmental Protection Agency (EPA). The aviation industry is further represented on the AOC through the participation of the following groups: the Airports Council International (ACI), the American Association of Airport Executives (AAAE), the National Association of State Aviation Officials (NASAO), and the Air Transport Association (ATA).

Accomplishments: Program efforts during the first year have been focused on project initiation:

- 9/05: TRB solicitation for research projects, 120 proposals received.
- 1/06: First meeting of the AOC, 17 standard and 12 special research projects initiated
- 5/06: Technical panel meetings for FY06 projects.
- 7/06: Second AOC meeting, 17 standard and 12 special research projects initiated
- 11/06: Technical panel meetings for FY07 projects.

Total: 58 research projects initiated

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.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- 01/07: Third AOC meeting.
- 07/07: Fourth AOC meeting.
- Publication of Project 11-03(S01-01) Innovative Finance for Alternative Sources of Revenue for Airports.
- Publication of Project 11-03(S03-01) Aviation Forecasting Techniques.
- Publication of Project 11-03(S03-02) Airport Ground Access/Egress Mode Choice Models.
- Publication of Project 11-01(T3) Compilation of Airport Law Resources.
- Publication of Project 11-02(T1) Model for Improving Energy Use in U.S. Airport Facilities.
- Publication of Project 11-02(T2) Airport Ground Access: Updating and Building Upon the Work of TCRP Reports 62 and 83.
- Publication of Project 11-02(T3) Improving Stabilization and Use of Aircraft Evacuation Slides at Airports.

FY 2008 PROGRAM REQUEST:

Vision 100 authorized $10 million per year for the ACRP. $10 million was appropriated in FY 2007. In FY 2008, the FAA has requested $10 million for the ACRP as part of the Airport Improvement Program.

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.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

TRB published reports documenting the airport research to be conducted.

- Publication of Project 1-01 Guidebook for Managing Small Airports.
- Publication of Project 2-02 Managing Runoff from Aircraft and Airfield Deicing and Anti-Icing Operations.
- Publication of Project 2-03 Airport-Related Hazardous Air Pollutants Analysis.
- Publication of Project 2-04 Research Needs Associated with Particulate Emissions at Airports.
- Publication of Project 3-02 U.S. Airport Passenger-Related Processing Rates.
- Publication of Project 3-04 Guidebook for Airport-User Survey Methodology.
- Publication of Project 4-01 Aircraft Overrun and Undershoot Analysis for Runway Safety Areas.

- Publication of Project 4-02 Lightning-Warning Systems for Use by Airports.
- Publication of Project 5-01 Guidance for Developing Regionally Coordinated Airport Emergency Plans for CBRNE Events.
- Publication of Project 7-01 New Concepts for Airport Terminal Landside Facilities.
- Publication of Project 7-02 Airport Curbside and Terminal-Area Roadway Operations.
- Publication of Project 9-01 Guidelines for the Collection and Use of Geospatially Referenced Data for Airfield Pavement Management.
- Publication of Project 10-02 Planning Guide for Offsite Terminals.
- Publication of Project 11-01(T1) Compilation of Digest - Parts 13 and 16 Determinations and Related Documents.
- Publication of Project 11-01(T2) Theory and Law of Airport Revenue Diversion.
- Publication of Project 11-01(T4) Survey of Airport Laws and Regulation of Commercial Ground Transportation.
- Publication of Project 11-01(T5) Responsibilities for Implementation and Enforcement of Airport Land-Use Zoning Restrictions.
- Publication of Project 11-01(T6) Who is the owner or Operator for Purposes of the Right to Self-Fuel?
- Publication of Project 11-01(T7) The Impact of Airline Bankruptcies on Airports.
- Publication of Project 11-01(T8) The Law and Regulation of Airport Ownership.
- Publication of Project 11-01(T9) Survey of Elements of Disparity Studies for Airport Disadvantaged Business Enterprise Programs.
- Publication of Project 11-02(T4) Overview of Airport Safety Management Systems - Definition and Status.
- Publication of Project 11-02(T5) Quarantine Facilities for Arriving Air Travelers: Identification of Planning Needs and Costs.
- Publication of Project 11-03(S04-01) Safety Management and Security for Small and General Aviation Airports.
- Publication of Project 11-03(S10-01) Aircraft Traffic Operation Counts at Airports.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	9,900
FY 2007 Appropriated	10,000
FY 2008 Request	10,000
Out-Year Planning Levels (FY 2009-2012)	40,000
Total	69,900

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Contracts:					
Airport Cooperative Research Program	0	0	9,900	10,000	10,000
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
Total	**0**	**0**	**9,900**	**10,000**	**10,000**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	0	0	9,900	10,000	10,000
Total	**0**	**0**	**9,900**	**10,000**	**10,000**

Airport Cooperative Research Program Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Airport Cooperative Research Program							
Safety-Related Research	**$5,000**						
Conduct research on selected AOC proposals		◆	◊	◊	◊	◊	◊
Hazardous Air Pollutants Analysis		◆	◊	◊			
Manage/Optimize/Alternative Deicing Fluids		◆	◊	◊			
Particulate Emissions Analysis		◆	◊				
LIDAR Deployment for Obstruction Surveys		◆	◊	◊			
Aircraft Overrun and Undershoot Analysis for RSAs		◆	◊				
Airport Lightning-Warning Systems		◆	◊				
Runway Structure Hazard-Mitigation Analysis		◆	◊				
Training of Emergency Response Personnel		◆	◊	◊			
Developing Airport Safety Management Systems		◆	◊	◊			
Airport Emergency Plans for CBRNE Events		◆	◊				
Improved Civil Aircraft Arresting Systems		◆	◊	◊			
Improving Use of Aircraft Evacuation Slides		◆	◊				
Airport Quarantine Facilities		◆	◊				
Capacity-Related Research	**$5,000**						
Conduct research on selected AOC proposals		◆	◊	◊	◊	◊	◊
Airport Management – Contracts /Software/ Revenue		◆	◊	◊			
Small Airport Management BMPs		◆	◊	◊			
Airport Passenger Movement/Processing Analysis		◆	◊	◊			
Community Attitudes to Aircraft Noise		◆	◊				
Enhancing Airport Land Use Compatibility		◆	◊	◊			
Automated People Mover Systems/Plans/Performance		◆	◊	◊			
Developing Airport Strategic Plans		◆	◊	◊			
Airport Terminal Design		◆	◊				
Airfield Pavement Management		◆	◊	◊			
Parking Technologies at Airports		◆	◊				
Airport Impacts of Very Light Jets		◆	◊	◊			
Airport Legal Issues		◆	◊	◊			
Improving Airport Ground Access		◆	◊	◊			
Aviation Forecasting Techniques		◆	◊				
Aircraft Traffic Operation Counts		◆	◊				
Total Budget Authority	**$10,000**	**$9,900**	**$10,000**	**$10,000**	**$10,000**	**$10,000**	**$10,000**

◆ - 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
AIP	N/A	Airports Technology Research – Capacity	$8,907,000

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

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 (AC) 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, the FAA is using data collected at the facility in developing the pavement design standards that airports throughout the world need to accommodate the 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 FY 2004, completed reconstruction and full-scale traffic testing of three concrete pavement test items at the NAPTF.
- In FY 2005, completed overlay construction at the NAPTF and conducted full-scale traffic testing of three asphalt concrete overlay test sections (rubblized sections as well as conventional overlay).
- Issued Layered Elastic Design (LED) FAA version 1.3, a pavement design-standard software based on NAPTF-generated data, to allow the introduction of the Airbus A380 and other new aircraft into the fleet mix.

- In FY 2006, delivered FAArfield 1.0 (FAA Rigid and Flexible Iterative Elastic Layered Design), a new desktop computer program for pavement thickness design that incorporates 3D finite element models of pavement structures
- Conducted technical workshops in airport pavement design using LEDFAA version 1.3 and the beta version of FAArfield (FEDFAA).
- Maintained an airport pavement database containing 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, located at the Innovative Pavement Research Foundation (IPRF) and Auburn University, to conduct research into concrete and asphalt airport pavement technology.
- In FY 2006, completed the first phase of full-scale testing of concrete-on-concrete overlay pavements at the NAPTF through the IPRF cooperative research program.
- Established a new Interagency Agreement with the U.S. Army Engineer Research and Development Center (ERDC) to cooperate on research projects of interest to both military and civil aviation.
- In FY 2005, released DOT/FAA/AR-04/46, a technical report entitled "Operational Life of Airport Pavements," that addresses the extent to which current FAA thickness design standards for airport pavements conform to the Agency's 20-year life requirement.
- Released ProFAA, a software program that combines an inertial profiler with simulations of the standard outputs from other commonly used devices, to analyze runway smoothness.

R&D Partnerships:

- FAA-U.S. Army ERDC*
- FAA-U.S. Air Force, Tyndall Air Force Base*
- FAA-Center of Excellence for Airport Technology, University of Illinois/Northwestern University**
- FAA-Boeing Company, Cooperative Research and Development Agreement ($7 million Boeing/$21 million total for the 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.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Continue analyzing full-scale data from the NAPTF.
- Coordinate with IPRF on reconstruction of full-scale test items for concrete overlay full-scale traffic tests at the NAPTF.
- Deliver a completed airport pavement thickness design package, including 3D finite element structural models, using FAArfield, an analytical program developed for the Agency.
- Complete a final report on implementing the new 3D finite element models in sensitivity and calibration studies and the development of new design procedures.

- Support development of a web-based MicroPAVER application for airport pavement management.
- Design and fabricate modules for 8-10 wheel gear loading.
- Develop models for airport funding strategies and passenger surveys.

FY 2008 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 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Continue analyzing full-scale data from the NAPTF.
- Publish new airport pavement design procedures based on data from the FAArfield computer program.
- Conduct technical workshops in pavement design using FAArfield.
- Develop conceptual guidelines and computer tools for terminal building design.
- Conduct full-scale traffic tests on flexible pavement test items at the NAPTF.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	40,735
FY 2007 Appropriated	8,503
FY 2008 Request	8,907
Out-Year Planning Levels (FY 2009-2012)	35,628
Total	93,773

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Contracts:					
Airports Technology Research – Capacity	7,750	8,630	7,303	7,185	7,414
Personnel Costs	0	0	1,200	1,318	1,493
Other In-house Costs	0	0	0	0	0
Total	**7,750**	**8,630**	**8,503**	**8,503**	**8,907**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	7,750	8,630	8,503	8,503	8,907
Total	**7,750**	**8,630**	**8,503**	**8,503**	**8,907**

Airports Technology - Capacity Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Airport Technology – Capacity Goal							
Airport Technology - Capacity	**$8,907**						
Continue full-scale testing at NAPTF		◆	◊	◊	◊	◊	◊
Continue analysis of full-scale data from NAPTF; maintain equipment, instrumentation, conduct material testing, develop pavement specifications, demolition and reconstruction activities		◆	◊	◊	◊	◊	◊
Develop advanced airport pavement design procedures; conduct related workshops in development, programming and documentation		◆	◊	◊	◊	◊	◊
Next phase of rigid pavement design, analysis of slab curling, materials characterization, field instrumentation, and continue support of airport technology center of excellence		◆					
Conduct non-destructive pavement testing		◆	◊	◊			
Support development of MicroPaver software		◆	◊	◊	◊	◊	◊
Conduct pavement roughness research		◆	◊	◊	◊		
Operate material testing lab		◆	◊				
Improve paving materials		◆	◊	◊			
Develop conceptual guidelines and computer tools for terminal building design		◆	◊				
Develop models for airport funding strategies, and passenger surveys		◆					
Personnel and Other In-House Costs							
Total Budget Authority	**$8,907**	**$8,503**	**$8,907**	**$8,907**	**$8,907**	**$8,907**	**$8,907**

◆ - Activities Accomplished ◇ - Activities Planned

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

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
AIP	N/A	Airports Technology Research – Safety	$9,805,000

Supports FAA Strategic Goals: Increased Safety, and Greater Capacity.

Intended Outcomes: The FAA conducts safety-related 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; and
- Reduce the negative impact of wildlife on airport safety.

Agency Outputs: Federal law requires the FAA to develop and publish standards and guidance material for airport design, construction, and maintenance. The Agency uses the airport advisory circular (AC) system as its principal means to communicate this guidance 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 and techniques that can improve airport lighting and marking to help reduce surface accidents and runway incursions; improve aircraft rescue and fire fighting to address double decked aircraft carrying up to 800 passengers; and 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: Projects funded under the AIP grants must conform to the FAA ACs or designated standards. AIP grants contribute about half of the approximately $2 billion spent each year to provide operationally safe and reliable airport pavements. 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 the completion of:

- Installation of the Engineered Materials Arresting System (EMAS) long-term durability test bed;
- Final report on anti-icing overlay at Chicago O'Hare during winter operations;
- Final report on a polyurea alternative marking material;
- Evaluation of a prototype foreign object debris (FOD) detection radar at a large airport;
- Report on installation criteria for taxiway centerline lights;
- Evaluation of small airport firefighting systems;
- Demonstrated use of aircraft lighting to make aircraft on the ground more conspicuous; and
- Synthetic turf studies.

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)**.

* 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.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Complete design criteria for an interior intervention vehicle.
- Complete trash transfer station studies.
- Conduct taxiway deviation studies.
- Complete installation of Next Generation High Reach Extendible Turret.
- Evaluate EMAS long-term durability.
- Complete construction of NLA Fire Test Mock Up.

FY 2008 PROGRAM REQUEST:

The Airport Technology FY 2008 research program is a collaborative effort among many government organizations, universities, and industry associations. The requested program funding provides the contract support necessary for an integrated, effective research program that delivers the standards and guidelines for maintaining and enhancing airport infrastructure.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Complete testing of proposed heliport/vertiport lighting standards.
- Complete Canada goose movement study.
- Evaluate effectiveness of a prototype alternative runway groove shape.
- Complete evaluation of a prototype radar-based airport advisory system.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	44,279
FY 2007 Appropriated	9,367
FY 2008 Request	9,805
Out-Year Planning Levels (FY 2009-2012)	39,220
Total	102,671

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Contracts:					
Airports Technology Research – Safety	9,667	3,670	7,685	8,049	8,312
Personnel Costs	0	0	1,200	1,318	1,493
Other In-house Costs	0	0	0	0	0
Total	**9,667**	**3,670**	**8,885**	**9,367**	**9,805**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	9,667	3,670	8,885	9,367	9,805
Total	**9,667**	**3,670**	**8,885**	**9,367**	**9,805**

Airports Technology - Safety Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Airport Technology – Safety Goal							
Airport Technology - Safety	**$9,805**						
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 and FOD radar		◆	◊	◊			
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; new soft ground materials		◆	◊	◊	◊	◊	◊
Continue development of improved methods for handling the NLA		◆	◊	◊	◊	◊	◊
Continue development of wildlife strike mitigation methods		◆	◊	◊	◊	◊	◊
Personnel and Other In-House Costs							
Total Budget Authority	**$9,805**	**$9,367**	**$9,805**	**$9,805**	**$9,805**	**$9,805**	**$9,805**

◆ - Activities Accomplished ◇ - Activities Planned

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

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
ATO Capital	**1A01E**	**Airspace Management Laboratory**	**$4,000,000**

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

Intended Outcomes: The mission of the Federal Aviation Administration's (FAA) Air Traffic Organization (ATO) System Operations – Airspace and Aeronautical Information Management (AIM) 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 aid the ATO in achieving its mission, the Airspace and AIM Laboratory ("Laboratory") provides value to our customers by managing our aeronautical information (AI) chain to supply accurate, high integrity, and timely information that supports safe and efficient air traffic operations. The Laboratory develops advanced decision support tools, databases and information management systems to enable facility-level and national management of the FAA's national airspace system resources. In addition, the Laboratory develops new capabilities that make it easier for FAA customers to operate safely and efficiently in the NAS.

Major categories of activities carried out by the Laboratory include:

- Demonstrating and developing new capabilities to improve the collection, processing and distribution of NAS resources that air traffic control and pilots depend upon to operate safely and efficiently. Efforts in this area include: 1) determining if proposed towers and obstructions pose a hazard to air traffic, 2) evaluating terrain and obstacles to determine the lowest permissible flight level, and 3) developing new concepts for creating and distributing Notices to Airmen (NOTAMs).
- Developing information systems, decision support tools and advanced geo-spatial capabilities to collect, manage and analyze air traffic control operational data such as flight information, flight plans, airspace utilization and navigation structures. These Laboratory products allow the FAA lines of business to evaluate performance metrics, determine fee for service charges (both international over-flights and domestic), and estimate airspace and Air Traffic Control (ATC) benefits from new technologies (e.g., the Next Generation Air Transportation System (NextGen) being managed by the Joint Planning and Development Office (JPDO)).
- Streamlining input, storage and output for FAA AIM systems to ensure the FAA has a single source of high quality data on navigation aids, airspace, communication systems, routes and procedures. The information is used to create customer products such as charts and publications as well as internal FAA products such as NAS modernization/improvement plans, environmental analyses and infrastructure data needed to run the FAA ATC systems (e.g., Host Computer System (HCS), En Route Automation Modernization (ERAM), Standard Terminal Automation Replacement System (STARS), Automated Radar Terminal System (ARTS)).

Customer/Stakeholder Involvement: The Airspace and AIM Laboratory continues to focus on providing value to FAA and its external customers, such as air carriers, airfreight, and general aviation. The Laboratory directly supports the missions of Finance and Cost Accounting, the Office of Financial Services, the Office of Aviation Policy, and the Operational Evolution Plan with performance metrics. 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 – Airspace and AIM, System Architecture and Investment Analysis, System Capacity, Air Traffic Planning and Procedures, En Route, Terminal and Air Traffic System Management. The Laboratory also has provided ongoing support for many NAS improvement projects such as field staffing analyses, airspace management, and noise analyses.

Highlights of Airspace and AIM Laboratory Accomplishments:

Air Traffic Operational Data Information System

- Developed an information management system to collect, quality check and distribute high fidelity air traffic operational data. This system is responsible for NAS performance metrics calculations and supports local, regional and NAS improvement planning. The system enables international over-flight fee collection and is used to evaluate domestic user fee collection scenarios.
  - Continued to expand and improve the quality of the Laboratory's air traffic operational data repository system that collects, stores and distributes information obtained from all FAA air traffic control facilities.
  - Developed new daily metrics reporting system designed to provide the field with feedback through next day performance metrics.
  - Began implementing automation processes to assist with fee for service collections – both international overflights and possible domestic user fees.

Aeronautical Information Management

- Implemented new technology to capture Airport Layout Plan information electronically from airport operators. The systems automate airport survey and airport layout plan collection and processing. Results of this activity will streamline airport arrival and departure procedure development and improve FAA's ability to manage airport improvements.
- Completed research, engineering and outreach to develop international standards for encoding and distributing aeronautical information. Co-led a joint EUROCONTROL and FAA effort to develop and adopt international standards for aeronautical data. Investments in aeronautical data standardization will dramatically reduce risks of future acquisitions and enable global sharing of aeronautical data. The adoption of these standards will lead to cost savings in aeronautical data collection, management and distribution as well as safety improvements resulting from enhanced data quality.
- Demonstrated new computer-based methodologies for constructing and publishing NOTAMs. The new approach leads to significant improvements in NOTAM quality and has the potential to reduce pilot violations of NOTAMs. Specifically, the Laboratory has deployed a Temporary Flight Restrictions (TFR) NOTAM system that improves standardization, readability and accuracy of TFR NOTAMs.
  - Initiated additional digital NOTAMs demonstration activity to digitally encode Airport surface NOTAMs. This NOTAM modernization prototype will further evaluate the risks and benefits of improving the quality of NOTAMs issued to pilots and air traffic control. This is a joint effort with the Air Force Air Mobility Command and the DOD NOTAM operations office.

Obstruction Evaluation and Airport Airspace Analysis

- Deployed new obstruction evaluation capabilities allowing proposed obstructions to be submitted digitally. Continued to automate additional evaluation criteria that enable the FAA to respond with decisions more quickly while ensuring a higher degree of safety for air traffic operations.

- Deployed national infrastructure to support paperless processing of obstruction evaluation cases.
- Deployed a new interface allowing proponents to submit proposed obstructions electronically.
- Began integrating the National Flight Procedures obstruction evaluation processes into the paperless obstruction evaluation system.

Minimum IFR Altitude (MIA) and Minimum Vector Altitude (MVA) Evaluation

- Developed and fielded initial capabilities to automate the design and evaluation of Minimum Instrument Flight Rules (IFR) Altitude (MIA) and Minimum Vector Altitude (MVA) areas for the En Route and Terminal environments. The system identifies the lowest altitudes that air traffic control can safely vector aircraft. Initial field evaluations indicate that analysis errors have been virtually eliminated.
  - Fielded new capabilities in the Sector Design and Analysis Tool (SDAT) to provide field facilities with initial capabilities to automate MIA/MVA area design and evaluation.
  - Conducted five En Route (Air Route Traffic Control Center -ARTCC) field evaluations that demonstrated the value of automating MIA and MVA analysis.

Airspace System Issue Identification and Operations Research

- Analyzed, and allowed the user to visualize, past and current traffic patterns.
- Analyzed system performance data, such as the results of 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.
- Evaluated traffic volume levels for system performance and capacity studies, such as a traffic volume evaluation at STARS facilities to estimate bandwidth requirements.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Providing analytical, decision support and operations research support to the FAA lines of business and external customers.
- Developing additional digital NOTAM prototype to encode airport surface NOTAMs and to distribute plain language NOTAMs to pilots.
- Investigating issues involved in modernizing FAA's aeronautical information distribution processes with external governmental and non-governmental customers.
- Releasing Aeronautical Information Exchange Model (AIXM) international data standard for use by the global aviation community. Continuing AIXM outreach efforts with industry and customers.
- Improving Minimum Vector Altitude and Minimum IFR Altitude design capabilities of SDAT and automating the process of submission and approval of new designs.
- Integrating airport layout plan and survey data into FAA's aeronautical information system repository.
- Supporting fee for service calculations and delivering additional performance metrics capabilities to the field and national FAA lines of business.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Demonstrate prototype digital airport surface NOTAM solution that automates NOTAM creation, storage and delivery. Develop future distribution system with trusted partners such as the United States Air Force.
- Automate obstruction evaluation by ensuring Minimum Vector Altitude and Minimum IFR Altitude areas are not penetrated by proposed obstacles.
- Automate obstruction evaluation by ensuring terminal procedures are not affected by proposed obstacles.
- Enhance AIXM data standard to become a global solution to aeronautical information exchange including exchange of digital NOTAMs. Work with international community and International Civil Aviation Organization (ICAO) to adopt AIXM as a standard.
- Develop systems to support international and domestic fee for service.
- Fully integrate electronic surveys and electronic airport layout plans into FAA's aeronautical information system (NASR).

FY 2008 PROGRAM REQUEST:

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

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	22,991
FY 2007 Appropriated	4,000
FY 2008 Request	4,000
Out-Year Planning Levels (FY 2009-2012)	12,000
Total	42,991

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Enacted**	**FY 2008 Request**
Contracts:					
Airspace Management Laboratory	0	0	6,930	4,000	4,000
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
Total	**0**	**0**	**6,930**	**4,000**	**4,000**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Enacted**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	0	0	6,930	4,000	4,000
Total	**0**	**0**	**6,930**	**4,000**	**4,000**

1A01E - Airspace & AIM Laboratory Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Airspace Management	**$4,000**						
Analyze, Deploy, and Enhance Air Traffic Data and Metrics Products and Projects							
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, including analysis supporting fee for service		◆	◊	◊	◊	◊	◊
Analyze, Enhance, and Support Analysis and Decision Support Tools							
Deliver airspace office automation capabilities, including minimum vector altitude and minimum IRF altitude capabilities		◆	◊	◊	◊	◊	◊
Integrate terminal procedures and MVA/MIA components of obstruction evaluation into the obstruction evaluation workflow system		◆	◊	◊	◊	◊	◊
Aeronautical Information Management							
Create fully integrated aeronautical information management system							
Automate and standardize aeronautical data inputs		◆	◊	◊	◊	◊	◊
Develop transformation engines to automate aeronautical data products and provide digital 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			◊	◊	◊	◊	◊
Demonstrate creation, collection and distribution of digital NOTAMs		◆	◊	◊	◊	◊	◊
Support development and deployment of international standard for aeronautical information (AIXM)		◆	◊	◊	◊	◊	◊
Total Budget Authority	**$4,000**	**$4,000**	**$4,000**	**$4,000**	**$4,000**	**$4,000**	**$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.

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
ATO Capital	**1A01F**	**Airspace Redesign**	**$5,000,000**

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

FAA Air Traffic Control Facilities Cited in This Program Description:

Acronym	Facility Name
DFW	Dallas Ft. Worth International Airport
HAATS	Houston Area Air Traffic System
IAH	George Bush Intercontinental Airport; Houston, Texas
LAS	McCarran International Airport; Las Vegas, Nevada
NCT	Northern California Terminal Radar Approach Control
PHX	Sky Harbor International Airport; Phoenix, Arizona
ZAB	Albuquerque Air Route Traffic Control Center
ZHU	Houston Air Route Traffic Control Center
ZJX	Jacksonville Air Route Traffic Control Center
ZKC	Kansas City Air Route Traffic Control Center
ZLA	Los Angeles Air Route Traffic Control Center
ZMA	Miami Air Route Traffic Control Center
ZME	Memphis Air Route Traffic Control Center
ZOA	Oakland Air Route Traffic Control Center

Intended Outcomes: The Airspace Management Program (formerly National Airspace Redesign) directly supports all four objects of the "Greater Capacity" goal of the FAA's Flight Plan 2006-2010. Airspace redesign accomplished through the Airspace Management Program will create a modern and effectively managed national airspace redesign that:

- Increases system capacity and efficiency by removing as many airspace constraints as possible;
- Manages complexity and congestion without continuously increasing sector splitting and growth in the number of sectors;
- Increases flexibility and predictability for the benefit of air traffic controllers and aviation system users;
- Balances the access needs of the diverse set of aviation system users;
- Maintains the highest levels of system safety and security; and
- Reduces expected delays and inefficient routing over the next ten years in New York, Philadelphia, Chicago, Los Angeles Basin, San Francisco Bay Area, and South Florida metropolitan areas.

Agency Outputs: The Airspace Management Program serves as the FAA's primary effort to modernize the nation's airspace. The purpose of this national initiative is to review, redesign and restructure airspace. The program includes:

- Regional Optimization and Redesign projects involve airspace changes that are targeted at local problem, but can have larger system-wide impacts. These projects can be smaller in scale, utilizing available resources, or can be larger in scale, encompassing multiple facilities that cross several Service Areas or FAA Regions.
- National High Altitude and Oceanic Redesign are national level efforts that Apply state-of-art design techniques in systematic way. These projects specifically leverage national automation and procedural enhancements. High Altitude Redesign has been a mechanism for influencing future infrastructure system requirements and the introduction of advanced concepts into airspace design. Oceanic Redesign capitalizes on the oceanic infrastructure and automation improvements across all oceanic and offshore facilities.

Customer/Stakeholder Involvement: The Airspace Management Program utilizes both formal and informal methods to solicit and include customer/stakeholder perspectives. Since the inception of FAA's national focus on airspace redesign, the program has worked with RTCA to communicate plans and receive appropriate feedback from the aviation customer community. Since 2001, the Airspace Working Group has been the main body to aid in understanding the operational views and perspectives of the diverse airspace customers and stakeholders. Airspace Working Group members represent major carriers, regional carriers, general and business aviation, and the military. Regarding environmental concerns, the Airspace Management Program communicates with communities through various forums and processes as prescribed by the National Environmental Policy Act.

Accomplishments: Through the Airspace Management Program (and its predecessor, National Airspace Redesign), the FAA has implemented many airspace changes that have resulted in significant operational improvements. These accomplishments include:

- Las Vegas Redesign & Phoenix/Northwest 2000 – redesigned terminal/en route airspace and random navigation/area navigation (RNAV) procedures.
- Honolulu Redesign – improved departure coordination procedures for flights; reduced departure times.
- Great Lakes Integrated Design Plan – implemented new routes and improved procedures; reduced delays and restrictions.
- Choke Points – implemented new sectors and route changes; reduced delays, miles in trail, and other restrictions.
- High Altitude Redesign Phase 1 Initial – improved information about Special Use Airspace (SUA) availability and usage, implemented waypoints to circumnavigate SUA supporting improved flight planning information; reduced flying distance around SUA.
- Oakland Oceanic Gateway – created new oceanic route access points; allowed Pacific bound aircraft to achieve desired altitudes quicker, saving fuel and time.
- Denver South – created new routings for Denver satellite airports; reduced complexity.
- Anchorage Center Redesign – created an oceanic specialty, added a new sector, and revised other sector boundaries; improved controller workload balance.
- ZHU/ZMA/ZJX Boundary Realignment – revised the boundaries that divide control of Gulf airspace; improved safety for Gulf flights.
- High Altitude Redesign Phase 1 – instituted non-restrictive routing, Navigational Reference System, and Q-Routes.

- Denver Redesign – developed Ski Country procedures; better-managed delays and demand at key airports.
- NY/NJ/PHL Redesign – instituted "Dual Modena" departure routes; increased departure throughput, reduced departure restrictions, and reduced taxi-out delays.
- Atlantic Oceanic Redesign – instituted Coded Caribbean Routes; reduced coordination and communication errors, increased use of shorter distance access routes, and saved 11-35 miles for flights from Philadelphia and Boston to the Caribbean.
- ZME 5th Area Redesign and ZKC East End – realigned sectors; balanced workload and reduce complexity.
- HAATS Airspace and DFW RNAV – instituted new RNAV departures for DFW; tripled arrivals for IAH and expected to increase throughput.
- LAS Redesign – re-instituted RNAV procedures; reduced flight distances.
- Bay to Basin Redesign and ZAB Redesign – instituted new sectors in ZLA and ZAB; reduced restrictions upon LAS and PHX.
- Southern CA Redesign (LAX Departure Optimization) – instituted new departure routes; allowed for more fuel efficient departures and reduced the number of leveled-off departures by over 70 percent.
- Northern California Terminal Airspace Redesign – realigned airspace between NCT and ZOA; reduced FAA operational costs and reduced flight distances for customers.
- Florida Airspace Optimization – added new sectors and routes; reduced delays and restrictions in the busy east coast corridor.
- Central California Terminal Airspace – realigned en route airspace from Los Angeles center to Santa Barbara TRACON, providing enhanced service to general aviation customers in central California.
- Southern CA Redesign (LAX Arrival Optimization) – instituted new arrival routes; allowed for more fuel efficient arrival altitudes into LAX.
- High Altitude redesign Expansion Q-Routes – implemented remianing RNAV Q-routes for the southwest and southeast, expanding number of routes available to customers.
- Airspace for New Runways – implement airspace changes to support new runways, specifically Minneapolis, Cincinnatti, St. Louis, Atlanta, adding new capacity and efficiency to the system.
- Midwest Airspace Enhancement – large scale redesign of terminal and en route airspace to reduce complexity in the busy Great Lakes Corridor and to leverage previous runways built in Cleveland and Detroit.
- Northern California Airspace Redesign (Dual Arrival Routes and Sector 33 Split) – en route airspace was realigned to add a new sector and to support improvements in arrival throughput at the Bay area airports.

R&D Partnerships: The Airspace Management Program works closely with the FAA's Federally Funded Research and Development Center, MITRE's Center for Advanced Aviation Development (CAASD). MITRE-CAASD's work includes investigating, innovating, and developing modeling, simulation, and analysis capabilities facilitating airspace design. MITRE-CAASD will also research and explore issues that influence strategic policy in airspace management and design, such as sectorization concepts.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- NY/NJ/PHL Metropolitan Airspace Redesign – completion of environmental work.

- Houston Area Air Traffic System (HAATS) Airspace – completion of environmental work.
- Chicago Airspace Project – initial eastbound sectors and routes.
- Northern California Redesign (ZOA) – Three Tier Redesign, phase 1.
- Southern California Redesign – initiate environmental work.

FY 2008 PROGRAM REQUEST:

The requested funding will allow the Airspace Management Program to implement airspace design projects associated with:

- Regional optimization and redesign: includes NY/NJ/PHL Metropolitan Airspace Redesign, Chicago Airspace Project, Bay-to-Basin and Northern California Redesign (ZOA).
- National High Altitude and Oceanic Redesign: includes redesign of airspace above Flight Level 290 and work in all oceanic (New York, Oakland, and Anchorage) airspace and offshore airspace. Also includes alignment of airspace planning with future facility planning.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- NY/NJ/PHL Metropolitan Area Airspace Redesign (initial phases).
- Chicago Airspace Project (additional airspace changes for new runway).
- Houston Area Air Traffic System (HAATS) Airspace.
- Bay-to-Basin and Northern California Redesign (ZOA).

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	0
FY 2007 Appropriated	2,800
FY 2008 Request	5,000
Out-Year Planning Levels (FY 2009-2012)	12,000
Total	19,800

Budget Authority ($000)	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Enacted	FY 2007 Enacted	FY 2008 Request
Contracts:					
Airspace Redesign	0	0	0	2,800	5,000
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
Total	**0**	**0**	**0**	**2,800**	**5,000**

OMB Circular A-11, Conduct of Research and Development ($000)	FY 2004 Enacted	FY 2005 Enacted	FY 2006 Enacted	FY 2007 Enacted	FY 2008 Request
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	0	0	0	2,800	5,000
Total	**0**	**0**	**0**	**2,800**	**5,000**

1A01F - Airspace Redesign Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Airspace Design							
Equipment and other ATO Capital expenditures to support Airspace Management Program projects	**$ 5,000**	◆					
Develop/Initiate regional optimization and redesign			◊	◊	◊	◊	◊
Develop/Initiate high altitude and oceanic redesign			◊	◊	◊	◊	◊
Total Budget Authority	**$5,000**	**$2,800**	**$5,000**	**$3,000**	**$3,000**	**$3,000**	**$3,000**

◆ - 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
R,E&D	A11.d.	Atmospheric Hazards/Digital System Safety	$3,574,000

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

Intended Outcomes: The Atmospheric Hazards/Digital System Safety (DSS) Research Program supports FAA's strategic goal of increased safety by reducing the number of accidents or potential accidents associated with aircraft icing and failures to software-based digital flight controls and avionics systems. The program supports FAA's aviation safety goal by developing and testing technologies that detect frozen contamination, predict anti-icing fluid failure, and ensure safe operations both during and after flight in atmospheric icing conditions. To improve digital system safety, researchers are working to ensure the safe operation of emerging, highly complex software-based digital flight controls and avionics systems.

A major goal of the program is to reduce aviation's vulnerability to all in-flight icing hazards through the application of its research to improve certification criteria. Commercial airplanes are not yet certified to fly in icing conditions to an icing envelope that includes supercooled large droplet (SLD) icing conditions. The program's researchers have contributed to the development of technical data and advisory materials to correct this omission. A study by the Engine Harmonization Working Group indicates that over 100 in-service engine events, many resulting in power loss and at least six multiple engine flameouts, occurred in high ice water content environments over the period of 1988 to 2003. Future efforts will focus on research addressing this issue.

The program will develop new guidelines for testing, evaluating, and qualifying digital flight controls and avionics systems for the certification of aircraft platforms. Additionally, the program supports development of policy, guidance, technology, and training needs of the Aircraft Certification Service and Flight Standards Service that will assist and educate FAA and industry specialists in understanding digital systems safety and assessing how it may be safely employed in systems such as fly-by-wire, augmented manual flight controls, navigation and communication equipment, and autopilots.

Agency Outputs: The FAA establishes rules for the operation of aircraft that encounter icing conditions as well as rules for the use of software, digital flight controls, and on-board avionics systems. The agency uses the research results to generate Advisory Circulars (ACs), and various other forms of technical information detailing acceptable means for meeting requirements, to guide government and industrial certification and airworthiness specialists and inspectors.

Research Goals: To reduce the number and severity of accidents, or potential accidents, associated with icing and failures to software-based digital flight controls and avionics systems, the program develops and assesses ways to ensure that airframes and engines can safely operate in atmospheric icing conditions, and ensure the proper operation of software, complex electronic hardware, and digital systems.

Atmospheric Hazards

- By FY 2009, investigate the scaling of altitude effects on runback ice formation and size and velocity effects on aerodynamic impact of runback ice for thermal ice protection for simulated flight conditions.
- By FY 2010, complete characterization of high ice water content environments potentially hazardous to engines.

- By FY 2011, complete experimental work on the physics of engine icing in high ice water content environments.
- By FY 2012, develop methods for the airworthiness testing of engines in simulated high ice water content environments.

Digital System Safety

- By FY 2009, evaluate the obsolescence and life cycle maintenance of aviation electronics to determine the availability and affordability of digital avionics repair parts.
- By FY 2010, evaluate complex hardware techniques and tools for qualification, verification, and assurance to develop additional evaluation methods that may improve the certification process for complex hardware.
- By FY 2010, determine software development assurance levels.
- By FY 2011, evaluate model-based development criteria to promote faster development and shorter certification times for aircraft systems with safety-critical software and complex electronic hardware.
- By FY 2012, evaluate alternatives to existing verification and validation techniques; improved techniques will provide a way to identify system requirement errors early in the development process before implementation into the system.

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, including:

- Aircraft Safety Subcommittee of the FAA Research, Engineering, and Development Advisory Committee – representatives from industry, academia, and other government agencies annually review the activities of the Atmospheric Hazards/Digital System Safety Research Program.
- Technical Community Representatives Groups – FAA representatives apply formal guidelines to ensure that the program's R&D projects support new rule making and the development of alternate means of compliance with existing rules.
- Ice Protection Harmonization Working Group of the FAA Aviation Rulemaking Advisory Committee– a group that ensures the effectiveness of the agency's rule making. Members of the working group and full committee identify research requirements and priorities, and they provide guidance for including SLD within the icing environment and installing ice detectors to warn flight crews of ice accumulation on critical surfaces.
- G-12 Aircraft Ground Deicing Committee of the Society of Automotive Engineers (SAE) – this subcommittee assists in updating holdover time guidelines and establishing standards for de/anti-icing methodologies, deicing fluids, and ground ice detection.
- SAE AC-9C Aircraft Icing (In-flight) Subcommittee – this subcommittee assists in updating the Aircraft Icing Handbook, including the Icing Bibliography, and in establishing standards for icing simulation methods.
- RTCA (formerly known as Radio Technical Commission for Aeronautics) – members of this U.S. Federal Advisory Committee and its special committees help to ensure the effectiveness of the agency's rulemaking by identifying research requirements and priorities and providing guidance for the update of documents, such as avionics software, and electromagnetic hazards.
- Certification Authorities Software Team – a group of international certification software and complex electronic hardware (CEH) specialists who collaborate and make recommendations to regulatory authorities on the resolution of software and CEH aspects of safety.

R&D Partnerships: The program maintains a number of cooperative relationships:

- National Aeronautics and Space Administration (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.
- Environment Canada – based on an international memorandum of cooperation for research on in-flight icing conditions.
- NASA Langley Research Center – assesses software-based digital flight controls and avionics systems and electromagnetic hazards research.
- Aerospace Vehicle Systems Institute – cooperative industry, government, and academia venture for investigation and standardization of aerospace vehicle systems to reduce life-cycle cost and accelerate development of systems, architectures, tools, and processes.

Accomplishments: The FAA has provided international leadership in aircraft icing research for more than 20 years. The in-flight portion of the program has made significant contributions to characterizing the atmospheric icing environment and the aerodynamic and performance effects of ice accreted in flight. The ground portion of the program has developed test methods necessary for the evaluation of ground deicing and anti-icing fluids in a wide range of environmental conditions and explored new technologies and procedures to promote safe takeoff in ground icing conditions. In recent years the program has developed technical data for the issuance of several advisory circulars and technical information bulletins, supported conferences on aircraft in-flight icing and ground deicing, and developed technical data used by many of the world's airlines in their application of aircraft deicing and anti-icing fluids. Annually, the aircraft icing program conducts research for the determination and substantiation of test methods for the time of effectiveness and aerodynamic performance of modern de/anti-icing fluids and provides technical data for holdover time and procedural guidelines followed by many of the world's airlines for ground operations in icing conditions. Significant accomplishments from prior years include:

Aircraft Icing

- FY 2006:
  - Developed snow generation system to test the time of effectiveness of modern de/anti-icing fluids in a controlled laboratory environment.
  - Completed development of facility simulation capability for SLD icing testing to show safe operation in SLD environments in accordance with new proposed rules.
  - Completed documentation and analysis of residual and inter-cycle ice for pneumatic boots at low airspeeds to provide data for guidance to ensure safe operation of pneumatic boots on low speed aircraft in icing conditions.
- FY 2005:
  - Investigated and documented characteristic features of runback ice for thermal ice protection systems to provide data for guidance to ensure safe operation of thermally protected aircraft in icing conditions.
  - Enhanced in-flight icing simulation capability at the McKinley Climatic Laboratory suitable for testing of full scale engines and rotor blades for substantiation of safe operation of engines and helicopters in icing conditions.

- FY 2004:
  - Investigated and analyzed atmospheric icing environment - supercooled water and mixed-phase conditions – to provide data for formulation of expanded atmospheric icing envelopes for new proposed rules.
- FY 2003:
  - Developed technical data for update of the Aircraft Icing Handbook.

Digital System Safety

- FY 2006:
  - Completed research on object-oriented technology (OOT) in aviation that will provide input for policy and guidance on the use of OOT systems and support harmonization with international certification authorities on the use of OOT.
  - Completed research on component integration and verification considerations in integrated modular avionics (IMA) systems; results will lead to more effective systems development and enhance the certification of digital flight controls and avionics systems.
  - Evaluated the criteria and use of microprocessors in aviation and the identification of safety concerns for microprocessors; results will be used to develop test methods for modern, complex microprocessors that will improve the process of certifying aircraft avionics.
- FY 2005:
  - Studied deterministic operations of Ethernet equipment and provided evaluation criteria for the certification of Ethernet databases; results were incorporated into a handbook that provides network designers with guidelines for developing Ethernet databases that will be deployable in certifiable avionics systems.
  - Completed research on software development tools that led to a handbook for developers and certifying authorities to use to evaluate the tools from the system and software safety perspective and provided a basis for future software development tool qualification guidelines.
  - Completed research on software verification tools that identified specific evaluation criteria that could be used to determine whether the performance of the tool was acceptable and thereby improve the ability of the certification engineer to qualify software using these tools.
- Previous Years:
  - Investigated issues concerning the structural coverage of object-oriented software that clearly showed that there is a desire and emerging trend by suppliers of commercial airborne safety-critical systems toward the use of object-oriented technology (OOT), and thereby an increasing need by certifiers for the proper application of structural coverage analysis to OOT.
  - Investigated three forms of the modified condition decision coverage (MCDC) criterion that assists with the assessment of the requirements-based testing process for Level A software and provided data to support the right choice for the type of structural coverage to use.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

Aircraft Icing

- Continue research to characterize high ice water content environments for engines to ensure their safe operation in such conditions.
- Investigate use of ground ice detectors to demonstrate compliance with FAA requirements.
- Continue analysis of data from propeller icing test at McKinley Climatic Laboratory; data that will be used to provide data for guidance to ensure safe flight of propeller aircraft in icing conditions.

Digital System Safety

- Identify language and tool-specific issues concerning the structural coverage of OOT software at the source code and object code levels that will assist certification engineers in meeting requirements defined in RTCA DO-178B.
- Show analysis of aspects of commercial off-the-shelf (COTS) component integration related to the verification of the integration of components into a generic aviation platform that includes a handbook that will be useful for FAA and industry practitioners of integrating IMA systems on aircraft.
- Develop evaluation criteria for airworthiness of newly proposed databases that will define a suitable approach to develop and evaluate data networks for safety-critical avionics; results will provide guidance to FAA certification engineers.
- Define a safe, secure process for implementing LANs onboard aircraft; results will provide a network assurance process for FAA certification engineers.
- Identify methods to manage, integrate, verify, and validate system and software requirements that provide a basis for the proper management of requirements within the RTCA DO-178B process and a best practices handbook for the certification engineers.

FY 2008 PROGRAM REQUEST:

Ongoing Activities

Researchers will continue to refine laboratory methods for determining de-icing fluid holdover times in a variety of environmental conditions, including ice pellet conditions. In collaboration with NASA, they will support flight research to acquire atmospheric data for high ice water content environments. They will continue to study the enhancement and validation of icing simulation methods, with an emphasis on engine testing in high ice water content conditions.

In addition, researchers will continue to evaluate complex electronic hardware techniques and tools for qualification, verification, and assurance.

New Initiatives

The program will begin research on onboard network security and integrity for aviation data on the Internet, as well as investigation of COTS technology in complex and safety-critical systems for obsolescence and life cycle maintenance of aviation electronics and environmental qualification of industrial and commercial components.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

Aircraft Icing

- Conduct collaborative flight research to acquire atmospheric data for high ice water content environments.

- Complete analysis of data from propeller icing test at McKinley Climatic Laboratory to provide data for guidance to ensure safe flight of propeller aircraft in icing conditions.

Digital System Safety

- Evaluate complex electronic hardware techniques and tools for qualification, verification, and assurance.
- Investigate COTS technology in complex and safety-critical systems for obsolescence and life cycle maintenance of aviation electronics.
- Investigate model-based development criteria to promote faster development and shorter certification times for aircraft systems with safety-critical software and complex electronic hardware.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	82,971
FY 2007 Request	3,848
FY 2008 Request	3,574
Out-Year Planning Levels (FY 2009-2012)	14,612
Total	105,005

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Contracts:					
Digital System Safety	1,306	440	232	842	737
Atmospheric Hazards	1,408	1,864	1,287	1,316	1,052
Personnel Costs	1,707	1,621	1,786	1,614	1,653
Other In-house Costs	147	161	102	76	132
Total	**4,568**	**4,086**	**3,407**	**3,848**	**3,574**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	4,568	4,086	3,407	3,848	3,574
Development (includes prototypes)	0	0	0	0	0
Total	**4,568**	**4,086**	**3,407**	**3,848**	**3,574**

A11.d. – Atmospheric Hazards/Digital System Safety Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
064-110 Digital System Safety							
Digital System Safety	**$737**						
Identify object-oriented technology (OOT) issues		♦					
Show analysis of COTS component integration		♦					
Develop databus evaluation criteria		♦					
Define a safe, secure process for implementing LANs		♦					
Identify methods to manage, integrate, verify, and validate system and software requirements		♦					
Evaluate complex electronic hardware techniques and tools			◊	◊	◊		
Evaluate obsolescence and environmental qualification of electronic components			◊	◊			
Determine software development assurance level				◊	◊		
Evaluate model-based development criteria			◊	◊	◊	◊	
Evaluate verification and validation techniques						◊	◊
064-111 Atmospheric Hazards							
Aircraft Icing	**$1,052**						
Investigate use of ground ice detectors		♦					
Analyze propeller icing test data from McKinley Climatic Laboratory		♦	◊				
Characterize high ice water content environments for engines		♦	◊	◊	◊		
Complete experimental work on the physics of engine icing in high ice water content environments.			◊	◊	◊	◊	
Develop methods to test engines in simulated high ice water content environments				◊	◊	◊	◊
Investigate scaling of formation and aerodynamic effects of runback ice for thermal ice protection for simulated flight conditions		♦	◊	◊			
Personnel and Other In-House Costs	**$1,785**						
Total Budget Authority	**$3,574**	**$3,848**	**$3,574**	**$3,568**	**$3,608**	**$3,687**	**$3,749**

♦ - Activities Accomplished ◊ - Activities Planned

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

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A11.h.	Aviation Safety Risk Analysis	$9,517,000

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

Intended Outcomes: The Aviation Safety Risk Analysis Program helps achieve FAA's strategic goal of increasing aviation safety by promoting and expanding safety information sharing and safety risk management initiatives efforts. The program develops risk management methodologies, prototype tools, technical information, procedures, and practices that will improve aviation safety. In addition, the program aims to develop an infrastructure that enables the free sharing of de-identified, aggregate safety information that is derived from various government and industry sources in a protected, aggregated manner. It also conducts research to evaluate proposed new technologies and procedures that will improve safety by making relevant information available to the pilot during terminal operations.

Agency Outputs: The program will develop an infrastructure that enables the free sharing of de-identified, safety information that is derived from various government and industry sources in a protected, aggregated manner. In addition, the program is providing methodologies, decision support capabilities, and guidance material that provide aviation safety inspectors, aircraft certification engineers, analysts, and managers the capabilities of systematically assessing potential safety risks and applying proactive solutions to reduce aviation accidents and incidents. The program is also conducting research and analysis to maintain the desired level of safety while accommodating the need for more efficient use of the terminal area.

Research Goals: To reduce the number of aviation accidents and incidents by developing a secured safety information analysis system that provides access to numerous databases, maintains their currency, enables interoperability across their different formats, provides the ability to identify future threats, conducts a causal analysis of those threats, and recommends solutions.

- By 2009, develop a technical process to query de-identified safety data from any participating airline Flight Operations Quality Assurance (FOQA) or Aviation Safety Action Program (ASAP) program, aggregate it through a distributed database and make it accessible to appropriate industry stakeholders.
- By 2011, develop automated tools to monitor each database for potential safety issues and to analyze disparate data drawn from multiple sources, enhancing discovery, identification, and evaluation of safety risks.
- By 2012, develop advanced software capable of automatically gathering information from other databases and providing analysis in response to safety-oriented queries entered into a browser-based interface.

To reduce the risk for passengers and crews and enhance the traffic control process in the terminal area operations, pilot-in-the-loop simulation evaluations and operational flight data analysis will be conducted.

- By 2009, evaluate various devices that can be used to protect the flight crew from undesired laser cockpit illumination, reducing the probability of temporary blindness to the flight crew.
- By 2010, characterize risks associated with undesired laser cockpit illumination, providing FAA with data to determine mitigation strategies.

- By 2011, develop methods to model unusual attitude encounters outside the normal operating envelope, allowing FAA to approve advanced flight simulators that more realistically model the behavior of an actual aircraft.
- By 2012, identify new navigation technologies and data requirements for the development of new procedures to enhance the capacity and safety of the terminal area.

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

- Subcommittee on Aircraft Safety of the FAA Research, Engineering and Development Advisory Committee – representatives from industry, academia, and other government agencies annually review the program's activities.
- Technical Community Representative Groups – FAA representatives apply formal guidelines to ensure that the program's research projects support new rule making and the development of alternate means of compliance with existing rules.
- The System Approach for Safety Oversight – the primary goal of this Flight Standards Service program is to apply a systems approach, cooperative problem solving, and proactive risk management principles to operations affecting aviation safety.
- Joint Planning and Development Office, Safety Integrated Product Team – a national-level integrated safety management framework that addresses all facets of the air transportation system, building safety design assurance into operations and products.
- Commercial Aviation Safety Team – a FAA/industry collaborative effort to develop and implement data-driven safety initiatives.

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

- National Aeronautics and Space Administration, under a cost sharing agreement, to develop a demonstration project for FAA and the commercial aviation industry to share safety-related information and to use that information to proactively identify, analyze and correct safety issues that affect commercial aviation.
- The Civil Aviation Authority of the Netherlands, to conduct joint research on aviation system safety initiatives via a Memorandum of Cooperation.
- The Safety Management Focus Group, a group of safety directors from various major and regional carriers that provides industry reviews and evaluation of risk management decision support products.

Accomplishments: The FAA conducts research that assists in the oversight of FAA certificate holders, e.g., air operators, repair stations, training schools, etc. The research has identified and developed strategies to mitigate the risks associated with commercial operators certified under Title 14 Code of Federal Regulations Part 121 (14 CFR 121), repair stations certified under 14 CFR Part 145, and general aviation operations certified under 14 CFR Part 137. To improve capacity and improve efficiency in the terminal area, FAA developed methods to identify commercial aircraft touchdown points during commercial operations by using ILS or non-ILS information and provided measures of pilot reaction to laser illumination.

FY 2006

- Developed methods to identify commercial aircraft touchdown points during commercial operations by using ILS or non-ILS information providing information to aid in understanding causes of aircraft overruns and runway excursions.

- Released a working prototype of an integrated framework that describes the methodology for identification, classification, and assessment of aviation system hazards and risks.
- Developed a preliminary methodology that provides a baseline assessment of the current safety oversight for effectiveness, efficiency, and sustainability, identifies data inputs and could provide metrics such as the responsiveness of the air carriers to corrective and preventive actions, effects of oversight on safety precursors, inspection output and inspector workload and readiness.

FY 2005

- Completed enhancements to the Maintenance Malfunction Information Reporting (MMIR) System with capability to collect usage and flight profile data; the helicopter industry and FAA are using the MMIR data to improve maintenance reliability and product design.
- Provided measures of pilot reaction to laser illumination using FAA's B-737 flight simulator to support two Advisory Circulars: AC 70-1 "Outdoor Laser Operations" and AC 70-2 "Reporting of Laser Illumination of Aircraft".
- Provided technical data on standard probabilities of certain environmental and operational conditions to support transport airplane certification or safety assessment purposes.

FY 2004

- Provided technical data and recommendations for designing an effective repair station training program, including the recommended number of hours and topics for training mechanics, managers, supervisors, and inspectors. The FAA issued Advisory Circular 145-10 "Repair Station Training Program" in July 2005.

FY 2003

- Developed an all-encompassing quality audit and quality assurance system that is referenced in the Advisory Circular 120-79 "Developing and Implementing a Continuing Analysis and Surveillance System (CASS)" that provides guidance to air operators in meeting the CASS requirement of 14 CFR Parts 121.373 and 135.431.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

Risk Management Decision Support

- Develop the integrated framework and methodology for the identification, classification, and assessment of aviation maintenance and flight operations hazards.
- Develop a prototype decision support system that will provide FAA with improved certificate management and oversight capabilities. The major products will be identification of databases within FAA purview, databases required to be designed, and possible location of and access to existing databases needed to populate the described methodology.
- Develop descriptions of the various business relationships between 14 CFR Part 121 operators and 14 CFR Part 145 repair stations; the models will be used to identify the hazards and assess the risks involved with these types of relationships.
- Initiate development of a risk mitigation model that uses results from past risk mitigation actions to recommend future risk mitigation actions.

Aircraft Maintenance - Maintainability and Reliability

- Develop a proposed new quality management system to perform and monitor tool calibration at maintenance facilities; the new system will improve safety by reducing aircraft maintenance errors due to the use of out-of-tolerance tools.

- Complete a series of safety review studies that examine various aspects of aircraft maintenance performed in airline maintenance facility shops and in outsourced maintenance facilities; results will lead to improvements in FAA current policy and guidance on aircraft maintenance.
- Continue to develop inspection methods to determine the integrity of general aviation aircraft exhaust systems to prevent carbon monoxide poisoning.

Safety Analysis Methodology

- Complete a methodology to provide a different level of certification credit for design features intended to reduce flight crew errors.
- Continue to determine injury ratios for well-defined unsafe conditions (e.g., structure failure, electrical system failure, landing gear vibration, power plant failure, etc.) on aircraft systems or components.

Terminal Area Safety

- Conduct evaluations on the use of pilot-in-the-loop flight simulators for training of advanced maneuvers related to terminal area operations.
- Develop testing procedures and requirements to identify required navigational performance (RNP) constraints related to terminal area operations.
- Conduct evaluations on air traffic and flight procedures for terminal area operations by using the pilot-in-the-loop flight simulator.
- Develop tools to model the safety hazards of rejected landing procedure and to identify possible training solutions.
- Develop assessment tools for evaluating flight tasks under simulated conditions.
- Complete evaluation of the automatic land and hold short operations (LAHOS) light system for safety of terminal area operations.

FY 2008 PROGRAM REQUEST:

Ongoing Activities

Government, industry, and academia aviation safety subject matter experts will be invited to participate in the research efforts 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. The program will 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

Aviation Safety Information Analysis and Sharing (ASIAS) System: The objective of ASIAS is to demonstrate a working prototype of a network-based integration of information extracted from diverse, distributed sources. It is envisioned that ASIAS will operate and maintain distributed archives of airline industry flight data and safety reports. The research will develop innovative, advanced tools and methodologies that will, for the first time, be able to convert and integrate aviation safety data that is currently distributed across multiple organizations and archives into information on the operational performance and safety of the aviation system.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

Risk Management Decision Support

- Complete risk mitigation model that uses results from past risk mitigation actions to recommend future risk mitigation actions.
- Complete the integrated framework and methodology for the identification, classification and assessment of aviation maintenance and flight operations hazards.

Aircraft Maintenance - Maintainability and Reliability

- Complete the development of inspection methods to determine the integrity of general aviation aircraft exhaust systems to prevent carbon monoxide poisoning and propose standards for carbon monoxide detections devices.

Safety Analysis Methodology

- Complete the injury ratios for well-defined unsafe conditions (e.g., structure failure, electrical system failure, landing gear vibration, power plant failure/debris, etc.) on aircraft systems or components.

Terminal Area Safety

- Complete development of assessment tools for evaluating flight tasks under simulated conditions.
- Complete development of tools to model the safety hazards of rejected landing procedures and to identify possible training solutions.
- Evaluate the use of pilot-in-the-loop flight simulators for training of advanced maneuvers related to terminal area operations.
- Develop testing procedures and requirements to identify RNP constraints related to terminal area operations.
- Evaluate air traffic and flight procedures for terminal area operations using the pilot-in-the-loop flight simulator.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	64,106
FY 2007 Request	5,292
FY 2008 Request	9,517
Out-Year Planning Levels (FY 2009-2012)	33,622
Total	112,537

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Contracts:					
Aviation Safety Risk Analysis	6,194	6,260	3,303	3,232	6,402
Personnel Costs	1,528	2,091	1,494	1,947	2,892
Other In-house Costs	129	220	86	113	223
Total	**7,851**	**8,571**	**4,883**	**5,292**	**9,517**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	7,851	8,571	4,883	5,292	9,517
Development (includes prototypes)	0	0	0	0	0
Total	**7,851**	**8,571**	**4,883**	**5,292**	**9,517**

A11.h. - Aviation Safety Risk Analysis Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
060-110 Aviation Safety Risk Analysis							
Risk Management Decision Support	**$592**						
Develop an integrated framework for the identification, classification, and assessment of hazards		◆	◊				
Develop a prototype decision support system that will provide FAA with improved certificate management and oversight capabilities		◆					
Develop a risk mitigation model to recommend future risk mitigation actions		◆	◊				
Develop business relationships between 14 CFR Part 121 and 14 CFR Part 145		◆					
Assess current regulations, regulatory structure, and rulemaking methods				◊	◊		
Aviation Safety Information Analysis and Sharing	**$5,000**						
Develop a technical process to extract, aggregate and analyze de-identified data			◊	◊			
Develop automated tools to monitor databases for potential safety issues			◊	◊	◊	◊	
Develop advanced software capable of automated retrieving of supporting evidence related to a safety query as well as the automated analysis of the retrieved data			◊	◊	◊	◊	◊
Aircraft Maintenance – Maintainability & Reliability	**$0**						
Conduct a series of safety review studies that examine several aspects of outsourced maintenance		◆					
Develop a tool calibration program for aircraft maintenance		◆					
Develop standards for carbon monoxide detection devices and inspection methods to determine the integrity of exhaust systems		◆	◊				
Safety Analysis Methodology	**$0**						
Determine the outcome ratio for a limited number of well-defined unsafe conditions		◆	◊				
Develop a methodology to determine an appropriate certification credit level for design features intended to reduce the effect of system errors		◆					
Terminal Area Safety	**$810**						
Evaluate pilot-in-the-loop flight simulators for training of advanced maneuvers related to terminal area operations		◆	◊				
Develop testing procedures and requirements to identify RNP constraints		◆	◊	◊			
Evaluate 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		◆	◊				
Develop assessment tools for evaluating flight tasks under simulated conditions		◆	◊				
Evaluate the automatic LAHSO light system for safety of terminal area operations		◆					
Evaluate devices and risks associated with undesired laser cockpit illumination				◊	◊		
Determine methods to model unusual attitude encounters outside the normal operating envelope				◊	◊	◊	
Determine navigation procedure technologies and supporting data for new procedures				◊	◊	◊	◊
Personnel and Other In-House Costs	**$3,115**						
Total Budget Authority	**$9,517**	**$5,292**	**$9,517**	**$8,349**	**$8,334**	**$8,446**	**$8,493**

◆ - Activities Accomplished ◇ - Activities Planned

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

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
ATO Capital	**4A09A**	**Center for Advanced Aviation Systems Development**	**$22,854,000**

Supports FAA Strategic Goals: Increased Safety, Greater Capacity, International Leadership, and 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, systems engineering, and technical analyses.

Agency Outputs: CAASD research and development identifies and tests new concepts and technologies for the National Airspace System (NAS) in the areas of aviation safety, Performance-Based Air Traffic Management (P-ATM), performance-based navigation, airspace design, and traffic flow management that impact worldwide standards and applications. 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 products are helping to shape a P-ATM 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. CAASD is playing an instrumental role in the achievement of the NextGen goals and objectives, providing key operational and technological inputs based on its many years of research and analysis in areas such as Air Traffic Management (ATM), communications, navigation, and surveillance operations/capabilities. CAASD contributes directly to the goals and activities of the RTCA Air Traffic Advisory Committee, which is the principal forum to bring industry, aircraft operators, and FAA representatives together to define the operational needs and to identify an affordable NAS Architecture capable of satisfying those needs. Additionally, CAASD efforts contribute to the FAA's global aviation goals and the goals of the International Civil Aviation Organization (ICAO) through international aviation standards development activities.

Accomplishments: CAASD has supported the following accomplishments:

- Developed an end-to-end concept for air traffic operations known as Performance-Based Air Traffic Management (P-ATM). The concept includes fundamental shifts in the use of automation capabilities across the NAS, while still maintaining a human-centered operation. It is a cross-domain set of air traffic capabilities, procedures, and new roles and responsibilities that will revolutionize the way the FAA operates its air traffic system.
- Developed the enrouteTrainer, a stand-alone simulation prototype that provides students scenario-based instruction with a realistic high-fidelity practice environment, simulating the effect of winds, aircraft climb/descent rates, and aberrant conditions. enrouteTrainer technologies are expected to result in reduced training time (by as much as half) and reduced certification cost, with improved quality and consistency of training.
- Supported RTCA Special Committee 203 (SC-203) in the development of standards that will help assure Unmanned Aircraft Systems (UASs) operate safely within the NAS and are compatible with other NAS architectural components.

- Conducted simulations with En Route and Terminal subject matter experts with the objectives of validating the operational concepts for the future NAS operations and validating the productivity benefits that would be anticipated as these operational changes are realized.
- Transitioned future Traffic Flow Management (TFM) probabilistic-based concepts from paper study to concept validation prototype.
- Developed tools and techniques for estimating controller productivity in the future NAS.
- Explored advanced applications for ADS-B technology, with particular focus on using the technology for flight following poor weather.
- Performed merging and spacing trials in Atlanta using integrated ghosting and airborne capabilities. Merging and spacing tools improve the effectiveness of RNAV in the terminal area.

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:

- Cargo Airlines Association, Embry-Riddle Aeronautical University, on ADS-B and its use (situational awareness (traffic and weather information in the cockpit) and self-spacing);
- Embry Riddle Aeronautical University, Lockheed-Martin, NASA Ames & Langley, UPS, Boeing, Federal Express, Crown Consulting, and Raytheon (development of a standard for distributed Air Traffic Management simulation);
- EUROCONTROL (related to future ATM developments);
- George Mason University, Air Transportation Systems Engineering Laboratory (research on airport capacity modeling);
- George Mason University, Interdisciplinary Center for Economic Science (economic analyses);
- NASA Ames (Multi-Center Traffic Management Advisor);
- NASA Langley on Wake Vortex and surface issues (capacity improvement);
- Massachusetts Institute of Technology, Engineering Systems Division (developing tools & techniques for enterprise systems engineering);
- Massachusetts Institute of Technology, International Center for Air Transportation (unmanned aircraft systems and National Airspace System capacity research);
- MIT Lincoln Laboratory (wake vortex technologies and surveillance requirements and solutions resulting from evolving FAA security requirements);
- Santa Fe Institute (research on complexity and complex systems engineering);
- United Parcel Service (research on techniques for merging and spacing);
- The University of Virginia (research on Nanotechnology);
- Virginia Polytechnic Institute and State University (system capacity analysis & modeling); and
- The Volpe National Transportation Systems Center (operational evaluation of Air Traffic Management research topics).

In addition, CAASD has strong collaborative relationships with a number of the other R&D Programs described in this Plan. These relationships include the Joint Planning and Development Office, Safe Flight 21- Alaska Capstone, Wake Turbulence, Unmanned Aircraft Systems Research, and Advanced Technology Development and Prototyping.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Provide operational feasibility and validation analysis of candidate productivity-enhancing capabilities for the terminal domain, including extended validations of terminal concepts and end-to-end demonstrations. Conduct analyses of the safety of the proposed system and of aircraft intent data necessary to support the proposed system.
- Develop En Route capabilities required to evaluate operational feasibility and validate productivity gains of the Performance-Based Air Traffic Management concept and procedures for the mixed data link equipage environment. Results will inform decisions on NAS evolution strategies and the NextGen and NAS enterprise architecture.
- Continue the ZID field evaluation of the enrouteTrainer prototype, developed by MITRE to train new controllers using a stand-alone high-fidelity scenario-based instruction, speech synthesis and recognition and intelligent tutoring. The Trainer is expected to shorten training time as well as improve the quality and consistency of training.
- Identify technical, operational, and safety risks and mitigations to permit implementation of advanced wake vortex avoidance procedures, enabling improvement in capacity at selected airports with modest infrastructure investment.
- Research and explore sector and airspace management concepts that examine operational efficiency, productivity, and workload balancing to inform national decisions that are required in the 2007-2008 timeframe on airspace policy and facility structure.
- Conduct human-in-the-loop validation of future Traffic Flow Management (TFM) concepts, requirements and benefits, focusing on emerging concepts that are showing promise for how the FAA can better manage the uncertainties of the TFM system, like weather.
- Provide technical and systems engineering analysis of UAS operations concerning detect, sense and avoid concepts, air-ground communications requirements, and national and international standards for development and operation, resulting in integrated guidance to commercial and government operators of UASs.
- Conduct testing on merging and spacing concepts for greater capcity and improved ATC productivity.
- Continue exploration of ADS-B applications with a focus on the concept of RNP paths around weather, including laboratory simulations and analysis.

FY 2008 PROGRAM REQUEST:

CAASD provides independent advanced research and development required by the FAA to obtain technical analyses, prototypes and operational concepts needed to fulfill the vision for the FAA's Flight Plan, the NextGen Integrated Plan, and the NAS enterprise architecture. CAASD has unique knowledge, skills, and capabilities in aviation research, systems engineering and analysis. Its expertise is critical to the FAA in transforming the nation's air transportation system in an effective and timely manner.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Analyze operational feasibility and validation of candidate productivity-enhancing capabilities for traffic management, including extended valuations of TFM/Time-based metering concepts and begin to assess candidate concept extensions, such as delegation of separation responsibility to the cockpit.
- Refine the P-ATM concept and expand the assessment to address failure/exception conditions. Conduct human-in-the-loop experiments with FAA Operational Supervisors to evaluate key P-ATM concepts and aid FAA decision-making on En Route system evolution.

- Continue to emphasize integration of Performance-Based Navigation with Airspace Design, Traffic Flow Management (TFM), Communications, Navigation and Surveillance (CNS), and other operational functional capabilities to increase benefits and move toward a Performance-Based NAS. This should significantly increase user benefits and reduce controller workload.
- Develop advanced intelligent tutoring systems for the enrouteTrainer that will enable self-paced/accelerated training, and increased standardization while reducing training staffing costs. Prepare technology transfer package to integrate validated enrouteTrainer capabilities into ERAM.
- Research and explore sector and airspace management concepts (e.g., dynamic sectorization) for operational efficiency, productivity, and workload balancing to enable national decisions on airspace policy and facility structure.
- Identify gaps in the TFM future vision, particularly how it leads to the NextGen. Address gaps through concept development, refinement, and evaluation.
- Renew work in the development of the Aviation Environmental Policy Management Tool (APMT) by developing requirements and modeling needs for the aviation community.
- Continue to provide technical and systems engineering analysis of UAS operations concerning detect, sense and avoid concepts, air-ground communications requirements, and national and international standards for development and operation, resulting in integrated guidance to commercial and government operators of UASs.
- Identify technical, operational, and safety risks and mitigations to permit implementation of advanced wake vortex avoidance procedures, enabling improvement in capacity at selected airports with modest infrastructure investment.
- Refine M&S/Continuous Descent Arrival (CDA) Phase 2 concepts, algorithms and simulations to allow the application to be put into operations by air transport aircraft thus providing benefits to the airline as well as the FAA.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	206,632
FY 2007 Appropriated	30,100
FY 2008 Request	22,854
Out-Year Planning Levels (FY 2009-2012)	125,664
Total	385,250

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Enacted**	**FY 2008 Request**
Contracts:					
Center for Advanced Aviation Systems Development (CAASD)	47,108	46,794	37,895	30,100	22,854
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
Total	**47,108**	**46,794**	**37,895**	**30,100**	**22,854**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Enacted**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	50,848	46,794	37,895	30,100	22,854
Development (includes prototypes)	0	0	0	0	0
Total	**50,848**	**46,794**	**37,895**	**30,100**	**22,854**

4A09A - Center for Advanced Aviation System Development Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Research, Engineering and Development	**$17,369**						
Validate and demonstrate the productivity savings of selected NAS en route, terminal and TFM capabilities and initiatives, and inform implementation decisions related to those initiatives		◆	◊	◊			
Conduct analyses of key requirements issues (e.g. system safety) and plan for NAS evolution to implement productivity improvements, including defining functional and system requirements and NAS architecture changes		◆	◊	◊	◊	◊	◊
Expand and enhance the use of the enrouteTrainer in ZID field training stages such as use in additional areas of specialization, remedial and proficiency training		◆					
Continue and expand ZID field evaluation of the enrouteTrainer; develop enhanced intelligent tutoring capabilities; and prepare technology transfer package to integrate these capabilities into ERAM			◊	◊	◊	◊	◊
Develop en route capabilities required to evaluate operational feasibility and validate productivity gains of Performance-Based ATM (P-ATM) Operations		◆	◊				
Expand assessment and evaluation of key P-ATM operational changes. Analyze system performance / safety, develop end-to-end concepts / procedures, and operational / system evolution planning		◆	◊	◊	◊	◊	◊
Define future concepts, capabilities and requirements needed to achieve the TFM future vision		◆	◊	◊	◊	◊	◊
Identify gaps in the existing set of concepts needed to meet the evolving TFM future vision and outline a plan to address those gaps		◆	◊	◊	◊	◊	◊
Renew efforts to develop requirements and modeling for the Aviation Environmental Portfolio Tool			◊	◊	◊	◊	◊
Working with the FAA and industry, develop, test, select, validate, and integrate Phase Merging and Spacing (M&S) algorithms		◆	◊	◊	◊		
Perform M&S simulations			◊	◊	◊		
Research and develop new broadcast services capabilities and transfer new builds to the FAA		◆	◊	◊			
Air Traffic Operational Research and Special Situation Support	**$5,485**						
Develop and refine air traffic control training component requirements		◆	◊	◊	◊	◊	◊
Analyze and model the flows and sector structures that will leverage procedural changes and future facilities; continue concept exploration and analyses on sectorization		◆	◊	◊	◊	◊	◊
Determine the potential safety risks, operational concepts, and standards associated with increased unmanned aircraft system access to the NAS		◆	◊	◊	◊	◊	◊
Explore ADS-B-enabled concept of RNP paths for weather avoidance		◆	◊				
Total Budget Authority	**$22,854**	**$30,100**	**$22,854**	**$26,180**	**$27,720**	**$35,112**	**$36,652**

◆ - 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
S&O	N/A	Commercial Space Transportation Safety	$128,000

Supports FAA Strategic Goals: Increased Safety, Greater Capacity, International Leadership, and Organizational Excellence.

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 licensed or permitted 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:

- Compile and maintain a database of historical data on failures and reliability of rocket-powered vehicles. An exhaustive database would include not only percentage reliability and number of vehicles, but type and class of vehicle and to the extent possible the results of the failure analysis. Included are orbital space launch vehicles and available data on suborbital (non-missile) vehicles (X-15 and rocketpowered lifting bodies). The ultimate goal is to provide the industry with insight into what fails and why.
- Perform a comprehensive review of the scientific literature regarding ground support personnel and flight crew rest and duty time associated with ground support personnel and flight crew performance.
- Perform comprehensive research and survey of the aviation and space flight training providers available to identify what is available, by whom, and its applicability.

Agency Outputs: The research program completes or provides inputs for the development of regulations, advisory circulars, and/or guidelines that identify the requirements for the safe operation of expendable as well as reusable launch vehicles (ELV/RLV). These outputs include:

- Comprehensive database on launch vehicle and applicable rocket powered vehicle failures.
- Comprehensive review of the scientific literature regarding ground support personnel and flight crew rest and duty time associated with ground support personnel and flight crew performance. This review will produce a report summarizing the issues, anticipated threats to ground support personnel, and flight crew readiness posed by crew rest and duty time restrictions and recommendations to address the same.
- Comprehensive research and survey of the aviation and aerospace space flight training providers in the areas of; 1) Physiological Training, 2) High Altitude (Hyperbaric Chamber), 3) Unusual Attitude Training, 4) High-g (gravity), 5) High Altitude Flight, 6) Pressure Suit Training, 7) High Performance Glider, 8) High-Performance Jet, and 9) Parachute Training. This research and survey will produce a comprehensive report detailing the area of training, the provider name and address, course description & outline, areas of expertise, background and experience, facilities, equipment, relevant pictures, and cost.

Customer/Stakeholder Involvement: The research for the database on launch vehicle and applicable rocket powered vehicle failures was requested by the Commercial Space Transportation Advisory Committee (COMSTAC) Reusable Launch Vehicle Working Group (RLVWG). It will be useful for both AST and new launch vehicle companies.

The research on crew rest and duty cycle is being performed to evaluate the current regulations and if necessary introduce a revision to the regulation that improves upon the latest understanding of human physiology as it pertains to crew rest and duty time.

Accomplishments: FY 2007 is the first year of funding for new activities known as "Historical Data Base of Failures and Reliability of Rocket-powered Vehicles", "Safety Operations Personnel Duty and Rest Analysis", and "Human Space Flight Training Preparation Survey".

R&D Partnerships: AST will partner with the Volpe National Transportation Systems Center as well as Clemson Univeristy to perform a comprehensive review of the scientific literature regarding ground support personnel and flight crew rest and duty time associated with ground support personnel and flight crew performance.

AST will partner with the Futron Corporation, which will provide leading-edge aerospace and aeronautical research in the area of space flight training.

MAJOR ACTIVITIES AND ANTICIPATED FY 2007 ACCOMPLISHMENTS:

AST expects to compile and get a comprehensive historical database that can be maintained on failures and reliability of rocket-powered vehicles.

AST expects through the two research projects concerning 1) crew rest and duty cycles and 2) human space flight training preparation survey, to prepare two draft reports summarizing the findings. In addition, AST expects to prepare a draft Advisory Circular that will provide additional guidance for those licensees that must meet the human space flight training regulations.

FY 2008 PROGRAM REQUEST:

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

KEY FY 2008 PRODUCTS AND MILESTONES:

None identified as yet. However, as research is conducted during the year, there may be indications of additional research efforts required during FY 2008, with appropriate products and milestones determined at that time.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	75
FY 2007 Appropriated	125
FY 2008 Request	128
Out-Year Planning Levels (FY 2009-2012)	512
Total	840

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Enacted**	**FY 2008 Request**
Contracts:					
Commercial Space Transporation Safety	0	0	75	125	128
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
Total	**0**	**0**	**75**	**125**	**128**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Enacted**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	0	0	75	125	128
Total	**0**	**0**	**75**	**125**	**128**

Commercial Space Transportation Safety Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Commercial Space Transportation Safety	**$128**						
Historical Data Base of Failures and Reliability of Rocket-powered Vehicles							
Report on comprehensive data base on launch vehicle and applicable rocket powered vehicle failures		♦					
Safety Operations Personnel Duty and Rest Analysis							
Report on review of scientific literature on ground support personnel and flight crew rest and duty time associated with ground support personnel and flight crew performance		♦	◊	◊	◊	◊	◊
Human Space Flight Training Preparation Study							
Report on areas of training, provider information, course description, facilities, equipment, relevant pictures, and cost		♦	◊	◊	◊	◊	◊
Total Budget Authority	**$128**	**$125**	**$128**	**$128**	**$128**	**$128**	**$128**

♦ - Activities Accomplished ◇ - Activities Planned

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

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A13.a.	Environment and Energy	$15,469,000

Supports FAA Strategic Goals: Increased Safety, Greater Capacity, International Leadership, and Organizational Excellence.

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 (NextGen) plan. The Program specifically supports the following outcomes:

The Flight Plan Noise Exposure Performance Target to reduce the number of people exposed to significant noise by one percent per year through FY 2010 as measured by a three-year moving average, from the three-year average for calendar year 2000 – 2002. Specific activities include:

- Conduct research and develop analytical tools to better understand the relationship between noise and emissions and different types of emissions, and to provide the cost-benefit analysis capability necessary for data-driven decision-making.
- Through the Partnership for AiR Transportation Noise and Emissions Reduction (PARTNER) Center of Excellence (COE) identify and better measure the issues and impacts associated with aircraft noise, and generate improved solutions to mitigate these problems.
- Assess the impact and advance implementation of operational procedures to reduce noise in the National Airspace System (NAS).
- Minimize the impact of aircraft noise – actions include: advancing the state of science/knowledge concerning effects of aircraft noise; improving aircraft certification standards and operational procedures; and implement improved noise control technologies and mitigation measures.

The Flight Plan Aviation Fuel Efficiency Performance Target improves aviation fuel efficiency as indicated from the amount of fuel burned per revenue plane-mile by 5 percent, measured by a three-year average for calendar years 2003-2005, from the three-year average for calendar years 2000-2002, and maintain that level of achievement in the face of increased capacity and air traffic through FY 2010. Specific activities include:

- Conduct research and develop analytical tools to better understand the relationship between noise and emissions and different types of emissions, and to provide the cost-benefit analysis capability necessary for data-driven decision making.
- Through the Partnership for AiR Transportation Noise and Emissions Reduction (PARTNER) Center of Excellence (COE), identify and better measure the issues and impacts associated with aviation emissions, and generate improved solutions to mitigate these problems.
- Assess the impact and enable implementation of operational procedures to reduce aviation emissions in the National Airspace System (NAS).
- Minimize the impact of aviation 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.

The Flight Plan International target is to foster international environmental standards, recommended practices, and guidance material that are technically feasible, economically reasonable, provide a measurable environmental benefit and take interdependencies between various emissions and between missions and noise into account. Specific activities include:

- Working with the international aviation community to reduce aircraft noise – actions include:
  - Improving aircraft certification standards and operational procedures.
  - Promoting compatible land use.
  - Applying abatement technologies around populations exposed to aircraft operations.
- The NextGen goal to promote environmental stewardship by reducing significant noise and emissions impacts in absolute terms and balancing aviation's environmental impact with other societal objectives. Specific activities include:
  - Developing better science-based understanding of impacts of aircraft noise and aviation emissions on local air quality and climate change to enable the NextGen goal of three-fold growth in capacity by 2025, while reducing significant noise and emissions in absolute terms.
  - Assessing the ability of technologies for airframes, more efficient engines, advanced propulsion concepts, new fuels and materials to reduce source noise and emissions.

Agency Outputs: The program is developing and validating methodologies, models, metrics, and tools to assess and mitigate the effect of aircraft noise and aviation emissions in a manner that balances the interrelationships between emissions and noise and considers economic consequences. It is also developing computer models and impact criteria for use by civil aviation authorities in assessing proposed actions. Researchers are also developing a better science-based understanding of the effects of aircraft noise and aviation emissions.

Research Goals:

- By FY 2008, 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 for integrated noise and emissions tools.
- By FY 2008, develop methods and models to analyze aircraft and ground support equipment emissions and their impact on air quality.
- By FY 2008, enable implementation of a new continuous-descent approach (CDA) noise abatement and fuel burn (emissions) reduction procedure at low-traffic airports during nighttime operations.
- By FY 2008, identify air traffic management advances required to adopt CDA procedure at medium and high capacity airports during all operations.
- By FY 2009, develop new technical guidance for noise and emissions certification.
- By FY 2010, develop and disseminate a preliminary 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 2010, develop noise and emissions exposure models for airspace management activities.
- By FY 2010, provide computer models and impact criteria for use by civil aviation authorities in environmental assessments.

- By FY 2010, test and deploy first elements of the website to educate and inform the public about aviation and the environment and to enable the community to participate actively in public processes.
- By FY 2013, develop and field a fully validated suite of tools, including the Aviation Environmental Design and Aviation Environmental Portfolio Management tools, which will allow cost benefit analyses.
- By FY 2013, use hazardous air pollutants and particulate matter direct measurements from engines to replace factors used in modeling tools.

In addition, the program is conducting government-industry sponsored research through the Partnership for AiR Transportation Noise and Emissions Reduction (PARTNER) Center of Excellence (COE) to identify and measure more accurately the issues and impacts associated with aircraft noise and aviation emissions, and generate improved solutions to deal with these problems.

Specifics of these cooperative research efforts include:

- By FY 2009, develop and disseminate new standards and methodologies to quantify and assess the impact of aircraft noise and aviation emissions for use by industry, government, and the public – also suggest a new metric to assess the acceptability of sonic boom from supersonic aircraft.
- By FY 2009, develop methodologies to quantify and assess the impact of Particulate Matter and Hazardous Air Pollutants (HAP).
- By FY 2010, assess the impacts of aviation on regional air quality including the effects of oxides of nitrogen (NOx) emissions that result when aircraft climb and cruise.
- By FY 2010, test and deploy elements of an Internet capability to educate and inform the public about aviation and the environment.
- By FY 2011, assess the level of certainty of aviation's impact on climate change, with special emphasis on the effects of contrails.

Customer/Stakeholder Involvement: The FAA works closely with other federal agencies, industry, academia, and international governments and organizations to design R&D efforts that can 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 Aviation Rulemaking Advisory Committee* – a formal standing committee composed of representatives from aviation associations and industry. The committee conveys its recommendations, advice, and information to FAA for consideration in rule making activities, and its harmonization working groups ensure that domestic and international aircraft noise certification regulations impose uniform standards upon the aircraft of all countries.
- *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 Federal Interagency Committee on Aviation Noise (FICAN)* – encourages 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.

- *Particulate Matter (PM) Roadmap* – developed by government and industry 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. Ultimately, if warranted, this activity will guide the development of aviation related technology that results in reduced particulate emissions.
- *NextGen* – FAA is leading an Environmental Integrated Product Team (E-IPT) responsible for all environmental dimensions of the JPDO. The IPT comprises FAA, NASA, the Environmental Protection Agency (EPA), DoD, Department of Commerce, Council on Environmental Quality, Department of the Interior, and Office of the Secretary of Transportation, as well as industry, academia, local government, and community groups. The efforts of the IPT are centered on advancing the national vision and recommendations for aviation in the NextGen and in the congressionally mandated study on "Aviation and the Environment."

R&D Partnerships: Through a series of Memorandums of Agreement (MOA), 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. In FY 2005, FAA signed an MOA with DoD to pursue joint activities to understand and mitigate aviation noise and emissions. The FAA is also pursuing collaborative agreements with DoE and EPA to leverage resources to address aviation's environmental impact.

- Through the JPDO NextGen, the program established an IPT comprising FAA, NASA, EPA, DoD, Department of Commerce, Council on Environmental Quality, Department of the Interior, and Office of the Secretary of Transportation, as well as industry, academia, local government, and community groups. The IPT is pursuing an intensive, balanced approach, emphasizing alignment across stakeholders in developing needed business and technology architectures, as well as other relevant tools, metrics, and products to address aviation's environmental impact.
- The Volpe National Transportation Systems Center 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.

Accomplishments: The number of people exposed to significant noise levels was reduced by about 90 percent between 1975 and 2006. 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. Specific recent accomplishments include:

FY 2006

- Released advanced version of highly influential advanced computer models for airport and heliport noise analysis – over 1000 users in over 40 countries. The models are used in over 160 U.S. airport studies involving more than $1.8 billion in airport noise compatibility grants, and recently provided the basis for an aircraft noise exposure prediction model for air tours in the Grand Canyon National Park.
- Released advanced version of a computer model that is used extensively by over 300 domestic and international users in airport air quality analyses and has won the EPA's highest endorsement.

- JPDO E-IPT instituted a framework for establishing national goals for aviation and the environment and completed a ”gap analysis” of environmental R&D programs necessary to meet NextGen goals.
- Reported to Congress regarding a comprehensive national study of ways to reduce aircraft noise and emissions.

FY 2005

- Developed a handbook on aviation emissions that serves as the definitive source on this evolving issue.
- Developed a first order approximation to help airports assess aircraft particulate emissions and demonstrate compliance with the National Environmental Policy Act and the Clean Air Act.
- Developed a novel methodology for assessing noise, local air quality emissions, and aviation climate impacts using a common currency.

FY 2004

- 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 addressing all aspects of noise and emissions. The tools will facilitate better-informed decisions that can cost in excess of 10 billion dollars to government and industry.
- Developed a modeling capability to produce annual inventories of aircraft greenhouse gas emissions and to assess aviation’s forecasted global emissions.

FY 2003

- Established the PARTNER COE 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.
- Developed new Continuous Descent Approach noise abatement procedures in collaboration with NASA, academia, manufacturers, and airline and airport operators.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

Noise and Emissions Analyses and interrelationships

- Complete an annual assessment of noise exposure and fuel burn.
- Deliver Aviation Environmental design Tool (AEDT) Version 1.1, including Environmental Design Space (EDS), capability for ICAO Committee on Aviation Environmental Protection (CAEP)/8 Application.
- Deliver Aviation Portfolio Management Tool (APMT) Version 1.0 for CAEP/8 Application.
- Assess noise and emissions for various technology and operational scenarios.
- Demonstrate the benefit of assessing interdependencies through a significant example problem.
- Continue upgrades to Integrated Noise Model (INM), Emissions Dispersion Modeling System (EDMS), Modeling System For Assessing Global Noise Exposure (MAGENTA), and System For Assessing Aviation Global Emissions (SAGE) modules for incorporation into AEDT and to support existing customers as necessary.
- Develop business case and cost allocation for implementation of CDA.

- Work with candidate airports for appropriate implementation of CDA.
- Include provisions for CDA usage in airspace redesign projects.
- Develop cockpit and controller tools to enable CDA implementation at higher traffic levels.

Aircraft noise

- Promulgate new procedures and technical guidance for noise certification for aircraft (subsonic jet and large transport airplanes, small propeller airplanes, and rotorcraft) that are both harmonized and simplified.
- Study low frequency noise impact metrics and assess mitigation techniques; complete low frequency noise metrics assessment and publish a report.
- Complete aircraft low frequency noise study and publish report; obtain measurements, annoyance data, develop impact metrics and mitigation techniques.
- Investigate how average Day-Night-Level (DNL) performs compared to other noise impact metrics.
- Complete Land Use metrics study and publish a report.
- Conduct a study to analyze the four elements of the Balanced Approach (technology to reduce noise at the source, land use planning and management, quieter operational procedures, and operational restrictions) to noise abatement and their relationships.
- Continue to assess potential benefits of using newly developed noise reduction technologies; identify technology goals for long-term reduction of aircraft noise.
- Based on scoping study results, develop interactive website/software to communicate complex noise technical information in a manner suitable for public distribution (NoiseQuest) and complete educational component of NoiseQuest.
- Advance the sonic boom metric definition and continue to assess the applicability of existing noise metrics to sonic boom and determined annoyance of low boom waveforms to inform future decision-making regarding supersonic flight over land.
- With the "Aviation emissions activity," conduct two COE focused sessions at a national and an international conference.

Aviation emissions

- Continue to develop and publish procedures and technical guidance materials for aircraft engine exhaust emissions testing and certification that are internationally harmonized and simplified, taking into account modernization in measurement methodologies and advancements in technical understanding.
- Continue to develop and disseminate methodologies and procedures to quantify and assess the impact of Particulate Matter and Hazardous Air Pollutant emissions on the environment.
- Conduct analysis of actual aircraft engine emissions measurements to better understand the generation of emissions during engine start-up, ground idle and taxi operation, during aircraft ground roll immediately prior to takeoff, and under varying ambient conditions.
- Continue to:
  - Assess potential benefits of using newly developed emissions reduction technologies, and identify technology goals for long term reduction of aircraft engine emissions.
  - Assess the atmospheric and health effects of aviation related emissions through the PARTNER COE.
  - Test and analyze particulate matter emissions from aircraft engines as identified under the PM Roadmap.

- Complete study to collect particulate matter data using light detection and ranging technology to enhance dispersion analytical models.
- Develop preliminary agreed upon methods to measure PM from commercial aircraft.
- Develop a model of near field plume expansion to feed local air quality models.
- Assess whether there are unique health effects, particularly for NextGen scenarios, associated with particulates and hazardous air pollutants from aviation sources.
- Initiate assessment of uncertainty of impact of aviation on climate change with special emphasis on the effects of contrails.
- Initiate an assessment of the impacts of aviation on regional air quality including the effects of NOx emissions attributable to aircraft climb and cruise activities.
- With the "Aircraft noise activity," conduct two COE focused sessions at a national and an international conference.

FY 2008 PROGRAM REQUEST:

In accordance with the National Environmental Policy Act, 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 research efforts identifying noise and emissions 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. However, aviation noise and emissions are highly interdependent phenomena. Future environmentally responsible aviation policy and rule making must 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, FAA is developing a robust new comprehensive framework of aviation environmental analytical tools and methodologies to perform these functions. The long-term aim is to provide a seamless, comprehensive set of tools to address all aspects of noise and emissions. The elements of this framework include:

- EDS capability to provide integrated analysis of noise and emissions at the aircraft level.
- AEDT comprises EDS and other integrated aviation noise and emissions modules – will provide integrated capability of generating interrelationships between noise and emissions and among emissions at the local and global levels.
- 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 AEDT and APMT tools will allow:
  - Government agencies to understand how proposed actions and policy decisions affect aviation noise and emissions.

  - Industry to understand how operational decisions affect proposed projects affecting aviation noise and emissions.
  - The public to understand how actions by government and industry affect aviation noise and emissions.

Anticipated benefits of this initiative include the ability to:

- Optimize environmental benefits of proposed actions and investments.
- Improve data and analysis on airport/airspace capacity projects.
- Increase capability to address noise and emissions interdependencies in the resolution of community concerns.
- Aid in more effective R&D portfolio management.
- Remove environmental roadblocks to capacity growth.
- Continue global leadership for the United States in environmentally responsible aviation.

Other activities include:

- Continue activities through the COE to identify and measure better 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, MAGENTA), as necessary, to support existing customers and transition to AEDT.
- Support 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 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

Noise and Emissions Analyses and interrelationships

- Complete an annual assessment of noise exposure and fuel burn.
- Complete a significant example analysis to demonstrate the benefit of cost-benefit analyses.
- Deliver Aviation Environmental Design Tool (AEDT) Version 2.0 for CAEP/8 application.
- Deliver Aviation Portfolio Management Tool (APMT) Version 2.0 for CAEP/8 application.
- Deliver Environmental Design Tool Version 2.0, including validated vehicle library and demonstrated capability within AEDT framework for the Committee on Aviation Environmental Protection (CAEP)/8 application.
- Complete integrated system level analyses of Next Generation Air Transportation System (NextGen) scenarios and strategies (e.g., operations, technologies, policies, etc.).
- Continue upgrades to INM, EDMS, MAGENTA, and SAGE modules for incorporation into AEDT and to support existing customers as necessary.
- Continue working with candidate airports for appropriate implementation of CDA.
- Demonstrate continuous descent approach (CDA) procedures in high-density environment.
- Work with several airports to implement CDA for mixed operations.

Aircraft noise

- Promulgate new procedures and technical guidance for noise certification for aircraft (subsonic jet and large transport airplanes, small propeller airplanes, and rotorcraft) that are both harmonized and simplified.
- Complete comprehensive noise annoyance survey.
- Publish report on noise annoyance metrics, including new metric for supersonic aircraft.
- Complete peer review of noise annoyance data.
- Publish guidance on land use best practices.
- Continue to assess potential benefits of using newly developed noise reduction technologies; identify technology goals for long-term reduction of aircraft noise.
- Continue advancement of NoiseQuest website.
- With the "Aviation emissions activity," conduct two COE focused sessions at a national and an international conference.

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.
  - Develop and disseminate standards and methodologies to quantify and assess the impact of Particulate Matter (PM) and Hazardous Air Pollutants (HAPs) emissions in the aviation environment.
  - Assess potential benefits of using newly developed emissions reduction technologies, and identify technology goals for long term reduction of aircraft engine emissions.
  - Advance best practices in aviation emissions PM and HAPs measurements.
  - Initiate collecting PM and HAPs profiles and measurements to isolate sources.
- Continue assessment of the relative effect of various emissions on climate forcing functions.
- Continue comparison of detailed chemistry computations to aviation environmental tools approximations.
- Continue developing a model of near field plume expansion to feed local air quality models.
- Assess whether there are unique health effects, particularly for NextGen scenarios, associated with particulate matter emissions and hazardous air pollutants from aviation sources, with specific focus on the aircraft engine.
- Continue assessment of uncertainty of impact of aviation on climate change with special emphasis on the effects of contrails.
- Complete assessment of the impacts of aviation on regional air quality including the effects of NOx emissions attributable to aircraft climb and cruise activities.
- Initiate development of guidance material related to dispersion modeling (i.e., assessment of aviation-related emission concentrations that effect local air quality).
- Initiate evaluation of the necessity for establishing standards pertaining to particulate matter emissions from aircraft engines.
- With the "Aircraft noise activity," conduct two COE focused sessions at a national and an international conference.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	136,983
FY 2007 Request	16,008
FY 2008 Request	15,469
Out-Year Planning Levels (FY 2009-2012)	60,268
Total	228,728

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Contracts:					
Aircraft Noise	3,921	1,164	1,366	1367	1,359
Engine Emissions	2,340	467	1,596	1,766	1,600
Noise & Emissions Analyses	0	8,436	10,748	10,700	10,213
Personnel Costs	1,580	1,575	1,985	2,005	2,036
Other In-house Costs	87	153	145	170	261
Total	**7,928**	**11,795**	**15,840**	**16,008**	**15,469**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	7,928	11,795	15,840	16,008	15,469
Development (includes prototypes)	0	0	0	0	0
Total	**7,928**	**11,795**	**15,840**	**16,008**	**15,469**

A13.a. - Environment and Energy Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
091-016 Noise and Emissions Analysis	**$10,213**						
Develop architecture for noise/emissions modules communication			◊			◊	◊
Develop model for assessing global exposure to noise from transport aircraft			◊			◊	◊
Validate the methodologies used to assess aircraft noise exposure and impact (INM, AEM)			◊		◊		
Release INM updates		◆		◊			
Enhance aircraft noise and emissions modeling for airspace management activities				◊		◊	◊
Release EDMS updates			◊				
Forecast future global emissions and complete updates to the SAGE model			◊				
Release screening model for airport air quality, version 1, and updates				◊			
Validate methodologies used to assess aviation emissions and their impact on air quality		◆	◊				
Develop first-order approximation method for aircraft engine PM emissions			◊				
Publish handbook for airport air quality analysis and updates			◊	◊	◊		
Guidance document for estimating and reducing emissions from ground support equipment							
Resource and guidance materials, and assessment protocol concerning hazardous air pollutants		◆	◊		◊		
Develop AEDT		◆	◊	◊	◊		
Develop AEPMT		◆	◊		◊		
Harmonize AEDT and APMT databases and code management protocols		◆		◊		◊	◊
Integrate cost and socioeconomic data		◆		◊		◊	◊
Aircraft Noise	**$1,359**						
Assess aircraft noise reduction technology research		◆	◊	◊	◊	◊	◊
Prepare noise COE reports, conferences, findings, and other publications		◆	◊	◊	◊	◊	◊
Publish Advisory Circular 36-4 (and updates)			◊		◊		
Develop a new international noise standard for subsonic jets and large airplanes		◆			◊		
Develop a new international noise standard for small props and helicopters				◊			
Advance and validate methodologies used to assess aircraft noise exposure and impact (INM, AEM)				◊	◊		
Engine Emissions	**$1,600**						
Assess technological and scientific bases to support future ICAO engine emission standards			◊		◊		
Develop alternative, simplified engine exhaust emissions certification test procedures			◊	◊		◊	◊
Update Advisory Circular 34-1				◊		◊	◊
Develop measurement/sampling protocol for PM emissions from aircraft engines			◊	◊		◊	◊
Develop science/metrics and reduce uncertainties to assess impact of aviation on climate change		◆		◊	◊		
Prepare COE reports, findings, and other activities		◆	◊	◊	◊	◊	◊
Personnel and Other In-House Costs	**$2,297**						
Total Budget Authority	**$15,469**	**$16,008**	**$15,469**	**$15,069**	**$14,962**	**$15,111**	**$15,126**

◆ - Activities Accomplished ◇ - Activities Planned

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

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A11.a.	Fire Research and Safety	$7,350,000

Supports FAA Strategic Goals: Increased Safety, Greater Capacity, International Leadership, and Organizational Excellence.

Intended Outcomes: The Fire Research and Safety Program helps achieve FAA's strategic goal of increasing aviation safety by reducing the number of accidents associated with aircraft fires and mitigating the effects of a post crash ground fire. The program supports FAA's aviation safety goal by developing technologies, procedures, test methods, and criteria that can prevent accidents caused by hidden in-flight fires and fuel tank explosions and improve survivability during a post-crash fire. To improve fire safety, research focuses on near-term improvements in interior materials fire test methods and criteria, fire detection and suppression systems, aircraft fuel tank explosion protection, and long-range development of ultra-fire resistant cabin materials.

Agency Outputs: The FAA issues aircraft fire safety rules that improve material selection, design criteria, and operational procedures. The 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 research, which is also resulting in new materials and government-owned patents, FAA provides industry with critical new safety products and information.

Research Goals: To reduce the number of accidents and incidents caused by in-flight fire, to prevent fuel tank explosions, and to improve survivability during a post crash fire, near term research will be conducted to develop improved fire test standards for interior and structural materials, improved fuel tank inerting systems and extended inerting applications, and new or improved fire detection and extinguishment systems. Additionally, long-range research will be conducted to develop the enabling technology for ultra-fire resistant materials. The following milestones/goals directly support the ultimate strategic goal of in-flight fire prevention and improved post crash fire survivability:

- By FY 2009, characterize the behavior of composite wings exposed to a fuel fire, compare the results with conventional aluminum wings, and assess the impact on safety.
- By FY 2010, characterize cabin and fuselage fires in very large transport aircraft (VLTA) similar to the Airbus A380.
- By FY 2011, evaluate improvements in post crash fire survivability, under full-scale fire test conditions, provided by ultra-fire resistant materials.
- By FY 2012, develop fire safety design criteria for composite aircraft and VLTAs to maintain the same level of safety provided by contemporary transport aircraft.

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

- Aircraft Safety Subcommittee of the FAA Research, Engineering and Development Advisory Committee – representatives from industry, academia, and other government agencies annually review the program's activities.
- Technical Community Representative Groups – FAA representatives apply formal guidelines to ensure that the program's research projects support new rule making and development of alternate means of compliance for existing rules.

- Aircraft manufacturers (U.S. and foreign), airlines, foreign airworthiness authorities, chemical companies, material suppliers, and aircraft fire safety equipment manufacturers – focus on interior material fire tests and improvement of fire detection and suppression systems.
- National Transportation Safety Board (NTSB) – focus on in-flight fire incidents, on-site accident investigations, and related testing.

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, halon replacement, and lithium battery fire hazards.
- FAA-sponsored International Aircraft Materials Fire Test Working Group – R&D involves development and standardization of improved material fire tests.
- Interagency working group on fire and materials – promotes technology exchange among U.S. Government agencies and prevents unwarranted duplication of work.
- Interagency agreement with the National Institute of Standards and Technology – develops fire retardant mechanisms and rapid screening tools for flammability.
- Memorandum of cooperation with the British Civil Aviation Administration – 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.
- Arrangements with Fortune 100 companies to share development costs for new fire resistant materials.

Accomplishments: The FAA operates the world's most extensive aircraft fire test facilities. The 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 (available on-line at http://www.fire.tc.faa.gov/reports/reports.asp) highlighting research results that have led to major improvements in aircraft safety.

Outstanding program accomplishments include:

FY 2006

- Evaluated the effectiveness and safety of nitrogen-enriched air used to extinguish a hidden fire above the cabin ceiling.
- Developed an improved fire test method for heating, ventilation, and air conditioning (HVAC) ducting.
- Evaluated the cabin hazards caused by outgassing from a composite fuselage material subjected to a simulated postcrash fuel fire.
- Determined the fire hazards of lithium ion batteries shipped as air cargo.
- Conducted engine nacelle fire extinguishment tests to determine the suitability of a promising new environmentally friendly agent, NOVEC 1230, as a replacement for the currently used halon.

FY 2005

- Issued the first Department of Transportation licenses to manufacture the patented microcalorimeter for evaluating the heat release rate of extremely small samples of advanced ultra-fire resistant material.

- Developed technology to support the use of low false alarm cargo fire/smoke detectors.
- Determined the vulnerability of An-26 insulation to ignition by a small arc, resulting in the issuance of a proposed Airworthiness Directive requiring its removal from affected aircraft.
- Characterized the fire performance of ultra-fire resistant chlorinated biphenol polymers for aircraft interior applications.

FY 2004

- Conducted flight tests in National Aeronautics and Space Administration 747 shuttle carrying aircraft to measure performance of FAA fuel tank inerting system and measure fuel tank vapor concentration (first time ever done).
- Determined the limiting concentration of oxygen to prevent fuel tank explosions.
- Evaluated the effectiveness of halon hand-held extinguishers against hidden fires in standard and wide body aircraft.
- Developed technology and requirements for the protection of shipped oxygen cylinders during a cargo compartment fire resulting in the issuance of a Notice of Proposed Rulemaking.

Previous Years

- Developed and demonstrated a simple and cost effective fuel tank inerting system.
- Developed improved and new flammability tests for thermal acoustic insulation, measuring in-flight fire resistance and post crash burn through resistance, respectively.
- Developed minimum performance test standards for halon replacement agents.
- Developed and demonstrated an on-board cabin water spray system for significantly improving post crash fire survivability.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

Fire Safety Improvements

- Standardize improved fire test methods previously developed for HVAC ducting and electrical wiring.
- Calculate the cost benefit of onboard inert gas generation systems (OBIGGS) modified with capability to suppress hidden and cargo compartment fires.
- Assess the safety impact of the heat transfer characteristics of a composite fuselage (vs. aluminum) subjected to a hidden in-flight fire.
- Develop a fire test method for composite fuselage materials to safeguard against ignition and flame spread during a hidden in-flight fire.

Fire Resistant Materials

- Develop easy-to-use computer model for predicting the flammability of plastics.

FY 2008 PROGRAM REQUEST:

Ongoing Activities

Research will continue related to the prevention and extinguishment of hidden in-flight fires and crewmember safety during firefighting. In FY 2008 prevention will focus on fire test standards for materials not previously addressed, the effective use of portable extinguishers to access and extinguish hidden fires, and crewmember safety during cockpit smoke venting and extinguishing agent exposure.

The fire safety in the Boeing 787, because of the extensive use of composites to replace metal structure, will continue to be addressed. More realistic full-scale fire tests will be conducted, building on the intermediate scale tests conducted in FY 2007. The full-scale test results will be used in correlation with small-scale test data to determine, if required, a suitable post crash fire test method for fuselage composite materials.

Fuel tank explosion protection research will focus on issues arising from the initial introduction of fuel tank inerting in commercial transports by Boeing; concept used by Boeing was based on technology developed under this program. The main emphasis will be on improving the resistance of the air separation membranes, the devices that generate inert gas, to contamination and the usefulness of oxygen sensors in the fuel tanks.

Long term, applied research will continue to develop ultra-fire resistant (virtually fireproof) interior materials. In FY 2008, researchers will manufacture fireproof cabin components (sidewall, ceiling) using fire smart polymer technology and evaluate the fire and mechanical performance of the components. Also research will commence to develop non-halogen (environmentally friendly) fire smart polymers.

New Initiatives

No new initiatives are planned in FY 2008.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

Fire Safety Improvements

- Develop guidance on the effective access and extinguishment of hidden fires by hand-held extinguishers.
- Examine adequacy of current requirements for cockpit smoke venting and allowable exposure to halon extinguishing agents.
- Assess the need for and develop, if required, improved fire test criteria for materials in hidden areas not previously addressed.
- Evaluate and develop improvements in the reliability and efficiency of fuel tank inerting systems.
- Develop pass/fail criteria for the new in-flight fire resistance test method for structural composite materials.
- Conduct full-scale fire tests to determine the need for a fire test method for fuselage composite materials to improve post crash fire safety.

Fire Resistant Materials

- Manufacture and demonstrate fireproof cabin components.
- Initiate development of non-halogen (environmentally friendly) fire smart polymers.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	134,360
FY 2007 Request	6,638
FY 2008 Request	7,350
Out-Year Planning Levels (FY 2009-2012)	34,775
Total	183,123

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Contracts:					
Fire Research and Safety	6,311	3,263	2,570	2,816	3,355
Personnel Costs	3,043	2,890	3,379	3,588	3,650
Other In-house Costs	314	372	233	234	345
Total	**9,668**	**6,525**	**6,182**	**6,638**	**7,350**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	9,668	6,525	6,182	6,638	7,350
Development (includes prototypes)	0	0	0	0	0
Total	**9,668**	**6,525**	**6,182**	**6,638**	**7,350**

A11.a. - Fire Research and Safety Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
061-110 Fire Research & Safety							
Fire Resistant Materials	**$526**						
Develop computer model for predicting plastics flammability		♦					
Manufacture and demonstrate fireproof cabin components (scaled up size)			◊				
Develop non-halogen fire smart polymers			◊				
Evaluate improvement in post-crash fire survivability provided by ultra-fire resistant materials during full-scale fire tests						◊	
Fire Safety Improvement	**$2,829**						
Assess need/develop improved fire test criteria for hidden materials not previously addressed			◊				
Standardize the improved fire tests previously developed for ducting and wiring		♦					
Calculate benefit of OBIGGS modified to suppress hidden & cargo compartment fires		♦					
Examine adequacy of cockpit smoke venting and allowable halon exposure			◊				
Develop guidance on the access and extinguishment of hidden in-flight fires			◊				
Evaluate and develop improvements in the reliability & efficiency of fuel tank inerting systems			◊				
Assess safety impact of reduced heat losses from composite fuselage skin exposed to hidden in-flight fire		♦					
Develop fire test method for composite materials to protect against hidden in-flight fire		♦					
Develop pass/fail criteria for composite materials in-flight fire test method			◊				
Conduct composite fuselage full-scale postcrash fire tests			◊				
Characterize and assess composite wing behavior when subjected to a postcrash fuel fire				◊			
Characterize cabin and fuselage fires in very large transport aircraft (VLTA)					◊		
Define composite fuselage & VLTA fire safety design criteria							◊
Personnel and Other In-House Costs	**$3,995**						
Total Budget Authority	**$7,350**	**$6,638**	**$7,350**	**$8,457**	**$8,546**	**$8,815**	**$8,957**

♦ - Activities Accomplished ◊ - Activities Planned

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

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A11.g.	Flightdeck/Maintenance/System Integration Human Factors	$9,651,000

Supports FAA Strategic Goals: Increased Safety, Greater Capacity, International Leadership, and Organizational Excellence.

Intended Outcomes: The Flightdeck/Maintenance/System Integration Human Factors Program helps achieve the FAA's Flight Plan goals for increased safety and greater capacity 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.
- Developing methodologies to identify and mitigate risk factors in automation-related operator errors.
- Developing requirements, knowledge, guidance, and standards for design, certification, and use of automation-based technologies, tools, and support systems.
- Addressing human performance capabilities and limitations involving Operational Improvements in the JPDO's Segments 2 and 3 slated for development and implementation in 2010-2015.

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

Research Goals:

By FY 2008:

- Evaluate methods to mitigate the potential for incidents and accidents by assessing and removing causal factors of human error from flight deck operations and aviation maintenance.
- Begin developing guidance on how advanced technology can be used for inspection training and reducing errors in general aviation maintenance.
- Facilitate the operational implementation 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). This tool will 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. It will also address equipment and testing assumptions.

By FY 2009:

- Develop a system safety approach to understand error patterns of pilots, maintenance personnel, and inspectors, and identify intervention strategies.

- Develop certification guidelines and human factors standards for integrating advanced technologies.
- Develop training guidelines for flight deck error management.

By FY 2012:

- Improve design of computer-human interfaces to reduce information overload and resulting errors.
- Improve pilot situational awareness, and provide corrective mechanisms to compensate for pilot skills degradation or automation failure.
- Assess cognitive and contextual factors to improve operator performance and reduce errors.
- Apply program-generated knowledge of human factors to improve selection and training of aviation system personnel.
- Examine effective roles for pilots and how those roles are best supported by allocation of functions between human operators and automation.
- Address human automation integration issues regarding the certification of pilots, procedures, training, and equipment associated with enhanced CNS/ATM operations necessary to achieve NextGen capabilities.

Customer/Stakeholder Involvement: Program researchers work directly with colleagues in FAA, other government agencies, academia, and industry to support the following R&D programs and initiatives:

- NASA's Aviation Safety Program.
- FAA's Voluntary Safety Program Office initiatives including Advanced Qualification Program (AQP), Flight Operations Quality Assurance (FOQA), and Aviation Safety Action Program (ASAP).
- FAA Research, Engineering and Development Advisory Committee – representatives from industry, academia, and other government agencies annually review the activities of the program and provide advice on priorities and budget.

R&D Partnerships: The Flightdeck/Maintenance/System Integration Human Factors Program collaborates with industry and other government programs through:

- Joint Safety Analysis Teams and Joint Safety Implementation Teams 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 – FAA participates in this group to promote a joint vision for automation and related technical areas.
- Domestic and international aviation maintenance industry partners like Boeing, Continental Airlines, British Airways, and the International Association of Machinists– the emphasis is on achieving research results that can be applied to real-world problems.
- Society of Automotive Engineers G-10 subcommittees – FAA participates on all of the Society's subcommittees involving human factors to adapt their findings to aviation standards, guidelines, etc.
- Nineteen FAA grants to universities supporting research on air carrier training, flight deck automation, aviation accident analysis, general aviation, and aviation maintenance technician and inspector training.

Accomplishments: The program's accomplishments include:

FY 2006

- 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 by using the Human Factors Analysis and Classification System to determine how often each error type is in the causal chain of events and finding the exact types of errors committed that lead to a fatal accident.
- Developed an industry-wide benchmark for aviation maintenance inspection. This computer-based inspection training program will standardize inspection training processes in the general aviation industry.
- Provided guidance on an acceptable vision standard for personnel involved in nondestructive inspection and testing and visual inspection of aircraft and aircraft components.
- Improved a Line Operations Safety Audit (LOSA) methodology that has been adopted by ICAO to help air carriers identify human-centered safety vulnerabilities.
- Completed a Flight Plan Target automation report specifying pilot proficiency standards for Technically Advanced Aircraft.

FY 2005

- Developed a manual, adopted for use by the International Civil Aviation Organization (ICAO), that addresses appropriate human factors considerations in designing flight deck operating documents.
- Produced human factors design and evaluation considerations for aviation applications, such as electronic flight bags and head-up displays in air transports.
- Completed initial mapping of flight data parameters onto AQP qualification standards.
- Developed initial performance models for the use of automation in air carrier cockpits.
- Developed and validated a proceduralized pilot Crew Resource Management (CRM) training and assessment system.

FY 2004

- Developed an inexpensive, reliable method to measure night vision goggle cockpit lighting compatibility.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

Information Management and Display

- Identify human factors issues in instrument procedures design.
- Provide an understanding of how broadband technology may aid maintenance personnel in their tasks and improve the work environment.
- Develop maintenance human factors "best practices" documents, practical tools, and surveillance tools to aid industry.
- Identify factors that can maximize the likelihood of successful implementation of ASAP for aircraft maintenance programs.
- Provide guidelines for manufacturers to use when designing cockpit instrument panel layouts for rotorcraft.
- Develop guidance for pilot proficiency standards for advanced avionics.

Human-Centered Automation

- Distribute automation knowledge assessment, diagnosis and remediation methodology and training guidelines.
- Develop certification guidelines for integrated technology in general aviation cockpits.
- Continue development of human factors Certification Job Aid for FAR Parts 25 and 23 flight decks.
- Develop Human Performance Assessment.
- Develop guidance stipulating the minimum see-and-avoid optical system needed for an unmanned aerial vehicle ground station operator to detect an approaching airborne object.
- Provide human factors guidance for the operation of unmanned aerial vehicles with the NAS.
- Develop guidance on the extent to which test criteria used by Designated Pilot Examiners conforms to the pilot certification requirements of 14 CFR Part 61 and the Practical Test Standards.
- Develop educational materials that will help reduce accidents caused by problems of visibility in the aviation air and ground environments.
- Continue research to assess the financial cost of FOQA events.
- Develop human factors recommendations for effective decision-making among voluntary safety program teams.
- Continue to analyze LOSA as additional air carrier data is collected.
- Distribute guidelines for reliable resolutions to ASAP incident reports.
- Provide input to an Advisory Circular on implementation of air carrier internal evaluations.
- Provide 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.
- Complete detailed general aviation fatal accident human error analysis, using Human Factors Analysis and Classification System, to determine how often each error type is the “initiating” error in the causal chain of events and what the exact types of errors are committed that lead to a fatal accident.
- Evaluate how well civilian, instrument-rated helicopter pilots maintain control of their aircraft after inadvertent VFR flight into IMC across a variety of flight altitudes and speeds.

Selection and Training

- Develop training methods to prepare newly hired pilots to handle unexpected events in high-density operations.
- Investigate methods to prepare low-time pilots for high-density operations.
- Validate simulator training requirements for low-time regional pilots.
- Identify what human factors maintenance unmanned aircraft issues need be addressed so that the Federal Aviation Administration can begin to develop policies, procedures, and approval processes to enable operation of unmanned aerial vehicles.
- Develop educational materials that will help reduce general aviation accidents.
- Distribute training methods and guidelines to ensure pilot skill retention for critical flight tasks.
- Validate statistical methods to link Threat and Error Management ASAP classification schemes to LOSA and AQP performance data.

- Develop and evaluate off-the-shelf advanced technologies, such as virtual reality, for training and evaluation in aviation maintenance.
- Develop a "best practices" document to inform the aviation community of potential problems associated with fatigue in combination with environment when performing Liquid Penetrant and Fluorescent Magnetic Particle Inspection.
- Provide guidance and develop educational tools for the FAA/Industry Training Standards program that will integrate different technologies into any aircraft platform.
- Develop guidance for maintenance and operator training and qualification requirements related to the operation of unmanned aerial vehicles within the NAS.
- Develop a reference manual describing pilot awareness, knowledge and skill elements for technically advanced aircraft.
- Develop guidance on how advanced technology can be used for inspection training and reducing errors in general aviation maintenance.
- Design a prototype inspection training system for general aviation inspectors.

FY 2008 PROGRAM REQUEST:

The program will continue to focus on providing technical information and advice to improve pilot, 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, certification, and operational approval of flight decks, equipment, and procedures. Near-term and transition to NextGen requirements are addressed.

Information Management and Display

- Develop human factors guidance for instrument procedures design.

Human-Centered Automation

- Explore improved automation training methods for new hire pilots.
- Establish human factors guidelines for electronic flight bag use in the cockpit.
- Field the human factors Certification Job Aid for FAR Parts 25 and 23 flight decks.

Human Performance Assessment

- Identify intervention strategies to either prevent or reduce the likelihood of general aviation accidents.
- Develop improved methods to record and analyze flight safety data.
- Develop advanced data analysis methods for linking various voluntary safety data sources.
- Study the decision process of voluntary safety teams.

Selection and Training

- Develop pilot proficiency recommendations for current-generation technically advanced aircraft (TAA).
- Investigate methods to improve new-hire pilot training for high-density operations.
- Investigate methods to improve unexpected event pilot training.
- Investigate methods to encourage air carriers to expand ASAP programs to other segments of operations.

Initiatives - Human-automation integration activities are necessary to ensure accruing intended capacity benefits from NextGen Operational Improvements:

- Determine information requirements necessary to accomplish self-spacing, merging, spacing, and passing in en route airspace is allowed under certain conditions in certain airspace via CDTI, ADS-B.
- Assess human-automation function allocation trade-offs for those activities identified above.
- Identify certification and operational approval issues and requirements necessary to ensure timely and efficient implementation of self-spacing, merging, spacing, and passing in en route airspace is allowed under certain conditions in certain airspace via CDTI, ADS-B.
- Identify human error risks associated with the new operations and appropriate mitigation strategies.
- Develop research plans for initial air-ground integration simulations to quantify human performance in terms of workload, situational awareness, and task performance at increasing capacity levels and in mixed equipage environments.

Other Initiatives:

- Investigate methods to incorporate safety data into scenario-based pilot training.
- Recreate the Human Factors Guide for Aviation Maintenance and Inspection.
- Develop methods to improve training and procedures for flight deck distractions during critical flight phases.
- Develop methods to incorporate situationally oriented flight tasks into scenario-based training.
- Measure the status and impact of regulatory change related to human factors maintenance in Canada and Europe and other regulatory domains.
- Identify criteria that influence general aviation pilot decision-making and what influences pilots to make either a good or bad decision based on those criteria.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

Information Management and Display

- Complete guidance on communicating maintenance ASAP derived actions and recommendations using the web-based ASAP safety-information and program-tracking tool.
- Develop maintenance human factors “best practices” documents, practical tools, and surveillance tools to aid industry.
- Complete guidelines for the display of weather on multi-function displays.
- Provide guidelines for manufacturers to use when designing cockpit instrument panel layouts for rotorcraft.
- Develop human factors guidelines for instrument procedure design.

Human-Centered Automation

- Field Certification Job Aid for FAR Parts 25 and 23 flight decks.
- Develop a risk assessment tool applicable to pre-certification of maintenance procedures and equipment.
- Develop training guidelines for automation use by newly hired pilots.
- Develop certification guidelines for integrated technology in general aviation cockpits.
- Prepare a report on the validation study of the advanced knowledge assessment tool.

- Determine information requirements necessary to accomplish self-spacing, merging, spacing, and passing in en route airspace is allowed under certain conditions in certain airspace via CDTI, ADS-B.
- Assess human-automation function allocation trade-offs for those activities identified above.
- Identify certification and operational approval issues and requirements necessary to ensure timely and efficient implementation of self-spacing, merging, spacing, and passing in en route airspace is allowed under certain conditions in certain airspace via CDTI, ADS-B.
- Identify human error risks associated with the new operations and appropriate mitigation strategies.
- Develop research plans for initial air-ground integration simulations to quantify human performance in terms of workload, situational awareness, and task performance at increasing capacity levels and in mixed equipage environments.

Human Performance Assessment

- Prepare draft report of improved methods to record and analyze flight safety data.
- Revise the Human Factors Guide for Aviation Maintenance and Inspection.
- Prepare phase I report on advanced data analysis methods to link voluntary safety data sources.
- Prepare report on decision processes used by voluntary safety programs teams.
- Prepare phase I report on methods to incorporate flight safety data into scenario-based training.
- Provide human factors guidance for the operation of unmanned aerial vehicles within the NAS.
- Develop guidance on the extent to which test criteria used by Designated Pilot Examiners conform to the pilot certification requirements of 14 CFR Part 61 and the Practical Test Standards.

Selection and Training

- Develop pilot proficiency recommendations for very-light jets.
- Test the application of advanced training technology, like virtual reality, for maintenance.
- Provide ASAP enhancements for reporting factors contributing to aviation incidents.
- Link threat and error management ASAP classification themes to LOSA and AQP data.
- Develop training guidelines for new-hire pilots in high-density operations.
- Validate simulator training requirements for low-time regional pilots.
- Develop training for critical skill retention.
- Complete phase I report on advanced pilot training methods for unexpected events.
- Complete phase I report on methods to encourage air carriers to implement ASAP across operations.
- Develop training guidelines and procedure development guidelines for flight deck interruptions during critical flight phases.
- Investigate methods to incorporate situationally oriented flight tasks into scenario-based training.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	195,864
FY 2007 Request	7,999
FY 2008 Request	9,651
Out-Year Planning Levels (FY 2009-2012)	153,580
Total	367,094

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Contracts:					
Flight deck/Maintenance/System Integration Human Factors	4,647	8,157	5,338	4,954	6,408
Personnel Costs	2,856	2,664	2,626	2,902	3,066
Other In-house Costs	841	879	135	143	177
Total	**8,344**	**11,700**	**8,099**	**7,999**	**9,651**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	8,344	11,700	8,099	7,999	9,651
Development (includes prototypes)	0	0	0	0	0
Total	**8,344**	**11,700**	**8,099**	**7,999**	**9,651**

A11.g. – Flight Deck/Maintenance/System Integration Human Factors Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
081-110 Flightdeck/Maintenance/System Integration Human Factors							
Selection and Training	**$2,165**						
Investigate methods to prepare low-time pilots for high-density operations		◆	◊	◊			
Validate simulator training requirements for low-time regional pilots		◆	◊	◊	◊		
Develop training for critical skill retention		◆	◊	◊	◊	◊	◊
Link Threat and Error Management ASAP classification themes to LOSA and AQP data		◆	◊	◊	◊	◊	
Provide guidance and develop educational tools for the FAA/Industry Training Standards program that will integrate different technologies into any aircraft platform		◆	◊	◊	◊		
Develop and evaluate off-the-shelf advanced technologies, such as virtual reality, for training and evaluation in aviation maintenance		◆	◊	◊			
Develop guidance on how advanced technology can be used for inspection training and reducing errors in general aviation maintenance		◆					
Human Performance Assessment	**$380**						
Develop human factors recommendations for effective decision-making among voluntary safety program teams		◆	◊	◊	◊	◊	◊
Provide human factors guidance for the operation of unmanned aerial vehicles within the NAS		◆	◊	◊			
Develop guidance on the extent to which test criteria used by Designated Pilot Examiners conform to the pilot certification requirements of 14 CFR Part 61 and the Practical Test Standards		◆	◊				
Human-Centered Automation	**$2,598**						
Complete Certification Job Aid for FAR Part 23 and 25 flight decks		◆	◊				
Develop certification guidelines for integrated technology in general aviation cockpits		◆	◊	◊	◊	◊	◊
Determine information requirements necessary to accomplish self-spacing, merging, spacing, and passing in en route airspace allowed under certain conditions in certain airspace via CDTI, ADS-B			◊	◊			
Assess human-automation function allocation trade-offs for those activities identified above			◊	◊			
Identify certification and operational approval issues and requirements necessary to ensure timely and efficient implementation of self-spacing, merging, spacing, and passing in en route airspace allowed under certain conditions in certain airspace via CDTI, ADS-B			◊	◊			
Identify human error risks associated with the new operations and appropriate mitigation strategies			◊	◊			
Develop research plans for initial air-ground integration simulations to quantify human performance in terms of workload, situational awareness, and task performance at increasing capacity levels and in mixed equipage environments			◊	◊			
Information Management and Display	**$1,265**						
Develop guidelines for instrument procedures design		◆	◊	◊	◊	◊	◊
Develop guidelines for the display of weather on multi-function displays		◆	◊				
Provide guidelines for manufacturers to use when designing cockpit instrument panel layouts for rotorcraft		◆	◊	◊			
Develop maintenance human factors "best practices" documents, practical tools, and surveillance tools to aid industry		◆	◊	◊			
Identify factors that can maximize the likelihood of successful implementation of ASAP for aircraft maintenance programs		◆					
Personnel and Other In-House Costs	**$3,243**						
Total Budget Authority	**$9,651**	**$7,999**	**$9,651**	**$37,499**	**$36,967**	**$39,245**	**$39,869**

◆ - Activities Accomplished ◇ - Activities Planned

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

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A12.c.	GPS Civil Requirements	$3,600,000

Supports FAA Strategic Goals: Greater Capacity.

Intended Outcomes: This funding will address the Presidential Policy which states, "The Secretary of Transportation shall provide resources to the Secretary of Defense for assessment, development, acquisition, implementation, operation, and sustainment of additional designated Global Positioning System civil capabilities beyond the second and third civil signals already contained in the current Global Positioning System program." The $3.6 million will be used to fund: 1) system engineering analysis and prototyping for new GPS L1C civil signal, modernized GPS to meet civil integrity requirements, and 2) GPS Civil Signal Monitoring that entails software and hardware upgrades for global monitoring of all civil signals to include L1C/A, L2C, L5, and L1C.

Agency Outputs: System engineering analysis expertise and artifacts needed to reduce technical risk for GPS infrastructure modernization activities performed by DoD.

Research Goals: Identify the most efficient and cost effective manner for the GPS architecture, in combination with civil augmentations systems, to meet integrity, performance, and civil monitoring requirements for global positioning, navigation and timing for civil and military aviation.

Customer/Stakeholder Involvement: This activity will include civil and military aviation participation from service providers, system safety engineering, regulatory approvals, operational implementation, and program management.

R&D Partnerships: Department of Defense.

Accomplishments: Primary objective will be to improve the technical readiness level (TRLs) for civil aviation integrity and performance improvements to GPS as part of the overall modernization effort. Higher TRLs (lower risk) improvements will be implemented by DoD.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

N/A Funding starts in FY 2008.

FY 2008 PROGRAM REQUEST:

The agency requests $3.6 million in FY 2008 to perform system/safety engineering analysis activities to lower the TRL for an improved time keeping system for GPS-III, capable of meeting civil integrity requirements, and to define an evolutionary plan for civil augmentation systems consistent with GPS modernization.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Initiate the research & development and prototyping of a GPS satellite time keeping system capable of meeting civil clock integrity requirements.
- Complete an evolutionary plan for civil GPS augmentation systems consistent with GPS modernization.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	0
FY 2007 Request	0
FY 2008 Request	3,600
Out-Year Planning Levels (FY 2009-2012)	13,728
Total	17,328

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Contracts					
GPS Civil Requirements	0	0	0	0	3,600
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**3,600**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	0	0	0	0	3,600
Total	**0**	**0**	**0**	**0**	**3,600**

A12.c. GPS Civil Requirements Products and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
GPS Civil requirements	**$3,600**		◊	◊	◊	◊	◊
Personnel and Other In-House Costs							
Total Budget Authority	**$3,600**	**$0**	**$3,600**	**$3,469**	**$3,416**	**$3,432**	**$3,411**

◆ - Activities Accomplished ◇ - Activities Planned

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

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A12.a.	Joint Planning and Development Office	$14,321,000

Supports FAA Strategic Goals: Increased Safety, Greater Capacity, International Leadership, and Organizational Excellence.

Intended Outcomes: As the steward of the Next Generation Air Transportation System (NextGen), the Joint Planning and Development Office (JPDO) seeks to address long-term imbalances in aviation capacity and demand. At the same time, it seeks to ensure that the future operating environment is safe, well managed, environmentally responsible, and harmonized with international standards. JPDO's mission is to lead the transformation of today's aviation system into that of the future, the scope of which contributes to all of FAA's current strategic goals.

Agency Outputs: The JPDO is responsible for defining and facilitating the implementation of NextGen. At this stage in the transformation, outputs are a series of plans and analyses that define a proposed end-state and a path for achieving it. The objective is to drive collaborative decisions - involving government and industry - that will ultimately achieve the transformation.

Research Goals:

FY 2008

- Consistent with the refined foundational documents - Concept of Operations, Enterprise Architecture, and Operational Improvement Roadmap - continue to identify and facilitate all pre-implementation activities. In each year, this includes near- and longer-term research, the resolution of policy issues, and a broad range of analysis to support decision making.
- Initiate demonstrations of promising technologies and procedures that could yield benefits to the community. Demos beginning in FY 2008 will test tools and procedures for trajectory-based operations in both oceanic and domestic airspace, high-density airport operations, and global interoperability.
- Track and ensure that partner agencies are implementing programs (e.g., ADS-B) in the near-term to support a transition to the end-state architecture.

FY 2009

- Based on research results, assist agencies in deploying critical infrastructure for NextGen operations.
- Establish Policy for NAS wide aircraft equipage rules and Airspace/Route access.
- Initiate research in key areas such as "Flight Object", and Space Based navigation, along with Decision Support Tools.

FY 2010-2011

- Continue research on Four Dimensional Trajectory (4DT) Management, RTSP & Levels of Service, Equivalent Visual Ops (CDTI), and Roles of Pilots & Controllers.

FY 2012 and Beyond

- Initiate research in Super Density Operations, 4DT on Surface, Right Sizing of Facilities.
- Identify alternatives as a result of needed research that may be immature.

Customer/Stakeholder Involvement: The JPDO is truly a collaborative enterprise. Employees from NASA and the Departments of Transportation, Commerce, Defense, and Homeland Security actively lead and/or participate in JPDO activities. Similarly, the JPDO Board includes

executives from each department/agency, as well as the White House Office of Science and Technology Policy. The Senior Policy Committee includes Secretaries, Deputy Secretaries, and/or Administrators from the participating organizations, as well as the Director of the Office of Science and Technology Policy.

The private sector is also an integral part of the JPDO's work. In FY 2006, the NextGen Institute was established as an alliance of major aviation stakeholder communities. The Institute operates under guidelines set forth in the funding agreement between FAA/JPDO and the host organization, the National Center for Advanced Technologies. The agreement states that the Institute will be governed by a 16-member council that is broadly representative of the aviation community. The Institute supports JPDO by recruiting and assigning industry experts to participate in forums and perform technical work. The Institute has already hosted a series of workshops to gather input on research, demonstrations, operational concepts, and financial implications.

Accomplishments: Major accomplishments and associated benefits of the JPDO efforts include:

FY 2006

- Developed the NextGen Block-to-Block Concept of Operations and coordinated it through the NextGen stakeholder community for comment and feedback.
- Developed the NextGen Block-to-Block Enterprise Architecture, aligned the Architecture with the Concept of Operations, and began coordination and review through the NextGen stakeholder community.
- Baselined the Operational Improvement Roadmap to set research targets for the Integrated Product Teams.
- Conducted an initial benefit/cost analysis of the air traffic management portion of the Operational Vision.
- Published the NextGen FY 2008 Agency Budget Guidance for Research and Implementation, which begins to align programs to NextGen and identify key research areas.
- Delivered the FY 2005 Progress Report to Congress describing the JPDO's progress in carrying out the NextGen Integrated Plan.
- Developed initial JPDO Systems Engineering Management Plan (SEMP) to facilitate interaction with other agencies and stakeholders.
- Established the Architecture Integration Council, which includes the chief architects for all partner agencies. This body will ensure the cooperation and engagement of the relevant agencies' chief architects during development of the NextGen architecture.

FY 2005

- Made significant progress in resource alignment within the federal government and U.S. industry to develop and implement the NextGen in the most expedient and cost-effective manner.
- Produced and updated the NextGen Integrated Plan as the long-term strategic business plan, detailing goals, objectives, and requirements for eight transformational areas.
- Established and staffed, with federal and industry participants, eight integrated product teams to work collaboratively with government and industry to develop research agendas and strategies for achieving NextGen.
- Performed the first major evaluation of the Operational Vision in Portfolio Segments, to validate the ability to deliver two-to-three times today's capacity.

- Established the NextGen Operational Improvement Roadmap to guide the transition from today's system to the next generation.
- Developed initial NextGen Segment Portfolios of policy, research and modernization requirements based on the OI Roadmap.

FY 2004

- Initiated resource alignment within the federal government and U.S. industry to develop and implement the NextGen in the most expedient and cost-effective manner.
- Produced the outline for the Integrated National Plan as the long-term strategic business plan for NextGen that detailed NextGen goals and objectives, and requirements for transformation in eight specific areas, each individually significant yet interdependent on the others.
- Produced the framework for establishing with federal and industry participants eight integrated product teams that would work collaboratively with government and industry to plan for and develop research agendas and strategies for achieving NextGen.
- Established the framework for the NextGen Operational Improvement (OI) Roadmap to guide the transition from today's system to the Next Generation System.
- Developed initial plan for the NextGen Segment Portfolio's of needed policy, research and modernization requirements based on the NextGen OI Roadmap.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Continue development of the Enterprise Architecture and Concept of Operations, to include the Curb-to-Curb phases of NextGen operations as well as the strategic and policy implications of NextGen operations in 2025. The Architecture and Concept of Operations will be coordinated and closely aligned with the Operational Improvement (OI) Roadmap, thus providing three distinct but synchronized representations of NextGen:
  - The Enterprise Architecture is a structured documentation of NextGen, capturing the activities, capabilities, data interchanges, and salient relationships associated with NextGen.
  - The Concept of Operations provides a textual operational description of NextGen in the 2025 timeframe. This will be a key source to inform and initiate a dialog with the stakeholder community.
  - The OI Roadmap provides a temporal dimension to the operational capabilities. This allows the reader to understand the timeframe when certain capabilities will be realized, as well as some of the interdependencies among capabilities. These documents will provide the necessary foundational information to define implementation and research guidance to NextGen partner agencies.
- Engage the Senior Policy Committee on the following near-term, high priority policy decisions: the appropriate mechanism for implementing a system-wide safety management system; roles and responsibilities of the partner agencies in implementing a national integrated surveillance approach; navigation backup strategy; an appropriate mechanism to ensure information sharing among agencies; and the roles of government agencies and the private sector in aviation weather.
- Continue to use the NextGen Institute to access world-class private sector expertise, tools, and facilities for application to NextGen activities and tasks. Among the studies to be conducted by the Institute in FY 2007 are: options for area navigation backup systems; NextGen spectrum requirements; and identification of NextGen implementation strategies.

- Conduct detailed planning for several demonstrations to be undertaken in FY 2008, including Oceanic Trajectory-Based Operations, High Density Airport Operations, Domestic Trajectory-Based Operations, Network Enabled Weather, and Global Interoperability. These demonstrations will test operational concepts, demonstrate technologies that could address operational challenges, and provide alternatives for architectural tradeoffs.
- Continue system-of-system modeling, simulation, and evaluation to ensure benefits, costs, and trade-offs are understood across the full range of goals.
- Continue outreach efforts aviation trade associations and non-traditional organizations (e.g., groups representing both leisure and business travelers) to solicit views as to how NextGen can best meet the needs of the traveling public.

FY 2008 PROGRAM REQUEST:

Ongoing Activities

- Continue modeling, simulation, and evaluation to ensure benefits, costs, and trade-offs are understood across the full range of goals.
- Revise, coordinate, and cost the research and implementation agendas for subsequent years.
- Publish Annual Agency Budget Guidance and work with agencies and industry on research areas and implementation of NextGen-related programs.
- Continue refining foundational documents - Concept of Operations, Enterprise Architecture, and Operational Improvement Roadmap - in response to the outcome of demonstrations, research, changes in agency budgets, etc.
- Refine NextGen metrics.
- Plan FY 2009 operational demonstrations.
- Continue alignment of agency goals and objectives with NextGen goals and objectives.

New Initiatives

- Conduct demonstrations, including Oceanic Trajectory-Based Operations, High Density Airport Operations, Domestic Trajectory-Based Operations, Network Enabled Weather, and Global Interoperability. These demonstrations will test operational concepts, demonstrate technologies that could address operational challenges, and provide alternatives for architectural tradeoffs.
- Facilitate the transfer of technologies from research programs that are ready for implementation (e.g., NASA, FAA, DHS and DoD Advanced Research Projects Agency program) to the federal agencies with operational responsibilities and to the private sector, as appropriate.
- Draft the initial NextGen Requirements document, which will decompose and synthesize the foundational documents into a set of functional, performance, and interoperability requirements. Ultimately, these requirements will be used to aid decision-making and investment prioritization in partner agencies.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

Planning and Agency/Industry Alignment

- Update, coordinate, validate and begin implementing the early opportunity projects for the Integrated National Plan for NextGen, and identify other opportunities for subsequent implementation.

- Coordinate aviation and aeronautics research programs to achieve the goal of more effective and directed research that will result in only performing the most promising and applicable research.
- Set goals, priorities and metrics, and reporting structure, and coordinate research activities within JPDO member agencies and with U.S. aviation and aeronautical firms.
- Facilitate the transfer of technologies from research programs that are ready for implementation (e.g., NASA and DoD Advanced Research Projects Agency program) to the federal agencies with operational responsibilities and to the private sector, as appropriate.

Systems Integration and Transformation Analysis

- Continue to refine research plans, which will describe research and supporting activities required to drive implementation decisions to effect the NextGen transformation.
- Continue refining foundational documents - Concept of Operations, Enterprise Architecture, and Operational Improvement Roadmap - in response to the outcome of demonstrations, research, changes in agency budgets, etc.
- Continue modeling planned improvements to test their efficacy in accomplishing NextGen goals.
- Conduct analyses, trade studies, and demonstrations to select the best approaches/alternatives for transforming the current air transportation system to NextGen.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	25,978
FY 2007 Request	18,100
FY 2008 Request	14,321
Out-Year Planning Levels (FY 2009-2012)	55,729
Total	114,128

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Contracts:					
Joint Planning & Development Office	3,000	3,659	16,539	16,112	12,910
Personnel Costs	0	1,200	1,313	1,867	1,256
Other In-house Costs	0	200	67	121	155
Total	**3,000**	**5,059**	**17,919**	**18,100**	**14,321**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	3,000	5,059	17,919	18,100	14,321
Development (includes prototypes)	0	0	0	0	0
Total	**3,000**	**5,059**	**17,919**	**18,100**	**14,321**

A12.a. - Joint Planning & Development Office Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Joint Planning & Development Office							
Planning and Agency/Industry Alignment	**$2,500**						
Update and carry out an integrated plan for a Next Generation Air Transportation System		◆	◊	◊	◊	◊	◊
Coordinate and facilitate the transfer of technologies from aeronautics research programs and direct research that will result in achieving NextGen		◆	◊	◊	◊	◊	◊
Systems Integration and Transformation Analysis	**$10,410**						
Accomplish the coordination to create and carry out the plan to achieve more directed programs through applicable research and systems integration		◆	◊	◊	◊	◊	◊
Develop Enterprise Architecture for systems-of systems engineering and expand lower levels of the enterprise		◆	◊	◊	◊	◊	◊
Evaluate and validate cross IPT, integrated system-wide concepts, procedures, policies, business cases, etc. to assure potential alternatives exist that could meet all the National Plan Objectives		◆	◊	◊	◊	◊	◊
Conduct policy analyses that focus on early decisions to establish guiding principles for the transformation		◆	◊	◊	◊	◊	◊
Model the planned system improvements to validate their efficacy in accomplishing the NextGen goals. Update roadmaps and research agenda's as required		◆	◊	◊	◊	◊	◊
Assist agencies in selecting the best approaches/alternatives for transforming the current air transportation system to NextGen		◆	◊	◊	◊	◊	◊
Personnel and Other In-House Costs	**$1,411**						
Total Budget Authority	**$14,321**	**$18,100**	**$14,321**	**$13,979**	**$13,844**	**$13,961**	**$13,945**

◆ - Activities Accomplished ◇ - Activities Planned

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

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
ATO Capital	1A01L	Local Area Augmentation System (LAAS) for GPS	$1,000,000

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

Intended Outcomes: LAAS will provide improved performance over existing ILS systems and only requires one system to cover all runway ends in contrast to ILS, which requires separate installations for each runway end. The program supports FAA increased safety and capacity goals by applying the latest in safety assurance policy and eliminating the need for ILS clear zones. International interest in LAAS is increasing and requires the FAA to continue its leadership role through the agreements it has already initiated with Australia, Spain, Germany, and Brazil.

Agency Outputs: The outputs will be the Category-II/III ground facility specification, system certification plan, and draft system architecture.

Research Goals: The program will develop requirements and assess the feasibility of modifying the existing Category-I architecture to meet Category-II/III auto-land requirements. This information will be used to support FAA policy regarding future terminal area and precision approach navigation plans within the NAS.

Customer/Stakeholder Involvement: AVS continues to support GNSS requirements development for non-precision and precision approach operations, and also participates in LAAS efforts to meet Category-II/III auto-land operations. Industry (e.g., Boeing) is actively participating with the FAA on developing and assessing LAAS auto-land requirements. Boeing and Airbus are strong advocates of LAAS as the long-term solution for all precision approach operations and are already equipping aircraft with LAAS avionics. Federal Express, Continental Airlines, and numerous other air carriers intend to implement LAAS when it becomes available. The Department of Defense (DoD) also plans to implement LAAS-technology in their Joint Precision Approach Landing System (JPALS) program, a military version of LAAS.

R&D Partnerships: Boeing and the FAA are currently negotiating an MOA that will establish mutual objectives for LAAS Category-II/III activities and a partnership for achieving those objectives. This cooperation consists of analysis initiated under FAA contract and continues under internal Boeing funds.

Accomplishments: Category-I key risk areas have all been reduced to low and can be leveraged to further mitigate risk for LAAS Category-II/III auto-land operations. A framework has been established by Boeing and the FAA to define the LAAS ground facility and airborne requirements necessary to demonstrate compliance with auto-land criteria.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

No FY 2007 or prior-year funding is available for LAAS ATD&P activities.

FY 2008 PROGRAM REQUEST:

Ongoing Activities

Current activities in the overall LAAS program include approval of a Category-I system at Memphis airport in late 2008. Ongoing efforts are to finalize Category-II/III baseline requirements allocation between primary stakeholders and to draft ground facility specifications and airborne Minimum Operational Performance Standards (MOPS).

New Initiatives

The program will conduct documentation and analysis to mature requirements and lower risk to the FAA and industry concerning implementation of LAAS technology. These efforts will focus on developing ground facility specifications and the appropriate airborne requirements. Experience gained under Category-I LAAS R&D will be leveraged to assess and document the minimal design changes necessary to meet auto-land criteria.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Develop Category-II/III ground facility specifications and airborne requirements.
- Assess and document Category-I design changes necessary to meet Category-II/III auto-land requirements.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	16,500
FY 2007 Appropriated	0
FY 2008 Request	1,000
Out-Year Planning Levels (FY 2009-2012)	0
Total	17,500

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Enacted**	**FY 2008 Request**
Contracts:					
Local Area Augmentation System (LAAS) for GPS	0	0	0	0	1,000
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**1,000**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Enacted**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	0	0	0	0	1,000
Total	**0**	**0**	**0**	**0**	**1,000**

1A01L – Local Area Augmentation System (LAAS) for GPS Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Local Area Augmentation System (LAAS) for GPS The program will conduct documentation and analysis to mature requirements and lower risk to the FAA and industry concerning implementation of LAAS technology	**$1,000**		◊				
Total Budget Authority	**$1,000**	**$0**	**$1,000**	**$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.

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
ATO Capital	**1A01D**	**NAS Requirements (Weather)**	**$1,000,000**

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

Intended Outcomes: Weather has a significant impact on safety and efficiency and affects activities across all domains. Weather accounts for approximately 65 percent of all delays and avoidable weather delays are estimated to cost airlines, air cargo operators and other users approximately $4 billion annually. Weather is a contributing or causal factor in over 20 percent of all accidents (and in very near 90 percent of general aviation accidents) and almost 25 percent of fatal accidents. Accidents and injuries from icing and turbulence alone cost approximately $300 million per year. FAA's Air Traffic Organization, Operations Planning, System Engineering, National Airspace System (NAS) Weather Policy and Requirements Group manages aviation weather requirements at the NAS level and aims to decrease avoidable weather delays plus reduce accidents caused by weather. The staff manages mostly non-capital requirements met by both FAA and National Weather Service (NWS), principally through aviation weather policy and standards development, research & development weather portfolio management and representing FAA in the Joint Program Development Office (JPDO) Weather Integrated Product Team (IPT).

This budget line item provides an established but flexible means for FAA to direct attention and resources to concerns affecting system efficiency and safety of the present and future NAS. 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 decrease avoidable weather delays and reduce accidents caused by adverse weather through implementation of new R&D weather products and to promote U.S. current and NextGen practices at ICAO for global harmonization and accelerated change.

Deliverables supported by the NAS Requirements line will continue the technology transfer program, the Qualified Internet Communications Provider program and annual Surface Observations Service Standards report, on-going representation of the U.S. interests within the international community; and development of weather policies.

Agency Outputs: This line item enables:

- Management of the technical transfer of aviation weather products from research & development into operational use to include introduction of new in-flight icing, thunderstorm, turbulence and volcanic ash capabilities in the NAS;
- Weather in the cockpit standards;
- Development of an FAA tactical weather avoidance policy that includes standardized quantitative thresholds for convection and related phraseology for controller communication with pilots and potential procedures for controlled tactical avoidance;
- Surface and airborne observation service standards for efficiency, improved forecasts, and traffic flow management tool enhancements;
- Graphical Area Forecast Implementation; and
- Ongoing liaison with 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.

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 attached acronym list 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 Joint Program Development Office (JPDO);
- The weather and satellite services in the Department of Commerce, National Oceanic and Atmospheric Administration;
- ICAO and the World Meteorological Organization;
- The Office of the Federal Coordinator for Meteorology; and
- 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 Icing Product (CIP).
- Transferred other products into the final R&D phase (experimental) including Cloud Top Height (CTH) and Ceiling and Visibility Analysis.
- Developed and tested a safety risk assessment process for R&D products before being implemented on Government platforms.
- 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:

FAA's Air Traffic Organization, Operations Planning, System Engineering, National Airspace System (NAS) Weather Policy and Requirements Group partners with the Agency's Aviation Weather Research program, other Air Traffic Organization offices, Flight Standards, Aircraft Certification, and NWS offices as a part of the technology transfer process. The office partners with the Flight Standards and NWS personnel on a full range of aviation weather development activities. The office partners with the Joint Program Development Office (JPDO) to align FAA and NextGen weather architecture and address public/private roles and responsibilities for efficient sourcing. In the international arena, the office closely partners with ICAO and its contracting members.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Continue the AWTT process to implement enhancements to the Graphical Turbulence Guidance (GTG), Cloud Top Height (CTH), and CONUS Analysis products into operational use.
- Develop and implement a NAS-wide R&D prioritization process that takes into account both safety and efficiency benefits of weather products.

- Continue to develop and implement a safety risk management process that identifies and mitigates the risks of implementing specific weather products and also determines the operational suitability of the products for use by all users.
- Conduct analysis on minimizing differences between FAA Standards and ICAO SARPS.
- Evaluate metrics under development or in use that quantitatively relate delay statistics to operationally significant weather for applicability to measuring effectiveness of weather information.
- Develop concept for a set of metrics that would evaluate the effectiveness of weather information on performance of the NAS in operationally significant weather.
- Represent U.S. aviation interests at ICAO Regional Air Navigation Meteorological Group Meetings.
- Provide support to NWS in the design of aviation weather products and services in response to FAA requirements.

FY 2008 PROGRAM REQUEST:

The requested funding will allow the program to continue to focus on enhanced safety, enhanced efficiency and international leadership. Specific areas will include continued activities associated with the Aviation Weather Technology Transfer (AWTT) process, ICAO representation, and weather impact assessments.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Continue the AWTT process to implement icing products for Alaska for operational use and various other products in the experimental and testing stages of implementation.
- Implement and continue to use the safety risk management system to identify and mitigate risks for aviation weather product use before implementation.
- Coordinate the development of Operational Improvements (OIs) and Preliminary Implementation Plans (PIPs) for weather.
- Align JPDO Weather Enterprise Architecture with FAA Enterprise Architecture Roadmap.
- Develop plan to align FAA with NextGen policies to optimize government and commercial vendors roles in observations, forecasting, and dissemination.
- Update NAS wide weather mission and needs statement for NextGen.
- Continue to develop users' needs analyses, simulations, and performance requirements and integrate ATO, NextGen and AVS requirements.
- Develop various Concept and Requirements Definition (CRD) for weather.
- Develop NextGen Network Enable Weather Requirements.
- Continue to manage the Weather Portfolio Investment Management Plan.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	11,178
FY 2007 Appropriated	800
FY 2008 Request	1,000
Out-Year Planning Levels (FY 2009-2012)	5,000
Total	17,978

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Enacted**	**FY 2008 Request**
Contracts:					
NAS Requirements Development (Weather)	3,000	1,488	790	800	1,000
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
Total	**3,000**	**1,488**	**790**	**800**	**1,000**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Enacted**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	3,000	1,488	790	800	1,000
Total	**3,000**	**1,488**	**790**	**800**	**1,000**

1A01D - NAS Requirements (Weather) Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
NAS Requirements (Office of Weather Policy and Standards, NAS Weather Office, ATO-P)	**$1,000**						
AWTT Process							
Implement Graphical Turbulence Guidance FL100-200		◆					
Implement Forecast Icing Product – Severity		◆					
Implement Graphical AIRMETS		◆	◊	◊	◊		
Implement Graphical Area Forecast		◆	◊	◊	◊		
Continue implementation of R&D products		◆	◊	◊	◊	◊	◊
ICAO							
Provide graphical 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 Meteoro-logical messages for the World Area Forecast System		◆	◊	◊	◊		
Complete a user guide for the Broadcast of Aeronautical Information Services on the World Area Forecast System		◆	◊				
Provide US policy positions to 9 ICAO operations, study and planning groups		◆	◊	◊	◊	◊	◊
Complete guidance for aviation weather products to be made available in the cockpit		◆	◊	◊	◊	◊	
Develop improved forecast algorithms for icing products.		◆	◊	◊	◊	◊	
Provide operational requirements for the World Area Forecast Center and two Volcanic Ash Advisory Centers		◆	◊	◊	◊	◊	
FAA Flight Plan Initiative							
Evaluate effectiveness of FAA and NWS weather information in reducing weather delays		◆	◊	◊			
Develop concept for a set of metrics that would evaluate the effectiveness of weather information on performance of the NAS in operationally significant weather		◆	◊				
Aviation Weather Requirements Development							
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		◆	◊				
Total Budget Authority	**$1,000**	**$800**	**$1,000**	**$1,000**	**$1,000**	**$1,000**	**$1,000**

◆ - 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
ATO Capital	**1A13**	**NextGen Demonstrations and Infrastructure Development**	**$20,000,000***

Supports FAA Strategic Goal: Greater Capacity, International Leadership

[The FAA has identified this program as a "Transformational" program for the Next Generation Air Transportation System.]

Program Goals and Intended Outcomes: The Joint Planning and Development Office (JPDO) is the steward of the Next Generation Air Transportation System (NextGen). Over the past year, the JPDO developed a NextGen Concept of Operations and an initial Enterprise Architecture. This activity supports the establishment of an operational framework for the future.

Agency Outputs: Validation and the pre-implementation activities associated with Four Dimension Trajectory Based Operations and Air Traffic Management.

Four Dimension Trajectory Based Operations - the four dimensions measure spatial coordinates, altitude and time. A set of systems would collect and disseminate 4D data to provide complete situational awareness to pilots, controllers and air traffic managers. The goal is allow flights to find their best route, rather than restrict them to controllable paths.

Air Traffic Management - currently FAA controls air traffic in the National Airspace System (NAS) using defined flight paths and airspace restrictions that do not take full advantage of the capabilities of an aircraft or its systems. NextGen would transition FAA to a more collaborative environment where pilots and FAA managers would work together to tailor an aircraft's route for optimum safety and efficiency.

Beyond defining these initial concepts, the FAA and JPDO, with its many partners, must test and mature these concepts and the technologies that support them. This investment prepares partner agencies to make investment decisions and deploy new capabilities.

Customer/Stakeholder Involvement: The JPDO has been active in defining, sponsoring and planning of the demonstrations and engineering activities.

Customer:

JPDO, NextGen Institute, RTCA.

R,E&D Partnerships:

NASA, EUROCONTROL, European Commission- SESAR.

Accomplishments:

New start.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

New start in FY 2008.

FY 2008 PROGRAM REQUEST:

FY 2008 is the first year JPDO has requested funding for demonstrations and infrastructure development activities to test central NextGen concepts. The results will be used to identify early

* The AMOUNT shown for NextGen includes only the R&D portion of the total line item amount. R&D represents 40 percent in FY 2008 and beyond.

implementation opportunities, refine longer-term objectives, and if results dictate, eliminate certain concepts from further consideration.

Two demonstrations are planned: Oceanic Trajectory Based Operations and High Density Airport Time-based RNAV/RNP. The first demonstration is a proof-of-concept validation based on working prototypes in an operational environment to measure flight profile predictability and efficiency on long-duration international flights, where fuel burn optimization is a prime concern. This activity demonstrates the benefits of flexibility in a four-dimensionally managed environment through en route degrees-of-freedom; demonstrate exchange of operational data between aircraft operators and air traffic service providers for informed decision making in near real-time to increase productivity; and demonstrate efficient transition from the oceanic/en route phase of flight to the domestic/enroute and offshore/descent phases of flight to increase transition area efficiency and productivity. The second demonstration will show fuller use airspace to accommodate the expected demand. It links two important activities, time based metering and procedures that reduce separation minima (RNAV/RNP), to more fully and efficiently utilize every landing opportunity at the airport runway. The demonstration will also test whether FAA can increase capacity without additional staffing.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

Concept Demonstrations

- *Oceanic Trajectory Based Operations Demonstration* – Planes flying over oceanic space must currently fly designated routes. Trajectory-based flight uses individual flight plans that can be tailored as needed to avoid congestion and take advantage of shorter routes. By making full use of existing technology, such as Advanced Technologies and Oceanic Procedures (ATOP), this demonstration will test various aspects of trajectory management in the oceanic environment. Today's air traffic control concept of operations does not make full use of ATOP, which allows for enhanced trajectory tracking, data communications and capabilities that predict conflicts when flight routes change. This demonstration is necessary to develop trajectory-based requirements and procedures for oceanic flight. The results will be used to pursue early implementation opportunities, where appropriate, and to refine the NextGen concept of operations. This demonstration is a part of the plan to create a global concept for strategically managed airspace, seamlessly integrated across international boundaries and existing air traffic environments.
- *High Density Airport Time-based RNAV/RNP Demonstration* – This activity accelerates the first integrated demonstration of super density terminal operations described in the NextGen concept. These demonstrations result in a set of requirements and operational procedures for initial stages of super density terminal operations. The demonstration focuses on the integration of RNAV/RNP routings and Traffic Management Advisor (TMA). RNAV/RNP and other procedures reduce separation minima and provide full, efficient use of the runways and airspace in high-density airport/metropolitan environments.

Initial Performance Based Services

- *Variable Separation* – Performance-based services are a basic principle of NextGen: the more sophisticated the capabilities of the aircraft, the more likely the pilots can get their preferred trajectory. The performance-based concept calls for separation standards to vary according to aircraft capabilities and pilot training. This activity will result in a set of separation standards requirements and algorithms to implement them. This includes changes to automation, procedures, and training. This also funds an analysis of performance-based data processing to see if it is appropriate for lowering separation minima. Performance-based data processing is a way to integrate all information about an aircraft's path and location to

provide full situational awareness and predict possible problems. This analysis includes the concept of integrating departure and arrival control and the expansion of major metropolitan and terminal airspace also known as "Big Airspace".

Program Management

- *JPDO* – The JPDO's oversight of NextGen requires approximately $18 million annually. Prior to FY 2008, the entire amount was requested through the Research, Engineering, and Development appropriation. Beginning in FY 2008, as a few programs move toward implementation, there is a rationale for requesting part of the funding through the ATO Capital appropriation. A detailed description of the program management request can be found in the RE&D budget request.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	0
FY 2007 Appropriated	0
FY 2008 Request	20,000
Out-Year Planning Levels (FY 2009-2012)	48,000
Total	68,000

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Enacted**	**FY 2008 Request**
Contracts:					
NextGen Demonstrations and Infrastructure Development	0	0	0	0	20,000
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**20,000**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Enacted**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	0	0	0	0	20,000
Total	**0**	**0**	**0**	**0**	**20,000**

1A13 - NextGen Demonstrations and Infrastructure Development Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Oceanic Trajectory Based Operations Demonstration	**$4,800**						
Demonstrate improved trajectory-based operations in mixed-equipage, oceanic airspace with actual aircraft procedures			◊				
Demonstrate standard separation in a full-equipage, fully automated environment with no voice communication			◊				
Demonstrate trajectory-based operations in transition airspace, between oceanic and domestic en route, using oceanic data link and Advanced Technologies and Oceanic Procedures (ATOP) automation			◊	◊	◊	◊	
Demonstrate trajectory-based operations in mixed-equipage, high altitude airspace with actual aircraft procedures			◊	◊	◊	◊	◊
Demonstrate auto-negotiations between flight automation and ground automation without human intervention			◊	◊	◊	◊	◊
High Density Airport Time-based RNAV/RNP Demonstration	**$4,600**						
Demonstrate Traffic Management Advisor (TMA) and Area Navigation / Required Navigation Performance (RNAV/RNP) routing to increase throughput and efficiency for large, super density airports			◊				
Demonstrate greater throughput in congested, domestic, en route airspace using point-in-space metering linked to RNAV/RNP routes			◊	◊	◊		
Variable Separation	**$10,000**						
Develop separation standards that vary according to aircraft capability and pilot training			◊				
JPDO Program Management	**$600**		◊	◊	◊	◊	◊
Total Budget Authority	**$20,000***	**$0**	**$20,000**	**$12,000**	**$12,000**	**$12,000**	**$12,000**

◆ - 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.

* The AMOUNT shown for NextGen includes only the R&D portion of the total line item amount. R&D represents 40 percent in FY 2008 and beyond.

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
ATO Capital	1A01C	Operations Concept Validation	$3,000,000

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

Intended Outcomes: Operational concept validation challenges and tests the validity of common situational awareness assumptions behind new mechanized systems for distributing weather and traffic information, and provides the high-quality performance requirements needed to ensure that the next generation of National Airspace System (NAS) ground and airborne support systems succeed. This process brings tactical and strategic assumptions behind controller roles and responsibilities, and decision support tools in general – as well as requirements affecting information type, update rate, and display within the systems – under strict scrutiny and redirects them, as 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 that 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; and
- 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 working in conjunction with the JPDO also has conducted a detailed survey of major stakeholders to obtain their ranking of future concept sub-elements designed 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 (released by the RTCA, August 1997), A Concept of Operations for the NAS Airspace System in 2005 (released by Air Traffic Services, September 1997), and the RTCA NAS Concept of Operations and Vision of Future Aviation (released by the RTCA, December 2002). More recently, JPDO has provided plans, concept of use and other documentation; these documents have provided guidance to the development of the

NAS Architecture Version 6. 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.
- 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, and 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

- 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.
- Validated user concepts for joint FAA/NASA activities, including human-in-the-loop simulations.
- Validated information requirements for flight object management.
- Analyzed the concept of de-emphasizing geographic dependency when assigning facilities for airspace use.

Concept system design

- Analyzed core factors related to common trajectory.
- Assessed controller workload in various U.S. traffic situations – results will help to validate density concepts and alerts used with collaborative decision-making and traffic flow management products.
- Developed and analyzed the separation normalization concept referred to as “three miles everywhere.”
- Evaluated the impact on cross-facility coordination of splitting front and back rooms, and centralizing the core automation functions apart from the controller facilities.

R&D Partnerships: This work directly relates to the FAA/NASA Memorandum of Understanding on ATM research and development and to the objectives of the Next Generation Air Transportation System objectives advanced by the Joint Planning and Development Office. 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 that would impose an undue burden on all carriers and manufacturers participating in the global airspace system.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

Operational concept development

- Deliver detailed concepts for end-to-end flight data management. The concept documents the ownership of flight data from filed to execution to post analysis.
- Deliver detailed concepts of operations for the evolution of Traffic Flow Management.
- Deliver an initial concept for flexible exchange of airspace across domains.
- Deliver detailed concepts for multi-layered planning, evolution of service provider roles.
- Expand the business continuity planning concept on facilities risk, roles and procedures.

Concept validation

- Conduct high-level concept validation for restructuring en route operations into a high airspace/low airspace split for productivity and training efficiency – include the analysis of cognitive and situational awareness issues, such as the local knowledge requirements and decision support.
- Conduct fast-time simulation of the multi sector planner concepts with focus on the coordination among the area flow managers intra- and inter-center.

Concept system design

- Support the development of flight plan information requirements for next generation flight plan advanced by the International Civil Aviation Organization (ICAO) and a transition design to the flight object.
- Develop detailed system design requirements for the common trajectory service in the new en route automation system.
- Support the development of the ICAO performance manual with guidance on measurement and transition strategy from today to the performance based ATM system.

FY 2008 PROGRAM REQUEST:

The FY 2008 request continues to evolve the NAS operations concept. From its initial broad perspective and early validation emphasis, the concept work is focusing more specifically on internal investigations of opportunities for increased productivity, and on reducing the influence of geographic location in the process of delegating responsibilities for controlling particular airspace.

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

The validation process investigates all opportunities to exploit the potential productivity and flexibility benefits offered by changes in technology and communications. These opportunities include continued use of legacy requirements for local knowledge, changes in work methods to make high altitude airspace more “generic,” and turning to performance based procedures for infrastructure and customer cost efficiencies.

Leveraging work 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 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

Operational concept development

- Develop a detail concept for high altitude airpsace and changes in procedures.
- Develp a detail concept for unlimited dynamic resectorization.
- Develop a second-level concept for trajectory-based operations as stated in the JPDO NextGen concepts document.

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 that would allow comparable results across program validation efforts in the U.S. and Europe.
- Conduct validation of alternative concepts for delegation for separation authority.
- Conduct validation of Traffic Flow Management evolution.
- Conduct human-in-the-loop analysis of high/low airspace split on training requirements for sector controllers along with the information needs and systems requirements.

Concept system design

- Extend closed-loop system dynamic modeling of decisions and demand dynamics related to scheduling and management of aircraft with the Aircraft Operations Center (AOC) and service providers.
- 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

	Amount ($000)
Appropriated (FY 1982-2006)	21,838
FY 2007 Appropriated	3,000
FY 2008 Request	3,000
Out-Year Planning Levels (FY 2009-2012)	12,000
Total	39,838

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Enacted**	**FY 2008 Request**
Contracts:					
Operations Concept Validation	2,700	2,000	2,970	3,000	3,000
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
Total	**2,700**	**2,000**	**2,970**	**3,000**	**3,000**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Enacted**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	2,700	2,000	2,970	3,000	3,000
Total	**2,700**	**2,000**	**2,970**	**3,000**	**3,000**

1A01C - Operations Concept Validation Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Operations Concept Validation	**$3,000**						
Operational Concept Development							
Develop a detail concept for high altitude airspace and changes in procedures		◆	◊	◊			
Develop a detail concept for unlimited dynamic resectorization		◆	◊	◊	◊		
Develop 2nd level concepts for trajectory-based operations			◊	◊			
Concepts of operations for the evolution of Traffic Flow Management		◆	◊	◊			
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		◆	◊	◊	◊	◊	
Conduct high-level concept validation for restructuring en route operations into high/low airspace split for productivity and training efficiency		◆	◊	◊			
Conduct validation of alternative concepts for delegation for separation authority			◊	◊	◊	◊	◊
Conduct validation of Traffic Flow Management evolution			◊	◊	◊	◊	◊
Conduct human-in-the-loop analyses of the high/ low airspace split on training requirements for sector controllers along with the information needs and systems requirements		◆	◊	◊	◊		
Concept System Design							
Extend closed-loop system dynamic modeling of decisions and demand dynamics related to scheduling and management of aircraft with AOC and service providers		◆	◊	◊	◊	◊	◊
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 RTSP		◆	◊	◊	◊	◊	◊
RTCA							
Develop Aviation Community inputs to MASPS, MOPS and Integrated Plans to Support Future Concepts and Modernization		◆	◊	◊	◊	◊	◊
Total Budget Authority	**$3,000**	**$3,000**	**$3,000**	**$3,000**	**$3,000**	**$3,000**	**$3,000**

◆ - 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
R,E&D	A11.b.	Propulsion and Fuel Systems	$4,086,000

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

Intended Outcomes: The Propulsion and Fuel Systems Program helps achieve FAA's strategic goal of increasing aviation safety by reducing the number of accidents associated with the failure of aircraft engines, components, and fuel systems. The program supports FAA's aviation safety goal by developing technologies, procedures, test methods, and criteria to enhance the airworthiness, reliability, and performance of civil turbine and piston engines, propellers, fuels, and fuel management systems. In addition, the program is working with fuel, airframe, and engine manufacturers to test new unleaded fuels as they become available to seek a safe alternative to current leaded aviation gasoline (avgas). To improve safety, the program will conduct the research needed to develop tools, guidelines, and data to support improvements in turbine engine certification requirements.

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 and sponsors technology workshops, demonstrations, and other means of training and technology transfer. The Propulsion and Fuel Systems Program provides the technical information, R&D resources, and technical oversight necessary for the agency to deliver the propulsion, fuel, and fuel transfer system technologies.

Research Goals: To enhance the safety and reduce the risk associated with the failure of engine systems, the propulsion program is developing criteria, guidelines, and data to support improvements of turbine engine certification standards. The current focus is to ensure the structural integrity and durability of critical rotating engine parts throughout their service life. This research is providing analytical tools to meet the requirements of Advisory Circular (AC) 33.14-1, "Damage Tolerance for High Energy Turbine Engine Rotors", allowing aircraft turbine engine manufacturers to assess the risk of fracture and manage the life of rotor disks. Research is also being conducted to establish an improved understanding of other material factors and manufacturing anomalies that can shorten the fatigue life of rotor disks. In the general aviation piston engine arena, the goal is to find a replacement for current leaded avgas (100LL). The replacement fuel should perform as well as 100LL in general aviation (GA) piston engines. This unleaded high-octane replacement fuel must not cause any accidents and should be a seamless, transparent change to a GA pilot. Extensive laboratory and test cell dynamometer engine testing will evaluate and characterize all new fuel formulations provided by industry for consideration.

- By FY 2010, evaluate the feasibility of using ethanol and ethanol blends as a general aviation fuel.
- By FY 2012, evaluate the feasibility of modifying general aviation piston engine controls to accommodate alternative fuels for 100LL.
- By FY 2012, develop a design methodology for use by industry to prevent cold dwell fatigue in turbine engine rotor disks and define a technique to assess the risk of the current aircraft fleet for cold dwell fatigue.
- By FY 2012, evaluate and characterize all candidate replacements formulations for 100LL.

- By FY 2012, develop advanced damage tolerance methods to reduce the risk of failure of turbine engine rotor disks.

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

- *Subcommittee on Aircraft Safety of the FAA Research, Engineering and Development Advisory Committee* – representatives from industry, academia, and other government agencies annually review the program's activities.
- *Technical Community Representative Groups* – FAA representatives apply formal guidelines to ensure that the program's research projects support new rule making and development of alternate means of compliance with existing rules.
- *The Coordinating Research Council (CRC) Unleaded Aviation Gasoline Development Group* – representatives from Texaco, Exxon Mobil, Phillips Petroleum, Chevron, British Petroleum, Cessna, Raytheon (Beech), Teledyne Continental, and Textron Lycoming facilitate two-way transfer of technology between government and industry to benefit all participants.
- *The CRC Molecular Marker Ad Hoc Committee* – representatives from turbine engine manufacturers, major oil companies and FAA provide oversight to ensure the safe implementation when adding molecular markers to jet fuel.
- *The Aerospace Industries Association (AIA)* – working subcommittees on rotor integrity and rotor manufacturing.
- *The National Transportation Safety Board* – Recommendations A-90-89 and A-90-90 recommend that a damage tolerance philosophy be implemented in the design and maintenance of failure critical engine parts and A-98-28 recommends that FAA, in cooperation with industry, address the uncontained engine failure events caused by cold dwell fatigue.

R&D Partnerships: Propulsion and Fuel Systems Program R&D partners include:

- Turbine Rotor Material Design Program - Southwest Research Institute (SwRI) has teamed with Pratt and Whitney, General Electric, Honeywell, and Rolls Royce to provide DARWIN™, a probabilistic-based rotor life and risk management certification tool.
- The AIA working subcommittees on rotor integrity and rotor manufacturing.
- Ohio State University, a member of the FAA Airworthiness Assurance Center of Excellence (COE), is conducting research on a failure mode of titanium rotor disks known as cold dwell fatigue.
- SwRI is conducting research to determine the acceptable level of fuel dye contamination allowable for the safe, continuous operation of turbine engines in partnership with the Defense Energy Support Center, Internal Revenue Service, Air Transport Association, American Petroleum Institute, General Electric Aircraft Engines, Pratt and Whitney, Rolls Royce, Honeywell and Boeing.
- 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 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 produce feasibility studies for the use of ethanol fuel blends as a possible unleaded piston fuel replacement for 100LL avgas.

Accomplishments: Outstanding program accomplishments include:

FY 2006

- Continued the enhancement of the DARWIN™ probabilistic rotor design code.
- Completed research on an experimental GA fuel provided by Exxon-Mobil under a cooperative research and development agreement; results demonstrated that amine-based additives show some promise as a replacement for 100LL.
- Completed research investigating the feasibility of using ETBE, an ethanol fuel blend, as a GA fuel; results showed there are significant range penalties associated with this fuel that make it an undesirable replacement for 100LL.

FY 2005

- Completed an enhanced version of the DARWIN™ code that addresses multiple subsurface defects in turbine engine rotor disks.

FY 2004

- Populated a rotor manufacturing induced anomaly database for the use by the engine industry in sharing lessons learned in the manufacture of critical rotating engine parts to prevent future accidents caused by manufacturing defects.
- Completed an industrial demonstration of the pool power controller for the vacuum arc remelting process that will aid in producing defect-free titanium material for the manufacturer of turbine engine rotor disks.
- Completed research on the performance in a GA piston engine of 30 unleaded fuel formulations specified by the CRC Unleaded Aviation Gasoline Development Group. The research showed that none of the candidate formulations match the detonation suppression capability of 100LL.

Previous Years

- Demonstrated, verified, and industrialized the probabilistic rotor design and life management code known as DARWIN™ for titanium alloys that provides turbine engine manufacturers a tool to augment their safe life approach.
- Demonstrated and verified the DEFORM™ defect deformation code for analysis of titanium alloy defects during the rotor disk forging process.
- Proved that the fleet octane requirement is the single most critical parameter for development of high octane unleaded aviation gasoline and that the motor octane rating of any potential candidate must be 100 or greater.
- Defined detonation detection procedures that were adopted by the American Society for Testing and Materials as a test standard (ASTM D6424) for use on candidate unleaded replacement fuels.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

Turbine Engine Research

- Continue enhancement of the DARWIN™ probabilistic rotor design code.

Unleaded Fuels and Fuel System Safety Research

- Continue laboratory characterization and engine ground testing of candidate unleaded fuels to replace 100LL avgas including ethanol and ethanol blends.
- Complete research on the effects of molecular markers in Jet A fuel.

- Continue research and engine tests on blended fuels containing ethanol for piston engines.

FY 2008 PROGRAM REQUEST:

Ongoing Activities

- Continue to advance DARWIN™, the probabilistically based turbine engine rotor design and life assessment code. This code is an FAA approved means to support a damage tolerant based certification enhancement to the current safe life design approach.
- Continue to develop advanced damage tolerance methods through experimentation and modeling to address the effects of complex time-temperature stress histories, small crack sizes, inherent anomalies in nickel alloys, crack geometries, and surface residual stress on fatigue crack growth life.
- Continue research into metallurgical factors that can shorten fatigue life of titanium rotor disk alloys.
- Continue to assess industry-provided lead free fuel formulation candidates, including petrochemical and ethanol based fuels to replace 100LL avgas.

New Initiatives

No new initiatives are planned in FY 2008.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

Turbine Engine Research

- Continue to advance DARWIN™ to enhance its predictive capabilities.

Unleaded Fuels and Fuel System Safety Research

- Continue laboratory characterization and engine ground testing of candidate unleaded fuels to replace 100LL avgas including ethanol and ethanol blends.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2005)	89,782
FY 2007 Request	4,048
FY 2008 Request	4,086
Out-Year Planning Levels (FY 2009-2012)	16,476
Total	114,392

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Contracts:					
Propulsion And Fuel Systems	5,461	6,089	4,508	2,592	2,463
Personnel Costs	1,052	922	1,155	1,366	1,476
Other In-house Costs	94	104	78	90	147
Total	**6,607**	**7,115**	**5,741**	**4,048**	**4,086**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	6,607	7,115	5,741	4,048	4,086
Development (includes prototypes)	0	0	0	0	0
Total	**6,607**	**7,115**	**5,741**	**4,048**	**4,086**

A11.b. - Propulsion and Fuel Systems Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
063-110 Propulsion and Fuel Systems							
Turbine Engine Research	**$2,021**						
Continue advancement of the Probabilistic Rotor Design and Life Management code (DARWIN™) to enhance its predictive capability		♦	◊	◊	◊	◊	◊
Develop advanced damage tolerance methods for turbine rotor disks							◊
Continue to develop a design methodology for use by industry to prevent cold dwell fatigue and for assessing the fleet risk							◊
Unleaded Fuels and Fuel System Safety Research	**$442**						
Complete research on the effects of molecular markers in Jet A fuel		♦					
Continue research on blended fuels containing ethanol for piston engines		♦					
Continue laboratory characterization and engine ground testing of candidate unleaded fuels to replace 100 octane low-lead gasoline, including ethanol and ethanol blends		♦	◊	◊	◊	◊	◊
Complete the evaluation of the feasibility of using ethanol and ethanol blends as a general aviation fuel					◊		
Evaluate the feasibility of modifying general aviation piston engine controls to accommodate alternative fuels for 100LL							◊
Personnel and Other In-House Costs	**$1,623**						
Total Budget Authority	**$4,086**	**$4,048**	**$4,086**	**$4,050**	**$4,075**	**$4,150**	**$4,201**

♦ - Activities Accomplished ◇ - Activities Planned

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

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
ATO Capital	**1A01A**	**Runway Incursion Reduction**	**$5,000,000**

Supports FAA Strategic Goals: Increased Safety, and Greater Capacity

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 has been developed to support Agency investment decisions. Current program initiatives are aimed at evaluating pilot situational awareness tools.

The Program directly contributes to achieving Objective 3, "reduce the risk of runway incursions," of the FAA's Flight Plan 2006 –2010 strategic goal of Increased Safety.

Airports referred to in this program description include:

DFW Dallas/Ft. Worth International Airport

SAN San Diego International Airport

LGB Long Beach – 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 3 of the current FAA Flight Plan.

Accomplishments:

- Evaluated operation of runway status lights (RWSL) at DFW.
- Developed (initial) RWSL, take-off hold lights (THL) enhancements.
- Installed two independent Low-Cost Surface Surveillance (LCSS), Systems at GEG.
- Evaluated operation of first LCSS system at GEG.
- Prepared enhanced airport lighting evaluation report.

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

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Complete a Runway Status Lights Safety Risk Document – 12/06 (COMPLETED).
- Prepare and present investment decision data to ATO EC.
- Complete the evaluation of second LCSS at Spokane.
- Establish RWSL crossing runways engineering test bed.
- Conduct intelligent FAROS shadow operations test.
- Conduct RIL Shadow Operations Test at Chicago ORD.

FY 2008 PROGRAM REQUEST:

The requested funding will allow the program to:

- Support implementation of RWSL at three additional airports.
- Conduct evaluation of the enhanced LCSS, System at GEG.
- Complete the FAROS field evaluation.
- Conduct pilot awareness of FAROS operations.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Continue researching potential technology solutions for small-to-medium-sized airports.
- Continue developing performance standards and requirements for selected runway incursion reduction technologies.
- Develop evaluation reports, technical specifications, and life cycle cost estimates for selected products.
- Install RWSL airfield lighting equipment and conduct evaluation of RWSL for the east side of DFW Airport.
- Conduct the RWSL operational evaluation at SAN.
- Complete RWSL THL Operational Evaluation.
- Define Airfield Lighting Configuration for RWSL RIL.
- Install FPAPI equipment at DFW.
- Conduct eFAROS OpEval at DFW.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	21,838
FY 2007 Appropriated	8,000
FY 2008 Request	5,000
Out-Year Planning Levels (FY 2009-2012)	12,000
Total	46,838

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Enacted**	**FY 2008 Request**
Contracts:					
Runway Incursion Reduction	8,200	9,027	6,440	8,000	5,000
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
Total	**8,200**	**9,027**	**6,440**	**8,000**	**5,000**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Enacted**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	8,200	9,027	6,440	8,000	5,000
Total	**8,200**	**9,027**	**6,440**	**8,000**	**5,000**

1A01A - Runway Incursion Reduction Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Runway Incursion Reduction	**$5,000**						
Runway Status lights (RWSL)							
Conduct operational evaluations		◆					
Resolve OPERATIONAL EVALUATION ISSUES			◊				
Prepare presentation to the Joint Resources Council		◆	◊				
Develop THL		◆	◊	◊			
Perform THL operational evaluation		◆	◊	◊	◊		
Develop system enhancements					◊	◊	
Low-Cost Surface Surveillance							
Install System 1		◆					
Evaluate System 1		◆					
Install and evaluate System 2			◊	◊	◊		
FAROS/Flashing Precision Path Indicator							
Conduct shadow operations		◆	◊				
Perform field evaluation			◊				
Total Budget Authority	**$5,000**	**$8,000**	**$5,000**	**$5,000**	**$5,000**	**$2,000**	**$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.

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
ATO Capital	**1A02A**	**Safe Flight 21 – Alaska Capstone**	**$15,000,000**

Supports FAA Strategic Goals: Increased Safety, Greater Capacity, International Leadership, and Organizational Excellence.

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 program provides tangible benefits that include: weather, terrain, and traffic information; flight following and locating capabilities; global positioning system (GPS) en route instrument flight rules infrastructure and non-precision instrument approaches; and training for pilots flying aircraft with Automatic Dependent Surveillance-Broadcast (ADS-B) avionics. The program is building an infrastructure, consistent with NAS modernization plans, while it identifies the transition path for procedure development/technology implementation and provides near-term safety benefits.

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

Capstone directly contributes to the FAA's Flight Plan 2006 –2010 strategic goal of Increased Safety under Objective 3, "reduce accidents in Alaska,." This program will expand through a three-phased approach from Bethel and Southeast Alaska throughout the entire state. The FAA strategy is to expand and accelerate the implementation of safety and air navigation improvement programs in Alaska. The Capstone Program Office recently finalized the Capstone Statewide Strategic Plan to provide for statewide implementation of ADS-B. "Bundled" capabilities/technologies such as ADS-B, FIS-B, Automated Weather Sensor Systems, and GPS/WAAS (Wide-Area Augmentation System) approaches have improved safety and access to remote locations in the Bethel/YK Delta and Southeast Alaska areas. By FY 2008, Capstone and related initiatives are expected to reduce accidents involving general aviation and Part 135 operators by 20 percent throughout Alaska.

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

- Make the Universal Access Transceiver data link and the GPS/WAAS navigation available to pilots statewide.
- Install 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;
  - Operator flight monitoring; and
  - Removal of the legacy navigation infrastructure.

Developmental work will continue on the following:

- Multilateration for runway safety and terminal surveillance;
- 1090 MHz data link; and
- Satellite usage for relay of voice and ADS-B information.

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, Aircraft Owners and Pilots Association, Airline Pilots Association, Alaska Aviation Safety Foundation, Alaska Airmen's Association, Department of Defense, State of Alaska Department of Transportation and Public Facilities, Air Traffic Control Association, Cargo Airline Association, MITRE Corporation, and commercial airlines.

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

- Achieved a 40 percent reduction in accidents for Capstone-equipped aircraft in the Y-K delta;
- Installed Ground Based Transceivers (GBT) in the Bethel area to provide critical information to controllers, dispatchers, and pilots;
- Installed certified ADS-B avionics in approximately 200 commercial aircraft operating in the Bethel area;
- Installed certified ADS-B avionics in approximately 70 commercial aircraft operating in the Southeast Alaska;
- 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 ten airports;
- Trained 140 pilots and associated personnel on ADS-B avionics in collaboration with the University of Alaska;
- Initiated use of the first GPS/WAAS receiver as sole means for en route navigation in Alaska; and
- Completed 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 CNS technologies as the nation enters the free flight era.

The FAA works closely with the aviation industry to support Safe Flight 21 – Alaska Capstone. This partnership allows industry to share in the funding of avionics and infrastructure and to build on ongoing industry initiatives. These initiatives include:

- Identifying/resolving ADS-B technology issues;
- Developing ADS-B operational concepts;
- Focusing data collection activities to answer operational and avionics certification issues;
- Addressing 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; and
- Ensuring that all stakeholders are included in Alaska Capstone planning and in the evaluation of operational enhancements/data link alternatives.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

The FAA expects to complete the following activities in FY 2007:

- Replace developmental GBTs in the Bethel area with production-level systems for Air Traffic surveillance;
- Upgrade avionics to meet recently approved industry standards;
- Continue to install primary flight displays, navigation displays and ADS-B avionics in up to 200 Southeast Alaska Capstone-participating aircraft;
- Expand use of arrival/departure procedures in Alaska;
- Install and commission GBTs in Southeast Alaska;
- Install and test ADS-B data displays in the Juneau control tower and flight service station;
- Test surveillance of mixed-equipage (transponder and ADS-B) via multilateration in the Juneau area; and
- Develop and demonstrate a prototype satellite communications system to complement the Capstone GBTs.

FY 2008 PROGRAM REQUEST:

The requested funding will provide:

- Ongoing test and evaluation, procedure development, certification tasks, and simulation activities;
- Initial approach control service for aircraft in the Bethel area; and
- Beginning expansion of avionics and ground infrastructure statewide.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

FY 2008 products and milestones involve activities that will prove beneficial for achieving program success:

- Install avionics and GBTs in Southeast Alaska; and
- Provide approach control services for aircraft in the Bethel area.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	132,928
FY 2007 Appropriated	16,800
FY 2008 Request	15,000
Out-Year Planning Levels (FY 2009-2012)	73,300
Total	238,028

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Enacted**	**FY 2008 Request**
Contracts:					
Safe Flight 21 – Alaska Capstone	21,000	28,768	14,360	16,800	15,000
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
Total	**21,000**	**28,768**	**14,360**	**16,800**	**15,000**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Enacted**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	21,000	28,768	14,360	16,800	15,000
Total	**21,000**	**28,768**	**14,360**	**16,800**	**15,000**

1A02A - Safe Flight 21 – Alaska Capstone Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Safe Flight 21 – Alaska Capstone							
Optional Enhancements	**$15,000**						
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 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			◊				
Total Budget Authority	**$15,000**	**$16,800**	**$15,000**	**$20,000**	**$20,000**	**$20,000**	**$13,300**

◆ - 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
ATO Capital	1A01B	System Capacity, Planning and Improvement	$6,500,000

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

Program Goals and Intended Outcomes: The System Capacity, Planning, and Improvements program identifies, analyzes, and evaluates system capacity enhancements for the National Airspace System (NAS). In conjunction with providing recommendations for airport improvements, procedural updates, and simulation studies, this program is now committed to delivering quality performance measurement systems and basic operations research to measure the level of efficiency and therefore provide quality system improvements. 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 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 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, and the users of the air transportation system, on a continuous basis. The Performance Data and Analysis Reporting System (PDARS) captures 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 the organization's Strategic Management Process, 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:

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. This system extracts radar data from the HOST, Automated Radar Terminal System (ARTS), or STARS computer systems. It records and integrates flight plan and track data in an interactive database. The data can then be queried to establish outcome metrics such as net time, distance, altitude, reroutes, etc. with the fidelity necessary to make meaningful distinctions in the performance of various facilities (both en-route and terminal).

Performance Metrics Development

- Includes the planning, coordination, data collection, and implementation of performance measures used to assess NAS operations. These metrics are also included in the Agency's strategic planning documents and databases to determine whether or not the Agency is meeting its targets. Currently metrics have been developed to measure operational errors, runway incursions, on-time arrivals, delays, ground stop minutes, airport arrival efficiency rate, and airport arrival capacity. Forecasted metrics include the development of an indicator

that effectively quantifies the impact of weather on NAS activity and the design of an enroute, system predictability, terminal departure, and efficiency rate metric.

ATO Strategic Management Process (SMP)

- Provides focus and alignment to successfully implement FAA Flight Plan initiatives and all activities necessary to achieve our objectives. The SMP is a structured system used to evaluate future alternative actions and rapidly implement those that are feasible. Performance metrics are the core of the SMP and are important both to senior management leading the ATO, and employees in operational roles driving functional excellence. SMP links effective measures across organizational tiers as those measures are cascaded to the field.

New Large Aircraft (NLA)

- Includes modeling, analysis, and procedural development services to assess the potential impact of the Airbus 380 aircraft. This working group is comprised of the airlines, aircraft manufacturer associations, pilot associations, and other Airline Industry participants. This working group is a source of collaboration and information which will help advance both domestic and foreign aviation communities' handling of the next generation of aircraft.

Airport Capacity Enhancement/Design Studies

- Investigates capacity and delay issues at major airports within the NAS. Through computer simulation and modeling the FAA works with airports and other aviation industry stakeholders to conduct studies to improve the operating efficiency of the infrastructure. The improvements will be in the form of recommendations that can include any of the following: new runways, taxiways, intersections, operating procedures, or a new terminal at a suggested location.

Capacity Benchmark Report

- Analyzes system capacity at the 35 Operational Evolution Plan (OEP) airports. The objective of the Benchmark report is to document the number of flights these airports can handle under optimum and less than optimum weather conditions. Additionally, this report projects future capacity based upon plans for new runways, revised air traffic procedures, and technological improvements. This report was developed and is used in conjunction with the Airline Industry to help drive innovation in their respective organizations.

International Terminal Benchmark Report

- Links a series of bilateral comparisons of U.S. terminal facilities with similar facilities worldwide. This process consists of pairing a particular U.S. airport with a participating foreign airport. Through the development of an agreed upon definition of flight and a comparable analysis of staffing, operational, and facility cost data, the FAA can compile a set of measurable performance metrics and gain a firm understanding of the relative performance of the agency's terminal service.

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 JFK International Airport New Large Aircraft (NLA) Airway Facilities Tower Integration Laboratory (AFTIL) Controller/Pilot Orientation.
- Supported the FAA Facilitation Group for the NLA program.
- Completed the Indianapolis Design Team Study.
- Completed the San Francisco International Airport NLA Ground Movement Study.
- Provided statistical data to support the airfield delay simulation performance measurements.
- Develop web-based software application infrastructure to provide service units with centralized access to ATO and performance measures linked to the corporate strategy.
- Completed PDARS installation at ten Terminal Radar Approach Control (TRACON) facilities identified in the FAA Operational Evolution Plan (OEP).
- Completed the Portland International Airport Study and presented the recommendations for completion of improvements contained in the final report.
- Completed the final draft of the 2004 Aviation Capacity Enhancement Plan.
- Conducted the Domestic Reduced Vertical Separation Minima Benefit Analysis.
- Completed evaluation of the most efficient flow of deicing pads at Denver.
- Analyzed the effect of runway closures at Denver due to pending runway reconstruction.

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.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Complete the LAX International Airport NLA AFTIL Controller/Pilot Orientation.
- Complete FACT II Report.
- Complete the Airfield Delay Simulation Performance Model Outputs.
- Expand PDARS installation at an additional six TRACONs specified in the FAA OEP.

- As part of the ATO Strategic Management Process:
  - Identify data sources, collect baseline data, conduct gap analysis and establish performance targets for all ATO Service/Business Units; and
  - Develop a web-based software application infrastructure to provide all ATO Service/ Business Units with centralized access to ATO and Service Unit cost and performance analysis, forecasting, reporting and initiative tracking capabilities.
- Link PDARS reports to PB Views.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Update the Airport Capacity Benchmark Report.
- Draw upon Airport Capacity Benchmark data to generate performance metrics that can be used in forecasting and target setting models.
- Complete PDARS installation at the remaining OEP TRACONs.
- As part of the ATO Strategic Management Process, develop:
  - System and process modifications based on the general needs of stakeholders, dissemination of Strategic Management Process software application to remaining Service Units, communication of strategy management best practices; and
  - New measures to monitor and assess strategic objectives, strengthen existing metrics, validate continuing relevance of metrics.

FY 2008 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 analyses to improve operational activity at the nation's most congested airports.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	35,658
FY 2007 Appropriated	5,500
FY 2008 Request	6,500
Out-Year Planning Levels (FY 2009-2012)	26,000
Total	73,658

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Enacted**	**FY 2008 Request**
Contracts:					
System Capacity, Planning and Improvement	6,500	3,968	6,435	5,500	6,500
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
Total	**6,500**	**3,968**	**6,435**	**5,500**	**6,500**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Enacted**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	6,500	3,968	6,435	5,500	6,500
Total	**6,500**	**3,968**	**6,435**	**5,500**	**6,500**

1A01B - System Capacity, Planning and Improvement Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
System Capacity, Planning and Improvement	**$6,500**						
NAS Performance Measurement							
Develop En Route & Oceanic Svc Unit SMP			◊	◊			
Develop Terminal Svc Unit SMP		◆	◊	◊			
Develop Flight Services Svc Unit SMP		◆	◊	◊			
Install PDARS at OEP airports		◆	◊	◊			
Airport Development							
Update capacity benchmarks study		◆	◊	◊	◊	◊	◊
Model and simulate NLA ground movements		◆	◊	◊	◊		
Develop metrics for 35 OEP airports		◆	◊	◊	◊	◊	◊
Complete 2005 ACE Plan		◆	◊				
Conduct (future) airport capacity task			◊	◊	◊	◊	◊
Conduct airfield delay simulation national goal forecasting			◊				
Develop airfield delay simulation performance model outputs		◆					
Capacity Improvement Initiatives							
Conduct LAX NLA AFTIL Controller/Pilot Orientation		◆	◊				
Obtain A380 design group and waivers			◊				
Develop performance measures model (RDSIM)			◊				
Total Budget Authority	**$6,500**	**$5,500**	**$6,500**	**$6,500**	**$6,500**	**$6,500**	**$6,500**

◆ - 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
R,E&D	A14.a.	System Planning and Resource Management	$1,184,000

Supports FAA Strategic Goals: Increased Safety, Greater Capacity, International Leadership, and Organizational Excellence.

Intended Outcomes: Through this activity, which manages FAA's R&D portfolio, FAA is meeting the President's criteria for research and development, increasing program efficiency, and reducing management and operating costs. The FAA is also increasing customer and stakeholder involvement in its programs and fostering greater acceptance 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 addition, this program produces the annual National Aviation Research Plan, undertakes strategic planning for the Research, Engineering and Development (R,E&D) program, administers the congressionally mandated R,E&D Advisory Committee (REDAC), conducts external program coordination, fosters future research opportunities, and provides program advocacy and outreach.

Agency Outputs: In FY 2007 FAA will:

- Host two REDAC meetings and, at least twelve subcommittee meetings, including support of the new Joint Planning and Development Office (JPDO) Subcommittee, which advises the Administrator regarding the work of the JPDO 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 FAA on its R,E&D program.
- Prepare the annual R,E&D budget submission.
- Manage the R,E&D portfolio.
- Publish the annual National Aviation Research Plan (NARP).
- Continue to coordinate research activities with NASA through FAA's R&D Field Offices; and Support the Next Generation Air Transportation System initiative.

Research Goal: In FY 2008 through FY 2012, FAA will maintain an R&D management workforce comprising no more than 10 percent of our overall R&D workforce and will sustain the System Planning and Resource Management budget at 2 percent or less of the total R,E&D budget.

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.

R&D Partnerships: The FAA's R&D partnerships are described in each budget line item.

Accomplishments: Program accomplishments include:

- Published and submitted the annual National Aviation Research Plan to Congress (February 2006).
- Managed two REDAC meetings and over twelve subcommittee meetings, which reviewed FAA's proposed FY 2008 R&D program.
- Developed the FY 2008 R,E&D budget submission.

- Supported the JPDO's Next Generation Air Transportation System activities.
- Met the research goal for R&D management workforce and funding for System Planning and Resource Management in FY 2006.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Deliver the National Aviation Research Plan to the Congress (February 2007).
- Provide strategic direction for FAA R,E&D program.
- Obtain REDAC review of and recommendations for FY 2009 R,E&D Program.
- Obtain REDAC guidance for the FY 2009 R,E&D Program.
- Coordinate R&D activities with NASA and other partners.
- Support Next Generation Air Transportation System activities.

FY 2008 PROGRAM REQUEST:

To see that it continues to meet the President's R&D criteria, the agency will re-evaluate its R&D strategies to ensure they remain viable and meet agency needs; foster external review and customer input to R,E&D programs and activities; and publish program activities and accomplishments.

The agency will continue to support the work of the REDAC in its task to advise the FAA Administrator on the R&D Program. In particular, it will seek the counsel and guidance of the committee for the FY 2009 program, review the proposed FY 2010 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 maintain its field offices at the NASA Ames and Langley Research Centers as a vital part of efforts to coordinate and integrate the research and development programs of the two organizations.

Ongoing Activities

Ongoing activities include:

- Publish the National Aviation Research Plan.
- Sustain R,E&D Advisory Committee Activities.

New Initiatives

No new initiatives are planned in FY 2008.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Deliver the National Aviation Research Plan to the Congress (February 2008).
- Prepare the annual R,E&D budget submission.
- Manage the FAA R&D portfolio.
- Conduct an R&D strategy assessment.
- Administer and facilitate REDAC activities by:
  - Obtaining REDAC recommendations on planned R,E&D investments for FY 2010.
  - Aiding the REDAC in its preparation of other reports, as requested by the Administrator.
- Continue participating in the JPDO Next Generation Air Transportation System activities.
- Support NASA research and development activities in support of national aviation goals.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	37,931
FY 2007 Request	1,234
FY 2008 Request	1,184
Out-Year Planning Levels (FY 2009-2012)	7,269
Total	47,618

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Contracts:					
R,E&D Plans and Programs	436	455	1,143	1,192	1,075
Personnel Costs	56	53	46	39	37
Other In-house Costs	5	8	0	3	72
Total	**497**	**516**	**1,189**	**1,234**	**1,184**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	497	516	1,189	1,234	1,184
Development (includes prototypes)	0	0	0	0	0
Total	**497**	**516**	**1,189**	**1,234**	**1,184**

A14.a. – System Planning and Resource Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
011-130 R,E&D Plans and Programs							
R,E&D Plans and Programs	**$374**						
Publish annual plan for R&D		◆	◊	◊	◊	◊	◊
Conduct R,E&D financial management		◆	◊	◊	◊	◊	◊
Prepare annual budget submissions		◆	◊	◊	◊	◊	◊
R,E&D Advisory Committee	**$124**						
Recommend FAA, R,E&D investments		◆	◊	◊	◊	◊	◊
Hold joint meetings with NASA's Aero-Space Technology Advisory Committee		◆	◊	◊	◊	◊	◊
NASA Field Offices	**$388**	◆	◊	◊	◊	◊	◊
Joint University Program (Quarterly Research Reviews)	**$189**	◆	◊	◊	◊	◊	◊
Personnel and Other In-House Costs	**$109**						
Total Budget Authority	**$1,184**	**$1,234**	**$1,184**	**$1,847**	**$1,827**	**$1,1836**	**$1,759**

◆ - Activities Accomplished ◇ - Activities Planned

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

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A11.l.	Unmanned Aircraft Systems Research	$3,310,000

Supports FAA Strategic Goals: Increased Safety, and Greater Capacity.

Intended Outcomes: The Unmanned Aircraft Systems (UAS) Research Program supports FAA's strategic goal of increasing safety by conducting research needed to ensure the safe integration of the UAS in the National Airspace System (NAS). The program's research activities focus on technology surveys, methodology development, data collection and generation, laboratory and field validation, and technology transfer.

Agency Outputs: Researchers are developing methodologies and tools to define UAS design and performance characteristics. They are evaluating technologies, conducting laboratory and field tests, performing analyses and simulations, and generating data to support standardization of UAS civil operations. New standards are being implemented to establish UAS certification procedures, airworthiness standards, and operation requirements. Policies and guidance materials are also being published to equip FAA certification engineers and safety inspectors with the knowledge and tools they need to ensure the safe integration of UAS into the NAS.

Research Goals: To safely integrate UAS into the NAS, FAA needs to develop airworthiness standards, devise operational requirements, establish maintenance procedures, and conduct safety oversight activities. The program is structured into five research areas: technology survey; detect, sense and avoid (DSA); control, command, and communication (C3); flight termination, and risk based management. The research will begin with a baseline survey to determine the existing technologies used in UAS. Technologies used to avoid mid-air collisions due to UAS operations will be examined. Communications issues that may arise due to the introduction of UAS into the NAS, as well as necessary safety procedures for the flight termination of UASs, will be researched. A risk-based approach will be used to identify the severity of potential hazards of UAS operations in the NAS.

- By FY 2010, determine performance characteristics and operational requirements for DSA technologies.
- By FY 2010, analyze data on the safety implications of system performance impediments to command, control, and communications in different classes of airspaces and operational environment.
- By FY 2012, conduct field evaluations of UAS technologies in an operational environment, including DSA, C3, and flight termination technologies.

Customer/Stakeholder Involvement: Full and safe integration of UAS into civil aviation requires FAA to work closely with other government and private agencies that have experience in developing and operating UAS:

- FAA Research, Engineering, and Development Advisory Committee (REDAC) Aircraft Safety Subcommittee – subcommittee representatives from industry, academia, and other government agencies annually review the activities of the program.
- Technical Community Representatives Groups – FAA representatives apply formal guidelines to ensure that the program's R&D projects support new rule making and the development of alternate means of compliance with existing rules.
- Department of Defense (DoD) – the DoD is the largest UAS user requesting unrestricted access to the NAS. The FAA will collaborate with DoD through Memorandum of

Understanding (MOU) and Interagency Agreements (IA) to leverage resources and implement new technologies for civil applications.

- Joint Planning and Development Office (JPDO) – the JPDO has identified UAS integration to NAS as one of the emerging challenges to the nation's air transportation system.

R&D Partnerships:

- Interagency agreements with other government agencies (DoD and Department of Homeland Security) and Memorandum of Cooperation with foreign civil aviation authorities.
- The FAA Center of Excellence on General Aviation Research – a consortium of university and industry partners who conduct R&D for FAA on a cost-matching basis.

Accomplishments:

Not applicable. This is a new research program.

FY 2008 PROGRAM REQUEST:

New Initiatives

The FY 2008 funding request will support FAA UAS research requirements that contribute to FAA's aviation safety goal.

- DSA efforts will include evaluations of different sensor systems in detection of non-cooperative intruders for potential conflicts, development of maneuver strategies and algorithms, and generation of test and simulation data to support standardizations. A DSA study on new sensor technologies, either airborne or ground-based, will generate data and develop methods to determine whether standards can be established and certification potentials will support the determination of DSA characteristics and performance requirements. Research efforts will also begin on the development of avoidance algorithms including procedural requirements, aircraft performance limitations, decision-making methods in resolving conflicts, autonomous maneuvers, risk factors, and safety implications.
- A study to identify potential safety implications of system performance impediments to command, control, and communications, in such areas as data integrity and accuracy, spectrum usage, and load control as well as operational issues will be initiated.
- A study on requirements of ground control stations (GCS) for certifications and operations including overall configurations, controls, feedbacks, displays, and pilot situation awareness will also begin within the C3 technical area.
- A survey to identify technologies either in use or planned for use in UAS designs and operations, including airframes, propulsion systems, avionics and navigation systems, flight control systems, and operational envelopes and limitations will be initiated.
- A safety mitigation strategy for particular UAS operations in given classes of airspaces will be initiated. This effort will be based on results of the initial study on UAS hazards and recommendations from the UAS SSRWG.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Initiate and complete the UAS overall technology survey with support documentation and data. This will provide FAA with a detailed overview of UAS technology status for certifications and operations in the NAS.
- Initiate and complete the risk based system safety study of potential hazards of UAS operations in the NAS, determine their severities, analyze mitigation strategies, and make safety recommendations.

- Develop risk-based management concept, methods, and tools to determine impacts of specific hazards, mitigation strategies, recommended approaches, safety measurements, and oversight requirements.
- Identify procedure requirements, potential risk factors, and mitigation strategies to terminate a flight without safety impacts to lives and properties on the ground.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	0
FY 2007 Request	1,200
FY 2008 Request	3,310
Out-Year Planning Levels (FY 2009-2012)	17,092
Total	21,602

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Contracts:					
Unmanned Aircraft System	0	0	0	1,200	3,158
Personnel Costs	0	0	0	0	136
Other In-house Costs	0	0	0	0	16
Total	**0**	**0**	**0**	**1,200**	**3,310**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	0	0	0	1,200	3,310
Development (includes prototypes)	0	0	0	0	0
Total	**0**	**0**	**0**	**1,200**	**3,310**

A11.l. – Unmanned Aircraft Systems Research Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
069-110 Unmanned Aircraft System Research							
Technology Surveys	**$500**						
Conduct survey of existing DSA capabilities		◆	◊				
Conduct technology survey on UAS designs and operations		◆	◊	◊			
Detect, Sense, and Avoid (DSA) Research	**$800**						
Determine performance characteristics and operational requirements for DSA technologies		◆	◊	◊	◊		
Conduct field evaluation of DSA technology						◊	◊
Command, Control, and Communications (C3)	**$600**						
Identify potential safety implications of system performance impediments to C3		◆	◊	◊			
Study requirements of GCS for certification and operations			◊	◊	◊		
Conduct C3 field tests and evaluate technologies						◊	◊
Flight Termination	**$758**						
Identify requirements, risks, and mitigation strategies for flight termination			◊	◊	◊		
Conduct flight termination procedure field test and evaluate technologies						◊	◊
Risk Based Management	**$500**						
Study potential hazards of UAS operations in the NAS		◆	◊				
Develop risk management concepts, models, and tools			◊	◊	◊	◊	◊
Personnel and Other In-House Costs	**$152**						
Total Budget Authority	**$3,310**	**$1,200**	**$3,310**	**$4,238**	**$4,236**	**$4,295**	**$4,323**

◆ - Activities Accomplished ◇ - Activities Planned

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

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
ATO Capital	**1A01J**	**Wake Turbulence**	**$3,000,000**

Supports FAA Strategic Goals: Increased Safety, and Greater Capacity.

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 (those that are adjacent to each other and separated by less than 2500 feet). The resulting increased numbers of departures per an airport's closely spaced parallel runway are expected to enhance the operational capacity of the National Airspace System (NAS).

The Wake Turbulence Research Program is tied both to the FAA Flight Plan 2007-2011 and the Operation Evolution Plan (OEP). Objective One for the Greater Capacity Goal of this year's Plan, "Increase capacity to meet projected demand and reduce congestion," includes an initiative to "Conduct research to improve safety and increase throughput using wake turbulence monitoring, operational procedures, and controller tools." A result of collaboration between the FAA and the aviation industry, the current OEP (version 8) further defines the program component for the Flight Plan 2007-2011 parallel runway initiative as: Safety, Policy, Procedures and Airspace, "Wake Turbulence Research and Development Effort to Enhance Departure and Arrival Operations for Closely Spaced Parallel Runways (CSPR)."

The desired outcome of the ATO Capital component of the 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 and continuing into FY 2007, the FAA will evaluate the prototype ground-based departure spacing system (Wake Turbulence Mitigation for Departures – WTMD) developed by NASA and will initiate the systems engineering planning required to integrate the capabilities of the WTMD prototype into the NAS. Funding in FY 2008 will provide the final assessments and programmatic tasks necessary to prepare for the procurement of the WTMD capability.

Agency Outputs: If NASA succeeds in creating 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; and
- Enhancements to FAA airport/TRACON automation systems and additional weather/wake sensors (if required) at affected airports.

Funding requested in FY 2008 allows for completion of the functional requirements definition and the procurement actions necessary for the FAA to make its final investment decision concerning the WTMD capability; and if the investment decision is favorable, initiate the procurement contract.

Customer/Stakeholder Involvement: Development of a ground-based departure spacing system is being jointly undertaken by the FAA and NASA as a component of an overall joint FAA/NASA Wake Turbulence Program. A key stratagem of the joint program is the requirement of periodic (semi-annual) program status meetings with key stakeholders. To involve an even broader audience to review the work being accomplished, the program leads hold forums (WakeNet USA) twice a year to make wake turbulence research results public. Program staff

members 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 Air Traffic Organization - System Operations Services, the Air Traffic Organization - Safety, and the Flight Standards Service. Collaborators outside of the Agency include: the Boeing Company, the Lockheed Martin Corporation, United Parcel Service, United Airlines, the Raytheon Company, the Air Line Pilots Association, and the National Air Traffic Controllers Association.

Accomplishments: (includes FY 2004 F&E funded and FY 2005 R,E&D funded activities related to the development of the Wake Turbulence Mitigation for Departures (WTMD) air traffic control decision support tool – program was not F&E funded in FY 2005):

- Acquired prototype pulsed Light Detection and Ranging (LIDAR) sensors and increased their wake turbulence detection and tracking rate to 85 percent of wakes created by arriving aircraft.
- Developed crosswind prediction algorithms that will be key components of the NASA ground-based departure spacing system prototype.
- Developed pulsed LIDAR scanning and processing techniques for detecting and tracking wake vortices of aircraft during takeoff and climb.
- Initiated wake turbulence data collection campaign at Lambert – St. Louis International Airport and at San Francisco International Airport focused on the wake transport of departing aircraft.
- Initiated system engineering processes required for the integration of the WTMD capability into the National Airspace System.

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. Entities participating in the program include:

- 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.
- Raytheon Company.
- MIT Lincoln Laboratory.
- Computer Sciences Corporation.
- NorthWest Research Associates.
- ASE Inc.
- Coherent Technologies Inc.
- CASE, LLC.
- Air Traffic Simulation, Inc.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Develop pulsed LIDAR processing techniques that will provide enhanced assessments of wake turbulence decay over a period of time.

- Support NASA's WTMD prototype evaluations in terms of usability by tower controllers and supervisors.
- Validate the reliability of the WTMD prototype's crosswind prediction algorithm.
- Install and operate a pulsed LIDAR at George Bush Intercontinental Houston Airport to collect wake transport data on departing 757 and heavier aircraft.

FY 2008 PROGRAM REQUEST:

In FY 2008, requested funding will provide for the system engineering assessments that define the WTMD required functionality in terms of existing FAA automation platforms and available weather information network. This functionality will be transformed into procurement specifications and statements of work. Initial benefits and cost analyses will be revised based on the performance of the WTMD prototype at Houston and modeled performance at other candidate airports. These will be inputs to the FAA investment decision process concerning WTMD. The FY 2008 requested funding would also fund the initial development and implementation contract startup tasks.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Complete functional requirements definition for the WTMD departure spacing tool.
- Develop WTMD plans for implementation and maintenance, startup implementation engineering.
- Complete assessments required for FAA's investment decision.
- Award development and implementation contract if FAA's investment decision is favorable.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	7,960
FY 2007 Appropriated	1,000
FY 2008 Request	3,000
Out-Year Planning Levels (FY 2009-2012)	4,000
Total	15,960

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Enacted**	**FY 2008 Request**
Contracts:					
Wake Turbulence	4,000	0	3,960	1,000	3,000
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
Total	**4,000**	**0**	**3,960**	**1,000**	**3,000**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Enacted**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	4,000	**0**	3,960	1,000	3,000
Total	**4,000**	**0**	**3,960**	**1,000**	**3,000**

1A01J - Wake Turbulence Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Wake Turbulence	**$3,000**						
Evaluate terminal winds algorithm		◆					
Evaluate NASA Prototype		◆					
Development of LIDAR processes for detecting and tracking wakes of departing aircraft		◆					
Development of Computer-Human Interface for Integrated Capability		◆					
Support of Wake Detecting LIDAR Systems		◆					
Complete functional requirements definition for WTMD	**$500**		◊	◊	◊	◊	◊
Develop plans for WTMD implementation and maintenance	**$450**		◊	◊	◊	◊	◊
Complete assessments required for FAA investment decision	**$550**		◊	◊	◊	◊	◊
WTMD Development and Implementation Contract startup	**$1,500**		◊	◊	◊	◊	◊
Total Budget Authority	**$3,000**	**$1,000**	**$3,000**	**$1,000**	**$1,000**	**$1,000**	**$1,000**

◆ - 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
R,E&D	A12.b.	Wake Turbulence	$10,755,000

Supports FAA Strategic Goals: Increased Safety, and Greater Capacity.

Intended Outcomes: The Wake Turbulence Program addresses FAA's goal for capacity and the DOT Reduced Congestion Strategic Objective to "Advance accessible, efficient, inter-modal transportation for the movement of people and goods." The program was originally focused on the near-term objectives of increasing airport capacity and the capacity of terminal airspace during inclement weather by developing modifications to air traffic control wake turbulence mitigation procedures used during these weather conditions. The program, in FY 2008, will address the broader research agenda required to progress to the envisioned Next Generation Air Transportation System (NextGen). The Wake Turbulence Research Program will address how to mitigate wake turbulence impacts to enable more efficient use of congested airspace and existing/future runways at the nation's busiest airports and how to integrate new types of aircraft (e.g., Airbus A-380 and very light jets) safely into the National Airspace System (NAS). Program outcomes include:

- Reduced flight delays during less than visual flight rules conditions.
- Flight efficient wake turbulence separation standards and procedures that will improve airport arrival and departure rates, and thus increase NAS productivity and capacity. Research provides operational concept inputs to NASA's more general technology based development program.
- Wake turbulence separation requirements and procedures that enable more flight efficient airspace route designs, the introduction of new aircraft designs, and more dense aircraft operations of the NextGen time frame.

Agency Outputs: The Wake Turbulence Program conducts applied research to develop improved air traffic control mitigation procedures that will help solve operational problems associated with today's generalized and static air navigation service provider (ANSP) wake turbulence mitigation procedures. As an example, during periods of less than ideal weather and visibility conditions, implementation of an enhanced wake turbulence mitigation procedure will allow air traffic control to operate these airports at arrival rates closer to their design capacity. Additionally, in partnership with NASA, the research program will define wake mitigation technology application solutions that safely enable more arrivals and departures from an airport's runways. New developments in the NASA wake vortex model will be incorporated into a set of modeling tools to assess required wake turbulence separations in the design of more efficient airspace routes and the introduction of new aircraft designs. The research program will also determine the feasibility and benefit of an aircraft-based wake avoidance capability and determine the functional requirements for such a capability.

Research Goals:

- By FY 2008, complete development of a suite of enhanced analysis tools for evaluating the potential of wake turbulence encounters resulting from the design of efficient airspace routes, air traffic control procedure changes, and the introduction of new aircraft designs.
- By FY 2010, determine pilot and ANSP controller situational display concepts required for implementation of the NextGen "Air Traffic Management" concept.

- By FY 2011, determine the NAS infrastructure requirements (ground and aircraft) for safely implementing the NextGen "Air Traffic Management" concept within the constraint of aircraft generated wake vortices.

Customer/Stakeholder Involvement: The program addresses the needs of the FAA Air Traffic Organization (ATO) and works with the FAA Aviation Safety organization to ensure new procedures and solutions are safe and that the airports and air routes targeted for their implementation are those with critical needs to reduce weather related air traffic delays and air route congestion. The program works with controllers, airlines, and pilots to include user recommendations and ensure that training and implementation issues are addressed in the program's research from the start.

Customers

- Pilots.
- Air navigation service provider personnel.
- Air carrier operations.
- Airport operations.

Stakeholders

- Joint Planning and Development Office.
- Commercial pilot unions.
- FAA air navigation service provider unions.
- Other ICAO air navigation service providers.
- Aircraft manufacturers.

R&D Partnerships: In addition to maintaining its partnership with FAA's Aviation Safety organization, this research program accomplishes its work via working relationships with industry, academia, and other government agencies. The coordination and tasking are accomplished through joint planning/reviews, contracts and interagency agreements with the program's partners:

- Volpe National Transportation Center.
- Mitre/Center for Advanced Aviation and Systems Development (CAASD).
- NASA Ames and Langley Research Centers.
- EUROCONTROL and associated research organizations.
- Massachusetts Institute of Technology's Lincoln Laboratory.

Accomplishments: The following represent major accomplishments of the wake turbulence program:

- FY 2006 – Provided wake turbulence information necessary for the ICAO determination of wake turbulence mitigation separations required for the A-380 aircraft.
- FY 2006 – Completed a detailed proposal for modifying the current air traffic wake turbulence mitigation procedures used for dependent staggered instrument landing system (ILS) approaches to an airport's CSPR.
- FY 2005-2006 – Enhanced the pulsed Light Detection and Ranging (LIDAR), which can measure distance, speed and rotation, for wake data collection capability, enabling it to capture wakes from both arriving and departing aircraft.
- FY 2005-2006 – By analysis and simulation, demonstrated feasibility of a cross-wind based air traffic wake turbulence mitigation decision support tool concept for enabling more closely

spaced departures from an airport's CSPR. NASA is developing a prototype that will verify the performance of a decision support tool based on this concept.

- FY 2005-2006 – Provided wake turbulence evaluation support in the integration of a new aircraft into the National Airspace System.
- FY 2004-2006 – Cooperative data exchange with European wake turbulence data collection efforts.
- FY 2002-2006 – Developed the most extensive wake turbulence transit and characterization data base in the world, used to determine feasibility of proposed changes to air traffic control's wake turbulence mitigation procedures.
- FY 2005 – Utilizing analyses of the wake turbulence data collected at San Francisco International Airport (SFO) and Lambert - St. Louis International Airport (STL) upgraded FAA's wake turbulence encounter model used for evaluating proposed changes to air traffic control procedures for routing aircraft into and out of airports.
- FY 2003-2004 – Three prototype pulsed LIDAR systems purchased and added to the STL wake turbulence data collection facility.
- FY 2003 – Provided for the development of a ground based pulsed Light Detection and Ranging (LIDAR) prototype system for detecting and tracking aircraft generated wake vortices.
- FY 2003 – Wake turbulence data collection facility established at the STL.
- FY 2002 – Continued wake turbulence data collection at SFO.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Implement dependent staggered ILS approaches to St. Louis closely spaced parallel runways 12R/L and 30R/L.
- Increase the data base for wake turbulence generated by departing aircraft by continuing data collection at STL and initiate collection efforts at other airports operating closely spaced parallel runways for departures.
- Complete FAA assessment of NASA's concept for wind dependent wake turbulence mitigation procedure for aircraft arriving on closely spaced parallel runways.
- Develop enhanced wake turbulence encounter analysis tools, and begin their application in the evaluation changes and introduction of new aircraft designs.

FY 2008 PROGRAM REQUEST:

Ongoing Activities

- Develop a national change to Air Traffic Order 7110.65 as it applies to the use of closely spaced parallel runways for dependent integrated landing system approach operations.
- Continue wake data collection and analyses at additional airports to support national and airport specific changes to air traffic control procedures for dependent integrated landing system approaches to an airport's closely spaced parallel runways.
- Evaluate reports of wake turbulence encountered as part of the FAA Safety Management System assurance process for changes to air traffic control procedures.
- Complete development of the enhanced suite of wake turbulence encounter analysis tools and begin their application in the evaluation of air route changes, modifications to en route air traffic control aircraft separation procedures changes and introduction of new aircraft designs.

NextGen Initiative

In FY08, FAA must begin developing the capabilities needed to make wake separation requirements supportive of NextGen shared separation and dynamic spacing super density operations. These capabilities are highly dependent on technologies that accurately predict the track and decay of wake vortices and provide this information to pilots and controllers. Some of the aspects of the NextGen Concept of Operations depend upon the aircraft as a participant in efficient, safe air traffic management. These capabilities also rely on procedures that minimize the effects of turbulence and cooperative processes that keep traffic flowing smoothly in all weather and visibility conditions. In addition, as capacity is dependent upon separation standards, and wake vortex is the primary driver of separation standards, the additional research also includes appropriate work relative to separation standards. The NextGen research initiative will result in enhanced methods of determining safe separation standards while optimizing capacity, for all flight regimes and all aircraft, including the effects of weather.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Development of enhanced analysis tools for evaluating the potential of wake turbulence encounters resulting from the design of airspace efficient routes, air traffic procedure changes, and the introduction of new aircraft designs.
- Analysis of wake turbulence data base to upgrade computational models of wake vortex transport and decay.
- Accomplish air traffic procedure/air route proposal reviews utilizing the enhanced suite of wake turbulence encounter analysis tools.
- Develop a national change to Air Traffic Order 7110.65 as it applies to the use of closely spaced parallel runways for dependent Instrument Landing System (ILS) approach operations.
- Develop airport specific procedure modifications to enable dependent ILS approaches to closely spaced parallel runways.
- Continue data collection to determine the characteristics of wake vortices generated by departing and arriving aircraft.
- Develop a wind prediction algorithm suitable for use in the development of a cross wind dependent wake mitigation for ground based decision support tool for approaches of 757 and “heavy” category aircraft to closely spaced parallel runways.
- Develop air traffic management (ground based and aircraft based) wake mitigation concepts (joint work with EUROCONTROL) and associated decision support tool capability requirements to include integration of weather information.
- Develop approach for establishing the criteria for defining a “wake free” zone, whose definition may vary depending on the aircraft following the wake generating aircraft.
- Determine ground and aircraft based situational display concepts relative to separation constraints (wake, weather, and visibility) required for implementation of the NextGen concept for air routes and approach/departure paths.
- Initiate development of approach to evaluate system-wide safety risk for new separation standards.
- Initiate development of recommendations for new separation standards and procedures based on improved communication, navigation, surveillance and aircraft performance capabilities within the constraints of aircraft generated wake vortices, weather and visibility.
- Generate supporting information for the separation reductions recommendations, verifying the reductions can be made with the same or reduced safety risk.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	19,157
FY 2007 Request	3,066
FY 2008 Request	10,755
Out-Year Planning Levels (FY 2009-2012)	41,861
Total	74,839

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Contracts:					
Wake Turbulence	0	3,966	2,036	2,833	10,485
Personnel Costs	261	163	225	222	251
Other In-house Costs	15	133	12	11	19
Total	**276**	**4,262**	**2,273**	**3,066**	**10,755**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	276	4,262	2,273	3,066	10,755
Development (includes prototypes)	0	0	0	0	0
Total	**276**	**4,262**	**2,273**	**3,066**	**10,755**

A12.b. - Wake Turbulence Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
041-150 - Wake Turbulence							
Analysis of wake data base to upgrade computational models	**$600**	◆	◊	◊	◊	◊	◊
Development of enhanced analysis tools for evaluating the potential of wake turbulence encounters resulting from the design of airspace efficient routes, air traffic procedure changes, and the introduction of new aircraft designs	**$1,600**	◆	◊	◊			
Accomplish wake turbulence assessments of potential air traffic routing and separation changes in the En Route airspace	**$400**		◊	◊	◊	◊	◊
Develop national modification to Air Traffic Control Order 7110.65 as it affects closely spaced parallel runway approaches	**$600**	◆	◊				
Develop airport specific procedure modifications to enable dependent ILS approaches to closely spaced parallel runways	**$400**	◆	◊	◊	◊	◊	
Development of air traffic management (ground based and aircraft based) wake mitigation concepts (joint work with EUROCONTROL) and associated decision support tool capability requirements	**$900**	◆	◊	◊	◊		
Continued data collection to determine characteristics of wake vortices generated by departing and arriving aircraft	**$1,185**	◆	◊	◊	◊	◊	
Develop crosswind dependent wind forecast algorithm suitable for use in prototype ground based air traffic control decision support tool for approaches to closely spaced parallel runways	**$500**	◆	◊	◊	◊		
Develop approach for establishing the criteria for defining a "wake free zone"	**$600**		◊	◊			
Develop an approach and evaluate system-wide safety risk for new separation standards	**$700**		◊	◊	◊	◊	◊
Develop recommendations for new separation standards and procedures based on improved communication, navigation, surveillance and aircraft performance capabilities within the constraints of aircraft generated wake vortices and weather.	**$2,100**		◊	◊	◊		
Generate information to support separation reductions while maintaining or reducing safety risks	**$900**		◊	◊	◊	◊	◊
Personnel and Other In-House Costs	**$270**						
Total Budget Authority	**$10,755**	**$3,066**	**$10,755**	**$10,560**	**$10,412**	**$10,471**	**$10,418**

◆ - Activities Accomplished ◇ - Activities Planned

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

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A11.k.	Weather Program	$16,888,000

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

Intended Outcomes: The Weather Program helps achieve FAA's strategic goals of increasing aviation safety by reducing the number of accidents associated with hazardous weather conditions, and increasing capacity by reducing the impacts of adverse weather events on the operational capacity of the National Airspace System (NAS). This research program also supports FAA Flight Plan goals of greater capacity. The FAA efforts undertaken in collaboration with the National Weather Service (NWS) and NASA increase FAA's ability to provide improved short-term and mid-term forecasts of naturally occurring atmospheric hazards, such as turbulence, severe convective activity, icing, and restricted visibility. Improved forecasts enhance flight safety, reduce air traffic controller and pilot workload, enable better flight planning, increase productivity, and enhance common situational awareness.

Agency Outputs: The weather research program develops new and improved weather algorithms for National Airspace platforms such as the Weather and Radar Processor, the Integrated Terminal Weather System, the Operational and Supportability Implementation System, the Advanced Technologies and Oceanic Procedures, the Dynamic Ocean Track System, and the Enhanced Traffic Management System, as well for as National Weather Service platforms.

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 weather products developed by FAA:

- Depiction of current and forecasted in-flight icing areas – enhances safety and regulatory adherence.
- Interactive data assimilation, editing, forecast and dissemination tools – improves aviation advisories and forecasts issued by the NWS as well as accessibility to users of aviation weather information.
- Depiction of current and forecast precipitation type and rate – enhances safety in the terminal area.
- Depiction of current and forecast terminal and en-route convective weather – enhances terminal and en route capacity.
- Short-term forecasts and prediction of ceiling and visibility in the national area – enhances en route safety.
- In-situ and remote detection and forecast of en route turbulence, including clear-air turbulence – enhances en route safety.
- Design approval guidance for weather products, enabling depiction hardware, weather product software, and archiving weather data.
- Operational approval guidance for new products and non-government vendors.

Research Goals: Research is on going to provide weather observations, warnings, and forecasts that are more accurate, accessible, and efficient, and to meet current and planned regulatory requirements. The goals of the research are:

- By FY 2009, develop a consolidated convective weather forecast capability.

- By FY 2015, develop high-glance-value weather products with longer forecast lead times and increased accuracy, for turbulence, severe convective activity, icing, and restricted visibility to be available electronically to all aviation users.
- By FY 2015, employ the aircraft as a node in the National Airspace System. Enable flight deck weather information technologies that allow pilots and aircrews to engage in shared situation awareness and shared responsibilities with controllers, dispatchers, Flight Service Station specialists, pertaining to preflight, en route and post flight aviation safety decisions involving weather.

Customer/Stakeholder Involvement: The Weather Program works within FAA, industry, and government groups to assure its priorities and plans are consistent with user needs. This is accomplished through:

- Close collaboration with FAA organizations, such as the ATO-P NAS Weather Office, ATO-E Oceanic and Off-Shore Programs Office, Flight Standards, and Aviation Safety.
- Guidance from the FAA Research, Engineering, and Development Advisory Committee.
- Guidance from the Joint Planning and Development Office Next Generation Air Transportation System initiative.
- Inputs from the aviation community, such as the annual National Business Aircraft Association conference, the Friends/Partners in Aviation Weather Forum, and scheduled public user group meetings.
- Feedback received from documents and publications produced by the aviation industry.

R&D Partnerships: The Weather Program collaborates 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 program also leverages research activities with members of industry, academia, and other government agencies through interagency agreements, university grants, Cooperative Research and Development Agreements (CRDAs), and Memorandums of Agreement (MOA).

Partnerships include:

- National Center for Atmospheric Research (in-flight icing, convective weather, turbulence, ceiling and visibility, modeling, weather information dissemination, weather radar techniques).
- National Oceanic and Atmospheric Administration laboratories (convective weather, turbulence, winter weather, ceiling and visibility, modeling, weather information dissemination, weather radar techniques, quality assessment/verification).
- Massachusetts Institute of Technology's Lincoln Laboratory (convective weather, weather radar techniques).
- National Weather Service's Aviation Weather Center and Environment Modeling Center (modeling, weather information dissemination).
- Naval Research Laboratory (ceiling and visibility, oceanic weather, volcanic ash).
- NASA Research Centers (in-flight icing, turbulence, satellite data).
- Army Cold Regions Research and Engineering Laboratory (in-flight icing).
- Universities (modeling).
- Airlines, port authorities, cities (user assessments).
- Research results are transferred to the private sector via CRDAs with WSI, Harris, Sonalyst, Freese-Notis, Jeppesen, and Parochus.

Accomplishments:

FY 2006

- Obtained approval of in-flight icing severity nowcast product for operational use.
- Implemented 4-hour winter precipitation product into Weather Support to Deicing Decision Making System.
- Implemented terminal convective weather forecast product into Integrated Terminal Weather System.

FY 2005

- Implemented improved accuracy and resolution of data on upper winds, temperature, and moisture through 13-kilometer rapid-update-cycle analyses and forecasts at National Weather Service.
- Implemented in-flight icing nowcast product with higher resolution into Aviation Digital Data Service (ADDS).

FY 2004

- Implemented up to 12-hour forecast of in-flight icing conditions into ADDS.
- Implemented up to 12-hour forecast of marine stratus burn-off at San Francisco International Airport.

Previous Years

- Achieved the Department of Commerce 2003 Silver Medal.
- Achieved the Office of Research and Acquisitions 2003 Mission Excellence Award.
- Implemented operational weather products that provided new capabilities of:
  - Current and up to two-hour forecast of convective weather.
  - Current and up to 12-hour forecasts of in-flight icing with initial operational capability.
  - Current and up to 12-hour forecasts of clear-air turbulence.
- Implemented operationally, at the National Weather Service, the enhanced ADDS with a flight path tool depicting vertical cross sections of weather along user-specified flight routes.
- Completed convective storm growth and decay field tests in Dallas, Orlando, Memphis, and New York. This research resulted in the accurate short-term prediction of the initiation, growth, and decay of storm cells, and enhanced the strategic and tactical flow management planning that allows more effective routing of traffic to/from airports and runways.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Implement in-flight icing severity nowcast product operationally.
- Implement mid-level turbulence forecast product operationally.
- Develop consolidated convective weather forecast capability.
- Obtain FAA approval of continental U.S. (CONUS) national ceiling, visibility, & flight category analysis products for operational use.
- Implement research quality rapid refresh weather research and forecast model.
- Evaluate flight level winds product.
- Implement multi-radar composites into NEXRAD operations.
- Collaborate with the Dallas-Fort Worth Air Route Traffic Control Center Traffic Management Unit on a Weather Information Decision Aid (WIDA) for convection.

- Conduct quality assessment evaluations of in-flight icing, and national ceiling and visibility products to support the aviation weather technology transfer process.
- Perform Helicopter Emergency Medical Services (HEMS) ADDS enhancement to enable pilots on GO/NO-GO weather decision.
- Initiate baselining of weather products and determine pilot weather information needs in the cockpit.
- Continue ATDS/revised Minimum Performance Standards (MPS) Technical Standard Order (TSO)-C63c and certification methodology for certification of airborne weather radar with turbulence detection capability.

FY 2008 PROGRAM REQUEST:

Ongoing Activities

- Develop algorithms for forecasts of freezing drizzle aloft.
- Develop consolidated convective weather forecast capability.
- Develop oceanic hazard diagnostic and forecast products.
- Transition weather research products to operations in the NWS, FAA, and industry weather systems.
- Continue development of automated data analysis and assimilation techniques.
- Establish weather product evaluation process for certification and operational guidance.
- Conduct advanced simulator weather simulations.

New Initiatives

No new initiatives are planned in FY 2008.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Implement in-flight icing severity forecast product operationally.
- Demonstrate consolidated convective weather forecast capability.
- Obtain FAA approval of the probabilistic and mountain-wave turbulence forecast product for experimental use.
- Implement CONUS national ceiling, visibility, and flight category analysis products operationally.
- Implement turbulence detection algorithm into NEXRAD operations.
- Develop Network Enabled Operations capability for ADDS.
- Obtain FAA approval for flight level winds product for test use.
- Obtain FAA approval for volcanic ash product for test use.
- Implement the rapid refresh weather research and forecast model, for experimental use.
- Demonstrate capability to provide metadata tags via the Real-Time Verification System to the System-Wide Information Management architecture for JPDO verification.
- Complete baselining weather products and determination of pilot weather information needs in the cockpit.
- Conduct weather product evaluation process for certification and operational guidance.
- Conduct advanced simulator weather simulations.
- Commence turbulence radar and Turbulence Auto-PIREP System (TAPS) infusion into the NAS.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	335,180
FY 2007 Request	19,545
FY 2008 Request	16,888
Out-Year Planning Levels (FY 2009-2012)	77,903
Total	449,516

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Contracts:					
Weather Program – Safety	19,073	19,248	19,212	18,432	15,936
Weather Program – Efficiency	2,981	0	0		0
Personnel Costs	1,264	1,224	1,074	1,035	863
Other In-house Costs	117	199	90	78	89
Total	**23,435**	**20,671**	**20,376**	**19,545**	**16,888**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	23,435	20,671	20,376	19,545	16,888
Development (includes prototypes)	0	0	0	0	0
Total	**23,435**	**20,671**	**20,376**	**19,545**	**16,888**

A11.k. – Weather Program – Safety Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
041-110 Aviation Weather Analysis and Forecasting							
In-flight Icing	**$921**						
Implement icing nowcast severity product operationally		♦					
Implement icing forecast severity product operationally			◊	◊			
Implement icing forecast product for AK operationally					◊		
Implement current icing product for AK operationally						◊	
Advanced Weather Radar Techniques	**$1,095**						
Implement multi-radar composites into NEXRAD ops		♦					
Implement turbulence detection alg. into NEXRAD ops			◊	◊			
Weather Technology Implementation	**$1,899**						
Collaborate with DFW ARTCC TMU on WIDA conv. tool		♦					
Develop NEO capability for ADDS			◊	◊			
Model Development and Enhancement	**$1,304**						
Implement research quality rapid refresh WRF		♦					
Implement rapid refresh WRF for experimental use			◊	◊			
Turbulence	**$1,209**						
Approval by FAA of mid-level turbulence forecasting product for operational use		♦					
Approval by FAA of probabilistic & mountain wave turbulence forecasting product for experimental use			◊	◊			
Implement low-level turbulence forecast product operationally						◊	
Implement turbulence forecast product for Alaska							◊
National Ceiling & Visibility	**$858**						
Approval by FAA of CONUS analysis products for oper. use		♦					
Implement CONUS analysis products operationally			◊	◊			
Implement AK forecast products operationally							◊
Convective Weather	**$2,648**						
Develop consolidated conv wx forecast capability		♦					
Demonstrate consolidated conv wx forecast capability			◊	◊			
Oceanic Weather	**$786**						
Evaluate Flight Level Winds (FLW) product		♦					
Approval of FLW prod for Test & Vol. Ash Analysis Exper			◊	◊			
Implement icing forecast product operationally							◊
Quality Assessment	**$3,216**						
Conduct evaluations to support AWTT process		♦					
Demo metadata tags via RTVS to SWIM for JPDO verification			◊				
Develop verification techniques & support AWTT process				◊			◊
Weather in the Cockpit	**$2,000**						
HEMS ADDS enhancement to enable GO/NO-GO Wx decision		♦					
Complete baseline of wx products & deter pilot info needs			◊				
Conduct wx prod eval process for cert & operational guidance			◊				
Conduct advanced simulator weather simulations			◊				
Commence turb radar and TAPS infusion into the NAS			◊				
Complete tech guidance to implement WIC technologies							◊
Personnel and Other In-House Costs	**$952**						
Total Budget Authority	**$16,888**	**$19,545**	**$16,888**	**$19,336**	**$19,286**	**$19,638**	**$19,643**

♦ - Activities Accomplished ◊ - Activities Planned

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

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
R,E&D	A14.b.	William J. Hughes Technical Center Laboratory Facility	$3,415,000

Supports FAA Strategic Goals: Increased Safety, Greater Capacity, International Leadership, and Organizational Excellence.

Intended Outcomes: The FAA sustains research facilities located at the William J. Hughes Technical Center (WJHTC) in support of its R&D program goals. These facilities consist of the Research and Development Flight Program (Aircraft), Simulation facilities, and the Research and Development Human Factors Laboratory (RDHFL).

Agency Outputs: R&D programs require specialized facilities to emulate and evaluate field conditions. For example, human factors projects require ground-based laboratories to perform human-in-the-loop simulations, measure human performance, and evaluate human factors issues. These laboratories are comprised of integrated cockpit and air traffic control workstation simulators, and the performance issues they delve into reflect the perspectives of the pilot and flight crew. Airborne and navigation projects require additional "flying laboratories" that are specially instrumented and reconfigurable to support a variety of projects.

Customer/Stakeholder Involvement: The WJHTC facilities directly support agency projects and integrated product teams in the following areas:

- Capacity and air traffic management technology.
- Communications, Navigation, And Surveillance.
- Operational Evolution Plan (OEP) concept validation.
- Next Generation Air Transportation System (NextGen).
- Weather.
- Airport technology.
- Aircraft safety technology.
- Human Factors.
- Information Security.
- Environment and Energy.
- Automated Dependent Surveillance-Broadcast.
- Terminal Instrumentation Procedures (TERPS).
- Wide/Local Area Augmentation System (WAAS/LAAS).

R&D Partnerships: In addition to FAA's research programs, WJHTC laboratories cooperate with the Canadian Ministry of Transport, NASA, U.S. Air Force, EUROCONTROL, RTCA, Aircraft Owners and Pilots Association, International Civil Aviation Association, academia, and industry.

Accomplishments: The technical laboratory facilities provide the reliable test bed infrastructure to support R&D program goals and outputs.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

The following programs are supported by the laboratories:

- Runway Incursion.
- Information Security.
- Separation Standards.
- Global Positioning System (GPS)/WAAS/LAAS.
- TERPS.
- Satellite Communication.
- Data Link.
- Acquisition Human Factors.
- Delay Reduction.
- Dynamic Vertical Reduced Separation Minima (DRVSM).
- The OEP.
- Airspace Re-sectorization Studies.

FY 2008 PROGRAM REQUEST:

The WJHTC will sustain technical laboratories/facilities that support R&D programs.

Ongoing Activities

- Next Generation Air Transportation System (NextGen).
- Capacity Initiatives (Airspace, Procedures).
- Information Security.
- Satellite Communication and Navigation Programs.
- Separation Standards.
- GPS/WAAS/LAAS.
- TERPS.
- Runway Incursion.
- Aircraft Safety.
- Air Traffic Control/Airway Facilities Human Factors.
- OEP Concept Validation.
- DRVSM.

New Initiatives

No new initiatives are planned in FY 2008.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

The test beds at the WJHTC provide the necessary infrastructure for R&D programs to achieve agency goals. Specific milestones and products are contained within individual programs.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	100,045
FY 2007 Request	3,430
FY 2008 Request	3,415
Out-Year Planning Levels (FY 2009-2012)	14,818
Total	121,708

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Contracts:					
WJHTC Laboratory Facility	979	983	572	779	667
Personnel Costs	2,401	2,293	2,712	2,584	2,642
Other In-house Costs	25	86	75	67	106
Total	**3,405**	**3,362**	**3,359**	**3,430**	**3,415**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Request**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	3,405	3,362	3,359	3,430	3,415
Development (includes prototypes)	0	0	0	0	0
Total	**3,405**	**3,362**	**3,359**	**3,430**	**3,415**

A14.b. – WJHTC Laboratory Facility Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
011-140 WJHTC Laboratory Facility							
Simulation Facilities (Target Generator Facility, Cockpit Simulators)	**$58**						
Approach Procedures		◆	◊	◊			
Next Generation Air Traffic System (NextGen)		◆	◊	◊	◊	◊	◊
Airspace Design		◆	◊	◊	◊	◊	◊
Operational Evolution Plan Concept Validation		◆	◊	◊	◊	◊	◊
Dynamic Vertical Reduced Separation Minima (DRVSM)		◆	◊	◊	◊	◊	◊
Research & Development Flight Program (Aircraft)	**$551**						
Satellite Communications and Navigation Programs		◆	◊	◊	◊	◊	◊
Separation Standards		◆	◊	◊	◊	◊	◊
GPS WAAS/LAAS		◆	◊	◊	◊	◊	◊
TERPS		◆	◊	◊	◊	◊	◊
Aircraft Safety		◆	◊	◊	◊	◊	◊
Runway Incursion		◆	◊	◊	◊	◊	◊
Next Generation Air Transportation System (NextGen)							
Research and Development Human Factors Laboratory	**$58**						
Air Traffic Control Human Factors		◆	◊	◊	◊	◊	◊
Airway Facilities Human Factors		◆	◊	◊	◊	◊	◊
Operational Evolution Plan Concept Validation		◆	◊	◊			
Personnel and Other In-House Costs	**$2,748**						
Total Budget Authority	**$3,415**	**$3,430**	**$3,415**	**$3,548**	**$3,644**	**$3,758**	**$3,868**

◆ - Activities Accomplished ◇ - Activities Planned

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

FAA Budget Appropriation	Budget Item	Program Title	Budget Request
ATO Capital	**1A01I**	**Wind Profiling and Weather Research Juneau**	**$4,000,000**

Supports FAA Strategic Goals: Increased Safety, and Greater Capacity.

Program Goals and Intended Outcomes: The Juneau Airport Wind System (JAWS) Program directly supports goals delineated in the FAA's Flight Plan 2006-2010. 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 2006-2010. It supports the strategic goal of Increased Safety by providing critical wind information to enable commercial and general aviation Required Navigation Precision (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.

JAWS is currently undergoing a Business Case, studying the cost and benefits to the system. Four identified alternatives that are being investigated: 1) allow Alaska Airlines to own and operate the JAWS system, 2a) FAA to continue to develop the JAWS system without the alert algorithms, 2b) a contractor to continue to develop the JAWS system without the alert algorithms, and 4) FAA to continue to develop JAWS with the alert algorithms. Alternative 2b is the preferred alternative; although, cost and benefit data are still being collected and an alternative decision has yet to be determined by the Executive Committee. FY 2008 key activities are based on the preferred alternative.

Agency Outputs: The JAWS program generates turbulence advisories and wind information, which is 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 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 ATO Capital program. The principal developer, NCAR, is primarily an aviation weather R&D organization.

FY 2007 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

The currently identified $1.1 million will allow only for the operations and maintenance of the current prototype system.

- Maintain the JAWS operational prototype in Juneau.
- Complete an Operational Evaluation Report of the prototype system.
- Develop the end-state JAWS on a COTS hardware platform (funds permitting).
- Complete safety mitigation efforts at the JAWS mountaintop anemometer sites.
- Continue to install the end-state JAWS system to allow for operational testing (funds permitting).
- Address security concerns of JAWS prototype system (funds permitting).

FY 2008 PROGRAM REQUEST:

The requested funding will allow the program to maintain and operate the current system prototype system, as well as continue into the completion process of the JAWS end-state system.

KEY FY 2008 MAJOR ACTIVITIES AND ANTICIPATED ACCOMPLISHMENTS:

- Continue to maintain operation of the JAWS prototype.
- Complete any security issues pertaining to the prototype.
- Continue development of the JAWS end-state system.
- Perform any follow-up safety issues at Profiler sites.
- Develop final test plan and procedures.

APPROPRIATION SUMMARY

	Amount ($000)
Appropriated (FY 1982-2006)	26,120
FY 2007 Appropriated	1,100
FY 2008 Request	4,000
Out-Year Planning Levels (FY 2009-2012)	0
Total	31,220

Budget Authority ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Enacted**	**FY 2008 Request**
Contracts:					
Wind Profiling and Weather Research Juneau	5,965	4,861	3,130	1,100	4,000
Personnel Costs	0	0	0	0	0
Other In-house Costs	0	0	0	0	0
Total	**5,965**	**4,861**	**3,130**	**1,100**	**4,000**

OMB Circular A-11, Conduct of Research and Development ($000)	**FY 2004 Enacted**	**FY 2005 Enacted**	**FY 2006 Enacted**	**FY 2007 Enacted**	**FY 2008 Request**
Basic	0	0	0	0	0
Applied	0	0	0	0	0
Development (includes prototypes)	5,965	4,861	3,130	1,100	4,000
Total	**5,965**	**4,861**	**3,130**	**1,100**	**4,000**

Wind Profiling and Weather Research, Juneau Product and Activities	FY 2008 Request ($000)	Program Schedule					
		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Juneau Airport Wind System							
Safety Mitigation							
Develop Anemometer Site Design Drawings		♦					
Upgrade Anemometer Sites		♦					
Operations and Maintenance (O&M)							
JAWS O&M (NCAR to maintain prototype)	**$4,000**	♦					
JAWS O&M (NCAR to maintain prototype)			◊				
Continue development of JAWS End-State System			◊				
Continue security development issues			◊				
Complete safety issues			◊				
Develop final test and evaluation plan			◊				
Total Budget Authority	**$4,000**	**$1,100**	**$4,000**	**$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.

APPENDIX B
Partnership Activities

The Federal Aviation Administration (FAA) enhances and expands its research and development (R&D) capabilities by partnering with other government, industry and academic organizations. Such partnerships help the FAA leverage critical resources and capabilities to ensure that the agency can achieve its goals and objectives. By reaching out to other government agencies, industry and the academic community, the FAA gains access to both internal and external innovators, promoting the transfer of technology, personnel, information, intellectual property, facilities, methods, and expertise. These partnerships also foster the transfer of the FAA technologies to the private sector for other civil and commercial applications. The Agency uses the following partnership mechanisms to achieve its goals.

Working with Government
- Memoranda of Understanding and Agreement
- Inter and Intra Agency Agreements

Working with Government, Industry and Academia
- Cooperative Research and Development Agreements

Working with Industry
- Small Business Innovation Research
- Intellectual Property and Patents

Working with Academia
- Joint University Program
- Aviation Grants
- Centers of Excellence

Working with Government

The FAA researchers collaborate with their colleagues in government, industry, and academia through memoranda of understanding/agreement (MOU/MOA) and other mechanisms. The National Aeronautics and Space Administration (NASA) is the FAA's closest R&D partner in the federal government. The two agencies cooperate on research through a series of memoranda of understanding. The FAA also works closely with the Department of Defense (DOD), especially in the environmental area. Table B.1 provides details of the agreements currently in place with NASA and DOD. For more information, see http://faa-www.larc.nasa.gov.

Table B.1 – Current Memoranda of Understanding

MOU and MOA		
Agreement Type	Subject	Objective
FAA/NASA MOU	A Partnership to Achieve Goals in Aviation and Space Transportation	Partnering in the pursuit of complementary goals in aviation and space transportation, including safety, airspace system efficiency, environmental compatibility, international leadership, and others.
FAA/NASA MOA (pending)	Cooperation in Aviation Transportation Research	Coordinating and cooperating in areas of mutual interest to avoid duplication of effort and obtain maximum leverage from each agency's capabilities and available resources. Areas of interest include, but not limited to, the Next Generation Air Transportation System, capacity, safety, environment, and centers of excellence.
FAA/NASA MOA	Commercial Space Transportation Infrastructure Development	Advancing and developing the national commercial space transportation infrastructure, including design, development, demonstration, and technology transfer of technologies, systems, equipment, processes, operating concepts, and facilities associated with spaceports and ranges.
FAA/DOD MOA	Collaboration on Research and Development to Measure and Mitigate the Environmental Impacts of Aircraft Noise and Aviation Air Emissions	Conducting and coordinating research and development projects and exchanging research and development data, analyses and related information and material concerning the environmental impacts of aircraft noise and aviation emissions.

In addition to MOUs, the FAA partners with other agencies through a variety of inter-agency committees and group. For example, the FAA and other interested federal agencies established the Federal Interagency Committee on Aviation Noise to encourage debate and agreement over needs for future aviation noise abatement and new research efforts. The committee conducts annual public forums in different geographic regions with the intent to align noise abatement research with local public concerns.

Working with Government, Industry and Academia

The FAA complies with all applicable federal guidelines and legislation concerning the transfer of technology. The FAA's goal is to transfer knowledge, facilities, equipment, or capabilities developed by its laboratories and R&D programs to the private sector. This helps expand the United States technology base and maximize the return on federal R&D investments.

Cooperative Research and Development Agreements (CRDAs)

These agreements allow the FAA and its partners to share facilities, equipment, services, intellectual property, and personnel resources with industry, academia, and state and local governments in collaborative R&D activities. CRDAs are a highly effective way to meet congressionally mandated technology transfer requirements. In fiscal year (FY) 2006, the FAA established 6 new CRDAs, bringing the present total of active agreements to 27. Details of the new CRDAs are shown in Table B.2.

Table B.2 – FAA Cooperative R&D Agreements, FY 2006

Cooperative R&D Agreements					
CRDA Number	FAA Program	Subject	Recipient Organization	Award Date	Completion Date
1993-A-0040	Weather	Development of advanced weather information systems with graphical display products	Harris Corporation Melbourne, FL	02/24/93	02/24/06
1993-A-0043	Weather	Development of advanced weather information systems with graphical display products	WSI Corporation Billerica, MA	09/13/93	09/13/06
1994-A-0065	Airport Technology	Testing of a soft ground arresting system developed to safely stop aircraft that overrun the available length of runway	DATRON Engineered Systems Division, Aston, PA	09/07/94	09/07/06
1996-A-0097	Airport Technology	Development of the National Airport Pavement Test Machine	The Boeing Company Seattle, WA	07/29/96	07/29/11
1998-A-0121	Weather	Utilize state-of-the-art mete-orological measurement, sensing, and display equipment to disseminate real-time weather warnings and forecasts to avi-ation users	Jeppesen Sanderson, Inc. Englewood, CO	04/15/99	04/15/07
1999-A-0124	Weather	Utilize state-of-the-art mete-orological measurement, sens-ing, and display equipment to disseminate real-time weather warnings and forecasts to aviation users	Sonalysts, Inc. Waterford, CT	04/09/99	04/09/07

Cooperative R&D Agreements					
CRDA Number	FAA Program	Subject	Recipient Organization	Award Date	Completion Date
1999-A-0138	Aircraft Safety Technology	Evaluation of high octane unleaded aviation gasoline for general aviation piston engines	Exxon Mobile Research and Engineering Company Florham Park, NJ	10/19/99	10/19/05
1999-A-0139	Aircraft Safety Technology	Evaluate the use of acoustic emission technology for the inspection of spherical Halon fire bottles and its performance in an industrial environment to identify problems related to its use	Walter Kidde Aerospace Wilson, NC	11/30/99	11/30/05
2001-A-0158	Controller Pilot Data Link Communications	Controller Pilot Data Link Communication Build 1A	ARINC Annapolis, MD	08/24/01	06/20/06
2001-A-0163	Weather	Utilize state-of-the-art meteorological, measurement, sensing, and display equipment to disseminate real-time weather warnings and forecasts to aviation users	Freese-Notis Weather, Inc. Des Moines, IA	03/22/02	03/22/06
2001-A-0164	Airport Technology	Utilize statistical analysis for determining airplane contact risks of varying span airplanes on taxiways of varying separation	The Boeing Company Seattle, WA	04/05/02	04/05/07
2002-A-0171	Capacity and Air Traffic Management Technology	Develop modeling and simulation tools to assist in tech implementation of capacity enhancing capabilities for the National Airspace System	The Boeing Company McLean, VA	07/17/02	07/17/07
2003-A-0179	Communications, Navigation, and Surveillance	Develop a software tool to convert unpublished instrument procedures	Universal Avionics Systems Corp. Tucson, AZ	03/31/03	03/31/07
2003-A-0181	Communications, Navigation, and Surveillance	Controller Pilot Data Link Communication Builds 1 and 1A	SITA Information Networking Computing, B.V. Vienna, VA	09/25/03	09/25/08
2004-A-0189	Office of Innovations and Solution	Video security system to enhance aviation security	Presearch Incorporated Fairfax, VA	01/27/04	01/27/07
2004-A-0193	Environment and Energy	Gasper Air Flow Characterization	B/E Aerospace Holbrook, NY	02/18/04	02/18/06
2004-A-0199	Air Traffic Organization	Research on the Success of the Radical Organizational Change at the Federal Aviation Administration's Air Traffic Organization	University of Maryland at College Park College Park, MD	05/13/04	05/13/07
2005-A-0203	Air Traffic Management	Efficiency of the Air Traffic Controller Operator Working Position	Frequentis, USA Rockville, MD	04/14/05	04/14/07

Cooperative R&D Agreements					
CRDA Number	FAA Program	Subject	Recipient Organization	Award Date	Completion Date
2005-A-0206	Advanced Traffic Management Systems	Evaluation of the Surface Management System Capabilities and Improvements	FedEx Express Memphis, TN	05/24/05	05/24/08
2005-A-0208	Air Traffic Models and Evaluation Tools	Utilize state-of-the-art technologies and the initial development of the Aviation Integrated Reasoning Modeling Matrix to develop a system that will support the current and future needs of the FAA	Optimal Systems, Monroeville, NJ	06/08/05	06/08/08
2005-A-0209	Information Resource Management	Electronic submission of confidential financial disclosure forms	HRWorX, LLC, Herndon, VA	08/25/05	08/25/07
2005-A-0213	Air Traffic Models and Evaluation Tools	Machine-graded aviation English test for pilots for measuring levels of English language proficiency	Ordinate Corporation, Menlo Park, CA	01/17/06	01/17/11
2006-A-0214	Aircraft Safety Technology	Testing of wireless headsets on an operating aircraft during ground pushback, engine run-up and ramp operations	JDA – Aviation Technology Solutions, Washington, DC	11/09/05	05/06/06
2006-A-0216	Air Traffic Models and Evaluation Tools	Development and improvement of a graphical user interface for the display of recorded air traffic data	Rowan University, Glassboro, NJ	07/25/06	07/25/07
2006-A-0220	Communications, Navigation, and Surveillance	Utilize ADS-B technology to facilitate procedures improving aircraft arrival rates and situational awareness in the air and on the airport surface while reducing fuel consumption and noise generation.	Aviation Communications & Surveillance Systems, Phoenix, AZ	09/21/06	09/21/08
2006-A-0221	Atmospheric Hazards/Digital System Safety	Testing to document the shape, location, and aerodynamic effects of propeller icing.	Hartzell Propeller, Inc., Piqua OH	05/12/06	02/12/07
2006-A-0222	Atmospheric Hazards/Digital System Safety	Testing to document the shape, location, and aerodynamic effects of propeller icing.	MT-Propeller USA, Inc., DeLand, FL	05/23/06	02/23/07

Working with Industry

Small Business Innovation Research (SBIR)

These contracts encourage the private sector to invest in long-term research that helps the federal government meet its R&D objectives. Eligible small business contractors compete for Phase I contracts to conduct feasibility-related experimental or theoretical research. A Phase II contract is awarded based on the results of Phase I, which is the actual research phase. Contractors are encouraged to pursue other than SBIR funding sources for Phase III and to attract venture capitalists to commercialize the innovation.

Patents issued through the U.S. Patent and Trademark Office

Inventors are encouraged to patent new technologies through the U. S. Patent and Trademark Office. A patent is a grant of a property right and gives the owner the right to exclude anyone else from making, using, or selling the invention. Inventions patented by the FAA inventors are available for commercial licensing with royalty payments being shared with the inventor and the agency. Legislation allows for inventors to receive up to $150,000 a year over their salary from royalty payments. The agency's Technology Transfer Program Office promotes the agency's patents for commercialization. Table B.3 provides a list of the current U.S. patents issued to the U.S. Department of Transportation, FAA.

Three (3) licensing agreements are in effect for Patent No. 5,981,290 "Microscale Combustion Calorimeter" and Patent No. 6,464,391 "Heat Release Rate Calorimeter for Milligram Samples." On September 20, 2006, the Federal Laboratory Consortium, Northeast Region, awarded the 2006 Excellence in Technology Transfer Award to the "Microscale Combustion Calorimetric Analysis of Polymer and for Milligram Samples" invented by Dr. Richard E. Lyon of the Airport and Aircraft Safety Research and Development Program.

Under the patent provisions of Government funding agreements, recipients must disclose each subject invention that they make to the Federal agency and may elect to retain title to any patentable subject matter. If the recipient retains title, the Government is granted a broad license to use the invention for Government purposes throughout the world.

The FAA has identified approximately 60 active patents resulting from FAA funded agreements. These patented technologies are available for use by the Government, and its contractors, on a cost-free basis when used for Government purposes. For more information, see http://www.tc.faa.gov/technologytransfer/ttpatentsthru_grant.html.

Table B.3 – Patents Issued for DOT/FAA

Patents Issued			
Patent No.	Date of Patent	Title	Description
6,899,540	5/31/05	Threat image projection system	A means for training and testing baggage screening machine operators.
6,812,834	11/02/04	Reference sample for generating smoky atmosphere	A reference sample for testing fire detectors and a method for testing using the reference samples.
6,470,730	10/29/02	Dry transfer method for the preparation of explosives test samples	A method of preparing samples for testing explosives and drug detectors of the type that search for particles in air.
6,467,950	10/22/02	Device and Method to Measure Mass Loss Rate of an Electrically Heated Sample	A device and a method for measuring the mass loss rate of a sample of combustible material placed on a mass-sensitive platform.
6,464,391	10/15/02	Heat Release Rate Calorimeter for Milligram Samples	A calorimeter that measures heat release rates of very small samples (on the order of 1 to 10 milligrams) without the need to separately and simultaneously measure the mass loss rate of the sample and the heat of combustion of the fuel gases produced during the fuel generation process.
6,116,049	09/12/00	Adiabatic Expansion Nozzle	A nozzle for producing a continuous gas/solid or gas/aerosol stream from a liquid having a high room temperature vapor pressure.
5,981,290	11/09/99	Micro-scale Combustion Calorimeter	A calorimeter for measuring flammability parameters of materials using only milligram sample quantities.

Working with Academia

Joint University Program for Air Transportation Research

This cooperative research partnership among three universities (Ohio University, the Massachusetts Institute of Technology, and Princeton) conducts scientific and engineering research on technical disciplines that contribute to civil aviation, including air traffic control theory, human factors, satellite navigation and communications, aircraft flight dynamics, avionics and meteorological hazards. The FAA and NASA benefit directly from the results of the research, and, less formally, from valuable feedback from university researchers regarding the goals and effectiveness of government programs. An additional benefit is the creation of a talented cadre of engineers and scientists who will form a core of advanced aeronautical expertise in industry, academia, and government. For more information, see http://www.princeton.edu/~stengel/JUPnew.html.

Aviation Grants

The FAA awards research grants to qualifying colleges, universities, and legally incorporated nonprofit research institutions. The evaluation criteria for grant proposals include the potential application of research results to the FAA's long-term goals for civil aviation technology. Table B.4 is a list of the FAA research grants initiated in FY 2006. In FY 2006, FAA awarded $4.4 million in new grants. It also awarded an additional $26.8 million to grants that originated in prior fiscal years for a total of $31.2 million in grant awards in FY 2006.

Table B.4. FAA Research Grants Originating in FY 2006

Research Grants				
FAA Program	Grant Number and Objective	Recipient Institution	Award and Completion Dates	Award Amount
LORAN-C	2006-G-001. Explore e-Loran applications in the NAS.	Aviation Management Associates, Inc.	3/16/2006 3/15/2007	$50,163
Flightdeck/Maintenance/ System Integration Human Factors	2006-G-002. Identify interventions for selected types of human error in General Aviation using the Human Factors Intervention Matrix (HFIX).	Clemson University	3/24/2006 3/23/2007	$176,771
Flightdeck/Maintenance/ System Integration Human Factors	2006-G-003. Establish color discrimination limits that can be classed as "safe" in the aviation environment.	City University London	6/23/2006 6/22/2007	$292,929

Research Grants				
FAA Program	Grant Number and Objective	Recipient Institution	Award and Completion Dates	Award Amount
Aircraft Catastrophic Failure Prevention Research; and Aging Aircraft	2006-G-004. Create a high quality data base that characterizes the mechanical response of 2024-T351 aluminum alloy and Ti-6-4 Titanium alloy.	Ohio State University	5/12/2006 9/30/2008	$199,810
NAS Spectrum Engineering	2006-G-005. Investigate the use of wireless networks on airport surface areas for aviation applications.	Ohio University	6/9/2006 6/8/2007	$199,900
Air Traffic Control/ Airway Facilities Human Factors	2006-G-006. Cognitive evaluation of potential approaches to increase the efficiency of air traffic controller training and staffing.	Massachusetts Institute of Technology	6/29/2006 6/28/2007	$147,699
Aircraft Catastrophic Failure Prevention Research; Atmospheric Hazards/Digital System Safety; Aircraft Catastrophic Failure Prevention Research; and Propulsion and Fuel Systems	2006-G-007. Develop and validate a constitutive material model for Kevlar and Zylon fabrics for use with finite element analysis programs.	Arizona State University	6/27/2006 6/26/2007	$375,000
Aging Aircraft	2006-G-008. Develop more specific safety risk analyses of UAS operations in the NAS and investigate the usefulness of alternative risk models that capture the integration of human, technical, environmental, and organizational risk factors.	Rutgers, The State University of New Jersey	7/13/2006 8/31/2007	$143,045
Weather Program	2006-G-009. Conduct a comprehensive review and evaluation of weather related flight training, testing, and standards for GA pilots.	Board of Trustees of the University of Illinois	07/25/06 01/24/07	$50,000
Propulsion and Fuel Systems	2006-G-010. Determine the impact of aviation grade ethanol on aircraft maintenance and engine service intervals.	South Dakota State University	8/2/2006 7/28/2009	$404,809

Research Grants				
FAA Program	Grant Number and Objective	Recipient Institution	Award and Completion Dates	Award Amount
Propulsion and Fuel Systems; and Aircraft Catastrophic Failure Prevention Research	2006-G-011. Develop and apply finite element modeling and simulation analysis methodologies for evaluation of aircraft engine containment.	George Washington University	8/2/2006 8/1/2008	$681,923
Aging Aircraft	2006-G-012. Assist the FAA initiative to maintain the safe operation of the existing GA fleet through improved maintenance practices and inspections.	Wichita State University	8/11/2006 10/10/2007	$200,000
Advanced Materials and Structural Safety	2006-G-013. Investigate information complexity issues in three types of ATC displays -- radar, information and support.	The Board of Regents of the University of Oklahoma	8/18/2006 8/17/2007	$99,901
GPS Anti-Jamming	2006-G-014. Develop technologies to reduce or eliminate the interference threat to GPS, or provide a warning to the user in the event that hazardous misleading information is present and the GPS cannot be used.	The Board of Regents of the University of Oklahoma	9/6/2006 12/5/2007	$989,417
Aircraft Catastrophic Failure Prevention Research; and Aging Aircraft	2006-G-015. Develop a manual technique for detection and self-repair of inaccessible, damaged wires as well as continue development of wires with the capability to perform automatic self-repair regardless of the damage mechanism.	University of Dayton	8/25/2006 8/24/2007	$308,846
Separation Standards	2006-G-016. Investigate aircraft separation standards and navigational equipment on oceanic airspace capacity and safety.	Rutgers, The State University of New Jersey	9/6/2006 9/5/2007	$106,668

Air Transportation Centers of Excellence

The FAA sponsors seven centers that are established through cooperative agreements with 70 academic institutions throughout the U.S. to assist in mission-critical research and technology. Through these long-term collaborative, cost-sharing efforts, the government and university/industry teams leverage their resources to advance aviation technology. The seven centers of excellence are established in the following areas.

- Airliner Cabin Environment
- Advanced Materials
- Aircraft Noise and Aviation Emissions Mitigation
- General Aviation Research
- Airworthiness Assurance
- Operations Research
- Airport Technology

The pages that follow provide a brief description of each of the seven centers with a table identifying the Center of Excellence grants awarded in 2006.

Airliner Cabin Environment – Established in 2004, the Center of Excellence for Airliner Cabin Environment Research is led by Auburn University. The Center conducts research on cabin air quality and on chemical and biological threats. Other member universities include: Purdue University, Harvard University, Boise State University, Kansas State University, the University of California at Berkeley, and the University of Medicine and Dentistry of New Jersey. http://www.acer-coe.faa.gov

Table B.5 – COE Grants Awarded in 2006 for Airline Cabin Environment

Airline Cabin Environment				
University Recipient	Grant Title	Amount	FAA Point of Contact	University Point of Contact
St. Louis University	Aircraft Recirculation Filter Research for Incident Assessment	$140,928	Dr. C. Ruehle	A. Stolzer
Kansas State University	Emergency Preparedness Exercise	$50,000	Dr. C. Ruehle	S. Eckles
Harvard University	Reduced Partial Pressure on Commercial Aircraft Review and Feasibility Studies	$293,807	Dr. C. Ruehle	J. Spengler

Advanced Materials – Established in 2003, the Joint Center of Excellence for Advanced Materials is managed by the University of Washington and Wichita State University, serving as co-leads. The Center conducts research on material standardization and shared databases, bonded joints, structural substantiation, damage tolerance and durability, maintenance practices, advanced material forms and processes, cabin safety, life management of materials, and nanotechnology for composite structures. Other member universities include Edmonds Community College, Northwestern University, Oregon State University, Purdue University, the University of California at Los Angeles, the University of Delaware, Tuskegee University, and Washington State University. http://www.jams-coe.com

Table B.6 – COE Grants Awarded in 2006 for Advanced Materials

Advanced Materials				
University Recipient	Grant Title	Amount	FAA Point of Contact	University Point of Contact
Wichita State University	Administration of the Center of Excellence for Composite and Advanced Materials (CECAM) at Wichita State University	$75,000	C. Davies	J. Tomblin
University of Washington	Administration of the FAA Center on Advanced Materials in Transport Aircraft Structures - AMTAS	$82,722	C. Davies	M. Tuttle
Wichita State University	Certification by Analysis	$200,000	A. Abramowitz	G. Olivares
University of Washington	Combined Global/Local Variability and Uncertainty in Integrated Aeroservoelasticity of Composite Aircraft	$160,000	C. Davies	E. Levine
Edmonds Community College	Course Development: Maintenance of Composite Aircraft Structures	$124.885	P. Shyprykevich	G. Moiser
Wichita State University	Crashworthiness of Composites - Material Dynamic Properties	$100,000	A. Abramowitz	S. Keshavanarayana
Purdue University	Damage Tolerance and Durability of Adhesively Bonded Composite Structures	$75,500	P. Shyprykevich	H. Kim
University of California at Los Angeles	Damage Tolerance and Durability of Fiber-Metal Laminate for Aircraft Structures	$75,000	C. Davies	T. Hahn
Wichita State University	Damage Tolerance Testing and Analysis Protocols for Full-Scale Composite Airframe Structures Under Repeated Loading	$300,000	P. Shyprykevich	J. Tomblin
Wichita State University	Damage Tolerance Testing and Analysis Protocols for Full-Scale Composite Airframe Structures Under Repeated Loading	$30,000	P. Shyprykevich	J. Tomblin
University of Washington	Development of Reliability Based Damage Tolerant Design Methodology	$160,000	C. Davies	K. Lin

Advanced Materials				
University Recipient	Grant Title	Amount	FAA Point of Contact	University Point of Contact
Wichita State University	Evaluation of Stir Welding Process and Properties for Aircraft Application	$235,000	C. Davies	D. Buford
Wichita State University	Fluid Ingestion Damage Mechanism in Composite Sandwich Structures	$275,000	C. Davies	J. Tomblin
Wichita State University	Methods of Evaluation of the Fitness Fiber Reinforced Composite Surfaces for Subsequent Composite Bonding	$100,000	C. Davies	W. Stevenson
Wichita State University	Production Control Effect on Composite Material Quality and Stability	$125,000	C. Davies	J. Tomblin
Wichita State University	Production Control Effect on Composite Material Quality and Stability	$1,000	C. Davies	J. Tomblin
Wichita State University	Production Control Effect on Composite Material Quality and Stability	$60,000	C. Davies	J. Tomblin
Wichita State University	Production Control Effect on Composite Material Quality and Stability	$75,000	C. Davies	J. Tomblin
Northwestern University	Structural Health Monitoring for Life Management of Aircraft	$75,000	P. Shyprykevich	J. Achenbach
Wichita State University	Technology Assessment of the Airworthiness of Unmanned Aerial Systems	$80,000	M. Vu	W. Horn
University of Delaware	VARTM Variability and Substantiation	$75,000	C. Davies	D. Heider

Aircraft Noise and Aviation Emissions Mitigation -- Established in 2003 with NASA and Transport Canada as co-sponsors, the Partnership for Air Transportation Noise and Emissions Reduction Center of Excellence is led by the Massachusetts Institute of Technology. The Center conducts research to identify, understand, and measure the impacts of aircraft noise and aviation emissions and, as appropriate, to mitigate these problems. The Center seeks to reduce uncertainty in issues dealing with climate impact and the health and welfare effects of emissions. Other member universities include Boise State University, Florida International University, the Pennsylvania State University, Purdue University, Stanford University, the University of Central Florida, and the University of Missouri-Rolla. http://web.mit.edu/aeroastro/www/partner or www.partner.org

Table B.7 – COE Grants Awarded in 2006 for Noise and Emissions

Noise and Emissions				
University Recipient	Grant Title	Amount	FAA Point of Contact	University Point of Contact
Massachusetts Institute of Technology	Assessment of Alternative Fuels for Commercial Aviation	$300,000	N. Brown	I. Waitz
Georgia Institute of Technology	CDA Implementation in Low-Throughput High-Density Traffic	$401,995	S. Lui	J. Clarke
Massachusetts Institute of Technology	Emissions, Measurements, Part-E Particulate Matter (PM) Chemistry and Microphysics Modeling	$150,000	C. Ma	I. Waitz
Georgia Institute of Technology	En Route Traffic Optimization to Reduce Environmental Impact	$70,035	A. Morales	J. Clarke
University of Missouri at Rolla	Engine Emissions Measurements	$450,000	C. Ma	P. Whitefield
Massachusetts Institute of Technology	Environmental Design Space	$150,000	J. DiPardo	I. Waitz
Georgia Institute of Technology	Environmental Design Space	$562,651	J, DiPardo	I. Waitz
Massachusetts Institute of Technology	Environmental Design Space	$664,984	J. DiPardo	I. Waitz
Massachusetts Institute of Technology/ University of North Carolina	Investigation of Air Quality Impacts of Aviation Emissions Using CMAQ	$146,500	M. Gupta	I, Waitz, S. Arunachalam and A. Hanna
Pennsylvania State University	Measurement, Metrics, and Health Effects of Noise	$170,000	M. Marsan	A. Atchley
Purdue University	Measurement, Metrics, and Health Effects of Noise	$150,000	M. Marsan	P. Davies
Purdue University	Noise Quest	$30,037	J. Pietrak	G. Eiff
Pennsylvania State University	Noise Quest Feasibility Study	$70,000	J. Pietrak	A. Atchley
Massachusetts Institute of Technology	Program Management for Aircraft Noise and Aviation Emissions Center of Excellence	$30,000	L. Maurice	I. Waitz
Massachusetts Institute of Technology	Program Management for Aircraft Noise and Aviation Emissions Mitigation Center of Excellence	$285,000	L. Maurice	I. Waitz
Purdue University	Research to Examine Land Use Decisions and their Relation to Airport Noise Concerns and Complaints	$149,998	P. Friesenhahn	G. Eiff
Massachusetts Institute of Technology/ Harvard University	Risk Assessment	$131,785	M. Gupta	I. Waitz and J. Spengler

General Aviation Research (CGAR) – Established in 2001, the Center of Excellence for General Aviation Research conducts safety-related research with application to non-commercial aviation. Embry-Riddle Aeronautical University serves as the lead and the prime and core member universities include Wichita State University, the University of North Dakota, Florida A&M, and the University of Alaska. http://www.cgar.faa.gov

Table B.8 – COE Grants Awarded in 2006 for General Aviation

General Aviation				
University Recipient	Grant Title	Amount	FAA Point of Contact	University Point of Contact
Embry-Riddle Aeronautical University	ASI Course Development	$112,110	J. Eaeyes	M. Friend
University of North Dakota	Business Jet Loads Data Acquisition	$84,000	T. DeFiore	Marshall
Embry-Riddle Aeronautical University	Compressed Ignition Engine Certification Issues	$67,000	X. Lee	P. Pierpont S. Roth
Embry-Riddle Aeronautical University	Course Development for Qualification Training for Technically Advanced Aircraft	$214,646	D. Hershler	M. Wiggins
Wichita State University	Enhanced Jet Exhaust Mixing to Reduce Jet Aircraft Engine Noise	$180,000	S. Byrnes	R. Myose
Embry-Riddle Aeronautical University	GA Airport Funding Strategies – Phase II	$101,993	K. Bagot	M. Bazargan
University of North Dakota	Helicopter Terrain Awareness Warning Systems and Enhanced Vision Systems Flight Testing	$403,117	L. Buehler	L. Martin
University of North Dakota	Joint Training Standards Development	$150,000	T. Glista	R. Graziano
Embry-Riddle Aeronautical University	Remote Airport Lighting System (RALS)	$349,650	D. Gallagher	M. Inman
Embry-Riddle Aeronautical University	Technology Survey of UAS Propulsion Systems	$73,000	X. Lee	P. Pierpont S. Roth
Embry-Riddle Aeronautical University	Training Standards Development for General Aviation Aircraft	$550,000	T. Glista	M. Summers
Embry-Riddle Aeronautical University	Wildlife Strike Database and Website Maintenance and Establishment of a Virtual National Birdstike Data Processing Center	$199,988	M. Hovan	A. Dickey
Embry-Riddle Aeronautical University	Year Six – Management and Administrative Support – General Aviation Center of Excellence	$2,500	P. Sparacino	S. Hampton
Embry-Riddle Aeronautical University	Year Six – Management and Administrative Support – General Aviation Center of Excellence	$191,042	P. Sparacino	S. Hampton
University of North Dakota	Helicopter Advanced Navigation Research Flight Training	$260,708	K. Knopp	L. Martin

Airworthiness Assurance – Established in 1997, the Center of Excellence for Airworthiness Assurance is a multi-institutional, multi-disciplinary team that includes 32 academic members. The Center conducts safety-related research in aircraft maintenance, inspection and repair, crashworthiness, propulsion and fuel systems safety, and advanced materials. http://www.coe.faa.gov/aace

Table B.9 – COE Grants Awarded in 2006 for Airworthiness Assurance

Airworthiness Assurance				
University Recipient	Grant Title	Amount	FAA Point of Contact	University Point of Contact
Wichita State University	Data and Methodologies for Structural Life Evaluation of Small Airplanes – Phase II	$166,500	M. Shiao	J. Locke
University of Utah	Development and Evaluation of Fracture Mechanics Test Methods for Sandwich Composites	$50,157	P. Shyprykevich	D. Adams
Wichita State University	Development of a De Facto Standards for Tool Calibration Program	$200,000	M. Vu	H. Chraghi
Wichita State University	Evaluation of Airworthiness for Aging Small Airplanes – Phase II	$278,500	M. Shiao	D. Cope
Wichita State University	Evaluation of Airworthiness for Aging Small Airplanes – Phase II	$135,500	M. Shiao	D. Cope
George Washington University	Explicit Finite Element Analysis of Uncontained Aircraft Engine Failure	$85,526	D. Altobelli	S. Kan
Florida International University	Identification and Validation of Analytical Chemistry Methods for Detecting Composite Surface Contamination and Water Moisture	$75,000	C. Davies	R. Srivastava
University of California at Berkley	Modeling, Analysis and Testing of Metallic and Composite Shielding	$173,913	P. Shyprykevich	T. Zohdi
Wichita State University	Operational Loads Monitoring of FAR Part 23 Airplanes	$250,000	M. Shiao	J. Locke
Ohio State University	The Evaluation of Cold Dwell Fatigue in Ti-6241	$419,800	P. Shyprykevich	J. Williams

Operations Research -- Established in 1996, the National Center of Excellence for Aviation Operations Research is managed by five universities including the University of California at Berkeley, Massachusetts Institute of Technology, Virginia Polytechnic Institute, the University of Maryland, and George Mason University. The Center performs research in the areas of traffic management and control, human factors, performance metrics and measurements, safety data analysis, scheduling, workload management and distribution, navigation, communications, data collection and distribution, and aviation economics. http://www.nextor.org

Airport Technology -- Established in 1995, the Center of Excellence for Airport Technology is led by the University of Illinois at Urbana-Champaign. Other member universities include Northwestern University, Embry-Riddle Aeronautical University, and Rensellear. The Center conducts research in airport pavement technology, wildlife hazard mitigation, lighting, and related topics. It recently entered into a 5-year cooperative agreement to continue operation through 2010.
http://cee.uiuc.edu/research/coeairporttech/

Table B.10 – COE Grants Awarded in 2006 for Airport Technology

Airport Technology				
University Recipient	Grant Title	Amount	FAA Point of Contact	University Point of Contact
University of Illinois - Urbana Champaign	CEAT Sponsored Activities Related to the Deployment of Bird Radars at JFK and SEA	$460,790	M. Hovan	E. Herricks
University of Illinois - Urbana Champaign	Center of Excellence for Airport Technology – CEAT	$393,235	D. Brill	D. Lange
University of Illinois - Urbana Champaign	Deployment and Operation of FOD Detection Radar	$224,094	M. Hovan	E. Herricks
Rensselaer Polytechnic Institute	Developing Methods to Improve Detect-ability of LED Fixtures with IR Cameras	$75,000	D. Gallagher	N. Narendran
University of Illinois - Urbana Champaign	GIS, Hazard Assessment & Hazard Visualization as Components of Wildlife Management at Airports	$211,037	M. Hovan	E. Herricks
Rensselaer Polytechnic Institute	Investigations of Blue LED Taxiway Lights	$75,000	D. Gallagher	N. Narendran
Rensselaer Polytechnic Institute	Metrics and Measurement Procedures for LED Lighting Systems	$100,000	D. Gallagher	N. Narendran
University of Illinois - Urbana Champaign	Research Support and Technical Guidance for the FAA Visual Guidance Program	$101,406	D. Gallagher	E. Herricks

Blank Page

Appendix C

Research, Engineering and Development Advisory Committee (REDAC)

The Federal Aviation Administration (FAA) values the ongoing involvement of the Research, Engineering and Development Advisory Committee in reviewing its current and planned research and development programs.[1] The FAA has established a formal process for the agency to reply to Committee recommendations. This document summarizes recent Committee recommendations with the FAA responses. In fiscal year 2006, the Committee submitted the following reports to the FAA:

- *Guidance for the FAA Fiscal Year 2008 R&D*, November 8, 2005
- *Transitioning Air Traffic Management Research into Operational Capabilities*, November 8, 2005 (final report)
- *Review of Skills Training and Needs of the Next Generation Controller Workforce*, November 8, 2005
- *Financing the Next Generation Air Transportation System*, June 8, 2006
- *Review of the FAA Fiscal Year2008 R&D Program Plans*, June 20, 2006
- *Separations Standards Working Group Final Report*, September 20, 2006

In fiscal year 2007, the FAA expects to receive the Committee's recommendations on the FAA's planned research and development investments for fiscal year 2009, including detailed recommendations from the standing subcommittees.

1. *Guidance for the FAA Fiscal Year 2008 R&D*, November 8, 2005

a. Subcommittee on Aircraft Safety Recommendations

Recommendation: The subcommittee recommends that a procedure for identifying and funding R&D projects for emerging issues, not only issues causing past accidents be developed and implemented. The reason for performing safety R&D is to address potential problems which may lead to accidents in the future, and all of these can not be identified solely based on past accidents. We were routinely presented the unstated assumption that the world is not changing, and therefore past accidents are indicators of future accidents. This is valid in many operational scenarios that are relatively constant from year to year and of course should be used as one of the metrics for investing in safety research. However, in operational scenarios that are changing, we need insight into (and openness to) new issues. Many of these issues and potential safety concerns are the result of new technology being introduced into the system. Examples of issues mentioned at the meeting, that may create new safety concerns include copper-clad aluminum wiring, EMI issues with RFID tags, high ice-water engine icing encounters, etc. The committee also feels that a significant emerging issue is the future development

[1] http://research.faa.gov/redac.asp

and implementation of NGATS by JDPO. The safety-related issues relating to this transition should be identified now, and incorporated into the safety research portfolio in coordination with JDPO and ATS.

FAA Response: We agree that it is important for R,E&D to be proactive to potential emerging issues as well as reactive to the current problems. The R,E&D process used by the Air Traffic Organization (ATO) and Aviation Safety (AVS) to prioritize aircraft safety research has the ability to identify and fund research for emerging issues and has done so in past portfolios. The Federal Aviation Administration (FAA), National Aeronautics and Space Administration (NASA), and the Voluntary Aviation Safety Information Sharing Aviation Rulemaking Committee have recently established a safety information analysis system that will enhance safety by identifying potentially unsafe events, trends, and practices that may be occurring in the NAS. This information system should provide the ability to identify future threats, conduct a causal analysis of those threats, and recommend solutions including R,E&D activities. As for coordination with the Joint Planning and Development Office (JPDO), ATO, and AVS are fully supportive of the JPDO mission and have senior executive representatives leading or as members of the Integrated Product Teams to ensure that aircraft safety related issues are identified and appropriate research is incorporated into the safety research portfolio.

The FAA also has an obligation to the safety of the aircraft in the existing fleet and their operation within the NAS. The historical accidents represent the largest repetitive causes of loss of life, so it is critical that FAA R,E&D activities address issues related to these accidents and enable implementation of identified solutions. Only then, and through continued monitoring of the effectiveness of these solutions for recurring threats, as provided by the information sharing system described above, can we be assured that the probability of similar accidents in the future has been greatly reduced or eliminated.

Recommendation: The subcommittee recommends that a procedure for funding researcher-initiated R&D be developed and implemented. In the current process by which research is identified and prioritized, the support of an FAA operational sponsor is required. While we support the current process for the majority of the research portfolio, the subcommittee feels that some percentage (15% was suggested) be reserved for researcher-initiated research projects. This could provide many benefits to the FAA and the aerospace community. It would facilitate the research on emerging issues as laid out in Recommendation 1, encourage innovation, improve flexibility and the ability to cooperate with NASA and other research organizations, and improve the participation of universities and the training of future engineers and scientist on FAA-oriented research. Such a program would also assist in attracting and retaining well-qualified research staff at the FAA.

FAA Response: The FAA agrees that researcher-initiated research projects may be beneficial to the R,E&D mission. It does not agree that it is necessary to have funding set aside for this purpose. We feel there are sufficient opportunities for FAA researchers to have input into the R,E&D requirements and the research done to meet those requirements. With the additional emphasis to be placed on research on emerging issues

(see recommendation above), there will be ample opportunities for innovation, flexibility, and cooperation with NASA, and other research organizations. FAA research should be focused on supporting the FAA mission, and in the case of aircraft safety, research should be directed to support the mission of AVS. The funding level for FAA R,E&D is roughly one-half of the level of 10 years ago, and the FAA must focus these limited funds on identified issues, rather than basic research done simply for the purpose of gaining knowledge.

Recommendation: The subcommittee recommends that research be well connected with operational needs and that researchers and managers be able to articulate this connection. Most researchers were well aware of relevant R&D at other agencies, and operational impacts of their work. Not all presenters were inconsistent in very basic terms such as "large aircraft", "air taxi", "commuters" and "regional" vs. "commuter" service. Management and researchers in applied R&D should be in contact and well versed in the operational connectivity of their work.

FAA Response: The FAA is making an effort to improve the collaboration between researchers and sponsors with the formation of Technical Community Representative Groups (TCRGs). Through the TCRGs, we will ensure that our researchers become more fully connected with the operational domain and aware of its needs and jargon. We will continue to enhance our coordination with other agencies.

b. Subcommittee on Environment & Energy

Issue 1: Achieving Budget and Portfolio Content Alignment with Key Agencies

The subcommittee noted that the needs to address the environmental challenges of the U.S. airspace system greatly exceed the available resources of any one agency. There is a shortage of funds and a critical need to achieve synergy of funding. This is particularly relevant of NASA, EPA, Department of Commerce (NOAA) and DoD.

Recommendation: The FAA Administrator should seek to enhance collaboration in environmental research and development with NASA, EPA, DoC, and DoD through the Joint Planning and Development Office (JPDO) Environmental Integrated Product Team (EIPT) as well as other appropriate forums. The Administrator should also ensure that there is representation from FAA's Office of Environment and Energy in the research and development advisory structure of each of these agencies.

FAA Response: We are continuing our efforts to collaborate with Federal partners through the JPDO as well as other forums. I am particularly encouraged by the high level of participation by the National Oceanic and Atmospheric Administration in the EIPT. While I agree with you that it would be useful to have representation from the Office of Environment and Energy in the research and development advisory structure of other Federal agencies, this is outside my direct control. However, you have my commitment to foster such participation as opportunities arise.

Issue 2: Portfolio Content

The programs in the current FAA environment and energy research portfolio are the byproduct of years of discussion amongst all stakeholders; hence the portfolio has the right content to address short, mid-term needs and the FAA should continue ongoing projects in FY08. However, the subcommittee also identified additional needs and an overarching need to address the balance in FAA's environment investment in all budget categories.

Recommendation: The subcommittee asked that FAA address fuel/energy and water quality issues and recommends that the FAA fund scoping studies on each of these areas. The FAA should also increase research funding to address particulate matter and hazardous air pollutants issues that are serious impediments to capacity growth. The FAA should also assess all of its environmental investments and determine an appropriate balance between near term mitigation activities and research.

FAA Response: I fully agree that fuel/energy is an important issue and have directed the Office of Environment and Energy to work with the subcommittee to define a work statement for a scoping study. While I agree that water quality issues are important, I am not sure these issues present research challenges that we are well suited to address. I have asked the Office of Environment and Energy to work with the subcommittee to determine the aviation impact on water quality research challenges before proceeding with the study.

I agree that particulate matter and hazardous air pollutants issues are serious impediments to capacity growth and that there are many research issues. Unfortunately, given other priorities we were unable to increase funding in this area. We will consider the appropriate level of investment as part of the fiscal year 2008 budget cycle. We will also assess our environmental investments and explore the right balance between near term mitigation activities and research as we prepare administration proposals for our reauthorization.

Issue 3: Partnerships

The subcommittee noted that the FAA has a number of critical strategic partnerships to address environmental issues. There is a need to carefully consider the potential benefits of these activities and focus resources on high payoff opportunities.

Recommendation: The Administrator should direct the Office of Environment and Energy to work with the Partnership for AiR Transportation Noise and Emissions Reduction (PARTNER) Center of Excellence to strengthen its partnerships with domestic stakeholders and build new linkages with international partners. The FAA should also increase its involvement in the Intergovernmental Panel on Climate Change processes, with the goal of ensuring that the best science informs decisions. Finally, the FAA needs to expand education, communication, and outreach strategies to communicate the breadth

of its efforts mitigating aviation's environmental impact to stakeholders. The FAA should also define metrics to measure success in such an endeavor.

FAA Response: Per your recommendation, the Office of Environment and Energy is working with PARTNER to strengthen collaboration with domestic stakeholders and seek new international partnerships. We have engaged in discussions of potential collaboration on aviation environmental research with Europe's Environmentally Compatible Air Transport System Network of Excellence. In December, a U.S. delegation representing the FAA and PARTNER met and negotiated specific projects for joint research and drafted Terms of Reference for collaborative activities. The delegation also held discussions on collaborative research with EUROCONTROL and the Netherlands National Aerospace Laboratory. We have significantly increased our involvement with the Intergovernmental Panel on Climate Change. My staff has led efforts to revise the guidelines for computing aviation emissions and has actively engaged in the Expert Review of the Fourth Assessment Report.

We are expanding our education, communications, and outreach strategies. In fact, under the PARTNER Center of Excellence we have recently hired a communications director to help us effectively communicate our research efforts to mitigate aviation's environmental impact. During the coming year we will strive to define success metrics for our communication efforts.

c. Subcommittee on Air Traffic Services

Reducing separations standards is an important element of achieving increased NAS capacity, especially in terminal airspace. Two principal elements of required interaircraft separation, navigation accuracy and surveillance capability, have improved markedly since the current separation standards were established. It is important to understand how these improvements, plus other technology advances, can lead to a decrease in required interaircraft separation without any derogation of safety.

Recommendation: Establish a working group which will examine the basis for current separation standards, review past and ongoing studies of separation requirements, and outline a recommended R&D program for the FAA to determine to what degree separation standards can be reduced using current technologies.

It is expected that this Working Group effort will require five or six one to two day meetings over a period of six months, and will culminate in a written report to the FAA via the REDAC.

FAA Response: A Separation Standards Working Group has been created. The Group is chartered to: 1) examine the basis for current separation standards in terminal airspace; 2) consider improved technologies and methodologies related to separation standards; and 3) recommend an FAA R&D program that determines to what degree standards can be revised to meet future demand with no derogation to safety. The Working Group has been meeting and projected to have their report completed by September 2006.

2. *Transitioning Air Traffic Management Research into Operational Capabilities*, November 8, 2005 (final report)

Recommendation: Create an executive-level transition oversight committee. FAA should form an internal, executive-level Transition Oversight Committee to review quarterly or semiannually all major projects in transition. The committee should be chaired by a senior FAA executive (e.g., Deputy Administrator), include representatives from all the major FAA organizations (e.g., Associate Administrators and Vice Presidents), and report to the Administrator.

FAA Response: We concur. Transition is one of the biggest challenges facing the introduction of new technologies, and some executive oversight is needed to manage that challenge. We will be looking, within the next 60 days, into how that oversight could be accomplished and incorporated into the FAA organization, perhaps using existing executive bodies such as the Executive Council or the creation of new program stakeholder groups.

Recommendation: Assign an executive-level manager to sponsor and have oversight responsibility for each major project in transition. FAA should assign an executive-level manager with ultimate responsibility for ensuring that a capable leader and staff are in place to manage the day-to-day program and that adequate funding exists for the successful implementation of the program. This manager should act as the ultimate escalation point to resolve program conflicts when necessary.

FAA Response: We concur and have developed a Development Liaison Team (DLT) team that provides recommendations to the Vice President for Operations Planning (ATO-P) on research technologies that should be pursued. During the realignment of the ATO-P organization we will be looking at how the (ATO-P) Vice President will provide oversight on the transition of major projects. We expect the realignment within the next 60 to 90 days.

Recommendation: Continue executive oversight throughout each program's lifecycle. It is important that executive involvement should not end at Joint Resources Council 2a (JRC-2a), but continue until deployment and operational use is well underway, with measured evidence that the promised capability is being realized.

FAA Response: We concur. The ATO-P Performance Analysis organization develops and maintains FAA performance metrics for measuring progress and improving performance. These metrics are published daily on the ATO Web site. Currently, this group is working to build measures that are not only at the system level, but also linked to field operations right down to the facility level.

Recommendation: Use industry best practices to transition research. FAA should develop transition processes based on best practices from industry to manage the

transition of research from the laboratory to operational use. Specific actions should include the following:

- Establish a clear link between the research product and an aviation community need that has been subjected to a business case analysis
- Identify any major technical risks or other uncertainties and strategies for their mitigation
- Define decision points throughout the development process that provide opportunities to adjust forward plans in the context of changing needs (e.g., terminating projects whose business case does not justify their continuation)
- Define standard deliverables throughout the transition process to facilitate the transfer of technology from laboratory to industry to operations
- Develop a formal transition plan that identifies funding, personnel, commitments, and key managers in each organization for projects involving research organizations outside the FAA (e.g., NASA, Federally Funded Research and Development Centers, academia, etc.).

FAA Response: We concur. In accordance with the FAA's Acquisition Management System, Section 1.2.11, the FAA continually improves its policies and guidance to increase the safety, capacity, efficiency, and effectiveness of Agency services. It does this through periodic comparison with the best practices of industry and other Government organizations. We look forward to working with you and request that you provide areas of improvement that you think will save time, reduce cost, and increase customer satisfaction.

Recommendation: Develop a program management career path. The FAA should develop a program management career path for those who wish to manage and not pursue a technical path.

FAA Response: We concur. The FAA has recently established a requirement for Program Management certification. This certification criterion establishes areas of competencies Program Managers need to master. We will work with Human Resources Management over the next 60 days to formalize the training and experience required to gain those competencies. An additional source of Program Management training is from the Center for Management and Executive Leadership, which offers approximately 79 courses tailored to FAA management and Program Management. Program Management Certification is required for all major programs, and we are expanding the training program to increase the familiarity with program management best practices for all program participants.

Recommendation: Include at least one spiral cycle to enable enhancements after Initial Operating Capability (IOC). Every major procurement should be constructed with at least one spiral cycle included in the baseline program. This will permit IOC to be achieved within the original cost and schedule parameters, yet enable at least one cycle of enhancements to incorporate technologies or lessons learned discovered during the development phase. Should it turn out that enhancements are not worthwhile, the reserved funding could be released for other purposes, such as to support unanticipated

deployment costs, a technology refresh, or downstream sustainment. Note that this has been done in the past, in, for example, the Airport Surveillance Radar - Model 9 (ASR-9) program.

FAA Response: We concur. We believe that we are already doing this through our Pre-Planned Product Improvement (P^3I) program. However, we recognize that at times the resources for P^3I have been used to make up shortfalls for initial deployment. We believe that through our new emphasis service unit performance management, FAA Enterprise Architecture (EA) and requirements definition that we will better manage initial deployments and the P^3I resources will be preserved.

Recommendation: Establish guidelines for how the research organizations transfer their knowledge and data to production contractors.

FAA Response: We concur. The FAA has been working to establish guidelines for transitioning knowledge and data to industry for some time. Previously in transitioning R&D products in the Free Flight Program Office there were several research outputs used as specifications and other information for use by the prime contractor. A set of standard deliverables that can be used by a contractor would provide benefit. As a result of the realignment, the ATO-P organization will manage the development of this knowledge and data. We solicit your recommendations on the guidelines and the content of the data required from the research organization.

Recommendation: Conduct research aimed at transforming the roles of the aviation workforce. FAA needs to establish a research program to understand and guide the transformation of the roles of pilots, dispatchers, and controllers in future ATM systems.

FAA Response: The FAA has existing human factors research programs addressing changes in roles and responsibilities involving controllers and pilots. Research initiatives include work on integration and certification of flight deck and air traffic control systems; examination of how changes in technology may drive changes to controller recruitment, selection, and training; and how implementation of new technologies leads to accrual of intended benefits and interacts with safety culture. Previous research on Technology Readiness Levels identified numerous human factors issues that need to be addressed as a research capability matures from concept exploration to development.

Recommendation: Ensure adequate funding for the transition phase. When the decision occurs to implement research results, funding must be identified for the transition process, to include production, deployment, training, and one cycle of enhancements. This budget should be reviewed and updated every six months to ensure that program management and senior leadership are kept informed.

FAA Response: We concur. In order for timely transition to occur, adequate funding is required. We will submit back to you within the next 60 days our ideas on how this could be accomplished. We are currently working within the Agency's RPD process to

create a line item to support Technology Development and transfer of technology. We would like to work with you to develop additional ideas and strategies.

Recommendation: Conduct independent reviews of the risks of new technologies. When a new and complex technology such as GPS is considered, FAA should conduct independent technical and economic reviews to ensure that all risks have been revealed and realistic mitigation steps and their likely costs identified. This may be done by either a special study by the REDAC augmented with outside experts or by forming an Aviation Science Board (ASB) modeled after the DoD Defense Science Board.

FAA Response: We concur. An independent review is needed for major acquisitions or systems that are on the critical path to gain buy-in from the stakeholders. Currently ATO-P Systems Engineering follows a comprehensive Risk Management model. We will look into incorporating an independent review that will coordinate with ATO-P Systems Engineering to merge their existing risk assessment model with an independent review process for assessing the risks of new technologies.

Recommendation: Continue using prototypes and field trials to mitigate risks.

FAA Response: Where possible, solutions may be implemented as commercial, off the shelf technology, without being prototyped in the NAS. However, we concur that the continued use of prototypes and field trials to understand how technology will work in the NAS is often required to mitigate risks and reduce implementation costs. As part of the recent ATO realignment, we created an Office of Technology Development with the mission to answer three important questions:

- Does a new technology or procedure work as claimed;
- Can it be operationally integrated into the NAS; and
- Is there a viable business case to do so?

We believe that field trials and prototypes are often required to definitively answer these questions before making a final investment decision. Technology Development will also collaborate with the Joint Planning and Development Office (JPDO) in prototyping the Next Generation Air Transportation System.

Recommendation: Migrate NAS systems to an open-systems architecture. FAA should audit all major existing NAS systems to determine if and when they can be moved into an open-systems architecture and take action to move in that direction. All new major procurements should be required to have an open-systems architecture.

FAA Response: We believe that new systems being procured by the FAA have an open systems architecture. We will get back to you within the next 30 days as to when and if an audit of all major existing NAS systems will be done.

Recommendation: Provide government furnished information when prudent.

FAA Response: We concur.

Recommendation: Establish best practices for collaboration with industry and research organizations. FAA should examine recent programs to identify best practices for engaging industry in the transition process and include these practices in program management doctrine and training.

FAA Response: We concur. In accordance with the FAA's Acquisition Management System, Section 1.2.11, the FAA continually improves its policies and guidance to improve the effectiveness of agency services. It does this through periodic comparison with the best practices of industry and other government organizations.

Recommendation: Strive for consensus, but do not be held hostage to it. Where possible, the FAA should strive to create benefit-driven incentives and community consensus. However, when this is not possible, meeting the needs of the Nation's air transportation system must transcend parochial interests, possibly by mandating certain equipments and procedures.

FAA Response: We concur. The establishment of the JPDO and the EA will allow management and the FAA to focus on needs versus special interests when developing and implementing the nation's air transportation system.

Recommendation: Involve FAA stakeholders in the planning and implementation of change.

FAA Response: We agree that major FAA stakeholders' participation and their contribution of requirements and insights is valuable. In the next 60 days we will identify methods for obtaining their participation during the early phases of design and development.

Recommendation: Develop noise measurement standards. Guidelines, measurement specifications, and noise monitoring methods should be developed and provided to FAA offices and airport managers. Existing noise modeling should be improved to better predict short-term day-to-day variations and effects such as local winds.

FAA Response: We fully agree that new operating paradigms will require new metrics and analytical techniques to assess community noise impact. The Partnership for Air Transportation Noise and Emissions Reduction (PARTNER), a Center of Excellence we cosponsor with NASA and Transport Canada, is engaged in a research effort to understand the impact of noise both around airports and en route and develop metrics that best characterizethis impact. Impact includes the influence of airport noise on annoyance, task performance, physiological responses, health effects, and sleep disturbance. The intent is to evaluate these metrics and, if warranted, transition them to

our analyses methods. Noise monitoring is a local airport function. However, we expect that our improved metrics and models will inform monitoring techniques in the future.

Recommendation: Continue the CPI efforts. FAA should continue the CPI program to reduce the uncertainty, time, and costs associated with certification, and methods should be developed to certify new concepts and technologies involving integrated air-ground systems. It is also recommended that there be one office responsible for the certification of integrated air and ground systems.

FAA Response: The FAA concurs with this recommendation and will continue to implement initiatives to better coordinate and communicate certification requirements to support an efficient introduction of integrated air-ground capabilities into the NAS. The Certification Process Improvement document has proven to be extremely beneficial to both the Aircraft Certification Service (AIR) and its applicants since its introduction a number of years ago. The FAA will strive to develop an Air Traffic Organization (ATO)- Aviation Safety (AVS) partnership using a similar framework to clearly define the roles, responsibilities, tasks, and timeline for a coordinated operational acceptance of integrated air-ground capabilities. The FAA is responsible for the procurement and maintenance of the NAS. The FAA NAS plans do not include aircraft, but include interfaces to aircraft. The Aircraft Certification Service – Avionics System Branch /Flight Standards Service – Flight Technologies and Procedures Division offers an AVS single-contact for NAS air-ground integration efforts.

Recommendation: Separate the certification and program management roles. FAA should separate the responsibilities of regulators from those of program advocates.

FAA Response: The FAA concurs with the intent of this recommendation. The FAA already has a separation between ATO program offices and AVS regulatory authorities. AVS will continue to be the regulator in accordance with its statutory responsibility. AVS, in coordination with ATO and industry, will continue to advocate for programs that promise safety, capacity, and efficiency gains.

The FAA does not concur with the example cited in the Finding. The RNP programs met with challenges based on the continued technical work entailed in operational approval, not because of any alleged competition with Wide Area Augmentation System.

Recommendation: Expand the use of Designated Engineering Representatives (DERs). Reduce the workload on certification offices by training and certifying DERs to support certification work, including the development of new procedures.

FAA Response: The FAA concurs with this recommendation and will continue to implement initiatives to better train DERs. The Aircraft Certification Service – Delegation and Airworthiness Programs Branch has undertaken an active program of DER training that includes initial and recurrent required seminars.

Recommendation: Develop best practices for human-in-the-loop assessments. Research is needed to develop experimental and analytical methods for human-in-the-loop performance assessments, with the goal of establishing a set of best practices and tools for the government and private sectors.

FAA Response: The FAA concurs with this recommendation. The FAA has collaborated with EUROCONTROL in developing a set of best practices for human-in-the loop simulation used in air traffic control experiments. A human factors coordination group has been chartered by the Associate Administrator for Aviation Safety and includes human factors experts from the Aircraft Certification Service, Flight Standards Service, and Civil Aeronautical Medical Institute. The group is directly involved in human factors aspects of modernization projects at their inception. The group has developed the Human Factors Certification Job Aid, which is being taught across the Aircraft Certification Service this year. The many aspects of new technology, such as intended function, novelty of equipment, and failure cases, do not easily lend themselves to a checklist approach. AVS is especially aware of this in the approval of new equipment such as Unmanned Aircraft Systems.

Recommendation: Develop and promulgate objective safety criteria. FAA should develop safety criteria and assessment methods and make them available to government and private sector entities.

FAA Response: The FAA concurs with the intent of this recommendation, but disagrees that safety criteria are absent from Controller-Pilot Data Link Communications and Automatic Dependent Surveillance-Broadcast. AVS is updating Advisory Circular AC 25.1309 – "System Design Analysis" for objective safety criteria in aircraft development. These criteria are harmonized with the criteria used by the Office of Air Traffic Oversight in regulation of Air Traffic Organization-Safety. Thus, hazard levels and risk definitions are maintained consistently across the air-ground environment.

Recommendation: Enable early operational advantages to promote equipage. Early operational advantages should be afforded to expedite aircraft equipage necessary to implement new concepts.

FAA Response: We concur. We will continue to work closely with industry to evolve towards a performance-based NAS concept that will allow operators to leverage existing aircraft equipage capabilities while showing increased performance value as aircraft equipage capabilities are increased. AVS promotes the notion of using existing regulations and considering additional regulations and standards only as necessary. Thus, AVS is committed to the research, development, and implementation of technically credible means of compliance practices that are economically viable as well.

Recommendation: Review separation standards and revise them as appropriate. FAA should review and, where needed, establish new risk assessment methods to judge existing separation standards and proposed procedures. This process would involve the international community and might best be done through an industry-government forum,

supported by a technical team. This initiative should institutionalize data collections to document aircraft operations, especially in "blunder situations."

FAA Response: The FAA concurs with the intent of this recommendation, that firm scientific safety and risk assessment methods should continue to be explored and adopted for evaluating and developing separation standards. ATO and industry have selected a number of areas to evaluate and the FAA has initiated/completed some safety studies to address them. The FAA is also attempting to implement new technologies in the NAS to their maximum benefit alongside legacy equipment still being used in the air and on the ground. The FAA has engaged the international community in several efforts, for example, the introduction of ADS-B.

The FAA does not concur with the blunder example cited in Section L of Appendix A. The current blunder methods and assumptions were established in concert with and adopted by industry and other stakeholders. They have been both challenged and validated a number of times in the past. AVS continues to explore modern and enhanced methods to perform safety and risk assessments, including the blunder issue.

3. *Review of Skills Training and Needs of the Next Generation Controller Workforce*, November 8, 2005

a. Leadership

Recommendation: The FAA should immediately designate an individual to be responsible and accountable for all the interdependent activities associated with the implementation of the "Plan for the Future." That individual should have executive and budgetary authority for implementing the plan. This authority should include all efforts regarding recruiting, selection, staffing, and training. It should also include coordinating the CTI schools, the Academy, OJT for terminal and en route. The individual should be accountable for evaluating workforce initiatives, for both the present requirement and for future NAS operational developments.

FAA Response: Ms. Maureen Knopes has been appointed as the interim lead for development and oversight of the Controller Workforce Integrated Action Plan. The job announcement for a new ATO Director of Air Traffic Controller Training and Development has been released. The new Director will focus exclusively on providing executive leadership and direction for the planning and development of all current and next-generation air traffic controller training. The Director will work closely with the Superintendent of the FAA Academy, the agency's Chief Learning Officer, and the ATO Vice Presidents and will ensure consistent application of corporate training policies and procedures.

b. Training Process Enhancements

Recommendation: The FAA should immediately convene an independent lean process review team to, in the near term, assure the response needed to meet immediate needs

and, in the far term, develop the training program for the future. Conduct a complete review of the current academy training program and facility training programs, and the age 56 exceptional controller process. Consider new training approaches, e.g., concurrent Radar and Associate Training. Review options on centralized versus decentralized training. Identify requirements and venues for training of advanced controller tools. Support assessments regarding the use of simulation throughout the training process. Training must be a requirements-driven and performance-based process. Training must focus on determined knowledge, skills and abilities to reach CPC. The FAA should accelerate current efforts in staffing standards model and functional requirements development.

FAA Response: The Controller Workforce Integrated Action Plan provides the integrated focus to address near-term training needs. The Human Factors Research and Engineering Division will conduct research to provide foundational information to address mid-term and long term training program needs. Training at the Academy and in the field is being assessed and procedures implemented to ensure efficient and effective processes are in place. Concurrent training for Radar and Radar Associate controller positions is being evaluated at three en route facilities. This training approach combines techniques and sectors together in a functional training concept in contrast to the traditional training path. Training data will be analyzed to assess time to CPC and performance. In addition, a new acquisition is underway that will be performance based and allow for maximum flexibility in allowing vendors to propose a training solution that focuses on meeting the performance measures and competencies defined for some "yet to be determined" point in the cycle from new hire to full CPC. A complete review of the age 56 exceptional controller process will be conducted. Options for centralized versus decentralized training will be investigated.

c. ATCS Performance Measures & Training Effectiveness

Recommendation: The FAA should immediately and consistently develop and implement performance-based metrics and standards for CTI, Academy, facility airspace, and OJT training entry/exit criteria to assess controller competencies. The FAA should seek to standardize, to the extent possible, scenario characteristics for training and exploit advanced simulation technology to converge on a common set of controller skills. The FAA should combine the use of objective measures of skill with behaviorally anchored rating scales to ensure effective use of training exit criteria. The FAA should examine best practice and lessons learned in training for air transport operations and investigate their application to controller performance.

FAA Response: Job task analyses for en route, terminal and systems operations are being initiated to support development of knowledge, skills, and abilities and performance measures. These metrics will facilitate the development of standardized assessment of controller competencies as well as entry and exit criteria for various phases of controller training. Additionally, an activity was recently begun to examine best practices and lessons learned in training for air transport operations and to investigate their application to controller performance.

d. Use of Simulation

Recommendation: In the next six months develop a set of technology requirements to support performance-based training objectives, identify and map skills to training technologies (CBT, part-task simulators, full fidelity simulation) to training objectives. It should also, address scenario and airspace specific development issues, evaluate MITRE (R-SAT) simulation training approach (and others) to be systematically matched with training outcomes for effective training delivery and investigate the use of simulators to provide early practice and testing.

FAA Response: There are at least two separate activities underway evaluating the use of simulators. First, the MITRE (R-SAT) simulator is being evaluated beginning in late March. Testing could start in one EnRoute center by early June. The test would continue through fall of 2006, with a report on results of the test available late in the year. Second, preliminary requirements documents have been prepared for both en route and tower simulators. Three proof-of-concept tower simulators are currently in deployment with one now operational at Chicago's O'Hare airport. Initial evaluations are very positive. Facilities will use personnel databases to track, measure, and report student training times and progress to measure the effectiveness of these simulators.

e. Standardization of Procedures

Recommendation: Immediately determine how to improve staffing flexibility, OJT and Academy effectiveness through: Identification of general techniques and consolidation that standardizes procedures and training across facilities such as control techniques for certain operational flows. Facilities at risk of personnel shortfall should be targeted for early implementation. Focus on procedure simplification and support for controller rapid indoctrination in local techniques including enhanced processes for reducing training effort and off-loading sector-specific requirements to perceptual and decision support tool. In this process the agency should anticipate the impact of future initiatives in procedure and equipment to enhance procedural standardization. In the next year, determine how standardized procedures could be improved for use of ATCS tools.

FAA Response: Activities that will be initiated in this area to incorporate standardized procedures to improve training effectiveness and staffing flexibility include: 1) identify general techniques and consolidation that standardize procedures and training across facilities; 2) focus on procedure simplification and support for controller rapid indoctrination in local techniques; 3) enhance process for reducing training effort including by off-loading sector-specific requirements to perceptual and decision support tools; and 4) anticipate the impact of future initiatives in procedures and equipment to enhance procedural standardization.

f. CTI - Academy Alignment

Recommendation: Immediately, give the CTI schools clear guidance to allow their graduates advance in Academy training. Immediately establish minimum requirements for CTI graduates to enter Academy training as well as requirements for advanced Academy placement. Streamline the transition between CTI and Academy and support currency training during transition. Develop a program of feedback to the CTI schools using Academy statistics to improve CTI curricula including use of training technologies.

FAA Response: There are many activities in this area including: 1) establish a minimum requirement for AT-CTI students to enter the Academy; 2) establish minimum requirements for advanced Academy placement to the extent appropriate; 3) stream-line the pre-hire process by centralizing hiring in Human Resources and reducing the time it takes to process medical and security clearances; and 4) develop a program of feedback to the AT-CTI schools using Academy statistics to improve AT-CTI curricula including use of training technologies.

g. Use of Team Training

Recommendation: In the next six months, implement an approach for leveraging the use of team training, whether in the form of team based collaborative learning, Air Traffic Teamwork Enhancement (ATTE), Crew Resource Management (CRM), or some other approach. Principles should be introduced at the Academy, and practiced in OJT.

FAA Response: An activity will be started to implement an approach for leveraging the use of team training, introduced at the Academy and practiced in OJT.

4. *Financing the Next Generation Air Transportation System*, June 8, 2006

Recommendation:

The goal of the working group that prepared this report was to identify the level of resources required as well as available options for funding and financing research and development, capital projects, and the operations cost of NGATS. The effort focused on the FY2006 through 2025 timeframe.

The approach the working group took was to compare a reference Status Quo scenario to the NGATS scenario. For each scenario Best, Worst, and Baseline cases were defined to scope the range of operating costs. The group also considered opportunities to reduce costs through introduction of advanced technologies and techniques or outsourcing, but did not consider issues such as labor contracts, privatization or major structural changes in the FAA organization.

The following findings summarize the effort:

- In both the Status Quo and NGATS scenarios, funding the FAA R&D, F&E, Operations, and AIP activities is estimated to require about $15 billion annually in 2005 dollars. FAA operations costs dominate these figures.

- The Status Quo scenario will provide insufficient increases in capacity to meet the growing demand. The Status Quo scenario is therefore not an acceptable option other than for analysis purposes. The NGATS provides the needed capacity and reduces total funding requirements by inserting technologies that provide the required increase in capacity with lower operation cost.

- The continued use of the current FAA trust fund revenue rates will lead to approximately a $1 billion shortfall over the next several years without an increase in the General Fund contribution. This projection assumes a General Fund contribution to the FAA budget on the order of 20%.

- The FAA relies on the current NASA aeronautics R&D program as the principal source of the technologies needed to provide the nearer-term NGATS aviation system capacity and operations cost reductions. The current restructuring of the NASA program introduces uncertainty in this reliance. Refocusing NASA efforts on lower Technology Readiness Levels (TRL 1, 2, & 3) is a particular source of concern because it shifts a greater R&D transition burden to the FAA. To accommodate this reduction in NASA support for transition will require an additional approximately $100 million annually in FAA R&D funds. If the current NASA effort were abandoned completely, the FAA would require a further $100-150 million annually in FAA research and development funds. More importantly, NGATS implementation would be delayed, probably by five years, while the FAA reestablishes the infrastructure needed to accomplish the work. This delay in NGATS would have a severe long-term impact on the FAA operations budget.The alternatives for closing the near term funding gap are to:
    - Significantly reduce Operations, F&E, R&D and/or AIP costs
    - Increase user taxes and fees,
    - Increase the General Fund contribution
    - Introduce some sort of financing (borrowing) that bridges the near-term gap and repays it with longer term surpluses, or
    - Some combination of these.

- The FAA is pursuing substantial cost reductions in operations and other costs, for example, the outsourcing of Flight Service operations. The working group identifies other cost saving opportunities. A composite annual cost savings on the order of $500 million is a reasonable objective for these cost reduction activities.

- The distribution of taxes/fees between user groups and the level of the general fund contribution are the basic problems to be solved. Each user group has a different model for determining the share of FAA costs it should pay. Once the shares are determined, the method of tax or fee collection may vary from user to user at a level to meet their allocated share.

- There are an infinite number of user fee/tax options with or without a General Fund contribution. The working group has identified four:
  - Current revenue approach with rate adjustments
  - Fuel tax or fee only
  - Weight/distance fee
  - Distance fee

  These have been analyzed against a set of developed criteria.. No one of them is expected to be acceptable by itself to the entire community. Defining a hybrid to create an approach that is acceptable to aviation industry groups will be required.

- Successfully transforming the NAS into a Next Generation Air Transportation System (NGATS) that meets America's future aviation needs is a demanding project that will require twenty years of consistent and stable funding, management, and oversight to be successfully and efficiently completed. All the while, the system must safely and efficiently provide services every day to satisfy an ever-expanding demand for air transportation.

- On the financial side, the operation and transformation of the NAS into the NGATS will require about $300 billion or $15 billion each year in constant 2005 dollars. While the budget will be managed to minimize year-to-year variations in revenue and expenses, some will occur. Hence, a flywheel is required to overcome these variations.

- On the program side, a process must be deployed that ensures successful and cost effective development and implementation of the NGATS. It must provide a consistent management and oversight mechanism and a mechanism for measuring ongoing cost, performance, and progress toward transformation of NAS to NGATS

- The Working Group has identified **Six Engines for Success** needed to meet these objectives:

  - First is the **Leader**. The twenty-year NGATS implementation period will require three to five leaders to over the life of the project. The selection and development of these leaders is probably the most important element to NGATS success. In addition to their being smart and hard working people they must know the NAS and the NGATS and the transformation between them. They must be innately people of vision and public purpose.

- A **Revenue Engine** that raises the required $15 billion each year through collection of user fees/taxes and a contribution from the General Fund. It is assumed that this engine is a variant of one or more of the funding approaches discussed in this report.

- A **Financial Stability Engine** that accommodates year-to-year variations in the revenue or expenses. The selected Financial Stability Engine could be any one of an infinite set of variations but will always be some combination of either reserve accounts (e.g. The Aviation Trust Fund) or borrowing authority or both.

- A **Program Engine** that provides the mechanism for consistent, stable program management of development, production, implementation, and initial operation of the sub-systems that transform the NAS into the NGATS.

- A **Planning, Management, And Oversight Engine** that provides the mechanism for maintaining the NGATS implementation plan, managing its accomplishment, providing for its oversight by the FAA, the aviation community, the Congress and the Administration.

- A **Metrics Engine** that facilitates the measurement of the on-going performance of the NAS and the progress toward its transformation to the NGATS. It should provide transparent measurements of specific metrics at any given time and the incremental change in that metric over time. It includes measurements of Safety, Capacity, Environmental Impact, FAA Costs, FAA Productivity, and User Benefits as a minimum.

FAA Response: The work from the National Airspace System Operations Finance Working Group provided the Agency with data that will assist us in developing our plans for financing the Next Generation Air Transportation System (NGATS). Funding the NGATS is a challenge and your report will assist me in my discussions with Congress.

5. *Review of the FAA Fiscal Year2008 R&D Program Plans*, June 20, 2006

a. Subcommittee on Aircraft Safety

Recommendation 1: The FAA needs to make an assessment of the impact of the budget cuts in NASA's aeronautics R&D. Subcommittee on Aircraft Safety is concerned that there may be inadequate resources in the FAA's budget for taking on safety-related research that NASA used to perform in the past but won't be funded to cover in the future.

FAA Response: We agree with the concern expressed by the subcommittee. Overall, the FAA has been coordinating with NASA to identify those areas of research that will be affected by NASA's reprioritization of its resources. As a result of coordination to date, FAA will request additional funding for Air Traffic Management research formerly

conducted by NASA in the coming years. In the aviation safety area, there has been coordination with NASA researchers and discussion of common research efforts.

Recommendation 2: The FAA should initiate a project to develop a common and standard approach for "risk assessment". This standard should become standard throughout the FAA for all departments. Today each department appears to be developing its own method for assessing risk.

FAA Response: The Next Generation Air transportation System (NGATS) envisioned eight transformational strategies that are intended to increase the capacity and efficiency of the air transportation system potentially three times its current capacity by 2025. One of the transformational strategies requires proactive safety improvement of the system in conjunction with capacity gains. This will be done through an integrated safety management approach led by the FAA. The objectives of this approach are to:

- Maintain aviation's record as the safest mode of transportation;
- Improve the level of safety of the United States air transportation system; and
- Increase the safety of the worldwide air transportation.

To complete these objectives the Joint Planning and Development Office (JPDO) Safety Integrated Product Team, led by FAA Office of Aviation Safety (AVS) is developing a safety management system (SMS) for adoption by all JPDO member agencies and their customers. The SMS is based on safety information analysis and sharing, safety risk management principles and a supporting safety culture.

AVS, as the JPDO FAA lead for SMS, is concurrently developing and deploying an SMS doctrine for all AVS organizations that support the JPDO goal. Each AVS organization and service will then develop their specific safety initiatives to implement an AVS SMS for their organization or service and the customers they are responsible for. AVS will develop and apply an SMS standard for their customers (SMS-P) and an SMS standard for the AVS organization (SMS-O). The SMS system incorporates standard safety risk management principles which will be implemented by all AVS organizations. Some examples are the recent AFS Advisory Circular on SMS for general aviation operators, AIR safety management steering group, and AOV oversight of the ATO SMS.

These initiatives provide guidelines for a structured safety risk management process that enables identification of emerging threats and changing risks proactively and allow AVS to focus and prioritize its resources on safety-critical issues at the precursor level to prevent future accidents.

Only through the implementation of an SMS approach can AVS move forward from the traditional "fix and fly" forensic method to the diagnostic and prognostic advanced safety management practices that can proactively improve safety commensurate with a three times capacity growth.

Recommendation 3: Research should be conducted on advanced materials and joining processes being introduced on new aircraft; on new wiring technologies and on large by-pass engines. Also, on aircraft modifications designed to mitigate the risk of MANPADS, on fires due to non HAZMAT-declared shipments, on expanding operational deployment of UAV's and on reversing the trend toward a dwindling pool of qualified AMT's.

FAA Response: The FAA shares the view there are a few unresolved technical issues in the safety arena that need to be investigated. This summer, the subcommittee will lend its knowledge and expertise to guide the FAA as it develops a prioritized safety research portfolio for FY 2009. Many of the research topics listed in the recommendation fall within the scope of the safety research program and will be considered. However, the aviation maintenance technician issue is best addressed indirectly through the Agency's support of university aviation programs.

b. Subcommittee on Environment and Energy

Subcommittee members expressed widespread concern that we need to be proactive in addressing fuel availability/energy independence.

Recommendation 1: Recommend that the Administrator direct AEE to work with DoE, DoD, and NASA to identify commercial needs and leverage research to commonly address this challenge.

FAA Response: The FAA fully agrees with the subcommittee's views and concerns. On May 24 representatives from the Office of Environment and Energy, Department of Defense, Department of Energy, National Aeronautics and Space Agency (NASA), members of the fuel supply, aircraft and engine manufacture and airline industries met at Seattle-Tacoma Airport for a one-day workshop. The workshop explored alternative fuels for aviation. The participants agreed that Government and the commercial sector should work together to promote alternative fuels to ensure supply availability, minimize price volatility, possibly improve operational performance, and explore the potential to reduce environmental impacts. The group expects to draft a national alternative fuels roadmap by October 2006.

The subcommittee members continue to be concerned about the balance of FAA environmental investment in mitigation via Airport Improvement Program (AIP) versus research, engineering and development (RE&D).

Recommendation 2: The FAA needs to evaluate the balance between investment in mitigation activities ($300 million plus) and development and engineering efforts to enable near term pioneering solutions to address environmental issues. This should be done taking into account the relative benefit of each investment.

FAA Response: The FAA is considering the balance between our investment in environmental mitigation, research development, and engineering efforts to address environmental impacts at the source. This is part of our larger effort to look at all our investments as we prepare the Administration's reauthorization proposal.

Recommendation 3: The subcommittee endorsed the above target initiatives. In particular, the FAA should provide additional funding to address pressing particulate matter (PM) and hazardous air pollutants (HAPs). The new initiative should also include work to address the need for alternative fuels to meet commercial needs. The 70% increase reflects the remarkable growth in environmental requirements imposed by NGATS. It also denotes the subcommittee's appreciation of the quality of the work. And it reflects the view of a very diverse set of stakeholders (airports, airlines, manufacturers, environmental organizations, academia, and other government agencies).

FAA Response: While we have been unable to increase investment in PM and HAPs research in our core budget, these issues will receive attention through the Airports Cooperative Research Program. The Joint Program and Development Office is also considering funding some efforts to address the near-term needs of airports for PM data to support expansion projects. The subcommittee also made some additional recommendations specific to the detailed program review:

Recommendation 4: PARTNER research could have long-term policy implications (i.e., noise metrics) and FAA needs to start considering how the research will be translated and applied.

FAA Response: The FAA agrees that we must be proactive and address the long-term policy implications of our research. We have officially named seven of the Partnership for Air Transportation Noise and Emissions Reduction Center of Excellence (PARTNER) research programs as potentially "leading to highly influential scientific disseminations." This is an Office of Management and Budget designation reserved for federally sponsored research programs with the potential to influence greater than $0.5 billion in federal spending. A special peer review process is required before the Federal Government can adopt and disseminate the results of such research programs. We are working with PARTNER's Director to organize peer reviews. We will ensure that these reviews consider how research will be translated and applied.

Recommendation 5: The Advisory Board noted that Project 13, Lateral Alignment, while having noble goals had questionable benefit; the general sense was that AEE investment should cease.

FAA Response: Per the subcommittee's recommendations, we have concluded this effort. Resources have been applied to our efforts addressing pressing PM and HAPs issues.

c. Subcommittee on Human Factors

Selection, Training and Staffing of Air Traffic Control

Recommendation 1: The Human Factors Subcommittee applauds the comprehensive response of the Controller Workforce Integrated Action Plan. The subcommittee strongly

recommends that the efforts in that plan (directed to current workforce selection and training) be leveraged to provide task analyses, procedural development and metrics for evolving capabilities in en route automation modernization (ERAM) and NGATS early products. The subcommittee sees an opportunity for human factors input early in the transition process to new paradigms of air traffic service provision. The subcommittee does not want to divert effort from the current CWIAP efforts, but rather to amplify these to lead research in technology transition with respect to training, selection and evaluation processes.

FAA Response: Interdependencies within the Controller Workforce Integrated Action Plan allow for human factors to contribute to task analysis, procedure development, and metric development when evolving to ERAM and NGATS. We have published a new request to develop Job Task Analyses for tower cab controllers and create a set of performance metrics for tower controllers. The core requirement in the request is to provide a method to select candidates better suited for the tower cab versus a radar position in the En Route Centers or the Terminal Radar Approach Control. The performance metrics will ensure fairness and cost-effective selection. We have scheduled a Strategic Task Analysis for controllers in FY 2007. The objective of this analysis is to review the nature of the controller's job and determine how it has changed, or is likely to change, as new technology is introduced. In addition, we have started a task analysis to support development of performance metrics for controllers in the tower, en route and terminal radar domains. These metrics will serve as measures of training success in a potential FY 2007 performance-based contract for controller training.

Recommendation 2: The Human Factors Research and Engineering Group should work closely with other offices developing partnerships with advanced technology developers (e.g., NASA Airspace Systems program and projects) to anticipate transition requirements for NGATS developments. Theses impacts will be felt in the human factor systems engineering, workforce planning, and air traffic training to model the impact of future concepts of operation, technology, and procedures on controller staffing, selection and training requirements. The development of methods, tools, and processes for modeling the evolving air traffic service provider work process is needed as part of that collaboration.

FAA Response: The FAA Human Factors Research and Engineering Group set up direct partnerships with research organizations, including NASA and the Massachusetts Institute of Technology. These partnerships address core human factors modeling issues associated with future air traffic management. The group recently sent performance data from the Technical Center controller-in-the-loop simulations to NASA to act as the foundation for their human-in-the-loop model development. The group's recent grant to the Massachusetts Institute of Technology addresses the use of structured training and standardized procedures and airspace to increase the efficiency of the first training. The group is working with the Office of System Engineering in Air Traffic Operations-Operations Planning on integrating human factors in their NAS enterprise architecture development. The group continues to evaluate the impact of technology on the workforce. We are working with the offices responsible for workforce planning and air

traffic training in the Controller Workforce Integrated Action Plan. The group looks forward to working with the JPDO, as they define the roles and responsibilities of NGATS air traffic service providers.

Flight deck/Maintenance/System Integration

Recommendation 3: The subcommittee recognizes and endorses the need for air-ground integration research in response to advanced information-centric distributed air traffic management initiatives. The subcommittee suggests that these research initiatives be coordinated with safety assessment and procedures development. Also, new research should extend and position past safety assurance and certification work to support new technologies transition.

FAA Response: A task started this year with NASA to identify human factors issues in air-ground integration. In transitioning NAS to NGATS, air-ground integration research will assess the interoperability of equipment and procedures. Our focus is on pilots and controllers sharing common information and expectations, resulting in a safe and efficient operation. We will coordinate with JPDO and identify NGATS requirements to evolve the previous safety assurance and certification work.

Recommendation 4: Subcommittee finds that the FAA Human Factors Office is uniquely placed to support a responsive transition strategy to future operations. We suggest that the office consider broadening the activities in air-ground integration with partnerships with NASA and JPDO.

FAA Response: The Human Factors Research and Engineering Group are continuing to work with NASA, JPDO, and others to address human performance needs. In the review of the draft NGATS Concept of Operations document, we identified human need gaps that require research in self-separation. We are supporting NASA's Aviation Safety and Airspace program to help in the transition to future operations. The group recently started a task with NASA to identify human factors issues and needs in integration of air-ground.

d. NAS Operations Subcommittee

Recommendation -- Wake Vortex Research: Continuation of research funding in this area at the current expenditure level is appropriate. Currently available improvements in navigation and surveillance technology could produce major improvements in terminal area capacity if the wake vortex hazards can be understood and efficiently avoided. The current program is producing new procedures that will go into effect this year at St. Louis that will provide operational benefits. Recent investment in wake research has validated additional operating benefits that may be appropriate at other airports. However, the suggested out-year funding for implementing these new procedures does not reflect the importance of the wake vortex in enabling terminal area capacity improvements.

FAA Response: See Below

Recommendation -- Separation Standards: A NAS Operations Subcommittee working group is currently looking at this issue and will shortly be making recommendations regarding research on separation standards. We expect that this working group will suggest that separation standards could be safely reduced or redefined as to the way they are structured and applied (a la stochastic separation.). Defining the details of these new approaches to safe separations will require new research into the statistics of flight technical error (in the context of modern FMS capability), into blunder statistics and recovery mechanisms, and into the impact of a stochastic separation approach. These efforts will require close coordination with the developing NGATS definition. The budget projection for separation standards (no money after 2006) will not support this urgent need.

FAA Response: See Below

Recommendation -- Unmanned Aircraft Systems: We need an R&D program that assesses the impact of integrating UAS into the NAS. "The funding for RE&D related to Unmanned Aircraft Systems in FY 08 and beyond does not reflect the complexity of the technical and operational issues associated with their routine integration into civil airspace. This is a critical national priority for homeland security and national defense missions as well as the emerging commercial potential enabled by this new species of aircraft.

FAA Response: See Below

Recommendation -- R&D Transition to Operational Utility: The committee notes that the transition from R&D product to operational utility is very long. Promising R&D products (at Technology Readiness Level 6) typically take more than 10 years to initial operational capability. In addition, recent cuts in funding levels in NASA Airspace System Program research and increased emphasis on earlier technology readiness levels is likely to widen this gap and thus the committee is concerned that in the coming years this transition delay will grow. In anticipation of the acceleration of technology deployments required to realize NGATS, the committee recommends that the FAA assess the costs of NGATS deployments and apply sufficient funds to accelerate the technology transfer and implementation.

FAA Response to Recommendations: The FAA agrees with the NAS Operations Subcommittee. There are shortfalls in basic and advanced research. This shortfall is in preparation for transition to implementation. This is true for the separation standards work recommended by the subcommittee, which includes wake vortex and unmanned aircraft. To address the shortfall in wake vortex and unmanned aircraft, the FAA is working internally and with the JPDO to highlight the shortfall and make a case for assuring FY 2009 funding. For basic research, the Agency is proposing several alternatives including seeking an increase in its RE&D authorization. For advanced research and development, the Agency is working to achieve a facilities and equipment

authorization which will include funding for predevelopment and focused development tasks.

e. Subcommittee on Airports

Recommendation 1: Subcommittee reconfirmed the proposed program for FY 06 and FY 07 research. FAA needs to continue to coordinate with the new and growing ACRP research program to assure that the two programs are complimentary.

FAA Response: The FAA agrees with this recommendation. All proposed research topics for consideration by the Airport Cooperative Research Program (ACRP) are reviewed and scored by FAA subject matter experts. They note any problems of potential duplication of ongoing FAA research. The Acting Associate Administrator for Airports is a member of the ACRP Board of Governors and informs the Board during its project selection meetings of any topics that could duplicate ongoing FAA research.

Recommendation 2: Subcommittee supports the increased funding in FY 08 for friction and winter operations research. Additional friction research and data collection on winter runway braking characteristics is needed (following up on the Midway accident). The research should include modification to simulators to include runway surface characteristics, and the development of aircraft-derived braking data into the research as well.

FAA Response: The FAA agrees. We will initiate additional friction research on winter runway braking and begin in FY 2007.

Recommendation 3: In FY 08 the Airport R&D Branch at the Technical Center should have a head count increase from 20 to 22 heads. The Subcommittee has stated previously that if the program grew from the historic $5.5M level to the higher levels that are now in place, the requested increase should be implemented. The two engineers should be included in the Airport Technology FY 08 budget request.

FAA Response: The FAA agrees that staffing for Airport Technology Research should increase to keep pace with the large congressionally approved funding increases. The FY 2007 President's budget submittal includes an increase of two positions for the Airport Research and Development Branch. We considered the REDAC's recommendation for an additional increase of two positions in FY 2008, but believe that an increase of one position is enough on top of the two provided in FY 2007.

Recommendation 4: Subcommittee suggested that the FAA should initiate research on EMAS systems to consider stopping characteristics within shorter distances by perhaps allowing higher deceleration capabilities.

FAA Response: We agree and will undertake this research in FY 2007.

6. *Separation Standards Working Group Final Report,* September 20, 2006

Finding 1. The current system, based on the separation standards that have evolved over the last 50 years, is safe, but still unable to meet projected demand. The separation standards (and the approach to establishing separation standards) now need to be reconsidered in order to meet the demand for increased capacity.

Finding 2. Most current separation standards have been developed empirically based on judgment, extrapolation of past experience, and limited analysis. In recent years, a more analytical approach has been applied. The current standards are not based on a consistent philosophy, varying from one part of the airspace to another; using varied analytical approaches and assumptions about behavior.

Finding 3. Some separation standards are strongly influenced by the possibility of gross deviations, or blunders. However, little is known about such blunders: their frequency of occurrence, their magnitude, under what circumstances they are most likely to occur. Existing information about blunders is primarily anecdotal.

Finding 4. Mathematical analyses require substantial data to accurately characterize reality. Historically, sufficient data has not been available. The result of insufficient data is overly conservative separation standards.

Finding 5. New separation standards may be developed by comparison with a reference system or by evaluating system risk against a threshold level. Comparing to a reference system is an appropriate method to support incremental changes to the current system. To evaluate the major changes in separation standards that will be required for the Next Generation Air Traffic System (NGATS), the evaluation against a threshold methodology may be necessary.

A disciplined process for identifying and analyzing risk when developing or revising separation standards is of vital importance. Analytical and probabilistic studies are essential in the determination of safe standards, but, by themselves, are not enough. They should be used together with judgment. Their role is to inform and quantify judgment. Guarding against unrealistic or diabolical phenomena should not be a basis for the establishment of separation standards.

Recommendation:
Establish an R&D program that will lead to consistent and safe reduction of separation standards and that will support NGATS. The process outlined below for setting separation standards should be adopted. This R&D program should include, but not be limited to:

Immediate

- Establish a research program to develop an understanding of the nature and frequency of blunders.

  - Performance Data Analysis & Reporting System (PDARS) appears to be a possible source for needed data.
  - Develop new systems, if needed, for automated reporting of such anomalies.
- Establish data needs for establishment of separation standards early in NGATS development so opportunities, such as demonstrations, can be used to collect data.
- If conservative separation standards are put in place, such as RNP Parallel Approach Transition (RPAT), establish a data collection process early in the implementation so operational data collected to reduce separations in the future.

Longer Term

- Conduct research to develop consistent approaches for the development of separation standards with all assumptions stated concisely.
- Conduct research to improve the methodology for evaluating separation standards against an absolute threshold (target level of safety). In particular, there needs to be a consistent, credible way to take into account the response of humans to rare events.

Finding 6. The next generation air transportation system will have:

- new roles and responsibilities for pilots and controllers and the automation that supports them,
- increased shared situational awareness on board the aircraft that will provide more timely and accurate information including intent of nearby vehicles,
- the potential, through good system design, for fewer unexpected deviations, and
- new backup systems to deal with system/subsystem failures, possibly accepting lesser performance capability than the system being backed up.

As surveillance, navigation, and communication performance increases, including communication of intent, separation standards will be driven more by the need to accommodate system failures than by variations in nominal system performance.

Recommendation:

Longer Term

- Establish a research program to develop an understanding of the roles of the human and automation in dealing with failures and the implication of those roles on separation standards.
- Managing failure gracefully is perhaps the most difficult design aspect of the NGATS. Specific and intense research into the human and automated alternatives will be required.

Finding 7. New technologies (e.g. GPS, ADS-B, CDTI, Datalink) offer the potential for reducing required separations. In particular, GPS-based RNP, together with the concept of containment, provides much more precise control and knowledge of an aircraft's intended trajectory, and ADS-B permits the pilot of other aircraft, as well as the air traffic

controller, to monitor the flight path of a proximate aircraft and rapidly sense deviations from its intended path.

Recommendation:

Immediate

- As more and more aircraft use RNP-based navigation, monitor their performance, and gather and analyze data to develop a statistical understanding of the performance of RNP-based systems in various flight regimes.
- Re-examine the design of parallel and converging approaches and departures based on an appropriate probability distributions (may not be Gaussian) or on data gathered using RNP-based navigation.
- The Performance-Based Advisory Rulemaking Committee (PARC) should redefine the definition of "established on approach" to include LNAV and VNAV. The requirement to be aligned with the runway centerline should be studied for possible elimination.
- Research into potential reduction of Arrival/Departure and Departure/Departure separations due to RNP guided missed approaches and departures should be pursued.

Longer term

- Develop (recommendations for) new separations standards based on the improved navigation, surveillance, communication, control, and automation technologies, which will be part of NGATS. Utilize lessons learned during the analysis of other standards.
- When the nature and frequency of blunders off an ILS course are better understood using data ILS/RNP parallel runway separation should be reevaluated. RNP/RNP parallel approach separation should be established.
- The No-Transgression Zone (NTZ) role for ILS operations should be re-defined based on real blunder information. Then, if still required, appropriate dimensions and shapes should be established.
- The role of the NTZ in RNP/RNP separations should be established. The NTZ may not be needed.

Finding 8. In designing NGATS, an air-based independent (from ATM system) backup collision avoidance system (similar to TCAS or perhaps a modified TCAS) will be required.

Back-up safety systems in the aircraft and air traffic control facilities have been set to prevent collision while minimizing false alerts when aircraft are operating at today's separation standards. As separation standards are reduced, procedures and alerting logic must be reexamined to optimize the balance between collision avoidance and false alerts.

Recommendation:

Longer Term

- Research is required for the future independent airborne collision avoidance system in the context of the ATM system construct and the associated separation standards.
- Research and analysis of alerting systems, such as Traffic Alert and Collision Avoidance System (TCAS), Terrain Awareness and Warning Systems (TAWS), Minimum Safe Altitude Warning (MSAW), and Conflict Alert (CA) function, should be initiated to minimize false alerts as separation standards are reduced and revised.

Finding 9. Evaluating the controllers' performance by distribution (stochastic control) rather than a hard limit may be able to increase capacity and effective throughput without compromising safety.

Recommendation:

Immediate

Research into the practicality of stochastic control in terminal operations (specifically landing spacing) should be initiated. Research should pursue the question of practicality and unintended consequences. This is an important area for research because it offers the prospect of some near term improvement in landing rates, and because stochastic control is more appropriate than deterministic control in automated systems such as NGATS.

Finding 10. In considering the possibilities for reducing separations standards, wake turbulence becomes the driving consideration. For NGATS, wake turbulence could become the primary limiter of capacity.

Recommendation:

Immediate

- Full support of existing research and implementation program should continue.
- Commission a team to conduct in-depth annual technical and programmatic reviews of the wake research and implementation program. The reviews should include the objectives, technical approach, schedule, and funding. The team should be composed of external experts knowledgeable in the areas of wake vortices in normal operating configurations, advanced Light Detection and Ranging (LIDAR) and other sensors that may be useable in detecting the strength of a wake vortex, aircraft behavior in the presence of wakes, and how this information can be used in the flight deck and air traffic facilities. This team should be structured along the lines of the Department of Defense Science Board and report to ATO leadership.

Longer Term

- Investigate advanced instrumentation such as LIDAR or other sensing methods to obtain direct measurements of vortex strength.
- Investigate the feasibility and practicality of wake vortex sensing/tracking to provide the flight crew an indication of encroaching wake vortex location, strength and upset risk.

Reducing separations standards, while preserving safety, is an intricate process. An evaluation of the overall system risk is necessary when the proposed separation is much different from the current. Mathematical analysis, real time simulations, field demonstrations, risk assessments, judgment, and a structured introduction should all be utilized.

Blank Page

APPENDIX D
Acronyms and Abbreviations

4DT	Four Dimensional Trajectory
A	
AC	Advisory Circular
ACB	Former Office of Innovations and Solutions
ACO	Aircraft Certification Office
ACR	Air Certification Office
ACRP	Airport Cooperative Research Program
ADS-B	Automatic Dependent Surveillance – Broadcast
AED	Automatic External Defibrillators
AEDT	Aviation Environmental Design Tool
AEE	[FAA – AEP] Office of Environment and Energy
AEP	[FAA – Staff Office] Aviation Policy, Planning and Environment
AEPMT	Aviation Environmental Portfolio Management Tool
AFCB	Arc-Fault Circuit Breaker
AFRL	Air Force Research Laboratory
AFS	[FAA – AVS] Flight Standards Service
AIA	Aerospace Industries Association
AIP	Airport Improvement Program
AMT	Aviation Maintenance Technician
AOS	Former office code for Airway Facilities Operational Support
AOV	[FAA – AVS] Air Traffic Safety Oversight Service
APMT	Aviation Portfolio Management Tool
AQP	Advanced Qualification Program
ARAC	[FAA] Aviation Rulemaking Advisory Committee
ARP	[FAA – Line of Business] Airports
ARTCC	Air Route Traffic Control Center
ASAP	Aviation Safety Action Program

ASB	Aviation Science Board
ASDE-X	Airport Surface Detection Equipment – Model X
ASEB	National Academy Aeronautics and Space Engineering Board
ASIAS	Aviation Safety Information Analysis & Sharing
AST	[FAA – Line of Business] Associate Administrator for Commercial Space Transportation
ASTM	American Society for Testing and Materials
ATC	Air Traffic Control
ATCS	Air Traffic Control Specialist
ATD&P	Advanced Technology Development and Prototyping
ATM	Air Traffic Management
ATO	[FAA – Line of Business] Air Traffic Organization
ATO Capital	[FAA Budget Appropriation]
ATO-P	[FAA – ATO] Office of Operations Planning
ATOP	Advanced Technology for Oceanic Procedures
ATR	EADS and Alenia Aircraft
ATS	Air Traffic Services
AT/SAT	Air Traffic Selection and Training
ATTE	Air Traffic Teamwork Enhancement
AVS	[FAA – Line of Business] Aviation Safety
AWTT	Aviation Weather Technology Transfer
C	
C3	Command, Control and Communications
C&V	Ceiling and Visibility
CAASD	[MITRE] Center for Advanced Aviation System Development
CAEP	[ICAO] Committee on Aviation Environmental Protection
CAMI	Civil Aerospace Medical Institute
CANSO	Civil Air Navigation Services Organization
CARI-6	The name of a radiobiological computer program
CBT	Computer Based Training

CDA	Continuous-Descent Approach
CDTI	Cockpit Display of Traffic Information
CEAT	Center of Excellence for Airport Technology
CEH	Complex Electronic Hardware
CFIT	Controlled Flight into Terrain
CFR	Code of Federal Regulations
CGAR	Center of Excellence for General Aviation Research
CNS	Communications, Navigation, and Surveillance
COE	Center of Excellence
COI	Communities of Interest
COMSTAC	[FAA] Commercial Space Transportation Advisory Committee
CONUS	Continental United States
COTS	Commercial off-the-shelf Software
CRC	Coordinating Research Council
CRDA	Cooperative Research and Development Agreement
CRM	Crew Resource Management
CSPR	Closely Spaced Parallel Runways
CTI	Collegiate Training Initiative
CWIAP	Controller Workforce Integrated Action Plan
D	
DARWIN™	Design Assessment for Reliability with Inspection
DEFORM™	A patented system used to analyze titanium alloy defects in turbine rotor disks
DER	Designated Engineering Representative
DHS	Department of Homeland Security
DLT	Development Liaison Team
DME	Distance Measuring Equipment
DNL	Day-Night-Level
DOC	Department of Commerce
DOD	Department of Defense

DOE	Department of Energy
DOT	Department of Transportation
DRVSM	Dynamic Vertical Reduced Separation Minima
DSA	Detect, Sense, and Avoid
DSS	Digital Safety System
E	
EA	Enterprise Architecture
EDMS	Emissions Dispersion Modeling System
EDS	Environmental Design Space
EIPT	Environmental Integrated Product Team
ELV	Expendable Launch Vehicles
EMAS	Engineered Materials Arresting System
EMI	Electromagnetic Interference
EPA	Environmental Protection Agency
ERAM	En Route Automation Modernization
ETBE	An ethanol fuel blend
EUROCONTROL	European Organization for the Safety of Air Navigation
EWIS	Electrical Wiring Interconnect Systems
F	
FAA	Federal Aviation Administration
FAARFIELD	An airport pavement thickness design package developed for the FAA
FACT	Future Airport Capacity Task
FAROS	Final approach runway occupancy signal
F&E	Facilities and Equipment
FFRDC	Federally Funded Research and Development Center
FICAN	Federal Interagency Committee on Aviation Noise
FIS-B	Flight Information Service-Broadcast
FOD	Foreign Object Debris
FOQA	Flight Operations Quality Assurance

FPI	Fluorescent Penetrant Inspections
FY	Fiscal Year
G	
GA	General Aviation
GAO	General Accounting Office
GCNSS	Global Communications Navigation and Surveillance System
GEOSS	Global Earth Observation System of Systems
GNSS	Global Navigation Satellite Systems
GPS	Global Positioning System
H	
HAP	Hazardous Air Pollutant
HAZMAT	Hazardous Material
HFIX	Human Factors Interaction Matrix
HRET	High Reach Extendable Turret
HUMS	Health and Usage Monitoring System
HVAC	Heating, Ventilation, and Air Conditioning
I	
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMA	Integrated Modular Avionics
IMC	Instrument Meteorological Conditions
INM	Integrated Noise Model
IOT&E	Independent Operational Test and Evaluation
IPT	Integrated Product Team
IR	Infrared
J	
JAWS	Juneau Area Wind System
JPDO	Joint Planning and Development Office

JRC	[FAA] Joint Resources Council
JUP	Joint University Program
L	
LAAS	Local-Area Augmentation System
LAHSO	Land and Hold Short Operations
LED	Light Emitting Diode
LGF	LAAS Ground Facility
LIDAR	Light Detection and Ranging
LL	Low-Lead
LOSA	Line Operations Safety Audit
LSDYNA	A proprietary finite element code
M	
MANPADS	Man-Portable Air-Defense Systems
MAGENTA	Modeling System for Assessing Global Noise Exposure
MAPoD	Model-Assisted Probability of Detection
MCDC	Modified Condition Decision Coverage
MITRE	A private, independent, not-for profit organization
MMIR	Maintenance Malfunction Information Reporting
MMPDS	Metallic Materials Properties Development Standards
MOA	Memorandum of Agreement
MoC	Memorandum of Cooperation
MOU	Memorandum of Understanding
MSD	Multiple-Site Damage
MTS	MITRE Technical Staff
MVMC	Marginal Visual Meteorological Conditions
N	
NAPTF	National Airport Pavement Test Facility
NARP	National Aviation Research Plan
NAS	National Airspace System

NASA	National Aeronautics and Space Administration
NAWC	Naval Air Warfare Center
NDB	Non-Directional Beacon
NDI	Non-Developmental Item
NextGen	Next Generation Air Transportation System
NEXRAD	Next-Generation Weather Radar
NGATS	Next Generation Air Transportation System
NLA	New Large Aircraft
NOAA	[DOC] National Oceanic and Atmospheric Administration
NOVEC	A 3M fire protection fluid
NOx	Oxides of Nitrogen
NTSB	National Transportation Safety Board
NWS	[DOC] National Weather Service
O	
OBIGGS	On Board Inert Gas Generating System
OEP	Operational Evolution Plan
OI	Operational Improvements
OJT	On the Job Training
OMB	Office of Management and Budget
OOOI	Out, Off, On, and In
OOT	Object-Oriented Technology
Ops	[FAA Budget Appropriation] Operations
OSTP	[Executive Office of the President] Office of Science and Technology Policy
P	
PARTNER	Partnership for AiR Transportation Noise and Emissions Reduction
PDARS	Performance Data Analysis and Reporting System
PM	Particulate Matter
R	
R&D	Research and Development

RDHFL	Research and Development Human Factors Laboratory
REB	[FAA] Research and Development Executive Board
R,E&D	[FAA Budget Appropriation] Research, Engineering and Development
REDAC	[FAA] Research, Engineering and Development Advisory Committee
RFI	Radio Frequency Interference
RFID	Radio Frequency Identification
RIRP	Runway Incursion Reduction Program
RLV	Reusable Launch Vehicle
RLVWG	Reusable Launch Vehicle Working Group
RNAV	Random Navigation/Area Navigation
RNP	Required Navigation Performance
RPD	Research Project Description
R-SAT	Rapidly-Deployable Stand-Alone ATC Trainer
RTCA	Company name (no longer an acronym)
RTSP	Real-Time Streamlining Protocol
RTVS	Real-Time Verification System
RWSL	Runway Status Light

S

S&O	[FAA Budget Appropriation] Safety and Operations
SAE	Society of Automotive Engineers
SAGE	System for Assessing Aviation Global Emissions
SBIR	Small Business Innovation Research
SEMP	Systems Engineering Management Plan
SF	Safe Flight
SFO	San Francisco International Airport
SLD	Supercooled Large Droplet
SMS	Safety Management System
SSRWG	System Safety Research Working Group
STFM DST	Surface Traffic Flow Management Decision Support Tools

SUA	Special Use Airspace
SWIM	System Wide Information Management
SwRI	Southwest Research Institute
T	
TAA	Technically Advanced Aircraft
TCAS	Traffic Alert and Collision Avoidance System
TCRG	[FAA] Technical Community Representative Group
TERPS	Terminal Instrumentation Procedures
TFM	Traffic Flow Management
TFMS	Traffic Flow Management System
TIS-B	Traffic Information Service-Broadcast
TMA	Traffic Management Advisor
TMI	Traffic Management Initiatives
TMU	Traffic Management Unit
TO	Technical Operations
TRACON	Terminal Radar Approach Control
TRB	Transportation Research Board
U	
UAS	Unmanned Aircraft Systems
UAV	Unmanned Aerial Vehicle
UAV	Uninhabited Aerial Vehicle
UEDDAM	Uncontained Engine Debris Damage Assessment Model
V	
VAAC	Volcanic Ash Advisory Center
VFR	Visual Flight Rules
VLJ	Very Light Jets
VLTA	Very Large Transport Aircraft
VMC	Visual Meteorological Conditions
VORS	Very High Frequency Omni Range Stations

W

WAAS	Wide-Area Augmentation System
WIDA	Weather Information Decision Aid
WJHTC	William J. Hughes Technical Center
WRF	Weather Research and Forecast
WTMD	Wake Turbulence Mitigation for Departures
WxIPT	Weather Integrated Product Team