

2.8 National Aviation Research Plan Program Management

Mission

The program provides leadership and services for both internal and external customers. First, we provide for the effective and responsible stewardship of the funds that users of the NAS have entrusted to the FAA for research and development. Second, we provide for our share in the sustainment and maintenance of the Air Traffic Management Laboratories at the William J. Hughes Technical Center. Third, we provide for the long-term research needs of the FAA in the Air Traffic Management arena through the Center for Advanced Aviation System Development (CAASD). Finally, we provide for the future protection of the FAA's critical information technology systems. We strive to provide our customers the outputs and outcomes they most need in return for their investment.

Intended Outcomes

This area supports FAA strategic goals and objectives in industry vitality, global leadership, business practices, and communications. Specifically, work in this area is directed towards better serving the interests of the nation and the flying public by:

- Increasing knowledge of the R,E&D program among the agency's customers and stakeholders.
- Increasing the participation of R,E&D customers and stakeholders in the program's formulation.
- Better managing limited R&D resources through more efficient and effective processes for the development and management of the FAA R,E&D investment portfolio.
- Fostering U.S. aviation industry leadership through international cooperation and harmonization in developing and implementing technologies that improve air traffic safety and efficiency.
- Achieving higher quality research and greater value through increased collaboration (partnerships) with the best academic and industrial R&D talent, both within the United States and internationally.

- Vitalizing the U.S. aviation industry by supporting R&D efforts toward the future technological and operational needs of NAS users.

Program Area Outputs

- The (annual) *National Aviation Research Plan (NARP)*, formerly known as the *Federal Aviation Administration Plan for Research, Engineering & Development*.
- Periodic and special R,E&D Advisory Committee reports and recommendations.
- The annual FAA R,E&D Budget.
- International planning and implementation documents providing for world-wide aviation research harmonization and interoperability.
- Agreements with other international civil aviation authorities for the cooperative development of aviation systems research programs.
- Cooperative research agreements with academia, other government agencies, and industry.
- Modern, available Air Traffic Management (ATM) laboratories needed to meet the needs of the individual ATM research programs.
- New information systems security tools and techniques.

Program Area Structure

The NARP Program Management effort is divided into the following areas:

- R & D Portfolio Strategic Management
- R,E&D Financial Management
- R,E&D Advisory Committee
- International cooperative research and development programs
- Collaboration with NASA on aviation research and development
- R,E&D Partnerships
- Center for Advanced Aviation System Development (CAASD)

- William J. Hughes Technical Center (WJHTC) Laboratories
- Information Systems Security Development

Effective stewardship of the FAA R,E&D program requires that all NAS users receive the best systems and services achievable for their investment. In the first four elements just listed, the FAA ensures that its R&D program effectively targets the needs of those who rely on the NAS, that the agency provides for R&D in its budget and R,E&D Plan, and that it properly accounts for its R,E&D financial resources

The next three elements are to ensure that the agency's research and development program is fully coordinated with other aviation research programs and that others conducting research and development are cognizant of FAA needs and direction. With limited resources available to virtually all the entities conducting aviation-related research and development, it is incumbent upon all of us to collaborate in the conduct of our programs and share in the results.

The final three elements provide the in-house component of our air traffic management research program. CAASD, FAA's federally funded research and development center, is engaged in providing fundamental, cutting-edge research and development of future ATM systems and procedures. The WJHTC laboratories provide the test beds for proposals for new systems, processes, or procedures. The Information Systems Security is concerned with safeguarding the systems and data from either accidental or deliberate intrusions.

Customer and Stakeholder Involvement

The FAA relies upon the R,E&D Advisory Committee (REDAC) for guidance on its research and development programs. The REDAC includes representatives of associations, users, corporations, other government agencies, universities and research laboratories—all either customers or stakeholders of FAA products and services. The REDAC is actively involved in shaping, reviewing, and questioning what the agency is presently doing or considering for the future.

Additional customer guidance comes from the various committee of RTCA, Inc., a non-profit standards organization for ATM systems.

Accomplishments

NARP Strategic/Financial Management and Portfolio Analysis

- The 2000 FAA *National Aviation Research Plan*, February 2000.
- The FY 2001 R,E&D Budget, February 2001.
- R,E&D Portfolio Development Process Re-engineering - Update, July-September, 2000.

R,E&D Advisory Committee

(See Appendix A.)

R&D Excellence

- Completed a standards-based review of the management of the R&D program and execution of a representative sample of R&D projects using the FAA-developed integrated Capability Maturity Model (iCMM).
- Developed a process improvement plan to make improvements to both management and execution of R&D programs as noted during the review.
- R,E&D Coordinated Efforts and Partnerships.

Joint University Program (University Research Program Group):

- Presentation of 15 RTCA Jackson Awards for excellence in aviation electronics.
- Presentation of the first FAA Excellence in Aviation Award, two Aerospace Industries Association of America (AIAA) Major Field Awards in aviation meteorology, and one Institute of Electrical and Electronics Engineers (IEEE) Major Field Award in control systems.

R&D Partnerships

- Received and incorporated the R,E&D Advisory Committee's guidance on the R,E&D Program.
- Established 125 research and development agreements with 19 countries and with a single air traffic organization representing 17 member states.

- Established an agreement with EUROCONTROL to do cooperative research and development in air traffic management programs.

Long-Range View

Work in this area will continue as long as the FAA performs research and development. Expected resource requirements in the “out-years” will remain at about 3-5% of the total R,E&D budget.

A01a —System Planning and Resource Management

GOALS:

Intended Outcomes: The FAA intends that its R,E&D programs more effectively meet customer needs, increase program efficiency, and reduce management and operating costs. The FAA further intends to increase customer and stakeholder involvement in its programs by fostering greater proliferation of U.S. standards and technology to meet worldwide aviation needs.

Agency Outputs: The FAA prepares the annual R,E&D budget submission to Congress and publishes the annual *National Aviation Research Plan (NARP)*. The agency hosts three R,E&D Advisory Committee (REDAC) meetings per year as well as a number of subcommittee meetings. REDAC produces periodic and special reports providing advice and recommendations on the R,E&D program to the FAA. The Agency intends to start developing and publishing a research and development strategic plan.

Customer/Stakeholder Involvement: REDAC reviews FAA research commitments annually and provides guidance for future R,E&D investments. The Advisory Committee is limited to a maximum of 30 members. These members represent customer and stakeholder groups including subject matter experts from various associations, user groups, corporations, government agencies, as well as universities and research centers.

Accomplishments: Each year, the agency provides R,E&D program status information through the *NARP* and submits the R,E&D budget requests to the Office of Management and Budget (OMB) and Congress. REDAC has provided the FAA with an independent strategic view on the agency's research commitments. In a recent report, the committee has reviewed the FAA's planned FY 2002 R,E&D Investments (April 2000). The Committee has also participated in a joint meeting with NASA's Aero-Space Technology Advisory Committee (April 2000) and has formed a new subcommittee to examine the Small Aircraft Transportation System (SATS) initiative.

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

MAJOR ACTIVITIES AND ANTICIPATED FY 2001 ACCOMPLISHMENTS:

R,E&D plans and programs

- Published the National Aviation Research Plan.

R,E&D advisory committee

- Submitted Committee review of and recommendations for FY 2002 R,E&D Program.
- Submitted Committee guidance for FY 2003 R,E&D Program.
- Participated in joint meetings with NASA's Aero-Space Technology Advisory Committee.

KEY FY 2002 PRODUCTS AND MILESTONES:

R,E&D plans and programs

- Publish the National Aviation Research Plan.

R,E&D advisory committee

- Prepare recommendations on planned R,E&D investments for FY 2003.
- Prepare other reports as requested by the Administrator.
- Participate in joint meetings with NASA's Aero-Space Technology Advisory Committee.

FY 2002 PROGRAM REQUEST:

This request will be used to further FAA's R,E&D program strategic management of its R&D activities.

Specifically, the agency will pursue the development of a research and development strategic plan to more closely link the agency's R&D program with its corporate strategic goals and to establish a performance-measurement-oriented baseline to track R&D contributions to agency strategic goals. The agency will engage the service of the REDAC in the preparation of this plan.

The agency will continue to support the work of the REDAC in its task to advise the Administrator on the FAA R&D Program. In particular, the agency will seek the counsel and guidance of the committee for the FY 2003 program, review the proposed FY 2003 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 as part of the President's Budget Request.

The agency will continue to provide cross-functional management team support for the FAA R&D Strategic Plan, ensure that programs planned in response to that plan are balanced across FAA strategic objectives, and

ensure the most important and beneficial work is accomplished within the available resources.

The agency will continue to provide the following core, essential services across all the service areas to produce the following:

- Financial management of the R,E&D program.
- Financial support for REDAC, a body of customers and aviation experts drawn from outside the FAA who provide guidance to the Administrator on R,E&D program planning and execution.
- Negotiation and execution of bilateral and multilateral agreements with international civil aviation authorities. These agreements establish cooperative R,E&D programs, system standards, and air traffic systems procedures.

APPROPRIATION SUMMARY

	Amount (\$000)
Appropriated (FY 1982-2000)	\$ 32,419
FY 2001 Enacted	1,162
FY 2002 Request	1,458
Out-Year Planning Levels (FY 2003-2006)	6,060
Total	\$ 41,099

Budget Authority (\$000)	FY 1998 Enacted	FY 1999 Enacted	FY 2000 Enacted	FY 2001 Enacted	FY 2002 Request
Contracts:					
R,E&D Plans and Programs	1,164	385	1,164	886	1,388
Personnel Costs	0	685	0	246	49
Other In-house Costs	0	94	0	30	21
Total	1,164	1,164	1,164	1,162	1,458

OMB Circular A-11, Conduct of Research and Development (\$000)	FY 1998 Enacted	FY 1999 Enacted	FY 2000 Enacted	FY 2001 Enacted	FY 2002 Request
Basic	0	0	0	0	0
Applied	1,164	1,164	1,164	1,162	1,458
Development (includes prototypes)	0	0	0	0	0
Total	1,164	1,164	1,164	1,162	1,458

2001 FAA NATIONAL AVIATION RESEARCH PLAN

A01a - System Planning and Resource Management Product and Activities	FY 2002 Request (\$000)	Program Schedule					
		FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY2006
<i>011-130 R,E&D Plans and Programs</i>							
R,E&D Plans and Programs	\$1,176						
Publish Annual Plan for R&D		◆	◇	◇	◇	◇	◇
R,E&D Financial Management		◆	◇	◇	◇	◇	◇
Prepare Annual Budget Submissions		◆	◇	◇	◇	◇	◇
R,E&D Advisory Committee Reports	\$212						
Recommendations on FAA, RE&D Investments		◆	◇	◇	◇	◇	◇
Joint Meetings with NASA's Aerospace Technology Advisory Committee		◆	◇	◇	◇	◇	◇
<i>Personnel and Other In-House Costs</i>	\$70						
Total Budget Authority	\$1,458	\$1,162	\$1,458	\$1,481	\$1,501	\$1,530	\$1,548

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

A01b —William J. Hughes Technical Center Laboratory Facility

GOALS:

Intended Outcomes: The FAA testbeds located at the William J. Hughes Technical Center (WJHTC) support R,E&D program goals to:

- Reduce the number of accidents and accident risk.
- Perform airspace studies and improve air-space design.
- Increase airport capacity.
- Reduce delays due to weather and system outages.
- Reduce unnecessary flight restrictions.
- Reduce user costs.

The WJHTC maintains and operates the agency testbed laboratories utilized by R,E&D programs in achieving the above goals. These centralized testbeds consist of non-operational NAS systems, aircraft, simulation facilities, communication systems, and a Human Factors Laboratory.

Agency Outputs: FAA programs develop the technical characteristics for new systems and procedures. R,E&D programs require their testbeds to emulate and evaluate various field conditions. Human factor projects require laboratories to perform human-in-the-loop simulations, measure human performance, and evaluate human factors issues. Airborne and navigation projects require “flying laboratories” that are specially instrumented and reconfigurable to support different projects. Developmental programs require simulation systems to recreate realistic scenarios.

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

- Capacity and air traffic management technology
- Communications, Navigation, And Surveillance (CNS)
- Operation concept validation
- Free Flight Phase 1/Phase 2
- Weather
- Airport technology

- Aircraft safety technology
- System security technology
- Human factors
- Information Security
- Capstone
- Environment and Energy
- Automated Dependent Surveillance-Broadcast (ADS-B)
- Global Positioning System (GPS)
- Terminal Instrumentation Procedures (TERPS)
- Wide/Local Area Augmentation System (WAAS/LAAS)

Accomplishments: The technical laboratory facilities provide the testbed infrastructure to support R,E&D program goals and outputs.

R&D Partnerships: In addition to the R,E&D programs listed, WJHTC laboratories cooperate with the Canadian Ministry of Transport, NASA, U.S. Air Force, Aircraft Owners and Pilots Association, Experimental Aircraft Association, International Civil Aviation Association, and academia.

MAJOR ACTIVITIES AND ANTICIPATED FY 2001 ACCOMPLISHMENTS:

The following programs have been supported by the laboratories:

- Runway Incursion
- Information Security
- Separation Standards
- GPS/WAAS/LAAS
- TERPS
- Satellite Communication
- Data Link
- TCAS/ADS-B
- Acquisition Human Factors
- Delay Reduction
- Runway Pavement Testing
- Aircraft Security
- Airport Movement Area Safety System (AMASS)

KEY FY 2002 PRODUCTS AND MILESTONES:

The testbeds at the WJH Technical Center provide the necessary infrastructure for R,E&D programs to achieve their goals. Specific milestones and

products are contained within individual programs.

FY 2002 PROGRAM REQUEST:

The WJHTC will maintain and operate technical laboratories/facilities that support R,E&D programs.

APPROPRIATION SUMMARY

	<u>Amount (\$000)</u>
Appropriated (FY 1982-2000)	\$ 59,449
FY 2001 Enacted	12,223
FY 2002 Request	12,545
Out-Year Planning Levels (FY 2003-2006)	54,745
Total	\$ 138,962

Budget Authority (\$000)	FY 1998 Enacted	FY 1999 Enacted	FY 2000 Enacted	FY 2001 Enacted	FY 2002 Request
Contracts:					
WJHTC Laboratory Facility	3,341	3,268	3,300	2,710	3,835
Personnel Costs	3,905	6,462	6,988	8,044	8,046
Other In-house Costs	800		787	1,469	664
Total	8,046	9,730	11,075	12,223	12,545

OMB Circular A-11, Conduct of Research and Development (\$000)	FY 1998 Enacted	FY 1999 Enacted	FY 2000 Enacted	FY 2001 Enacted	FY 2002 Enacted
Basic	0	0	0	0	0
Applied	8,046	9,730	11,075	12,223	12,545
Development (includes prototypes)	0	0	0	0	0
Total	8,046	9,730	11,075	12,223	12,545

2001 FAA NATIONAL AVIATION RESEARCH PLAN

A01b - William J. Hughes Technical Center Laboratory Facility Product and Activities	FY 2002 Request (\$000)	Program Schedule					
		FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY2006
<i>011-140 WJHTC Laboratory Facility</i>							
Systems Support Laboratory (En Route, Terminal, Automated Flight Station, Communications, and Scan Radars)	\$500						
Free Flight Phase 1		◆	◇	◇	◇		
Operational Concept Validation		◆	◇	◇	◇	◇	◇
Capacity Initiatives (Airspace, Procedures)		◆	◇	◇	◇	◇	◇
Information Security		◆	◇	◇	◇	◇	◇
Research & Development Laboratory (Target Generator Facility, Cockpit Simulator, Auto Tracking, Tech Center Data)	\$453						
Approach Procedures (SOIA)		◆	◇	◇	◇	◇	
Free Flight Phase 1		◆	◇	◇	◇		◇
Separation Standards		◆	◇	◇	◇	◇	◇
Operational Concept Validation		◆	◇	◇	◇	◇	◇
GPS/WAAS/LAAS		◆	◇	◇	◇	◇	◇
CDT/ADS-B		◆	◇	◇	◇	◇	◇
Data Link		◆	◇	◇	◇	◇	◇
STARS		◆	◇	◇	◇	◇	
Aviation Support Laboratory (Aircraft)	\$2,432						
Satellite Communications and Navigation Programs		◆	◇	◇	◇	◇	◇
Separation Standards		◆	◇	◇	◇	◇	
Capstone		◆	◇	◇			◇
GPS/WAAS/LAAS		◆	◇	◇	◇	◇	◇
TERPS		◆	◇	◇	◇	◇	◇
Data Link		◆	◇	◇	◇	◇	◇
Runway Incursion		◆	◇	◇	◇	◇	◇
ADS-B		◆	◇	◇	◇	◇	◇
Aircraft Safety		◆	◇	◇	◇	◇	
Human Factors Laboratory	\$450						
Air Traffic Control Human Factors		◆	◇	◇	◇	◇	◇
Airway Facilities Human Factors		◆	◇	◇	◇	◇	◇
Operational Concept Validation		◆	◇	◇	◇	◇	
<i>Personnel and Other In-House Costs</i>	\$8,710						
Total Budget Authority	\$12,545	\$12,223	\$12,545	\$12,985	\$13,433	\$13,924	\$14,403

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

A01c — Center for Advanced Aviation System Development (CAASD)**GOALS:**

Intended Outcomes: The FAA intends to apply expertise from the Center for Advanced Aviation System Development (CAASD) resources to air traffic service research to produce a safer, more efficient global air transportation system. Because it augments the agency's in-house resources in conducting research for the Air Traffic Services (ATS) line of business, CAASD is an essential component of the FAA's research program.

Agency Outputs: The CAASD research program provides detailed reports, briefings, and concept demonstration systems for use in the evaluation of new Air Traffic Management (ATM) and control operating concepts and/or infrastructure replacements. These products are critical elements in the initial development of a more efficient, more available, and safer next generation ATM and control system.

CAASD provides new technology research for applications for global air traffic management, including new developments in traffic flow management, navigation, separation assurance, surveillance technology, and system safety.

Customer/Stakeholder Involvement: The FAA is challenged to increase safety in the nation's civil aviation system while increasing capacity and efficiency. Outcomes within CAASD's work program span system stakeholder as well as FAA issues and needs. Collaborative traffic flow management is included among these important issues and needs.

The CAASD R,E&D effort supports the RTCA Free Flight Steering Committee. This committee provides the principal collaborative forum among industry, aircraft operators, and FAA representatives in developing plans and requirements for the NAS to evolve to free flight. It defines operational needs leading to free flight and identifies the required affordable NAS Architecture that satisfies those needs.

Additionally, the CAASD R,E&D effort supports the International Civil Aviation Organization (ICAO) in its efforts to develop worldwide navigation capabilities, including: a wide-area augmentation system; a local-area augmentation

system; and a worldwide air-ground communication capability using very high frequency air-ground digital radio. ICAO is the principal venue for international standards development and validation.

Accomplishments: CAASD has supported the following accomplishments:

- Development of longer-term operational concepts that move the ATM system closer to achieving free flight objectives.
- Development of procedure changes to improve runway safety and efficiency in the en route, terminal and oceanic domains.
- Conduct of Safe Flight 21 demonstrations in the Ohio Valley and Alaska that show how Communication, Navigation and Surveillance (CNS) technologies can be integrated with procedural changes to enhance service to air-space users.
- Development of information system requirements for capabilities in the en route and Traffic Flow Management domains to allow ATC specialists to provide a higher level of service to airspace users.
- Determined the expected level of performance (in terms of NAS delay, capacity, safety, predictability, flexibility, and/or access) of the future ATM, taking into account anticipated changes in areas such as: airspace user operations; previously committed ATM/airport system improvements; direction contained in the Operational Concept and the NAS Architecture; NAS modernization; and changes in user operations (traffic levels, location, characteristics).

R&D Partnerships: In accomplishing the outcomes in the CAASD work program, extensive partnerships have been forged with industry suppliers, aircraft operators, and other non-profit research institutions. These relationships include:

- George Mason University and NASA, on Wake Vortex, ADS-B and surface issues related to capacity.
- EUROCONTROL, on future ATM developments

2001 FAA NATIONAL AVIATION RESEARCH PLAN

- NASA Ames, on Multi-Center Traffic Management Advisor (TMA).
- Cargo Airlines Association, Florida Institute of Technology, and the University of Virginia, on ADS-B and its use for situational awareness (traffic and weather information in the cockpit) and self-spacing.
- UPS Aviation Technologies, on the Universal Access Transceiver.

In the modeling arena, CAASD has activities with Georgia Tech on Detailed Policy Assessment Tool (DPAT) and The Preston Group with Total Airport and Airspace Simulator and the Santa Fe Institute on agent based modeling. CAASD also is working with Catholic University on human factors stress monitoring techniques.

CAASD is working with the Volpe National Transportation Systems Center on TFM infrastructure modernization. Together, the centers are working with the NATCA Aviation Research Institute to obtain operational expertise on CAASD evaluations of new procedures and equipment. On its own, CAASD is working with Airbus, Boeing and Honeywell on path object concepts for future avionics systems and with Lockheed-Martin on enroute ATM modernization concepts.

MAJOR ACTIVITIES AND ANTICIPATED FY 2001 ACCOMPLISHMENTS:

- Defined and developed requirements for Free Flight Phase 2 capabilities.
- Developed an integrated detailed next-generation air/ground communication system program plan that has wide-spread buy-in from the airspace user community.
- Conducted evaluations of Free Flight Phase 1 capabilities to gather information on their utilization and on the system benefits derived from their use.

KEY FY 2002 PRODUCTS AND MILESTONES:

- Analyses that will contribute to the definition of requirements for the modernization of the

en route domain system architecture. This modernization will result in enhancements to decision-support system functionality and improvements in the quality and cost-effectiveness of operations and maintenance.

- Detailed guidance on the integration of Free Flight Phase 1 tools, i.e., User Request Evaluation Tool (URET), TMA, passive Final Approach Spacing Tool (pFAST), and Collaborative Decision Making (CDM) capabilities needed for full implementation of associated programs.
- Continued to develop metrics and evaluation plans to assess the benefits associated with Free Flight Phase 2 capabilities.
- Evaluated Safe Flight 21 results that support the development of requirements for the implementation of key CNS improvements and operational procedure changes.
- Determined the future navigation architecture and develop a consensus transition strategy, including the appropriate Global Positioning System (GPS) augmentation capability needed to enable a successful transition to a more effective navigation architecture for the NAS.

FY 2002 PROGRAM REQUEST:

Funding is requested for the following items:

- Additional research and development of Free Flight Phase 2 capabilities and potential enhancements.
- Continued support of Safe Flight 21 demonstrations.
- Analyses that support the definition of requirements for the modernization of the en route domain system architecture.
- Continued analysis of the expanded use of GPS and the implementation of advanced navigation systems.

APPROPRIATION SUMMARY

	Amount (\$000)
Appropriated (FY 1982-2000)	\$ 20,434
FY 2001 Enacted	3,991
FY 2002 Request	5,143
Out-Year Planning Levels (FY 2003-2006)	21,361
Total	\$ 50,929

Budget Authority (\$000)	FY 1998 Enacted	FY 1999 Enacted	FY 2000 Enacted	FY 2001 Enacted	FY 2002 Request
Contracts:					
Center for Advanced Aviation System Development	5,444	4,890	4,900	3,991	4,895
Personnel Costs	0	0	0	0	173
Other In-house Costs	0	0	0	0	75
Total	5,444	4,890	4,900	3,991	5,143

OMB Circular A-11, of Research and Development (\$000)	Conduct	FY 1998 Enacted	FY 1999 Enacted	FY 2000 Enacted	FY 2001 Enacted	FY 2002 Request
Basic		0	0	0	0	0
Applied		5,444	4,890	4,900	3,991	5,143
Development (includes prototypes)		0	0	0	0	0
Total		5,444	4,890	4,900	3,991	5,143

2001 FAA NATIONAL AVIATION RESEARCH PLAN

A01c - Center for Advanced Aviation System Development (CAASD) Product and Activities	FY 2002 Request (\$000)	Program Schedule					
		FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY2006
<i>011-160 Center for Advanced Aviation System Development (CAASD)</i>							
Research, Engineering and Development	\$1,510						
Developed an integrated Detailed Next-Generation Air/Ground Communications System Program Plan		◆	◇	◇	◇	◇	
Define Relationships Among Safety, Separation Standards, & Operational Capability to Enhance Safety Management		◆	◇	◇	◇	◇	
Investigate the Expanded Use of GPS and Advanced Navigation Systems		◆	◇	◇	◇	◇	◇
Continue Investigating Procedures, User Needs, System Requirements, and Architecture Implications for Enhanced Information Systems		◆	◇	◇	◇	◇	◇
Traffic Flow Operations Research	\$1,010						
Conduct Evaluations of Airspace Redesign Enhancements in All Operational Domains to Improve System Performance and Utilization of Resources		◆	◇	◇	◇	◇	
Continue Investigating Procedures, User Needs, System Requirements, and Architecture Implications for Enhanced Information Systems		◆	◇	◇	◇	◇	
Research New Air Traffic Management and Control Operating Concepts Evaluation and/or Infrastructure Replacements		◆	◇	◇	◇	◇	◇
Incorporate GPS Technology into Ongoing Work in Area of Low Cost Avionics to Make Full Use of Traffic Alert and Collision Avoidance System (TCAS)		◆	◇	◇	◇	◇	◇
Special Situation Support	\$2,375						
Define and Develop Requirements for Advanced Free Flight Concepts and Capabilities That Will Be Needed Beyond Free Flight Phase		◆	◇	◇	◇	◇	◇
Deliver and Evaluate a Core Set of Operational Capabilities (SMA, CDM, CTAS, and URET) at a Limited Number of Sites		◆	◇	◇			
Develop Alternative Methods for Using GPS Technology Inclusion of Free Flight Concepts in Domestic Airspace		◆	◇	◇	◇	◇	◇
Integrate DSS Requirements with FAA and Industry Technology Applications		◆	◇	◇	◇	◇	◇
<i>Personnel and Other In-House Costs</i>	\$248						
Total Budget Authority	\$5,143	\$3,991	\$5,143	\$5,222	\$5,291	\$5,393	\$5,455

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

A01d —Information Systems Security

GOALS: The increasing growth of cyber attacks and terrorism on critical infrastructures such as the National Airspace System (NAS) calls for a national-level effort to protect the increasingly vulnerable and interconnected U.S. computer and communications infrastructure. Executive Order 13010 identifies aviation transportation among one of the key protection areas. This budget submission focuses on extraordinarily difficult and challenging technical problems that must be addressed as a part of protecting the FAA's system infrastructure.

Intended Outcomes: The FAA will improve information systems security by developing and evaluating new technologies, technical information, and procedures that can be applied in both NAS and system support information systems, both new and legacy to improve the security posture of FAA systems against both active and passive attacks.

Agency Outputs: The research will transition into both future and legacy information systems used for all aspects of agency business, including the NAS, mission support, and administrative. Those systems will be more secure as a result of applying the new technology, improving the safety of the flying public, better protecting the nation's critical infrastructure, and enabling uninterrupted operations of the FAA.

Customer/Stakeholder Involvement:

- Internal stakeholders include all agency personnel since everyone routinely uses information systems for their business. Of special note are air traffic controllers (system availability and integrity), maintenance personnel (response to intrusions including system recovery), Aviation Security (incident analysis and enforcement), Regulation and Certification, Research and Acquisition, and the FAA Chief Information Officer (security system oversight).
- Federal stakeholders such as the President's Commission on Critical Infrastructure Protection, and the General Accounting Office have raised concerns about protecting the NAS information infrastructure in formal reports.

- External stakeholders include airlines and passengers (safety, efficiency, equipage, and maintenance); aircraft operators (safety, efficiency, equipage, and maintenance); pilots (safety); and International Civil Aviation Organization (standards and recommended practices).

Accomplishments: This is a new research, engineering and development program.

R&D Partnerships: Intended partners include: Lincoln Laboratory, Massachusetts Institute of Technology; the Computer Emergency Response Team – Coordinating Center (CERT-CC) at the Software Engineering Institute (SEI) of Carnegie-Mellon University; the University of Maryland; the National Security Agency; DOD entities (including AFRL, NRL, and DARPA), the Department of Treasury, and NASA.

MAJOR ACTIVITIES AND ANTICIPATED FY 2001 ACCOMPLISHMENTS:

This is a new research, engineering and development (R,E&D) program. FY 2001 activities and accomplishments are done in anticipation of inauguration of a funded R,E&D program in FY 2002.

- Initiated cooperative relationships with potential R&D partners (Lincoln Labs, SERC-CC, NIAP, AFRL, NRL, DARPA and NASA)
- Analyzed and determined Computer Security Incident Response Center (CSIRC) critical advanced technology requirements that can not be met by either commercial products or other on-going R&D efforts.
- Ascertained unique FAA R&D needs in Public Key Infrastructure (PKI) and other encryption technologies demanded by unique FAA mobile environments and situational awareness requirements.

KEY FY 2002 PRODUCTS AND MILESTONES:

- **Real Time Intrusion Detection and Monitoring**—Significant engineering shortfalls complicate the building and deployment of Intrusion Detection (ID) systems for large, heterogeneous systems such as the NAS.

Current ID systems cannot effectively function within the unique NAS environment due to the system's unique traffic flows and heavy demand for integration with a large number of partners and stakeholders such as the airlines, airports, etc. Current technology results in high false alarm rates and missed detection of actual intruders. The volume of audit data for the NAS requires a large personnel staff to analyze the reports and determine and develop effective ID algorithms. Integrating security data from the very large number of separate NAS subsystems will provide an unparalleled technical challenge. A research and development program is needed to develop intrusion detection technology tailored to FAA requirements and to integrate and tailor state-of-the-art commercial intrusion detection technology into FAA information systems. This effort will leverage on-going efforts by the USAF and the SEI and accelerate technology insertion into both legacy and new FAA systems.

- **Architecture**—FAA's information infrastructure is one of the largest and most complex in the world. Current techniques to architect the security of information systems need to be significantly improved to ensure that the points of greatest vulnerability have the greatest protection and that those protections remain as the information systems evolve. A research and development program is needed to develop new architectural approaches and to integrate those state of the art approaches into the FAA's information systems security architecture. According to our interactions with the National Information Assurance Partnership (NIAP) and MITRE, the FAA has been judged to be in the forefront of these efforts and cannot depend on commercial efforts to continue to provide the best protection to our future networks without continued R,E&D funding.
- **Public Key Infrastructure (PKI)**— The FAA will improve information systems security by researching and developing technologies, technical information, and procedures for public key infrastructure. Such improvements will enable secure transactions over the internet, intranet, and in non-TCP/IP based

networks such as used in air-to-ground communications via the Controller Pilot Data Link Communications program. Current concern is to develop new PKI concepts that can meet FAA unique requirements due to the mobile environment and situational awareness needs demanded by the agency's safety and security goals.

FY 2002 PROGRAM REQUEST:

The field of Information Systems Security (ISS) and Information Assurance (IA) is changing so rapidly that continued vigilance in evaluating and developing new ISS technologies is critical. Such technologies have a short "shelf-life." As soon as one threat has been discovered and new protection mechanisms have been developed to address it, more lethal threats are developed requiring newer and more robust mechanisms. The FY 2002 program will broaden the set of technologies evaluated and mature the technologies developed so they can be rapidly inserted into operational information systems.

In FY 2002, a small number of information systems will be selected to prototype the application of emerging ISS technologies. For example, emerging neural net and intelligent agent technologies may soon enable the analysis of large complex networks for vulnerabilities and can detect attacks in real-time. It is not clear yet, however, whether these technologies can scale to the size and complexity of the FAA's information systems infrastructure. Experiments will determine their robustness, scalability, and accuracy in finding vulnerabilities and detecting attacks.

As another example, a relatively new but very powerful way to specify information systems security requirements is through a standard product called "Common Criteria" (CC). These requirements become an integral part of an overall systems architecture, making it much easier for developers to understand how to build in protections when creating new information systems. A challenge facing the FAA is determining how to apply the CC to correctly allocate security requirements to the various parts of the FAA's architecture. Research will determine how to best apply the CC and make the necessary allocations to the FAA ISS architecture

and to use the outputs of the Protection Profiles developed in accordance with the CC in future FAA system acquisitions.

The FAA is currently investigating cooperative relationships with the Air Force Research Laboratory in Rome, NY, the Naval Research Laboratory in Washington, DC, the National Security Agency, the SEI, the University of Maryland, and Lincoln Laboratory at MIT to address these and other potential R&D efforts. Our aim is to leverage, to the highest degree, on-going R&D efforts from other government agencies and Federally Funded Research and Development Centers and to focus our investments to address unique FAA issues and requirements

that would not be addressed without additional R,E&D funding, and that cannot be met by commercial products. The three key ISS R,E&D areas of Intrusion Detection and Monitoring, Architecture and Public Key Infrastructure have the best potential for major payoffs to the FAA when leveraging other on-going R&D efforts. The FAA provides a critical infrastructure for the nation and has unique ISS needs that will not be met by the commercial community, due to the unique traffic and communication flows within the NAS and the needs for heightened protection against active cyber terrorism focused on the FAA.

APPROPRIATION SUMMARY

	<u>Amount (\$000)</u>
Appropriated (FY 1982-2000)	\$ -
FY 2001 Enacted	0
FY 2002 Request	2,581
Out-Year Planning Levels (FY 2003-2006)	<u>10,722</u>
Total	\$ 13,303

Budget Authority (\$000)	FY 1998 Enacted	FY 1999 Enacted	FY 2000 Enacted	FY 2001 Enacted	FY 2002 Request
Contracts:					
Information System Security	0	0	0	0	2,457
Personnel Costs	0	0	0	0	87
Other In-house Costs	0	0	0	0	37
Total	0	0	0	0	2,581

OMB Circular A-11, Conduct of Research and Development (\$000)	FY 1998 Enacted	FY 1999 Enacted	FY 2000 Enacted	FY 2001 Enacted	FY 2002 Request
Basic	0	0	0	0	0
Applied	0	0	0	0	2,581
Development (includes prototypes)	0	0	0	0	0
Total	0	0	0	0	2,581

2001 FAA NATIONAL AVIATION RESEARCH PLAN

A01d - Information System Security Product and Activities	FY 2002 Request (\$000)	Program Schedule					
		FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY2006
011-170 Information Systems Security							
Real Time Intrusion Detection and Monitoring	\$957						
Develop and Tailor Intrusion Detection Algorithms to the NAS and Other FAA System Requirements			◇	◇	◇		
Build and Test a New Proof of Concept Intrusion Detection System				◇	◇	◇	
Develop and Test Effectiveness of Intelligent Agents in Improving Intrusion Detection			◇	◇	◇	◇	◇
Identify Countermeasures			◇	◇	◇	◇	◇
Architecture	\$650						
Techniques to Improve Effectiveness Against Unauthorized Access			◇	◇			
Integrate State of the Art Architectural Approaches in the Information Systems Security (ISS) Architecture			◇	◇			
Integrate ISS into the FAA Architecture				◇			
Public Key Infrastructure	\$850						
Research and Develop Technologies, Technical Information and Procedures for PKI			◇	◇	◇		
Integrate and Test Developed PKI Technology into the FAA Architecture for Secure Transactions Over the Internet, Intranet, and in Non-TCP/IP Based Networks Such As Used in Air to Ground Communications via the Controller-Pilot Data Link Communications (CPDLC) Program			◇	◇	◇	◇	◇
<i>Personnel and Other In-House Costs</i>	\$124						
Total Budget Authority	\$2,581	\$0	\$2,581	\$2,621	\$2,656	\$2,707	\$2,738

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

A10a —Strategic Partnerships

GOALS:

Intended Outcomes: Focused in three, relatively narrow partnership areas the agency seeks to:

- Foster and facilitate FAA and NASA coordination and collaboration as a means of leveraging the resources of both agencies in producing research results that meaningfully meets the needs of the FAA.
- Pursue and support the transfer of technology between government and industry as a means of leveraging limited agency research resources.
- Provide a continuing source of cutting-edge ideas from leading aviation research universities that can be used by FAA and NASA project offices in addressing agency needs.

Agency Outputs:

University Research Programs

Joint University Program

Through quarterly technical review meetings, the universities present their research results in such diverse areas as:

- Design methods for robust and failure-tolerant flight control systems.
- High-accuracy global positioning system (GPS) navigation and altitude determination, e.g., Local Area Augmentation System (LAAS).
- Aircraft crew situational awareness.
- Pilot and controller situational awareness through common weather and traffic information.
- Guidance and control for wake vortex encounters.

Industry Research Programs

Technology Transfer Awards

- Award agency personnel for exceptional contributions to technology transfer projects.

FAA Field Offices at NASA Research Centers

- Provides NASA researchers on-site access to knowledgeable FAA personnel who can:

- Foster an FAA knowledge-base on FAA needs and requirements.
- Assist NASA researchers in focusing their research efforts in areas where work is needed.
- Foster and facilitate coordination and collaboration between NASA researchers. FAA personnel will ultimately use the products of that research.

Customer/Stakeholder

Involvement:

Customer/stakeholder feedback is solicited via continuing interface with the FAA R,E&D Advisory Committee. The committee has recently formed a subcommittee to advise the FAA on cooperative research ventures such as those supported by the R&D Partnership Program.

Accomplishments:

University Research Programs

Joint University program

- Received the 1999 RTCA William E. Jackson award.
- Received two Aerospace Industries Association of America major field awards (aviation meteorology).
- Received one Institute of Electrical and Electronics Engineers major field award (control systems).
- Negotiated a Memorandum of Agreement with NASA Ames for jointly funded research in a portfolio of civil aeronautics technologies.

Industry Research Programs

Technology Transfer Awards

- Made Technical Transfer Awards of approximately \$43K in FY 2000.

FAA Field Offices at NASA Research Centers

- Facilitated development of training strategies and materials for Free Flight Phase 1 Center TRACON Automation System (CTAS) Tools.
- Developed an educational CD-ROM, "Gate to Gate," about Air Traffic Control.

- Developed an enhanced FAA Wake Turbulence training package incorporating recent National Transportation Safety Board (NTSB) recommendations and NASA research data.
- Assisted NASA in the deployment of the Airborne Information for Lateral Spacing (AILS) demonstration at the Minneapolis-St. Paul Airport.

R&D Partnerships: The collective vision of this chapter is to provide safe and secure air transportation through partnerships that maximize the FAA R,E&D program investment. In effect, the programs of this chapter function as a clearinghouse for the major share of all partnerships occurring in the FAA R,E&D community.

MAJOR ACTIVITIES AND ANTICIPATED FY 2001 ACCOMPLISHMENTS:

University Research Programs

Joint University program

- Held quarterly reviews and published annual report.
- Transitioned FAA/NASA Joint University Program to FAA/NASA Ames program sponsorship.
- Initiated long-term research projects to complement FAA R,E&D.

Industry Research Programs

Technology transfer/cooperative activities

- Presented technology transfer awards.
- FAA Field Offices at NASA Research Centers
- Developed an integrated FAA/NASA 5-year wake turbulence research plan.
- Continued production and distribution of "Gate to Gate" CD-ROM.

- Implemented a Technology Transition Plan between NASA and FAA to facilitate transition of NASA-developed technologies into the NAS.

KEY FY 2002 PRODUCTS AND MILESTONES:

University Research Programs

Joint University program

- Publish research results reported on at quarterly reviews.

Industry Research Programs

Technology transfer

- Continue annual technology transfer awards.

FAA Field Offices at NASA Research Centers

- Continue FAA/NASA Coordination at the Langley and Ames Research Centers.
- Continue the development and implementation of Free Flight Phase 1 and 2 Tools.
- Continue the development and implementation of Aircraft structural safety programs.
- Continue the development and implementation of Terminal Airspace Productivity tools.
- Continue to study the feasibility of the Small Aircraft Transportation System.

FY 2002 PROGRAM REQUEST:

Industry and University Research Program Group

Funds are sought for three particular purposes:

- Sustain FAA's partnership with NASA in maintaining the research provided by the Joint University Program.
- Fund the Technology Transfer Awards program directed by the Congress.
- Maintain the FAA Field Offices at the NASA Langley and Ames Research Centers.

APPROPRIATION SUMMARY

	<u>Amount (\$000)</u>
Appropriated (FY 1982-2000)	\$ 43,418
FY 2001 Enacted	0
FY 2002 Request	609
Out-Year Planning Levels (FY 2003-2006)	<u>2,530</u>
Total	\$ 46,557

Budget Authority (\$000)	FY 1998 Enacted	FY 1999 Enacted	FY 2000 Enacted	FY 2001 Enacted	FY 2002 Request
Contracts:					
Strategic Partnerships	0	0	0	0	211
NASA Field Offices	258	0	0	0	368
Personnel Costs	1,446	973	0	0	21
Other In-house Costs	296	27	0	0	9
Total	2,000	1,000	0	0	609

OMB Circular A-11, Research and Development (\$000)	Conduct of	FY 1998 Enacted	FY 1999 Enacted	FY 2000 Enacted	FY 2001 Enacted	FY 2002 Request
Basic		0	0	0	0	0
Applied		21,000	1,000	0	0	609
Development (includes prototypes)		0	0	0	0	0
Total		21,000	1,000	0	0	609

2001 FAA NATIONAL AVIATION RESEARCH PLAN

A10a – Strategic Partnerships Product and Activities	FY 2002 Request (\$000)	Program Schedule					
		FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY2006
101-210 Strategic Partnerships	\$211						
Industry Research Programs							
Technology Transfer/Award		◇	◇	◇	◇	◇	◇
University Research Programs							
Joint University Program		◇	◇	◇	◇	◇	◇
Hold Quarterly Reviews	◇	◇	◇	◇	◇	◇	
101-220 NASA Field Offices	\$368						
Conduct Annual Reviews in Support of R,E,&D Efforts Between FAA NASA for Multiple Programs							
Provide Continuous Technical Liaison support Between FAA & NASA Centers Cooperative R,E,&D Programs							
Administer FAA's Portfolio of More Than 60 Memoranda of Agreement with NASA R,E,&D Program Offices							
<i>Personnel and Other In-House Costs</i>	\$30						
Total Budget Authority	\$609	\$0	\$609	\$619	\$627	\$639	\$646

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

This page intentionally left blank.