2.4 Aviation Security

Mission

The FAA's Aviation Security Research and Development (R&D) Division has the lead responsibility within the FAA for R&D programs related to civil aviation security. The division performs R&D to eliminate civil aviation security incidents and provides assistance in anticipating future risks to civil aviation.

Division programs accelerate and expand R&D and implement advanced technologies. Division products provide equipment and methods to counteract terrorist efforts against civil aviation.

Well-integrated, automated, aviation security systems that leverage benefits from a variety of technologies will produce better operational performance. The mission of the future will rely less on human intervention.

Intended Outcomes

The main goal of the Aviation Security R&D program is to mitigate terrorist threats to civil aviation. This promotes public confidence and directly benefits the aviation industry economically. The increasing extent and sophistication of terrorism makes it imperative that the FAA identify and develop practical, effective technologies applicable to aviation security systems. Aviation security systems must be comprehensive, addressing all potential aviation security vulnerabilities in the airport, on aircraft, and in the NAS as directed.

The FAA conducts extensive R&D to detect explosives, weapons, and other more sophisticated devices, to prevent their placement onboard aircraft. The Aviation Security R&D program focuses on automated aviation security systems and screening protocols that are the least intrusive and enable the highest throughput, which minimizes passenger delays and inconvenience. The FAA conducts R&D to identify methods of hardening aircraft fuselages to mitigate damage from explosives, weapons, surface-to-air missiles, and electromagnetic interference.

Program Area Outputs

The FAA, through the Aviation Security R&D program, promotes development of technologically improved products in explosives detection, aircraft hardening, airport security, and human factors. Program outputs include:

- Developing and distributing to FAA R&D security planners a structured, total airport security system definition and concept of operations
- Developing standard test protocols and performance criteria to aid in the operational deployment of improved aviation security systems
- Developing lists of accepted automated explosives detection devices (EDD) and approved explosives detection systems (EDS) for air carriers, airports, and other Government agencies
- Defining standardized, traceable methods of airport security screener training and evaluation
- Testing explosives-resistant luggage containers
- Exploring other blast mitigation techniques that will help ensure that potentially catastrophic terrorist acts do not result in the loss of aircraft

Aviation Security R&D products are EDS, EDD, technologies, specifications, analysis tools, and technology integration plans. These products are used by airports, air carriers, and airframe manufacturers to improve civil aviation security.

Program Area Structure

The Aviation Security R&D organization is divided into the aviation security R&D program into four interrelated areas:

- Explosives and weapons detection
- Aircraft hardening
- Human factors
- Airport security technology integration

Each area makes a significant contribution toward achieving the goals of the Aviation Security system of the future.

Explosives and Weapons Detection. This area develops new, improved methods and technologies to detect explosives in checked and carry-on baggage, on passengers, in air cargo, and in mail. Weapons detection for passengers, personnel, and

their carry-on luggage prevents the armed take-over of aircraft. These methods and technologies are used in airports prior to aircraft boarding. This program area also develops standards and specifications for detection equipment.

Aircraft Hardening. This area conducts research to increase civil aircraft survivability in the case of an in-flight explosion. It also seeks to identify the minimum weight of an explosive that will result in aircraft loss. Another consideration is to protect aircraft avionics and systems from the damaging effects of false electromagnetic or high-energy signal interference.

Aviation Security Human Factors. This area improves the human element of the aviation security system and develops methods to measure and maintain performance levels as aviation security components merge into an integrated system. It emphasizes staffing, personnel, training, performance, human factors engineering, and health and safety aspects of human performance capabilities and constraints.

Airport Security Technology Integration. This area focuses on technologies that prevent unauthorized access to aircraft and airport facilities. Major emphasis is on recommending future system definition and concept of operations. Technology products include state-of-the-art perimeter control, automated access control systems, and passenger baggage-matching systems that prevent unaccompanied luggage from being loaded into aircraft. The program develops simulation and modeling tools. One set of tools performs airport security analysis, while the other set is used to seamlessly integrate, improve, and reduce operating costs for technologies developed by other programs in the Aviation Security area.

The FAA Aviation Security R&D Division conducts six R&D projects to achieve the goals of the four Aviation R&D program areas. Three R&D projects—Checked Luggage, Cargo, and Checkpoint—support the explosives and weapons detection program area. Each of the other three program areas has a dedicated R&D project. These are Explosives Vulnerability and Mitigation Techniques, Human Systems Integration, and Security of Civil Aviation Airports and Air Carriers.

Any one program will not solve all the issues, because technology development has not reached a point where it can operate autonomously. A systems-oriented approach is being adopted, balancing and tailoring the application of people, procedures, and technology to each threat classification.

Customer/Stakeholder Involvement

The Aviation Security Improvement Act of 1990 (Public Law 101-604) provides direction to expand the FAA's System Security Technology program (SSTP) for aviation security as follows:

- Accelerate SSTP over a 36-month period
- Expand SSTP to address current and future threats
- Expand FAA aviation security initiatives in aircraft hardening and human factors

In 1996, the White House Commission on Aviation Safety and Security strongly emphasized continued R&D in all program areas and recommended deployment of existing explosives detection technology. Congress funded further R&D and the FAA's purchase and installation of EDS and EDD. The FAA Security Equipment Integrated Product Team (SEIPT) is currently deploying this detection equipment at various airports throughout the United States.

Other stakeholders include the National Academy of Sciences, the Aviation Security R&D Scientific Advisory Panel, the R&D Advisory Council, and the Aviation Security Advisory Committee, which hold frequent reviews of R&D plans and results. Efforts also include multi-interagency work with the Technical Support Working Group. Their recommendations include changes in the direction or emphasis of research plans.

Accomplishments

In effect since 1974, the FAA Aviation Security R&D program can point to significant accomplishments:

- Certified the CTX 5000 and established a demonstration effort that delivered four certified CTX 5000 explosive detection systems to air carriers for operational testing; with data collected and analyzed at airports in San Francisco, Atlanta, and Manila

- Provided critical input to the SEIPT initial deployment of 54 CTX 5000 explosive detection systems, beginning in January 1997
- Provided critical input to the SEIPT initial deployment of over 210 trace explosive detection devices to 18 airports in FY 97 and about 280 more in FY 98
- Studying additional trace detection prototypes, as a result of testing in airport environments
- Validated and refined explosives detection criteria based on joint U.S./U.K. Boeing 747 explosives testing and a Lockheed L1011 test performed with the manufacturing community
- Deployed trace detection devices and the CTX 5000 system at the 1996 Olympics in Atlanta and will support the 2000 Olympic games in Australia
- Developing and testing a second-generation computer tomography system, in conjunction with L-3 Communications
- Conducting a demonstration effort on hardened LD-3 luggage containers
- Established criteria to limit cross-contamination of explosives used to train and certify K-9 detection teams
- Conducting operational testing of a number of FAA-developed screener training enhancements
- Performed an international study of radio frequency identification tags, making positive passenger baggage matching (PPBM) cost-effective and operationally feasible when deployed in the field
- Completed an economic analysis of PPBM costs and provided the results to both industry and FAA rulemaking teams
- Completed the Blast/FX effects model and is in the process of adding the Toxic Effects model. The Blast/FX model shows the structural effect of explosives on airport facilities and casualties based on explosive weight and airport configuration scenarios.

Research and Development Partnerships

Since its inception, the Aviation Security R&D program has sought to establish productive relationships with many organizations. These organizations include U.S. Government agencies, industry, academia, and foreign countries that promote technology development for improved aviation security. Each of the FAA's partnering organizations contributes to the Aviation Security R&D mission by providing information, R&D, equipment, and/or facilities. The FAA uses these partnership agreements to leverage its Aviation Security R&D project investments. Three recent projects are a testament to this leveraging:

- A partnership with the Defense Advanced Research Projects Agency (DARPA), in which FAA investments were $25,000, resulted in airport Aviation Security R&D efforts exceeding $16 million
- A partnership in the industrial sector with Science Applications International Corporation (SAIC) resulted in a bulk detection effort worth an estimated $35 million from a $5 million FAA investment
- A cost-sharing agreement with two manufacturers to develop additional sources for certified EDS. These systems expected to come to market in FY 1999 will increase the efficiency and effectiveness of available detection options while reducing cost through competition.

Long-Range View

The FAA envisions an integrated aviation security system for the 21st century that incorporates the strengths of a variety of technologies that are continuously being monitored and upgraded to respond to changes in the threat environment. This integrated system will enable aviation security professionals to perform most effectively.

Automated detection technologies will enhance screener performance by providing detection that is constantly vigilant and not subject to distraction or fatigue, as in the case of human or canine screeners. This understanding of the aviation security system of the future guides and directs future Aviation Security R&D efforts and supports decisions for FAA investments.

Terrorist capabilities and techniques will continue to increase and evolve. This ever-changing threat necessitates continued funding of R&D for the foreseeable future. Aviation Security R&D efforts

will continue to focus on modifications and other technical improvements to deployed explosives detection equipment.

Identification and evaluation of explosives mitigation techniques will also continue.

Efforts will continue, expanding to include the entire aviation spectrum, including airports, airplanes, and other areas of the National Airspace System, as needed.

A07a Explosives and Weapons Detection

GOALS:

Intended Outcomes: This program supports goal 2 of the FAA Strategic Plan: "Aviation Security—Zero Incidents." It intends to eliminate the possibility of terrorist ability to conceal improvised explosives devices, weapons, and flammable gas or liquid explosives on aircraft. Specifically, it applies to objective 2B, in that it strengthens the baseline of security through accelerated development and application of advanced technology.

This is accomplished by making improved EDS and devices available to airlines and groups responsible for airline security, both domestic and international. These systems and devices decrease the U.S. air carrier and airport vulnerability to terrorist acts. Specifically, this program:

- Meets increased passenger flow while minimizing cost by developing automated systems
- Enhances the security of the worldwide flying public
- Promotes adaptation of the best existing and emerging U.S. technologies in response to continually evolving threat possibilities

Agency Outputs: The FAA establishes policies and rules for airline compliance to security directives. This rulemaking process depends on research and development, testing and evaluation, and data packages supporting equipment mandating decisions. The object of is to enhance the security of the flying public through continuous involvement in present and future threat detection and mitigation.

The FAA has deployed both Bulk and Trace explosives detection systems through the SEIPT.

Customer/Stakeholder Involvement: The FAA is the world leader in developing explosive detection research and in testing and evaluating related equipment.

- The FAA interacts with industry, academia, other Government agencies, oversight groups, special interest groups, Congress, foreign governments, national laboratories, individual researchers, and the general public.
- The FAA sponsors the National Academy of Science to assess program research initiatives and to review explosives detection research priorities. The Committee on Civil Aviation Security meets several times a year, and special panels address specific crucial areas of interest such as personnel screening and configuration management of explosives detection hardware and software. The committee's findings and recommendations directly affect the E/W program strategy and concepts.
- The explosives detection program must respond to congressional mandates such as Public Law 101-604 and section 303 of the Federal Aviation Administration Reauthorization Act of 1997, as well as the Aviation Improvement Act of 1990, the White House Commission on Aviation Safety and Security, the Aviation Security Advisory Committee Base Line Working Group, and the General Accounting Office (GAO).

Accomplishments: Explosives detection research results are used by the Office of Civil Aviation Security to assist it in the rulemaking process. Since 1991, the Explosives and Weapons Detection program has:

- Certified the world's first explosives detection system
- Established test and evaluation criteria and protocols for checked baggage
- Developed a world-wide accepted trace detection standard for electronic items
- Held two international symposia on explosives detection
- Sponsored three International Society for Optical Engineering (SPIE) conferences on domestic and international explosives detection
- Conducted an International Civil Aviation Organization (ICAO) workshop on trace detection standards for electronics explosives detection
- Completed an airport demonstration of certified explosives detection equipment at San Francisco and Atlanta international airports

- Supported the 1996 Olympic games with explosives detection equipment installations at five airports
- Developed competing technologies to the certified EDS
- Developed and tested personnel portal scanning systems
- Provided technical support to the SEIPT for airport deployment of bulk and trace detection equipment
- Tested carry-on baggage screening with the operator assist function

R&D Partnerships: The explosives detection program works closely with academia, industry, and other national laboratories. Partnerships with organizations reduce costs, where possible, by combining research initiatives that use the same technologies for slightly different purposes. More than 90 contracts, grants, CRDA's, and interagency agreements are in place with industry, academia, and other Government agencies. R&D partnership activities include:

- InVision Inc., working with the FAA, has produced the first certified explosives detection system in the world. It is now available and being sold domestically and internationally. They are currently supported under a cost sharing agreement to develop a more efficient system.
- Industry and the FAA share development in carry-on, checked, and cargo-scanning systems. This involvement includes joint funding agreements, cooperative research and development agreements, and FAA consultation to help companies improve existing systems through joint testing efforts.
- The interagency Technical Support Working Group supports explosives detection projects that can be applied to other agencies. These projects include document scanners, cargo screening systems, miniaturization, and performance improvement of trace detection technologies and industry collaboration with foreign governments' technology development programs.
- Bilateral agreements exist between the FAA and several international counterparts.

MAJOR ACTIVITIES AND ANTICIPATED FY 1999 ACCOMPLISHMENTS:

Bulk explosives/weapons detection

- Developed competitive computed tomography-based explosives detection system
- Developed improved quadrupole resonance prototype
- Developed new technologies based on emerging threats
- Set standards for carry-on and cargo-screening systems
- Completed evaluation of non-imaging passenger portal

Trace detection

- Benchmarked contamination levels for personnel and carry-on luggage
- Completed benchmark study for automated trace systems
- Built automated trace baggage system prototype
- Performed operational test of automated ticket screening device
- Set standards for electronics screening

Combined technology

- Developed automatic passenger screening portal for weapons and trace explosives detection

KEY FY 2000 PRODUCTS AND MILESTONES:

Bulk explosives/weapons detection

- Develop new technologies based on emerging threats
- Develop automated carry-on prototype
- Reduce false alarm rate in fielded EDS systems
- Test and evaluate commercially available cargo screening systems

Trace detection

- Determine feasibility of using trace for cargo screening
- Enhance/develop systems to handle emerging threats

- Develop trace detection standards for personnel screening
- Perform R&D to enhance performance of explosives detection canines
- Develop competitive trace automated baggage system

Combined technology.

- Combine explosives/detonator detector development.
- Develop combined technology personnel inspection system using bulk and trace technologies
- Develop NQR/X-ray detection system

FY 2000 PROGRAM REQUEST:

The program develops or enhances technologies that detect or discover emerging threats in both the trace and bulk detection areas. In some cases, capabilities are added to existing systems or completely new technology methods to handle the threats not addressed by current technologies. In each case, standards are developed to characterize the performance of the newly developed systems.

Combined technologies are used that merge a system's ability to analyze and integrate data from multiple sensors, thus providing an improved detection over single-system capability. This applies to baggage, cargo, and personnel scanning devices. The results of this research should increase the probability of detection and decrease the false alarm rates over existing technologies performing similar individual functions. New combinations of devices are being considered for use in environments inaccessible to public view.

Research continues into the development of faster, more automated, and cheaper systems that could more easily be integrated into an airport environment. The program makes maximum use of data and experience gained from deploying existing equipment.

A07a - Explosives and Weapons Detection Product and Activities	Program Schedule					
	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY2004
071-110 Explosives/Weapons Detection						
Bulk Explosives/Weapons Detection						
Developed Competitive Computed Tomography Based Explosives Detection System	◆	◇				
Developed Improved Quadrupole Resonance Prototype	◆		◇			
Develop New Technologies Based on Emerging Threats	◆	◇	◇	◇	◇	◇
Set standards for carry-on and cargo screening systems	◆					
Develop Automated Carry-on Prototype		◇				
Reduce False Alarm rate in fielded EDS System		◇				
Test and Evaluate All Commercially Available Cargo Systems		◇				
Airport Test of Advanced Baggage Screening System			◇	◇		◇
Improve existing 2nd/ 3rd generation Computed Tomography EDS				◇		◇
Trace Detection						
Benchmark contamination levels for personnel and carry-on luggage	◆					
Complete benchmark study for automated trace systems	◆					
Built Automated Trace Baggage System Prototype	◆					
Operational test of automated ticket screening device	◆					
Set standards for electronic screening	◆					
Determine Feasibility of using trace for Cargo Screening		◇				
Enhance/Develop Systems to Handle Emerging Threats		◇		◇		◇
Airport Test of Enhanced systems			◇		◇	
Develop trace detection standards for personnel screening		◇				
Perform R&D for Canine performance enhancements		◇				
Develop Competitive Trace Automated Baggage System		◇				
Upgrade Trace Systems for ICAO Markers				◇		
Develop Chemical Weapons Mitigation Systems				◇		
Combined Technology						
Develop automatic passenger screening portal for weapons and trace explosives detection	◆					
Combined Explosives/Detonator Detector Development		◇				
Develop Combined Technology Inspection Personnel System using bulk and trace technologies		◇				
Develop NQR/X-ray detection system		◇				
Develop Phase 1 Lab Prototype Combined X-Ray/Trace System			◇			
Develop Checkpoint Suite Prototype				◇		◇

Budget Authority ($ in Thousands)	FY 1996 Enacted	FY 1997 Enacted	FY 1998 Enacted	FY 1999 Enacted	FY 2000 Request
Contracts	25,044	38,629	30,832	37,696	35,370
Personnel Costs	3,283	2,297	2,796	3,462	4,827
Other Costs	673	471	572	542	479
Total	**29,000**	**41,397**	**34,200**	**41,700**	**40,676**

A07b Airport Security Technology Integration

GOALS:

Intended Outcomes: This program supports goal 2 of the FAA Strategic Plan: "Aviation Security-Zero Incidents." Specifically, it addresses plan objective 2A and 2C (which addresses specific aviation security vulnerabilities and reduction of international security incidents through cooperation with foreign governments). To achieve these objectives, the program strives to block terrorist access to the aircraft by analyzing airport vulnerabilities, investigating advanced perimeter control surveillance systems, and developing systems that provide strict accountability for luggage loaded onto an aircraft.

Additionally, the program supports the other aviation security programs by:

- Identifying advanced threats that the aviation community may face in the near future
- Developing sophisticated models to predict the operational effects of inserting security measures into the existing aviation system
- Developing communication protocols that allow advanced systems to work together

Overall progress in meeting these goals results from: (1) providing methods to increase passenger flow and reduce costs associated with security risk mitigation; (2) identifying and developing new technologies, methodologies, and procedures to enhance performance of security professionals; and (3) developing and maintaining an integrated security system approach for countermeasures to use against identified threats to the civil aviation system.

Agency Outputs: The FAA establishes the regulations governing airport and airline security and the rules for security inspections. It publishes these rules and regulations, with guidance for their implementation, in the form of advisory circulars. The Airport Security Technology Integration (ASTI) program also provides reports and other forms of technical information to aid the civil aviation security community in improving security methods.

Customer/Stakeholder Involvement: The FAA collaborates extensively with the domestic and international aviation security communities. The R,E&D efforts include industry participation with the Air Transport Association (ATA) to study the operational costs and effects of PPBM. This effort is designed to prevent the loading of unaccompanied baggage on aircraft. The FAA collaborates with the Société Internationale de Télécommunications Aéronautiques (SITA) and the International Air Transport Association (IATA) in developing standards for baggage tracking and reconciliation systems and tagging technologies.

The program responds to Public Law 101-604, the Aviation Security Act of 1990, the Aviation Security Advisory Committee (ASAC) recommendations, and the recommendations of the White House Commission on Aviation Safety and Security. These provide impetus for security research requirements and dissemination of the research results to industry.

Accomplishments: Results of the ASTI program are used by the aviation community and also by the Office of Civil Aviation Security in its rulemaking process. Among the results, the program has:

- Completed assessments of radio frequency (RF) technology for PPBM
- Completed evaluations of commercial off-the-shelf (COTS) airport vulnerability assessment tools against developed functional requirements
- Developed and implemented baseline methodology for vulnerability analysis of airports
- Provided statistical analysis of findings to industry
- Integrated security vulnerability countermeasures into an operational testbed to validate security benefits and operational impact
- Published functional requirements for an airport vulnerability analysis tool and validated selected COTS vulnerability assessment tools against these requirements
- Completed biannual technical reports that identify and prioritize advanced technical threats against civil aviation. This report drives research requirements and guides current and future research trends

- Completed an airport explosives security survey analysis and correlated information to identify vulnerabilities across 76 domestic airports; feedback on areas of concern and corrective action was provided to airports
- Published guidelines for industry on security revolving doors for use at concourse screening points
- Published functional guidelines for the PPBM system
- Developed guidelines for mitigating risk to blast effects
- Performed testbed studies in feasibility area of personnel access control
- Investigated advanced airport security command and control methods
- Identified opportunities for airport security and operations improvements via information integration

R&D Partnerships: The ASTI program—through partnership with the RTCA Subcommittee (SC) 183, and participation of industry—developed a standard for airport security access control systems. Relationships with ATA and the Regional Aircarrier Association (RAA) focus on the study of economic effects of PPBM on the industry. A yearlong cooperative study culminated with the publication of a project report that analyzed the economic effects of PPBM on the aviation industry. The FAA continues this relationship to fulfill the requirements of the White House Commission on Aviation Safety and Security recommendations for PPBM. The ASTI program determines the operational effects of alternative approaches to, and research of, technologies to increase the efficiency and security of reconciling baggage with passengers.

The program works with Airports Council International-North America (ACI-NA) to integrate operational airport design needs into a PPFM tool. When completed, this software package will be transferred to industry for use as a tool in configuring security systems and technologies into the airport environment.

The program and the State of Illinois are cosponsoring research on the security of cargo shipments in transit from remote cargo facilities to airlines' receiving points. The test will determine the feasibility of a positive driver ID and cargo seal system.

The program has interagency agreements with the DOD Office of Special Technology to coordinate activities relative to technology assessments. Also, the agency coordinates efforts with the U.S. Air Force and the DOD Defense Special Weapons Agency related to simulation and modeling of blast effects and biological and chemical effects on aviation facilities.

The ASTI program is the designated lead for the bilateral agreement with Canada's Department of Transport for physical security of airports. Participation in the General Services Administration, Interagency Advisory Committee on Security Equipment (IACSE) provides a forum for technology interchange.

Additionally, grants, cooperative research and development agreements (CRDA), and memorandums of understanding/agreement with industry, academia, and other government agencies provide leverage to the program in areas of mutual interest.

MAJOR ACTIVITIES AND ANTICIPATED FY 1999 ACCOMPLISHMENTS:

Domestic air travel

- Transferred assessments of RF technology for PPBM to industry
- Developed functional specification of cost-benefit model
- Conducted operational test of RF-based baggage-matching system in multiple airports
- Conducted evaluation of security systems to ensure in-transit security of cargo bound for carriage on passenger aircraft
- Developed a protocol standard for explosives detection systems to communicate with baggage-handling systems to ensure accurate tracking of alarmed bags
- Completed passenger and baggage flow model
- Incorporated enhancements to Blast Effects model
- Developed Toxic Effects model

Airport security

- Evaluated COTS airport vulnerability assessment tools and methods
- Refined threat/countermeasures database
- Developed an architecture for security monitoring equipment information integration
- Researched advanced countermeasures
- Developed operational testbed infrastructure in new security operations center

KEY FY 2000 PRODUCTS AND MILESTONES:

Domestic air travel

- Publish a threat analysis report for NAS specific subsystem component
- Publish report on operationally tested RF-based baggage-matching system in multiple airports
- Publish report on systems to ensure in-transit security of cargo bound for carriage on passenger aircraft
- Publish a communication protocol standard for EDS integration into automated baggage handling systems

Airport security

- Integrate EDS and other security vulnerability countermeasures into operational testbeds
- Develop airport vulnerability assessment methods to be used by field personnel
- Perform large-scale demonstration of advanced airport commands and control methods
- Test emerging sensors and systems for low-cost performance intrusion detection

FY 2000 PROGRAM REQUEST:

In FY 2000, the program will complete several key efforts and publish their results for use by the aviation community. These publications will include reports on RF technology that will likely influence establishment of worldwide standards in the field. The program will finalize, in cooperation with industry, a standard for communication between advanced detection systems and automated baggage-handling systems. Such a standard is critical to effective use of the new detection technologies. Additionally, the program will finalize its passenger baggage flow model. Airport and airline planners will use this planning tool to find the most efficient security equipment layout within existing and future terminals. The program will continue to support other aviation security programs by assessing future threats to aviation security, developing sophisticated simulation tools, and addressing new technology integration issues.

A07b - Airport Security Technology Integration Product and Activities	Program Schedule					
	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY2004
073-110 Airport Security Technology Integration						
Domestic Air Travel						
Transferred Radio Frequency (RF) Technology for Positive Passenger Bag Match (PPBM) to Industry	◆					
Update BI-Annual Report on Countermeasures to Identify Advanced Means of Attack Against Civil Aviation	◆		◇		◇	
Publish Threat Analysis Report for NAS Specific Subsystem Components		◇				
Developed Functional Specifications for Cost-Benefit Model	◆					
Publish Report on Operationally Tested RF-based Baggage Matching System in Multiple Airports	◆	◇				
Publish Report on Systems to Ensure In-transit Security of Cargo Bound for Carriage on Passenger Aircraft	◆	◇				
Developed a Protocol Standard for Explosives Detection Systems to Communicate with Baggage Handling Systems to Ensure Accurate Tracking of Alarmed Bags	◆					
Publish a Communication Protocol Standard for EDS Integration into Automated Baggage Handling Systems		◇				
Completed Passenger and Baggage Flow Model	◆					
Developed Blast Effects Model	◆					
Developed Toxic Effects Model	◆					
Airport Security						
Integrate EDS & Other Security Vulnerability Countermeasures into Operational Testbed		◇	◇			
Evaluated Commercial Off The-Shelf (COTS) Airport Vulnerability Assessment Tools and Methods	◆					
Refined Threat/Countermeasures Database	◆	◇	◇	◇	◇	◇
Developed an Architecture for Security Monitoring Equipment Information Integration	◆					
Develop/Refine Airport Vulnerability Assessment Methods to be Used by Field Personnel		◇		◇		◇
Advanced Countermeasures Researched	◆					
Large Scale Demonstration of Advanced Airport Commands and Control Methods		◇	◇			
Testing of Emerging Sensors and Subsystems for Low-Cost Airport Security Devices		◇	◇	◇	◇	◇
Develop/Refine Operational Testbed Infrastructure in New Security Operations Center	◆	◇	◇	◇	◇	◇

Budget Authority ($ in Thousands)	FY 1996 Enacted	FY 1997 Enacted	FY 1998 Enacted	FY 1999 Enacted	FY 2000 Request
Contracts	490	3,165	1,127	1,832	909
Personnel Costs	423	492	1,127	754	1,258
Other Costs	87	101	231	122	118
Total	1,000	3,758	5,000	2,708	2,285

A07c Aviation Security Human Factors

GOALS:

Intended Outcomes: This program supports the goal to improve the detection of explosives and weapons in the security portion of the 1998 FAA Strategic Plan. Specifically, the Aviation Security Human Factors program targets the Strategic Plan's focus areas of establishing a security baseline and defining the information security architecture.

This program leverages funding for equipment development by producing usable and effective products:

- Improved aviation security system performance and efficiency through better operator selection, training, and performance monitoring techniques for the various detection technologies
- Optimized human performance contributions to the overall aviation security system performance, merging individual detection systems into a combined technology system, through enhanced machine interfaces and integration

Agency Outputs: The FAA establishes standards for security activities, and this program conducts R&D for technical input essential to:

- Reduce security costs resulting from automation
- Reduce vulnerability to terrorist threats
- Decrease risk of catastrophic financial loss resulting from airplane sabotage
- Increase public confidence in the safety of air travel
- Increase global U.S. industrial competitiveness

Customer/Stakeholder Involvement: This program supports the Office of the Associate Administrator for Civil Aviation Security as mandated by the Aviation Security Improvement Act of 1990 (Public Law 101-604).

- Responds to requirements from the Aviation Improvement Act of 1990, the White House Commission on Aviation Safety and Security, Baseline Working Group on Aviation Security, and the General Accounting Office (GAO)
- Partners with multiple airlines to test and evaluate equipment, personnel, and procedures

Accomplishments: Results of Aviation Security Human Factors research are used by the Office of Civil Aviation Security in its rulemaking process. Among the results, the program has:

- Refined definition of knowledge, skills, and abilities needed for checkpoint screening
- Developed functional requirements for the Screener Proficiency Evaluation and Reporting System (SPEARS) components of screener selection, training, and performance monitoring
- Measured baseline checkpoint security performance.
- Developed screener selection tests for estimating future performance, interpreting both conventional x-ray and computed tomography (CTX 5000) images
- Developed Computer-Based Training (CBT) for both checkpoint operations and checked baggage evaluation with the CTX 5000
- Developed Threat Image Projection (TIP) for both conventional x-ray machines and the CTX 5000
- Developed dupe checklist system
- Developed manual domestic passive profiling system
- Developed Computer-Assisted Passenger Screening (CAPS) profiling system

R&D Partnerships: This program works closely with a variety of agencies and groups involved in aviation, such as:

- The International Aviation Security Human Factors Technical Advisory Group, to ensure effective communication of research results and avoid duplication of efforts
- Lawrence Livermore National Laboratory, through an interagency agreement
- Cooperative research grants, to develop and operationally test SPEARS screener selection, training, and performance monitoring components

- Domestic airlines and research organizations, including:
  - Alaska Airlines
  - Delta Airlines
  - EG&G Astrophysics Research Corporation
  - Northwest Airlines
  - Public Computer Systems
  - Rapiscan Security Products Inc.

MAJOR ACTIVITIES AND ANTICIPATED FY 1999 ACCOMPLISHMENTS:

Screener selection/training/testing

- Refined definitions of knowledge, skills, and abilities for using emerging detection technologies
- Improved screener selection, screener machine interfaces, CBT multimedia training, and performance monitoring systems for emerging detection technologies
- Criteria and data for rulemaking about screener selection, training, and proficiency assessment

Human systems integration (HSI)

- Completed evaluations of detection systems involving emerging technologies, such as bottle screening and millimeter wave detection
- Optimized combined detection technologies through component integration within futuristic screener stations
- Integrated new and emerging detection technologies into their operational environment
- Provided HSI evaluations on the manpower, personnel, training, human factors engineering, health, and safety aspects of security systems, especially those involving EDS and weapons detection technologies

KEY FY 2000 PRODUCTS AND MILESTONES:

Screener selection/training/testing

- Determine knowledge, skills, and abilities for using emerging detection technologies
- Improve screener selection, screener machine interfaces, CBT multimedia training, and performance-monitoring systems for emerging detection technologies
- Establish criteria and data for rulemaking about screener selection, training, and proficiency assessment

Human systems integration (HSI)

- Continue to evaluate detection systems involving emerging technologies, such as bottle screening and millimeter wave detection
- Integrate new and emerging detection technologies into their operational environment
- Provide HSI evaluations on the manpower, personnel, training, human factors engineering, health, and safety aspects of security systems, especially those involving EDS and weapons detection technologies

FY 2000 PROGRAM REQUEST:

This program focuses on producing key FY 2000 products to accomplish stated goals. Results emphasize R&D within the areas of screener selection/training/testing, and human systems integration. The program improves screener selection, screener machine interfaces, CBT multimedia training, and performance-monitoring systems for emerging detection technologies.

The research provides the basis for establishing criteria and data for rulemaking. It evaluates detection systems involving emerging technologies, such as bottle screening and millimeter wave detection. It also optimizes detection technologies through component integration within futuristic screener stations and integrates new and emerging detection technologies into their operational environment. Finally, it provides Human Systems Integration evaluations on the manpower, personnel, training, human factors engineering, health, and safety aspects of security systems, especially those involving EDS and weapons detection technologies.

A07c - Aviation Security Human Factors Product and Activities	Program Schedule					
	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY2004
076-110 Aviation Security Human Factors						
Screener Selection/Training/Testing						
Determine Knowledge, Skills, & Abilities Required for Screeners to Use Emerging Technologies	◆	◇	◇	◇	◇	◇
Improve Screener Selection, Screener-Machine Interfaces, Training Programs, and Performance Monitoring	◆	◇	◇	◇	◇	◇
Establish Criteria and Data for Rulemaking	◆	◇	◇	◇	◇	◇
Human Systems Integration (HSI)						
Provide HSI Evaluations on Manpower, Personnel, Training, Human Factors Engineering, Health and Safety Aspects of Security Systems	◆	◇	◇	◇	◇	◇
Evaluate New Detection Systems (e.g. Bottle Screening, Millimeter Wave Detection	◆	◇	◇	◇	◇	◇
Integrate New and Emerging Technologies into Operational Environment	◆	◇	◇	◇	◇	◇
Optimize Combined Detection Technologies Within Futuristic Screener Stations	◆	◇	◇	◇	◇	◇

Budget Authority ($ in Thousands)	FY 1996 Enacted	FY 1997 Enacted	FY 1998 Enacted	FY 1999 Enacted	FY 2000 Request
Contracts	2,039	4,446	4,723	4,078	4,114
Personnel Costs	423	492	679	1,064	1,032
Other Costs	87	101	138	140	110
Total	2,569	5,039	5,540	5,282	5,256

A07d Aircraft Hardening

GOALS:

Intended Outcomes: In accordance with the strategic goal of eliminating security incidents in the aviation system, the overriding program goal is to protect commercial aircraft from catastrophic structural or critical system failure due to an in-flight explosion. Secondary objectives are to investigate vulnerability from some spurious electromagnetic or high-energy signal interfering with aircraft electronic systems and to assess the threat presented by manually operated, highly mobile, surface to air missiles.

The program determines and identifies: (1) the minimum size of an explosive that would result in aircraft loss; (2) the methods and techniques that can be applied to the current and future fleet of commercial aircraft to decrease the level of vulnerability to explosive effects; and (3) the threat to aircraft from electromagnetic interference, projected energy, and surface-to-air missiles and practical countermeasures.

Agency Outputs: The program delivers documented explosive vulnerability data to the explosive detection community and, depending on research results, provides recommendations for rulemaking relative to mitigation techniques. In the area of other threats, the program provides reports to the staff of the Associate Administrator for Civil Aviation Security describing specific commercial aircraft vulnerability to threats as well as possible countermeasures. To meet these requirements, the program has been divided into the following three projects: explosive vulnerability and aircraft-design-related mitigation techniques, container hardening, and protection against advanced terrorist threats.

Customer/Stakeholder Involvement: The aircraft hardening program was initiated in 1990 in response to the directives of the President's Commission on Aviation Safety and Security and the mandates set forth in the Aviation Security Improvement Act of 1990. The program is continually assessed by the Security Subcommittee of the FAA R,E&D Advisory Committee and has been subjected to scrutiny and endorsed by the General Accounting Office. The program content directly supports the customer, the Assistant Administrator for Civil Aviation Security, and complies with the aviation security requirements document of the Office of Civil Aviation Security. Additionally, the program, as required, periodically reports technical progress directly to Congress.

Accomplishments:

- Validated established detection standards through analysis and explosive testing of the minimum size, type, and location of explosives that could cause a catastrophic aircraft failure
- Proved the feasibility of and determined the standards for explosive-resistant luggage containers used in wide body aircraft
- Provided prototype containers to the airlines to conduct an operational assessment of the cost and improved security effectiveness of implementing hardened containers as a continuation to the container effort that was suggested by various members of Congress
- Initiated a process, while working with DOD and other Government agencies, to assess the vulnerability of commercial aircraft to terrorist-induced electronic and mobile missile threats

R&D Partnerships: From the outset, the program has used expertise from the U.S. Air Force, U.S. Army, and U.S. Navy, as well as consulted with various Department of Energy laboratories and NASA. Relationships also have been established with the U.S. aircraft and container manufacturing industries, and research efforts have been coordinated with the United Kingdom, Israel, and France. The program also uses the services of many defense- and aircraft-related industries. The prime program objective is to collect data to support rulemaking. As the program uses a wide spectrum of industry experts, the program has transferred or will transfer all developed technologies directly to the appropriate private market.

MAJOR ACTIVITIES AND ANTICIPATED FY 1999 ACCOMPLISHMENTS:

Container hardening

- Transitioned container technologies to private industry

- Completed operational assessment of LD-3 hardened containers with airlines

Aircraft vulnerability

- Identified and validated through testing the vulnerability of narrow body commercial aircraft to explosive effects
- Validated, through explosive testing, the blast effects of a variety of different explosives for refining detection criteria

Projected energy, electromagnetic interference, and other terrorist threats

- Identified possible mitigation techniques to counter projected energy and other threats
- Developed procedures/rules for man portable air defense systems (MANPADS)

KEY FY 2000 PRODUCTS AND MILESTONES:

Container hardening

- Investigate and demonstrate protection for limited number of bags on narrow bodied aircraft
- Complete assessment of other than LD-3 size containers; make the decision on rulemaking

Aircraft vulnerability

- Assess security implications associated with the introduction of 800 passenger jets and/or high-speed civil transports
- Validate appropriate new techniques to mitigate explosive effects
- Develop new aircraft certification criteria

Projected energy, electromagnetic interference, and other terrorist threats

- Develop procedures/rules for electromagnetic interface

FY 2000 PROGRAM REQUEST:

In FY 2000, the program will continue focusing on the areas listed at the beginning of the "Goals" section above. As vulnerability assessments evolve, ideas to mitigate blast either through retrofitting the current fleet or instituting new design techniques and materials are being identified. These ideas and concepts are analyzed and tested and recommendations for new specifications are made as required. Special emphasis is placed on assessing and recommending hardening actions regarding the long-term implications of terrorism on new commercial aircraft concepts, such as the 800- to 1000-passenger jumbos and the high-speed civil transport.

In addition, analyses of the impact of electromagnetic interference, projected energy, and MANPADS on commercial aircraft are underway and anticipated to be complete by the end of FY 2000. These research efforts are primarily investigative in nature and involve an assessment of the potential vulnerability of an aircraft to these threats.

A07d - Aircraft Hardening Product and Activities	Program Schedule					
	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY2004
075-110 Aircraft Hardening						
Container Hardening						
Completed Operational Assessment of LD-3 Hardened Containers with Airlines	◆					
Complete Assessment of Other Than LD-3 Size Containers, Make Decision on Rulemaking	◆			◇		
Investigate and Demonstrate Protection for Limited Number of Bags on Narrow Bodied Aircraft	◆				◇	
Develop rules for narrow body protective units					◇	
Transition Container Technologies to Private Industry	◆				◇	
Aircraft Vulnerability						
Assess Security Implications Associated with the Introduction of 800 Passenger Jets and/or High Speed Civil transports		◇		◇		
Identified and Validated through Testing the Vulnerability of Narrow Body Commercial Aircraft to Explosives Effects	◆					
Projected Energy/Electromagnetics/Other Terrorists Threats						
Identified Possible Mitigation Techniques to Counter Projected Energy and Other Threats	◆					
Develop Procedures/Rules for Electromagnetic Interface			◇			
Develop Procedures/Rules for Projected Energy			◇			
Developed Procedures/ Rules For Man Portable Air Defense Systems (MANPADS)	◆		◇			
Publish Reports Identifying Cost-effective Alternatives For Mitigating The Threat Of Electromagnetic, Projected-energy Weapons and MANPADS				◇		
Assess Aircraft Design implications relative to Chemical/Biological Threats					◇	
Develop procedures/rules for Chemical/Biological Threat						◇

Budget Authority ($ in Thousands)	FY 1996 Enacted	FY 1997 Enacted	FY 1998 Enacted	FY 1999 Enacted	FY 2000 Request
Contracts	2,986	6,268	1,393	1,139	3,371
Personnel Costs	423	492	504	754	1,497
Other Costs	87	101	103	107	133
Total	**3,496**	**6,861**	**2,000**	**2,000**	**5,001**