

GAO

Report to the Chairman, Subcommittee
on Homeland Security, Committee on
Appropriations, House of
Representatives

March 2005

AVIATION SECURITY

Systematic Planning Needed to Optimize the Deployment of Checked Baggage Screening Systems



Highlights of [GAO-05-365](#), a report to the Chairman, Subcommittee on Homeland Security, Committee on Appropriations, House of Representatives

Why GAO Did This Study

Mandated to screen all checked baggage using explosive detection systems at airports by December 31, 2003, the Transportation Security Administration (TSA) deployed two types of screening equipment: explosives detection systems (EDS), which use computer-aided tomography X-rays to recognize the characteristics of explosives, and explosives trace detection (ETD) systems, which use chemical analysis to detect traces of explosive material vapors or residues. This report assesses (1) TSA’s use of budgeted funds to install EDS and ETD systems and the impact of initially deploying these systems, (2) TSA and airport actions to install EDS machines in-line with baggage conveyor systems, and the federal resources made available for this purpose, and (3) actions taken by TSA to optimally deploy checked baggage screening systems.

What GAO Recommends

GAO recommends that the Department of Homeland Security (DHS) direct TSA to take several actions needed to systematically evaluate baggage screening needs at airports, including identifying the costs and benefits of installing in-line EDS systems or stand-alone EDS machines in lieu of ETD machines, and prioritizing those airports where TSA would benefit by such actions. DHS generally concurred with GAO’s findings and recommendations and described corrective actions that it has initiated or plans to take to address the issues identified.
www.gao.gov/cgi-bin/getrpt?GAO-05-365.

To view the full product, including the scope and methodology, click on the link above. For more information, contact Cathleen A. Berrick at (202) 512-3404 or berrickc@gao.gov.

AVIATION SECURITY

Systematic Planning Needed to Optimize the Deployment of Checked Baggage Screening Systems

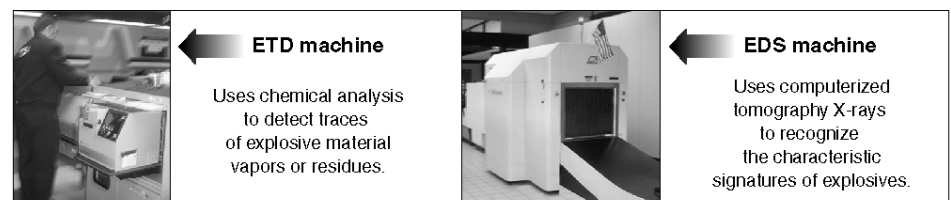
What GAO Found

TSA has made substantial progress in installing EDS and ETD systems at the nation’s more than 400 airports to provide the capability to screen all checked baggage using explosive detection systems, as mandated by Congress. However, in initially deploying EDS and ETD equipment, TSA placed stand-alone ETD and the minivan-sized EDS machines—mainly in airport lobbies—that were not integrated in-line with airport baggage conveyor systems. TSA officials stated that the agency’s ability to initially install in-line systems was limited because of the high costs and the time required for airport modifications. These interim lobby solutions resulted in operational inefficiencies, including requiring a greater number of screeners, as compared with using EDS machines in-line with baggage conveyor systems.

TSA and airport operators are taking actions to install in-line baggage screening systems to streamline airport and TSA operations, reduce screening costs, and enhance security. Eighty-six of the 130 airports we surveyed either have, are planning to have, or are considering installing full or partial in-line systems. However, resources have not been made available to fund these capital-intensive systems on a large-scale basis. Also, the overall costs of installing in-line baggage screening systems at each airport are unknown, the availability of future federal funding is uncertain, and perspectives differ regarding the appropriate role of the federal government, airport operators, and air carriers in funding these systems.

Moreover, TSA has not conducted a systematic, prospective analysis to determine at which airports it could achieve long-term savings and enhance efficiencies and security by installing in-line systems or, where in-line systems may not be economically justified, by making greater use of stand-alone EDS systems rather than relying on the labor-intensive and less efficient ETD screening process. However, at nine airports where TSA has agreed to help fund the installation of in-line baggage screening systems, TSA conducted a retrospective cost-benefit analysis which showed that these in-line systems could yield significant savings for the federal government. TSA further estimated that it could recover its initial investment in the in-line systems at these airports in a little over 1 year.

EDS and ETD Machines Used by TSA to Screen Checked Baggage



Source: GAO.

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Abbreviations

ATSA	Aviation and Transportation Security Act
DHS	Department of Homeland Security
EDS	explosives detection system
ETD	explosives trace detection
FAA	Federal Aviation Administration
LOI	letter of intent
OMB	Office of Management and Budget
TSA	Transportation Security Administration

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United States Government Accountability Office
Washington, DC 20548

March 15, 2005

The Honorable Harold Rogers
Chairman
Subcommittee on Homeland Security
Committee on Appropriations
House of Representatives

Dear Mr. Chairman:

As demonstrated by the 1988 bombing of a U.S. airliner over Lockerbie, Scotland, U.S. commercial aircraft have long been a target for terrorist attacks through the use of explosives carried in checked baggage. In 1996, the Federal Aviation Administration (FAA) established a long-term goal of screening all checked baggage for explosives to prevent such attacks and a timetable for deploying explosive detection systems at all airports by 2014. The terrorist attacks of September 11, 2001, however, increased the federal government's focus on screening checked baggage for explosives at U.S. airports. On November 19, 2001, the Aviation and Transportation Security Act (ATSA)¹ was signed into law, creating the Transportation Security Administration (TSA) and mandating, among other things, the screening of all checked baggage using explosive detection systems by December 31, 2002. To satisfy this mandate, TSA deployed two types of screening equipment to all airports in the United States where screening is required: (1) explosives detection systems (EDS), which use computer-aided tomography X-rays adapted from the medical field to automatically recognize the characteristic signatures of threat explosives and (2) explosives trace detection (ETD), which uses chemical analysis to detect traces of explosive materials' vapors and residue.

As we reported in February 2004, largely because of shortages of equipment and insufficient time to modify airports to accommodate EDS machines, TSA was unable, at certain airports, to meet the 2002 congressionally established deadline to screen all checked baggage for explosives using EDS and ETD machines.² Recognizing the obstacles

¹Aviation and Transportation Security Act, Pub. L. No. 107-71, 115 Stat. 597 (2001).

²GAO, *Aviation Security: Challenges Exist in Stabilizing and Enhancing Passenger and Baggage Screening Operations*, [GAO-04-440T](#) (Washington, D.C.: February 12, 2004).

encountered by TSA, Congress passed, and the President signed into law, the Homeland Security Act of 2002,³ which, in effect, extended the deadline for screening all checked baggage for explosives until December 31, 2003, for airports at which TSA was unable to meet the earlier deadline established by ATSA. We also reported that TSA fell short of fully satisfying the extended 2003 mandate and continued to face challenges in deploying and leveraging screening equipment and technologies. To further assess TSA's efforts to deploy equipment and screen checked baggage for explosives using EDS and ETD, we addressed the following questions: (1) How did TSA use the funds it initially budgeted to procure and install EDS and ETD systems and make associated airport modifications, and what was the impact of the initial deployment of EDS and ETD systems? (2) What actions are airports and TSA currently taking to install automated in-line EDS baggage screening systems,⁴ and what are the federal resources that have been made available to fund these systems? (3) What actions, if any, is TSA taking to plan for the optimal deployment of EDS and ETD equipment, including in-line checked baggage screening systems, in order to ensure the efficiency, cost effectiveness, and security of its checked baggage screening operations?

To address these objectives, we reviewed available documentation on TSA's checked baggage screening program, including contract obligations for modifying airports and procuring and installing EDS and ETD systems, inventory listings of EDS and ETD systems, funding and planning documentation for in-line systems, and cost analysis of in-line and stand-alone EDS equipment. Although we could not independently verify the reliability of all of this information, we compared it with other supporting documents, when available, to determine data consistency and reasonableness. On the basis of these efforts, we believe the information we obtained is sufficiently reliable for this report. We also reviewed the results of covert testing (undercover and unannounced) of checked baggage screening operations conducted by TSA's Office of Internal Affairs and Program Review and questioned TSA officials about the procedures used to ensure the reliability of the covert test data. Based on their answers, we believe that the covert test data are sufficiently reliable for the purposes of our review. Further, we interviewed officials from

³Homeland Security Act of 2002, Pub. L. No. 107-296, 116 Stat. 2135.

⁴In-line EDS checked baggage screening systems typically involve checked baggage undergoing automated screening with EDS machines while on a conveyor belt that sorts and transports baggage to the proper location for its ultimate loading onto an aircraft.

TSA, air carriers, airports, EDS and ETD equipment manufacturers, and airport industry associations to obtain information regarding TSA's efforts to improve checked baggage screening operations using EDS machines. We performed our work at TSA headquarters and 22 airports throughout the United States. At the airports we visited, we observed baggage screening procedures and discussed these procedures with TSA, airport, and airline officials. We chose these 22 airports based on one or more of the following factors: a large number of passenger boardings, the existence of an operational in-line system, whether the airport had received or requested TSA funding for an in-line system, whether the airport had begun screening all checked baggage using EDS or ETD, and the proximity to a larger airport also being visited by GAO. In addition, we surveyed all 155 federal security directors, who oversee federal security operations at one or more airports in the United States where screening is required to obtain their perspectives on the implementation of checked baggage screening operations at 263 airports under their supervision, and to obtain information on these airports' plans regarding the incorporation of EDS machines within the airports' baggage conveyor systems for screening checked baggage for explosives. We conducted our work from September 2003 through January 2005 in accordance with generally accepted government auditing standards. A detailed discussion of our scope and methodology is contained in appendix I. Terms used in this report are further defined in a glossary at the end of this report.

Results in Brief

From its creation in November 2001 through September 2004, TSA obligated about \$2.5 billion (93 percent) of the approximately \$2.7 billion it had budgeted for fiscal years 2002 through 2004 for procuring and installing explosive detection equipment—predominantly to screen checked baggage for explosives—and making associated airport modifications to accommodate the equipment.⁵ Specifically, TSA procured and placed about 1,200 EDS machines and about 6,000 ETD machines at over 400 airports and modified airports for the installation of this equipment. Although TSA made significant progress in fielding EDS and ETD equipment to the nation's airports, TSA placed this equipment in a stand-alone mode—usually in airport lobbies—to conduct the primary screening of checked baggage for explosives, rather than integrating EDS machines in-line with airports' baggage conveyor systems. TSA officials

⁵Obligations are amounts of orders placed or contracts awarded during a given period that will require payment during the same or a future period.

stated that they use EDS machines in stand-alone mode and ETD machines as an interim solution in order to meet the congressional deadline for screening all checked baggage for explosives. Officials stated that they employed these interim solutions because of the significant costs required to install in-line systems and the need to reconfigure many airports' baggage conveyor systems to accommodate the equipment. These interim screening solutions led to operational inefficiencies, including requiring a greater number of screeners and screening fewer bags for explosives each hour, as compared with using EDS machines in-line with baggage conveyor systems. Performing primary screening using ETD machines, as is the case for more than 300 airports, is more labor intensive and less efficient than screening using the EDS process. TSA's placement of stand-alone EDS and ETD machines in airport lobbies also resulted in passenger crowding, which presented unsafe conditions and may have added security risks for passengers and airport workers. Certain information we obtained and analyzed regarding explosive detection technologies and their effectiveness in TSA's checked baggage screening operations are classified or are considered by TSA to be sensitive security information. Accordingly, the results of our review of this information have been removed from this report.⁶

TSA and airport operators are taking actions to install in-line EDS baggage screening systems—to streamline airport and TSA operations, reduce screening costs, and enhance security—but resources have not been made available to fund these systems on a large-scale basis. Most airports that have installed or are planning to install these capital-intensive in-line systems have relied on or plan to rely on some form of federal funding to help install the systems. Although TSA and airports operators are taking actions to install in-line EDS baggage screening systems, identifying the resources to fund the systems on a large-scale basis continues to be a challenge. The issuance of letter of intent (LOI) agreements—TSA's primary method for funding in-line systems—has been limited to nine airports. An LOI, though not a binding commitment of federal funding, represents an intent by TSA to provide funds in future years if they are

⁶We issued two additional reports detailing the results of our review, which discuss results deemed to be classified or sensitive security information. The report that contains classified and sensitive security information is GAO, *Aviation Security: Systematic Planning Needed to Optimize the Deployment of Checked Baggage Screening Systems*, GAO-05-135C (Washington D.C.: February 4, 2005). The report containing sensitive security information but not the classified information is GAO, *Aviation Security: Systematic Planning Needed to Optimize the Deployment of Checked Baggage Screening Systems*, GAO-05-302SU (Washington D.C.: February 4, 2005).

appropriated by Congress. This in turn enables an airport to proceed with a project, such as installing in-line baggage screening systems, because the airport and investors are aware that allowable costs will likely be reimbursed. Further, TSA has not determined the total cost of installing in-line EDS baggage screening systems at airports determined to need these systems, the availability of funding for in-line systems is uncertain, and perspectives differ regarding the appropriate role of the federal government and airport operators in funding these systems.

Moreover, TSA has not yet conducted the systematic analyses needed to plan for optimally deploying EDS and ETD equipment—including installing in-line EDS baggage screening systems or replacing ETD machines with stand-alone EDS machines—at the nation’s more than 400 airports to enhance security and reduce TSA staffing requirements and long-term costs. Although TSA established criteria to prioritize airport eligibility for receiving LOI funds for in-line EDS systems and conducted a limited retrospective analysis for the nine airports that received LOI agreements, TSA has not conducted a prospective analysis to determine at which airports it could achieve long-term savings and improved security benefits by installing in-line baggage screening systems rather than continuing to rely on labor-intensive stand-alone EDS and ETD machines to screen checked baggage for explosives. TSA’s retrospective cost-benefit analysis conducted on the nine airports with signed LOI agreements to install in-line screening systems found that significant savings and other benefits, including reduced screener staffing requirements and increased baggage throughput, may be achieved through the installation of in-line systems. Also, for airports where in-line systems may not be economically justified because of the high cost of installing these systems, TSA has not conducted an analysis to determine whether it could achieve savings and other benefits by making greater use of stand-alone EDS systems rather than relying on the use of less efficient and more labor-intensive ETD machines at these airports. Further, although Congress has directed TSA to continue submitting quarterly reports on its plans for installing in-line baggage screening systems, TSA has not yet provided all of the information requested by Congress.⁷

⁷Conference Report 108-774 (Oct. 9, 2004), which accompanies the fiscal year 2005 Department of Homeland Security Appropriations Act, Pub. L. No. 108-334, 118 Stat. 1298 (2004), directs that TSA continue submitting quarterly reports on its plans for installing in-line systems, consistent with similar language included in House Report 108-169 (June 23, 2003), directing that TSA submit quarterly reports beginning September 1, 2003.

We are recommending that the Secretary of the Department of Homeland Security (DHS) direct the TSA Administrator to systematically evaluate baggage screening systems at the nation's airports to include the costs and benefits associated with installing in-line EDS baggage screening systems and deploying stand-alone EDS machines—in lieu of ETD machines—to conduct the primary screening of checked baggage at airports where an in-line system would not be cost-effective or for justified other reasons. We also made a recommendation to DHS addressing TSA's protocols for screening checked baggage and associated screener training, which is included in the restricted versions of this report.

We provided a draft of this report to DHS for its review. DHS, in its written comments, generally concurred with our findings and recommendations, and agreed that efforts to implement the recommendations are critical to a successful checked baggage screening program. DHS described some actions TSA has initiated to implement these recommendations, including conducting an analysis of the deployment of in-line checked baggage screening systems, and an analysis of those airports that would benefit from replacing ETDs with stand-alone EDS equipment. A copy of DHS's comments is included as appendix V.

Background

With the passage of ATSA in November 2001, TSA assumed from FAA the majority of the responsibility for securing the commercial aviation system.⁸ Under ATSA, TSA is responsible for ensuring that all baggage is properly screened for explosives at airports in the United States where screening is required, and for the procurement, installation, and maintenance of explosive detection systems used to screen checked baggage for explosives. ATSA required that TSA screen 100 percent of checked baggage using explosive detection systems by December 31, 2002. As it became apparent that certain airports would not meet the December 2002 deadline to screen 100 percent of checked baggage for explosives, the Homeland Security Act of 2002 in effect extended the deadline to December 31, 2003, for noncompliant airports.⁹ Prior to the passage of

⁸For additional details on ATSA and other legislation related to checked baggage screening, see appendix II.

⁹ATSA also authorized the use of alternative means to screen checked baggage, such as positive passenger bag match (i.e., air carriers determining whether the passenger is on the same aircraft as the checked baggage), canine searches, and searches of bags by hand for time periods when airports were not able to screen 100 percent of checked baggage using explosive detection equipment.

ATSA in November 2001, only limited screening of checked baggage for explosives occurred. When this screening took place, air carriers had operational responsibility for conducting the screening, while FAA maintained oversight responsibility. With the passage of ATSA, TSA assumed operational responsibility from air carriers for screening checked baggage for explosives. Airport operators and air carriers continued to be responsible for processing and transporting passenger checked baggage from the check-in counter to the airplane.

Explosive detection systems include EDS and ETD machines (see figs. 1 and 2). EDS machines use computer-aided tomography X-rays adapted from the medical field to automatically recognize the characteristic signatures of threat explosives. By taking the equivalent of hundreds of X-ray pictures of a bag from different angles, the EDS machine examines the objects inside of the baggage to identify characteristic signatures of threat explosives. TSA has certified, procured, and deployed EDS machines manufactured by two companies. ETD machines work by detecting vapors and residues of explosives. Human operators collect samples by rubbing bags with swabs, which are chemically analyzed to identify any traces of explosive materials. ETD is used both for primary, or the initial, screening of checked baggage, as well as secondary screening, which resolves alarms from EDS machines that indicate the possible presence of explosives inside a bag. TSA has certified, procured, and deployed ETD machines from three manufacturers.

Figure 1: EDS Machine Used by TSA to Screen Checked Baggage



Source: GAO.

Figure 2: ETD Machine Used by TSA to Screen Checked Baggage



Source: GAO.

The operational processes for conducting screening of checked baggage for explosives using ETD and EDS machines differ. Specifically, the ETD

screening process requires the screener to manually screen checked baggage by (1) swabbing an area of, or item in, the checked bag and (2) placing the swab in the ETD machine. The ETD machine then evaluates the sample on the swab to detect trace amounts of explosive residue. If these steps are not conducted correctly, the test may fail to detect explosives that are present. Since the first steps of this process require screeners to collect explosive particles, they are vulnerable to human error. In contrast, when using EDS machines as the primary means of detection, the screening is automated and the machine either alarms indicating the possible presence of explosives or does not alarm without screener involvement.

As we reported in February 2004, to initially deploy EDS and ETD equipment to screen 100 percent of checked baggage for explosives, TSA implemented interim airport lobby solutions and in-line EDS baggage screening systems.¹⁰ The interim lobby solutions involved placing stand-alone EDS and ETD machines in the nation's airports, most often in airport lobbies or baggage makeup areas where baggage is sorted for loading onto aircraft. For EDS in a stand-alone mode (not integrated with airport's or air carrier's baggage conveyor system) and ETD, TSA screeners are responsible for obtaining the passengers' checked baggage from either the passenger or the air carrier, lifting the bags onto and off of EDS machines or ETD tables, using TSA protocols to appropriately screen the bags, and returning the cleared bags to the air carriers to be loaded onto departing aircraft.

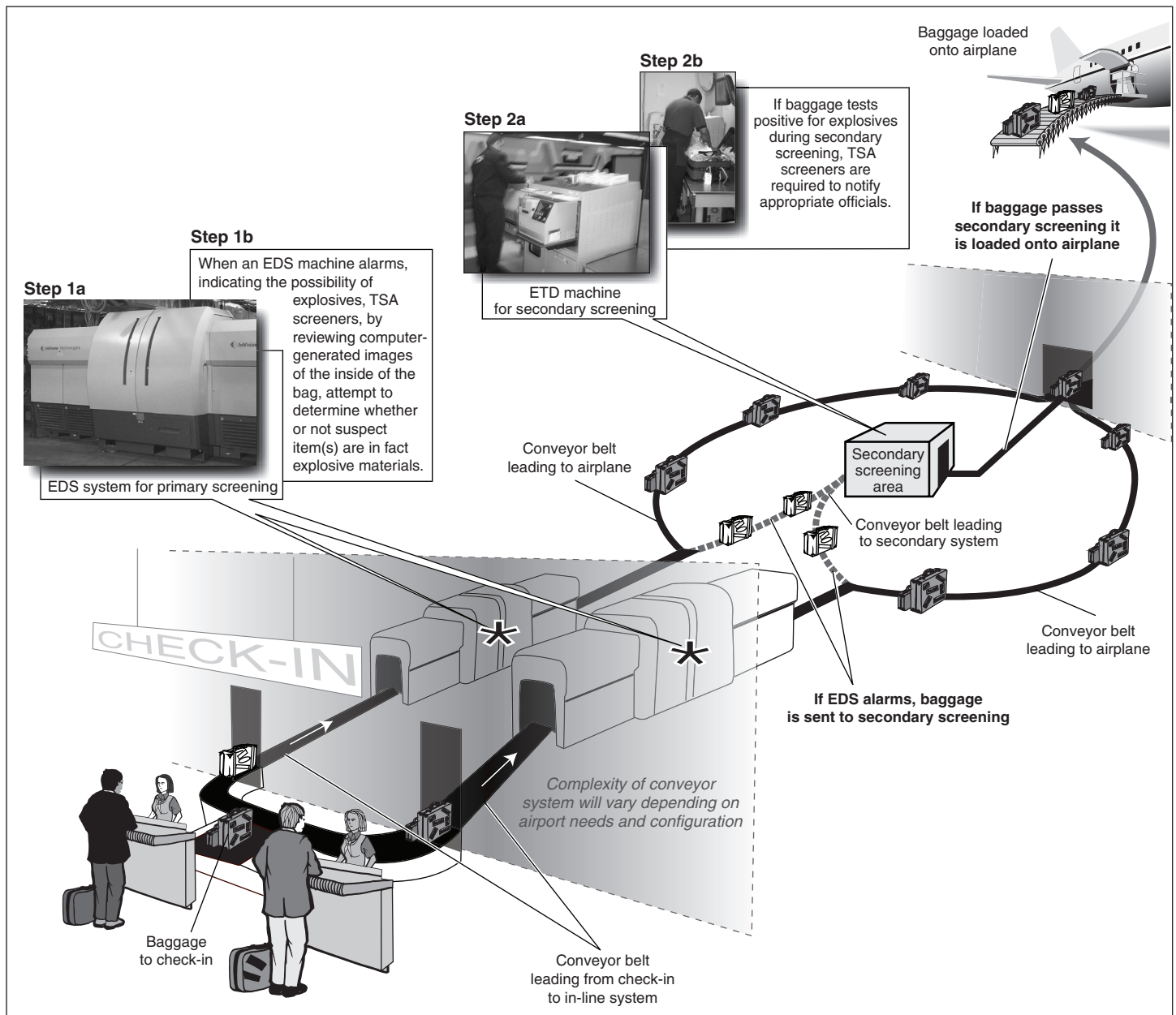
In addition to installing stand-alone EDS and ETD machines in airport lobbies and baggage makeup areas, TSA collaborated with some airport operators and air carriers to install integrated in-line EDS baggage screening systems within their baggage conveyor systems. While each in-line baggage screening system is unique, these systems generally operate in a similar manner, as shown in figure 3. Typically, in-line systems involve checked baggage undergoing automated screening while on a conveyor belt that sorts and transports baggage to the proper location for its ultimate loading onto an aircraft. During this automated process, all checked baggage on the conveyor belt passes through EDS machines where the bags are screened for explosives. If no explosives are detected during this primary screening, the bag continues forward on the main conveyor belt to be loaded onto the aircraft. If an EDS machine alarms,

¹⁰[GAO-04-440T](#).

indicating the possibility of explosives, TSA screeners, by reviewing computer-generated images of the inside of the bag, attempt to determine whether a suspect item is actually a threat.¹¹ If the screener determines that the suspect item is not a threat, the cleared bag continues on the conveyor belt system to be loaded onto the aircraft. If the screener is unable to make this determination, the bag is diverted from the main conveyor belt into an area where it receives a secondary screening in which the bag is opened and the contents of the bag are screened by a screener using an ETD machine and physical inspection. If the bag successfully clears secondary screening, it is placed on the main conveyor belt system to be loaded onto the aircraft. If the bag tests positive for explosives during secondary screening, TSA screeners are required to notify the appropriate officials.

¹¹This review procedure is known as on-screen alarm resolution, which TSA began to implement in May 2004 after pilot testing the procedure at several airports. To enhance the efficiency of an in-line screening system, TSA also may network several EDS machines together so that images from multiple EDS machines that alarm can be sent to a centralized location for screeners to review and resolve using the on-screen resolution procedure. This process is known as “multiplexing.”

Figure 3: In-line Checked Baggage Screening System



Source: GAO and Nova Development Corporation.

Both airports and the federal government have cooperated to jointly fund the installation of in-line EDS baggage screening systems. The federal government has used three funding mechanisms to modify airport

facilities to install in-line EDS systems—LOIs, other transaction agreements, and Airport Improvement Program funds from the FAA.¹² In 2003, Congress authorized TSA to issue LOIs for airport modifications related to the installation of in-line baggage screening systems.¹³ When an LOI is established to provide multiyear funding for a project, the airport operator is responsible for providing—up front—the total funding needed to complete the project, even though the LOI is not a binding commitment of federal funds. Work proceeds with the understanding that TSA will, if sufficient funding is appropriated, reimburse the airport operator for a percentage of the facility modification costs. Congress initially mandated a 75 percent federal government cost-share for LOIs in February 2003, but in December of that year it increased the cost-share to 90 percent.¹⁴ However, the fiscal year 2005 DHS Appropriations Act subsequently re-established the federal government cost-share at 75 percent for fiscal year 2005. Also, the President's fiscal year 2006 budget request for TSA proposes to maintain the 75 percent federal government cost share for projects funded by LOIs at large and medium airports.

TSA also uses other transaction agreements, which are administrative vehicles used by TSA to directly fund airport operators engaged, or planning to engage, in smaller in-line airport modification projects without undertaking a long-term commitment. These transactions, which can take many forms and are generally not required to comply with federal laws and regulations that apply to contracts, grants, or cooperative agreements, enable the federal government and others entering into these agreements to freely negotiate provisions that are mutually agreeable.

¹²As described below and in appendix II, Congress has supported in-line EDS baggage screening systems by authorizing funding mechanisms and appropriating funds, and issuing calls for expediting the installation of such systems. However, Congress does not require that in-line systems be installed to satisfy the 100 percent explosive detection system screening mandate.

¹³Consolidated Appropriations Resolution, 2003, Pub. L. No. 108-7, § 367, 117 Stat. 11.

¹⁴The Consolidated Appropriations Resolution mandated that each LOI provide for a 75 percent federal cost-share of the project's cost, with the remaining 25 percent to be paid by the airport operator at airports with at least 0.25 percent of the total number of passenger boardings each year at all airports (and 90 percent for projects at all other airports).

The Vision 100—Century of Aviation Reauthorization Act (Vision 100), Pub. L. No. 108-176, 117 Stat. 2490 (2003), instituted a 90 percent federal cost-share of the project's cost, with the remaining 10 percent to be paid by the airport operator at medium and large hub airports (and 95 percent for projects at any other airport).

In addition, airports have utilized Airport Improvement Program grants, which are awarded by the Secretary of Transportation for airport planning and development to maintain a safe and efficient nationwide system of public airports and for limited aviation security purposes. Some airport operators used the Airport Improvement Program in fiscal years 2002 and 2003 to fund facility modifications needed to accommodate installing in-line systems. However, provisions of ATSA and the Vision 100—Century of Aviation Reauthorization Act (Vision 100), as well as fiscal years 2004 and 2005 appropriations language, have limited the future availability of the Airport Improvement Program to fund in-line systems.¹⁵

TSA Equipped More than 400 Airports to Screen Checked Baggage for Explosives, but the Initial Deployment Led to Operational Inefficiencies, and Additional Security Risks

Since its inception in November 2001 through September 2004, TSA obligated about \$2.5 billion (93 percent) of the approximately \$2.7 billion it budgeted for fiscal years 2002 through 2004 for the procurement and installation of EDS and ETD machines to screen checked baggage for explosives and to modify airport facilities to accommodate this equipment. Although TSA made significant progress in fielding this equipment, TSA used most of the \$2.5 billion to design, develop, and deploy interim lobby screening solutions rather than install more permanent in-line EDS baggage screening systems. TSA employed these as interim solutions in order to meet the congressional deadline for screening all checked baggage for explosives because of the significant costs required to install in-line systems and the need to reconfigure many airports' baggage conveyor systems to accommodate the equipment. TSA officials also stated that they did not have time to conduct the planning needed or make airport modifications required for longer-term and more streamlined baggage screening operations. However, these interim lobby screening solutions used by TSA resulted in operational inefficiencies and additional security risks. Specifically, TSA's use of stand-alone EDS and ETD machines required a greater number of screener staff and resulted in screening fewer bags for explosives per hour, as compared with using EDS

¹⁵Section 119 of ATSA significantly increased the amount of Airport Improvement Program funds available for security-related projects but also provided that this increase would be substantially reduced at the conclusion of fiscal year 2002. In December 2003, section 142 of Vision 100 further reduced the availability of Airport Improvement Program funds by limiting the sources from which Airport Improvement Program funds could be used for security-related improvements. Subsequent prohibitions on the use of Airport Improvement Program funds for activities related to the installation of in-line explosive detection systems arose in the fiscal year 2004 Consolidated Appropriations Act, Pub. L. No. 108-199, 118 Stat. 283, enacted in January 2004, and again in the fiscal year 2005 Consolidated Appropriations Act, Pub. L. No. 108-447, 118 Stat. 2809, enacted in December 2004.

machines in-line with baggage conveyor systems. Also, screening with ETD machines, as is the case for more than 300 airports, is more labor-intensive and less efficient than screening using the EDS process. TSA officials also raised concerns about the possible security risks caused by baggage screening equipment being located in airport lobbies—causing overcrowding due to passengers waiting to have their bags screened.

TSA Procured and Installed Explosive Detection Equipment and Modified Airports to Integrate this Equipment to Screen Checked Baggage for Explosives

TSA used most of the airport modification and equipment procurement and installation funds to deploy interim lobby screening solutions at more than 400 airports to provide the means for screening all checked baggage for explosives as mandated by the Congress. As shown in table 1, the Congress earmarked about \$1.5 billion of the \$2.7 billion budgeted amount specifically to install EDS and ETD equipment, and to modify and prepare airport facilities to incorporate the use of this equipment for screening checked baggage for explosives. Congress earmarked and TSA budgeted the remaining \$1.2 billion for the procurement of EDS and ETD machines.

Table 1: Airport Modification, Procurement, and Installation Funding for EDS/ETD Equipment for Fiscal Years 2002-2004

Dollars in millions

	Public law	Airport modification and EDS/ETD installation funds	EDS/ETD procurement funds	Total
Fiscal year 2002 TSA budget (not earmarked)				
EDS/ETD procurement		\$0.0	\$703.5	\$703.5
Other non earmarked TSA funding		\$0.0	\$156.0	\$156.0
Total non earmarked budget		\$0.0	\$859.5	\$859.5
Earmarked TSA appropriations^a				
Fiscal year 02 supplemental	107-206	\$738.0		\$738.0
Fiscal year 03 consolidation	108-7	\$265.0	\$174.5	\$439.5
Fiscal year 03 emergency wartime supplemental	108-11	\$235.0		\$235.0
Fiscal year 04 DHS appropriations	108-90	\$249.4	\$149.7	\$399.1
Total earmarked appropriations		\$1,487.4	\$324.2	\$1,811.6
Total fiscal year 2002-2004 EDS/ETD funding^b		\$1,487.4	\$1,183.6	\$2,671.1
Less amount obligated as of September 30, 2004		(\$1,307.4)	(\$1,183.4)	(\$2,490.8)
Amount available for additional obligation as of September 30, 2004 ^b		\$180.0	\$0.3	\$180.3

Source: GAO analysis of TSA data.

^aThese earmarked appropriations are funds that Congress has specified can be spent by TSA only for the particular purpose indicated in the table.

^bTotals may not add because of rounding.

As of the end of fiscal year 2004, TSA used about one-half of the \$2.5 billion that it had obligated to modify airport facilities and to install EDS and ETD machines, and the remaining half primarily to procure EDS and ETD machines. As of September 30, 2004, TSA had obligated approximately \$1.3 billion of the approximately \$1.5 billion that had been earmarked for airport modifications and the installation of EDS and ETD equipment. As shown in table 2, TSA had used about \$885 million (about 68 percent) of these obligated funds for the general deployment and installation of EDS and ETD equipment at various airports as part of interim lobby solutions to quickly install checked baggage screening equipment. Also included in this amount are funds that TSA used for installing interim partial in-line baggage screening systems at some airports. In general, these systems were for sections of an airport, were not fully integrated into the airport's baggage handling system, and most often were temporary until a permanent in-line system could be installed. For example, TSA awarded the Port of Seattle about \$9 million for the construction of interim partial in-line systems and modification of the

baggage handling systems serving four airlines at the Seattle-Tacoma International Airport. These interim partial in-line systems, which are not fully integrated with the baggage handling systems, will be replaced by permanent in-line baggage screening systems that will be fully integrated with the airport's baggage handling systems by March 2007. Most of the remaining airport modification and equipment installation obligations are being used by TSA for work related to the permanent in-line integration of EDS baggage screening equipment into airportwide or individual terminal baggage conveyor systems at 33 airports. See appendix III for a listing of the 33 airports having in-line baggage screening systems installed and the source of TSA funding for the in-line systems.

Table 2: Fiscal Year 2002-2004 Airport Modification and EDS/ETD Installation Obligations as of September 30, 2004

Dollars in millions		
Reason for obligation	Amount obligated	Percentage ^b
Funding for general interim lobby deployment and integration of EDS and ETD equipment for screening checked baggage		
Planning, designing, and airport structural modification work performed at over 400 airports by TSA's prime contractor, Boeing Service Company and its subcontractors ^a	\$843.3	
Work performed by other individual contractors and EDS manufacturers	\$32.8	
Costs associated with transporting and upgrading EDS/ETD equipment	\$8.5	
Subtotal^b	\$884.7	68
Funding for permanent in-line integration of EDS screening equipment into airportwide or individual terminal baggage conveyor systems at 33 airports		
Initial letter of intent funding to nine airports for airport modification	\$259.4	
Other transaction agreement funding to eight airports for airport modification	\$82.6	
Airport modification and EDS equipment installation work performed by Boeing Service Company, other contractors, and EDS manufacturers at 25 airports	\$52.2	
Subtotal^b	\$394.3	30
Funding for engineering, testing, and analytical support services		
Engineering, testing, and analytical support services to TSA for airport facility modification and EDS/ETD installation activities	\$28.4	2
Total obligated^b	\$1,307.4	

Source: GAO analysis of TSA data.

^aSome of these funds were used for the permanent in-line installation and integration of EDS equipment into baggage conveyor systems at eight airports including two category X, and six category I and II airports. We were unable to determine the amount expended for this effort because at the time the work was accomplished, TSA did not require Boeing Service Company, the prime contractor responsible for deploying EDS and ETD equipment, to track obligations and expenditures at the airport level.

^bTotals and subtotals may not add because of rounding.

TSA contracted with Boeing Service Company in June 2002 to be the prime contractor for deploying EDS and ETD equipment at the nation's airports. This effort involved designing and implementing airport facility modifications for EDS and ETD equipment, such as new construction, infrastructure reinforcement, and modification of electrical systems required to install the EDS and ETD equipment. Originally, the period of performance for this contract was to expire on December 31, 2002. However, TSA extended the contract's period of performance in order for Boeing to perform activities associated with installing interim lobby solutions to help airports meet or to maintain compliance to screen 100 percent of checked baggage with explosive detection systems. These contract extensions have resulted in a \$486.3 million increase in TSA

obligations against this contract for work related to airport modifications and EDS and ETD installation from \$372.6 million in fiscal year 2002 to \$858.8 million as of September 30, 2004.¹⁶ Boeing had expended most (98 percent) of these funds for interim lobby screening solutions.

As of September 30, 2004, TSA had obligated almost 100 percent of the approximately \$1.2 billion that had been budgeted or earmarked for procurement of EDS and ETD machines. As shown in table 3, about 80 percent of these funds has been obligated for procuring EDS machines, with most of the remaining funding being obligated for procuring ETD machines.

¹⁶As of September 30, 2004, TSA has obligated \$1.3 billion against the Boeing contract; in addition to the \$858.8 million for airport modification and EDS/ETD installation, Boeing is receiving \$297.4 million for EDS/ETD maintenance, \$134.9 million for training baggage screeners, and \$2.5 million for EDS/ETD transportation and other costs.

Table 3: Fiscal Year 2002-2004 EDS/ETD Procurement Obligations as of September 30, 2004

Dollars in millions		Amount obligated		
Item/task description	Number of units	Subtotal	Total	Percent
Procurement of EDS machines and associated equipment				
Invision EDS machines and associated equipment				
CTX 2500 EDS designed for stand-alone configuration	82	\$31.0		
CTX 5500 EDS designed for both stand-alone or in-line configurations	357	\$190.5		
CTX 9000 EDS designed for in-line configuration	246	\$284.4		
EDS machine manufacturing ramp-up, engineering services and other costs		\$17.3		
L3 Examiner 6000 EDS designed for both stand-alone or in-line configurations	519	\$428.7		
Total EDS procurement	1,204		\$951.9	80
Procurement of ETD machines, parts and consumables				
Ionscan 400B ETD machines, parts, and consumables	3,162	\$121.5		
Itemiser ETD machines, parts, and consumables	1,785	\$65.5		
EGIS-II ETD machines, parts, and consumables	700	\$32.5		
Total ETD procurement	5,647		\$219.5	19
Other services and equipment procurement				
Other engineering, testing, and analytical support services to TSA for airport facility modification and EDS/ETD installation activities		\$6.6		
X-ray machines and other services		\$3.6		
Transportation of EDS equipment within and between airports		\$1.0		
Other charges for services and supplies		\$0.9		
Total other services and equipment			\$12.1	1
Total obligated^a			\$1,183.4	

Source: GAO analysis of TSA data.

^aTotal does not add because of rounding.

Table 4 summarizes the location of EDS and ETD equipment at the nation's airports by airport category,¹⁷ based on a June 2004 TSA inventory listing. The number of machines shown in table 4 includes EDS and ETD

¹⁷ TSA classifies the over 400 airports in the United States into one of five categories—X, I, II, III, and IV. Generally, category X airports have the largest number of passenger boardings, and category IV airports have the smallest number.

machines procured by both TSA and FAA prior to and during the establishment of TSA.

Table 4: EDS and ETD Machines Deployed at U.S. Airports as of June 2004

Airport category	Number		
	Airports	EDS machines	ETD machines
X	21	679	2,833
I	61	467	2,401
II	50	71	695
III	124	9	744
IV	190	2	473
Total	446	1,228	7,146

Source: GAO analysis of TSA data.

TSA's Initial Deployment of EDS and ETD Machines Resulted in Interim Solutions for Screening with Stand-alone Equipment Located Mainly in Airport Lobbies

Although TSA made significant progress in fielding EDS and ETD equipment to the nation's airports to screen checked baggage for explosives, as mandated by Congress, TSA primarily used this equipment as part of interim lobby solutions to screen checked baggage for explosives, rather than the permanent integration of EDS machines in-line with airport baggage conveyor systems. TSA fielded most of the EDS and ETD machines needed to screen checked baggage for explosives to the nation's over 400 airports by the congressionally mandated date of December 2003 (extended from the original deadline of December 2002), despite limited time to deploy the equipment and some of the equipment not being available when needed. In 1996, FAA, the organization then responsible for the procurement of checked baggage screening equipment, established a long-term goal of fielding explosive detection systems at all airports within 18 years—by 2014. As of June 2002, we reported that FAA had fielded 200 EDS and 200 ETD systems to 56 airports.¹⁸ In about two and one-half years following the mandate to screen all checked baggage for explosives, TSA's deployment of equipment resulted in 1,228 EDS machines and 7,146 ETD machines being available in over 400 airports, as shown in table 4. Initially, EDS manufacturers were unable to produce and deliver the number of machines needed by TSA, and TSA determined that a mix of EDS and ETD technologies would provide an efficient and effective means of passenger protection.

¹⁸GAO, *Aviation Security: Transportation Security Administration Faces Immediate and Long-Term Challenges*, [GAO-02-971T](#) (Washington, D.C.: July 25, 2002).

During our site visits to 22 category X, I, and II airports, we observed that in most cases, TSA used stand-alone EDS machines and ETD machines as the primary method for screening checked baggage.¹⁹ Generally, this equipment was located in airport lobbies and in baggage makeup areas. In addition, in our survey of 155 federal security directors, we asked the directors to estimate, for the 263 airports included in the survey, the approximate percentage of checked baggage that was screened on or around February 29, 2004, using EDS, ETD, or other approved alternatives for screening baggage such as positive passenger bag match or canine searches.²⁰ As shown in table 5, the directors reported that for 130 large to medium-sized airports in our survey (21, 60, and 49 category X, I, and II airports, respectively), most of the checked baggage was screened using stand-alone EDS or ETD machines. The average percentage of checked baggage reported as screened using EDS machines at airports with partial or full in-line EDS capability ranged from 4 percent for category II airports to 11 percent for category X airports. In addition, the directors reported that ETD machines were used to screen checked baggage 93 to 99 percent of the time at category III and IV airports, respectively.

¹⁹The 22 airports included 12 category X, 9 category I, and 1 category II airports.

²⁰A TSA federal security director oversees federal security operations at one or more U.S. commercial airports and has operational responsibility for the screening of passengers and checked baggage.

Table 5: Average Percentage of Checked Baggage Reported as Screened Using EDS, ETD, or Other Approved Method at 263 Airports on or around February 29, 2004

Airport category	X	I	II	III	IV	Total
Number of airports	21	60	49	73	60	263
Percentage of checked baggage screened using:						
EDS (at airports with no in-line EDS capability)	59	59	27	6	0	25
EDS (at airports with partial or airportwide in-line EDS capability)	11	8	4	0	0	3
Total^a EDS	70	67	32	6	0	28
ETD	18	33	66	93	99	69
Total^a EDS and ETD	88	99	98	99	99	98
Other approved method	12	1	2	2	1	2
Total^a	100	100	100	100	100	100

Source: Analysis of GAO federal security director survey data.

^aPercentages may not add because of rounding.

Interim Solutions Resulted in Operational Inefficiencies and Additional Security Risks

TSA’s interim solution of using stand-alone EDS and ETD machines as the primary method to screen checked baggage for explosives led to operational inefficiencies including (1) the increased use of screener staff, (2) a lower baggage throughput rate per hour for screening baggage for explosives, and (3) an increase in on-the-job injuries. Further, at many airports, TSA’s placement of the minivan-sized stand-alone EDS machines and ETD machines in airport lobbies at times resulted in passenger crowding, which presented unsafe conditions and may have added security risks for passengers and airport workers.

Stand-alone EDS and ETD machines are both labor- and time-intensive to operate since each bag must be physically carried to an EDS or ETD machine for screening and then moved back to the baggage conveyor system prior to being loaded onto an aircraft. With an in-line EDS system, checked baggage is screened within an airport’s baggage conveyor system, eliminating the need for a baggage screener or other personnel to physically transport the baggage from the check-in point to the EDS machine for screening and then to the airport baggage conveyor system. Further, according to TSA officials, ETD machines and stand-alone EDS machines are less efficient in the number of checked bags that can be screened per hour per machine than are EDS machines that are integrated in-line with the airport baggage conveyor systems. As shown in table 6, as

of October 2003, TSA estimated that the number of checked bags screened per hour could more than double when EDS machines were placed in-line versus being used in a stand-alone mode. According to a senior TSA official in the Office of Security Technology, these throughput numbers could change as TSA gains greater operational experience.

Table 6: Bags Per Hour Screened by Stand-alone and In-line EDS Machines and ETD Machines

Type of equipment	Bags per hour	
	Stand-alone	In-line
EDS machines		
CTX 2500—stand-alone only	120	NA
CTX 5500	180	250
CTX 9000—in-line only	NA	425
L3 6000	180	425
ETD machines—stand-alone only	36	NA

Source: TSA.

NA: Not applicable.

In January 2004, TSA, in support of its planning, budgeting, and acquisition of security screening equipment, reported to the Office of Management and Budget (OMB) that the efficiency benefits of in-line rather than stand-alone EDS are significant, particularly with regard to bags per hour screened and the number of TSA screeners required to operate the equipment. According to TSA officials, at that time, a typical lobby-based screening unit consisting of a stand-alone EDS machine with three ETD machines had a baggage throughput of 376 bags per hour with a staffing requirement of 19 screeners. In contrast, TSA estimated that approximately 425 bags per hour could be screened by in-line EDS machines with a staffing requirement of 4.25 screeners.

In order to achieve the higher throughput rates and reduce the number of screener staff needed to operate in-line baggage screening systems, TSA (1) uses a screening procedure known as “on-screen alarm resolution” and (2) networks multiple in-line EDS machines together, referred to as “multiplexing,” so that the computer-generated images of bags from these machines are sent to a central location where TSA screeners can monitor the images of suspect bags centrally from several machines using the on-screen alarm resolution procedure. When an EDS machine alarms, indicating the possibility that explosive material may be contained in the bag, the on-screen alarm resolution procedure allows screeners to

examine computer-generated images of the inside of a bag to determine if suspect items identified by the EDS machines are in fact suspicious. If a screener, by viewing these images, is able to determine that the suspect item or items identified by the EDS machine are in fact harmless, the screener is allowed to clear the bag, and it is sent to the airline baggage makeup area for loading onto the aircraft. If the screener is not able to make the determination that the bag does not contain suspicious objects, the bag is sent to a secondary screening room where the bag is further examined by a screener. In secondary screening, the screener opens the bag and examines the suspect item or items, and usually swabs the items to collect a sample for analysis using an ETD machine. TSA also uses this on-screen alarm resolution procedure with stand-alone EDS machines.²¹

A TSA official estimated that the on-screen alarm resolution procedure with in-line EDS baggage screening systems will enable TSA to reduce by 40 to 60 percent the number of bags requiring the more labor-intensive secondary screening using ETD machines. In estimating the potential savings in staffing requirements, TSA officials stated that they expect to achieve a 20 to 25 percent savings because of reductions in the number of staff needed to screen bags using ETD to resolve alarms from in-line EDS machines.

TSA also reported that because procedures for using stand-alone EDS and ETD machines require screeners to lift heavy baggage onto and off of the machines, the interim lobby screening solutions used by TSA led to significant numbers of on-the-job injuries.²² In addition, in responding to our survey about 263 airports, numerous federal security directors reported that on-the-job injuries related to lifting heavy baggage onto or off the EDS and ETD machines were a significant concern at the airports for which they were responsible. Specifically, these federal security directors reported that on-the-job injuries caused by lifting heavy bags onto and off of EDS machines were a significant concern at 65 airports, and were a significant concern with the use of ETD machines at 110 airports. To reduce on-the-job injuries, TSA has provided training to screeners on proper lifting procedures. However, according to TSA officials, in-line EDS screening systems would significantly reduce the

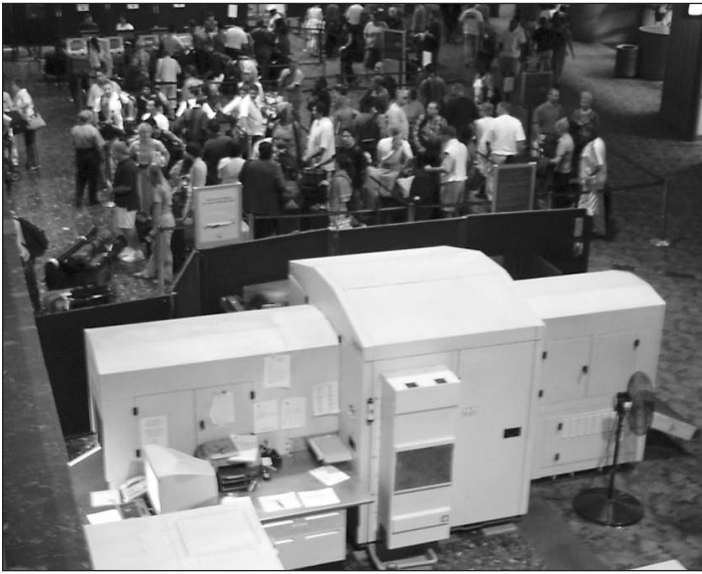
²¹TSA began implementing the on-screen alarm resolution procedure in May 2004 after pilot testing the procedure.

²²TSA was unable to provide GAO with data on the on-the-job injuries sustained during baggage screening operations.

need for screeners to handle baggage, thus further reducing the number of on-the-job injuries being experienced by TSA baggage screeners.

In addition, during our site visits to 22 large and medium-sized airports, several TSA, airport, and airline officials expressed concern regarding the security risks caused by overcrowding due to ETD and stand-alone EDS machines being located in airport lobbies. The location of the equipment resulted in less space available to accommodate passenger movement and caused congestion due to passengers having to wait in lines in public areas to have their checked baggage screened. TSA headquarters officials also reported that large groups of people congregating in crowded airport lobbies, as shown in figure 4, increases security risks by creating a potential target for terrorists. The TSA officials noted that crowded airport lobbies have been the scenes of terrorist attacks in the past. For example, in December 1985, four terrorists walked to the El Al ticket counter at Rome's Leonardo DaVinci Airport and opened fire with assault rifles and grenades, killing 13 and wounding 75. On that same day, three terrorists killed three people and wounded 30 others at Vienna International Airport.

Figure 4: Crowded Airport Lobby with Stand-alone EDS Screening



Source: TSA.

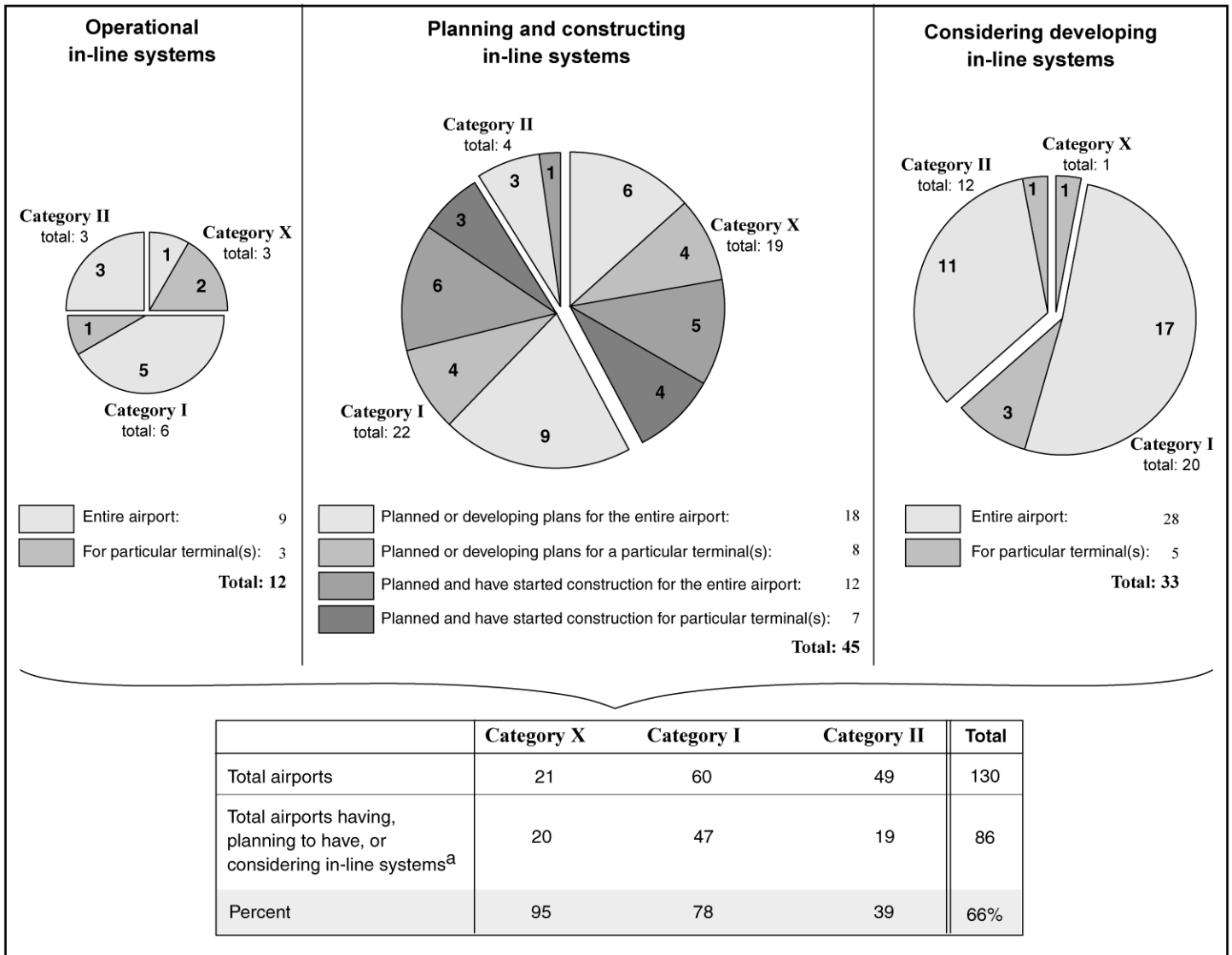
Airports and the Federal Government Are Taking Actions to Install In-line Baggage Screening Systems, but Resources Have Not Been Made Available to Fund These Systems on a Large-Scale Basis

Airport operators and TSA are taking actions to install in-line EDS baggage screening systems because of the expected benefits of these systems. However, airport operators and TSA have made limited progress in installing in-line baggage screening systems on a large-scale basis because sufficient resources have not been made available for the installation of these capital-intensive systems. To install in-line systems, airport operators and TSA work cooperatively, with airport operators responsible for the baggage conveyor systems and utilities, and TSA responsible for the EDS and ETD machines. Airport operators and TSA have also shared in the total costs—25 percent and 75 percent respectively under LOI agreements, which have been TSA's primary method for funding in-line systems. Most airports that have installed or are planning to install in-line systems have relied on or plan to rely on some form of federal funding to help install the systems. However, as of January 2005, TSA has not used LOIs to fund the installation of in-line systems beyond nine airports. Further, TSA has not determined the total cost of installing in-line EDS baggage screening systems at airports determined to need these systems. In addition, perspectives differ regarding the appropriate role of the federal government and airport operators in funding these systems.

Many Airports Have, Are Planning to Have, or Are Considering Installing In-line EDS Baggage Screening Systems

Airport operators and TSA are taking actions to install in-line EDS baggage screening systems because of the expected benefits of these systems. Our survey of federal security directors and interviews with airport officials revealed that 86 of 130 category X, I, and II airports (66 percent) included in our survey either have, are planning to have, or are considering installing in-line EDS baggage screening systems throughout or at a portion of their airports. As shown in figure 5, as of July 2004, 12 airports had operational in-line systems airportwide or at a particular terminal or terminals, and an additional 45 airports were actively planning or constructing in-line systems. Our survey of federal security directors further revealed that an additional 33 of the 130 category X, I, and II airports we surveyed were considering developing in-line systems.

Figure 5: Status of In-line EDS Systems for Category X, I, and II Airports Included in Survey of Federal Security Directors as of July 2004



Source: GAO analysis of data obtained from the federal security director survey and from interviews with airport officials.

^aThe total number of airports having, planning to have, or considering an in-line system is 86. The pie charts above include three category X and one category I airports twice because they currently have operating in-line systems either covering the total airport or a particular terminal or terminals and are in the process of planning and constructing additional in-line systems.

In addition to the expected benefits of reduced TSA screening personnel, enhanced security, and increased baggage throughput, airport officials anticipate that they will be able to streamline their airport

operations from installing in-line baggage screening systems. For example, some airport and air carrier officials we interviewed anticipate that in-line systems will result in less congestion at airline ticket counters by removing stand-alone EDS and ETD machines from crowded airport lobbies, thereby improving airline passenger flow and queuing in the terminals by not forcing passengers to wait in long lines at ticket counters to have their bags screened. Officials also believe that the installation of in-line systems would allow for airport growth because in-line EDS systems could screen checked baggage faster than stand-alone EDS and ETD systems and could be upgraded to accommodate growth in airline passenger traffic. Officials further stated that in-line systems would allow them to retain greater control and autonomy of their baggage handling systems by creating a streamlined process for moving checked baggage directly from where baggage is checked to the aircraft.

Total Costs of In-line EDS Baggage Screening Systems Are Unknown, and Federal Resources Have Not Been Made Available to Fund These Systems on a Large-Scale Basis

While in-line EDS baggage screening systems have a number of potential benefits, the total cost to install these systems is unknown, and limited federal resources have been made available to fund these systems on a large-scale basis. In-line baggage screening systems are capital-intensive because they often require significant airport modifications, including terminal reconfigurations, new conveyor belt systems, and electrical upgrades.

TSA has not determined the total cost of installing in-line EDS baggage screening systems at airports that it had determined need these systems to maintain compliance with the congressional mandate to screen all checked baggage for explosives using explosive detection systems, or to achieve more efficient and streamlined checked baggage screening operations. However, TSA and airport industry association officials have estimated that the total cost of installing in-line systems is—a rough order-of-magnitude estimate—from \$3 billion to more than \$5 billion. TSA officials stated that they have not conducted a detailed analysis of the costs required to install in-line EDS systems at airports because most of their efforts have been focused on deploying and maintaining a sufficient number of EDS and ETD machines to screen all checked baggage for explosives. TSA officials further stated that the estimated costs to install in-line baggage screening systems would vary greatly from airport to airport depending on the size of the airport and the extent of airport modifications that would be required to install the system. While we did not independently verify the estimates, officials from the Airports Council International-North America and American Association of Airport Executives estimated that project costs for in-line systems could range

from about \$2 million for a category III airport to \$250 million for a category X airport.²³

Airport operators have relied on several sources of federal funding to help pay for the planning and construction of in-line EDS baggage screening systems. We interviewed airport officials from 53 airports that either have or are in the process of planning or constructing in-line systems to determine the extent to which they have relied on or plan to rely on federal funding to install in-line systems.²⁴ As shown in table 7, officials at 42 of the 53 airports we interviewed reported that they relied on the use of federal funds from the FAA Airport Improvement Program and TSA to help fund the planning and construction of these systems. However, there was no readily available information that would allow us to determine to what extent these 42 airports relied on or plan to rely on the use of federal funds for constructing or planning their in-line systems. Only one of the 53 airports completed its in-line system without first receiving federal funds for the project, while an additional 10 airports have started planning or constructing their in-line systems without receiving federal assistance or a commitment to receive federal assistance.

²³Joint Statement of David Z. Plavin, President, Airports Council International-North America (ACI-NA) and Todd Hauptli, Sr. Executive Vice President, American Association of Airport Executives (AAAEE) before the House Aviation Subcommittee Hearing on Passenger and Baggage Screening Problems; February 12, 2004. GAO did not independently verify cost figures provided in this testimony.

²⁴These 53 airports were among 70 airports identified by federal security directors during our Web-based survey as either having or in the process of planning or constructing in-line systems. Officials at the remaining 17 airports indicated that their airports had not developed plans for in-line baggage screening systems.

Table 7: Source of Federal Funding Used for Airport Modification Planning and Construction of In-line EDS Systems as of July 2004

	Number by airport category			Total
	X	I	II	
Airports that have either constructed or are in the process of planning	19	27	7	53
Source of federal funding used				
Combination of Airport Improvement Program and TSA funding	5	0	0	5
Airport Improvement Program funding only	7	17	4	28
TSA funding only	3	5	1	9
Total	15	22	5	42
No federal funding used	4	5	2	11

Source: GAO analysis of information received from interviews with airport officials.

TSA and airport operators are relying on LOI agreements as their principal method for funding the modification of airport facilities to incorporate in-line baggage screening systems. The fiscal year 2003 Consolidated Appropriations Resolution approved the use of LOIs as a vehicle to leverage federal government and industry funding to support facility modification costs for installing in-line EDS baggage screening systems. When an LOI is established to provide multiyear funding for a project, the airport operator is responsible for providing—up front—the total funding needed to complete the project, even though the LOI is not a binding commitment of federal funds. Work proceeds with the understanding that TSA will, if sufficient funding is appropriated, reimburse the airport operator for a percentage of the facility modification costs, with the airport funding the remainder of the costs. LOIs issued by TSA for in-line baggage screening systems provide for reimbursement payments over a multiple year period, contingent upon the appropriation of sufficient funding to cover such projects.

As of January 2005, TSA had issued eight LOIs to reimburse nine airports for the installation of in-line EDS baggage screening systems for a total cost of \$957.1 million to the federal government over 4 years. In addition, TSA officials stated that as of July 2004, they had identified 27 additional airports that they believe would benefit from receiving LOIs for in-line systems because such systems are needed to screen an increasing number of bags due to current or projected growth in passenger traffic. TSA officials stated that without such systems, these airports

would not remain in compliance with the congressional mandate to screen all checked baggage using EDS and ETD.²⁵ However, because TSA would not identify these 27 airports, we were unable to determine whether these airports are among the 45 airports we identified as in the process of planning or constructing in-line systems. Table 8 identifies the nine airports awarded LOI agreements, total project costs, and the cost-share for the federal government and the airport.

Table 8: Airports Awarded LOIs

Airport	Total project cost	Total federal cost-share (75 percent)	Airport cost-share (25 percent)	Estimated in-line operational date
Atlanta	\$125.0	\$93.8	\$31.3	December 2005
Boston	116.0	87.0	29.0	Completed January 2003
Dallas-Fort Worth	139.2	104.4	34.8	June 2005
Denver	95.0	71.2	23.8	January 2005
Las Vegas (McCarran)	125.0	93.8	31.3	July 2005
Los Angeles and Ontario, Calif.	341.9	256.5	85.4	September 2007
Phoenix	122.0	91.5	30.5	Fall of 2006
Seattle	212.0	159.0	53.0	March 2007
Total	\$1,276.1	\$957.1	\$319.1	

Source: GAO analysis of TSA data.

Note: Total project costs do not include costs to procure and install EDS machines.

TSA officials stated that they also use other transaction agreements as an administrative vehicle to directly fund, with no long-term commitments, airport operators for smaller in-line airport modification projects.²⁶ Under these agreements, as implemented by TSA, the airport operator also

²⁵TSA officials stated that the number of airports that could benefit most from in-line checked baggage screening systems varies depending on changing airport circumstances, such as adding new terminals or an increased or decreased number of flights.

²⁶Other transaction agreements are administrative vehicles used by TSA to directly fund airport operators for smaller airport modification projects without undertaking a long-term commitment. These transactions take many forms and are generally not required to comply with federal laws and regulations that apply to contracts, grants, or cooperative agreements; and enable the federal government and others entering into these agreements to freely negotiate provisions that are mutually agreeable.

provides a portion of the funding required for the modification. As of September 30, 2004, TSA had negotiated arrangements with eight airports to fund small permanent in-line projects or portions of large permanent in-line projects using other transaction agreements.²⁷ These other transaction agreements range from about \$640,000 to help fund the conceptual design of an in-line system for one terminal at the Dallas Fort-Worth airport to \$37.5 million to help fund the design and construction of in-line systems and modification of the baggage handling systems for two terminals at the Chicago O'Hare International Airport. TSA officials stated that they would continue to use other transaction agreements to help fund smaller in-line projects.²⁸

Airport operators also used the FAA's Airport Improvement Program—grants to maintain safe and efficient airports—in fiscal years 2002 and 2003 to help fund facility modifications needed to accommodate installing in-line systems. As shown in table 7, 28 of 53 airports that reported either having constructed or planning to construct in-line systems relied on the Airport Improvement Program as their sole source of federal funding.

²⁷The eight airports included four category X airports: Dallas Fort-Worth International, Chicago O'Hare International, Detroit Metro Wayne County, and San Francisco International; three category I airports: Piedmont Triad International (North Carolina), Pittsburgh International, and Sacramento International; and one category II airport Harrisburg International (Pennsylvania). These eight airports were among the 45 airports that we identified as being in the process of planning or constructing in-line systems.

²⁸TSA also used four other transaction agreements to fund work related to interim solutions, three of these agreements were for partial in-line systems that eventually were to be replaced by permanent in-line systems.

Airport Officials Report That They Will Require Federal Funding to Install In-line EDS Baggage Screening Systems, but the Availability of this Funding Is Uncertain, and Perspectives Differ Regarding Funding Responsibilities of the Federal Government and the Aviation Industry

Airport officials at over half of the 45 airports that we identified are in the process of planning or constructing in-line systems stated that they will require federal funding in order to complete the planning and construction of these in-line systems. Despite this reported need, however, the President's fiscal year 2005 and 2006 budget requests do not provide, and the fiscal year 2005 DHS Appropriations Act does not include, funding for additional LOIs for in-line EDS baggage screening systems beyond the eight already issued. Also, the availability of federal funds from the Airport Improvement Program for future planning and construction of in-line baggage screening systems is limited. In addition, perspectives differ regarding the appropriate role of the federal government, airport operators, and air carriers in funding these capital-intensive systems.

Officials at 28 of the 45 airports that we identified in figure 5 as planning or constructing in-line baggage screening systems stated that they could not or would not move forward with installing these systems without funding support from TSA.²⁹ Also, in our review of correspondence to TSA regarding 26 airports' interest in receiving LOIs, officials from half of the 26 airports stated that they would have to delay, suspend, or abandon their plans for installing in-line systems until TSA committed to funding these projects. According to TSA officials, the high cost of developing final design plans for in-line systems has resulted in airports delaying plans to install the systems until they are confident that TSA will be able to support their funding needs.

Although airport officials stated that they will require federal funding to install in-line systems—and TSA officials reported that additional airports will require in-line systems to maintain compliance with the congressional mandate to screen 100 percent of checked baggage for explosives—TSA officials stated that they do not have sufficient resources in their budget to fund additional LOIs beyond the eight LOIs that have already been issued. Vision 100, among other things, provided for the creation of the Aviation Security Capital Fund to help pay for placing EDS machines in line with

²⁹These 28 airports include 8 of the 9 airports that have been awarded LOIs by TSA for planning and constructing in-line systems.

airport baggage handling systems.³⁰ However, according to OMB officials, the President's fiscal year 2005 budget request, which referred to the Vision 100-mandated appropriation of \$250 million for the Aviation Security Capital Fund, only supported continued funding for the eight LOIs that have already been issued and does not provide resources to support new LOIs for funding the installation of in-line systems at additional airports. Further, while the fiscal year 2005 DHS Appropriations Act provides \$45 million for installing explosive detection systems in addition to the \$250 million from the Aviation Security Capital Fund, Congress directed, in the accompanying conference report, that the \$45 million be used to assist in the continued funding of the existing eight LOIs. Further, the President's fiscal year 2006 budget request for TSA provides approximately \$240.5 million for the continued funding of the eight existing LOIs and provides no funds for new LOI agreements for in-line system integration activities.

In addition, the availability of Airport Improvement Program funds for airport security-related improvements, though expanded for a time, is presently limited as a resource for the installation of in-line EDS baggage screening systems. Following the events of September 11, ATSA authorized the use of Airport Improvement Program funds for security-related enhancements through fiscal year 2002. ATSA also provided for the use of Airport Improvement Program funds to replace airport baggage handling systems and to reconfigure airport terminal baggage areas as required to install explosive detection equipment, but Vision 100 amended this provision to allow only a specific portion of Airport Improvement Program funds to be used for this purpose after December 12, 2003.³¹ Subsequent prohibitions found in the fiscal year 2004 Consolidated

³⁰Vision 100 authorizes up to \$500 million for aviation security for each of fiscal years 2004 through 2007, of which \$250 million is a mandatory appropriation to the Aviation Security Capital Fund. Of that mandatory amount, the act designates \$125 million as priority funding to fulfill intentions to obligate under LOIs. In the fiscal year 2004 Department of Homeland Security Appropriations Act, Congress provided \$250 million for the physical modification of airports to install checked baggage explosive detection systems but did so separate from the Aviation Security Capital Fund because a provision of that act precluded the use of funds to establish the Fund in fiscal year 2004. The Intelligence Reform and Terrorism Prevention Act of 2004, Pub. L. No. 108-458, 118 Stat. 3638, enacted in December 2004, increases the authorized appropriation for aviation security from Vision 100 from \$250 million to \$400 million for each of fiscal years 2005 through 2007. The \$250 million mandatory appropriation remains the same.

³¹Vision 100 limited the source of funding available to carry out this provision (49 U.S.C. § 47102(3)(b)(x)) to amounts apportioned under 49 U.S.C. § 47114.

Appropriations Act, enacted in January 2004, and again in the fiscal year 2005 Consolidated Appropriations Act, enacted in December 2004, prohibit the use of Airport Improvement Program funds for activities related to the installation of in-line explosive detection systems.

A 75 percent federal cost-share will apply to any project under an LOI for fiscal year 2005.³² Further, the President's fiscal year 2006 budget request for TSA requests to maintain the 75 percent federal government cost share for projects funded by LOIs at large and medium airports. However, in testimony before Congress, an aviation industry official expressed a different perspective regarding the cost sharing between the federal government and the aviation industry for installing in-line checked baggage screening systems. Testifying in July 2004, the official said that airports contend that the cost of installing in-line systems should be met entirely by the federal government, given its direct responsibility for screening checked baggage, as established by law, in light of the national security imperative for doing so, and because of the economic efficiencies of this strategy. Although the official stated that airports have agreed to provide a local match of 10 percent of the cost of installing in-line systems at medium and large airports, as stipulated by Vision 100, he expressed opposition to the administration's proposal, which was subsequently adopted by Congress for fiscal year 2005, to reestablish the airport's cost-share at 25 percent.³³

In July 2004, the National Commission on Terrorist Attacks upon the United States (the 9/11 Commission) also addressed the issue of the federal government/airport cost-share for installing EDS in-line baggage

³²The fiscal year 2003 Consolidated Appropriations Resolution authorized TSA to issue LOIs for terminal modifications related to the installation of in-line baggage screening systems and mandated that each LOI provide for a 75 percent federal cost-share of the project's cost, with the remaining 25 percent to be paid by the airport operator at airports with at least 0.25 percent of the total number of passenger boardings each year at all airports (and 90 percent for projects at all other airports). Subsequently, Vision 100 instituted a 90 percent federal cost-share of the project's cost, with the remaining 10 percent to be paid by the airport operator at medium and large hub airports (and 95 percent for projects at any other airport) though TSA continued to operate at the 75 percent cost-share. The fiscal year 2005 DHS Appropriations Act, signed into law in October 2004, reestablished the federal cost-share at 75 percent for any medium or large hub airport during fiscal year 2005.

³³TSA officials stated that the increased cost-share to 90 percent stipulated in Vision 100 would further constrain their ability to fund future LOIs, as well as impact their ability to assist airports to achieve and maintain compliance with the congressional mandate to screen all checked baggage for explosives.

screening systems.³⁴ Specifically, the commission recommended that TSA expedite the installation of in-line systems and that the aviation industry should pay its fair share of the costs associated with installing these systems, since the industry will derive many benefits from the systems. Although the 9/11 Commission recommended that the aviation industry should pay its fair share of the costs of installing in-line systems, the commission did not report what it believed the fair share to be.³⁵

TSA Has Not Systematically Planned for the Optimal Deployment of Checked Baggage Screening Equipment to Ensure the Efficient and Cost-Effective Screening for Explosives while Enhancing Security Benefits

TSA has not conducted the analyses needed to plan for optimally deploying EDS and ETD equipment—including installing in-line EDS baggage screening systems or replacing ETD machines with stand-alone EDS machines—at the nation’s more than 400 airports to enhance security and reduce TSA staffing requirements and long-term costs. Although TSA established criteria to prioritize airport eligibility for receiving LOI funds for in-line EDS baggage screening systems, it has not conducted a systematic, prospective analysis to determine at which airports it could achieve long-term savings and enhanced security by installing in-line systems rather than continue to rely on labor-intensive stand-alone EDS and ETD machines to screen checked baggage for explosives. TSA’s retrospective analysis of the nine airports that received LOIs identified the potential for significant cost savings through the installation of in-line EDS baggage screening systems and the merit of conducting prospective analyses of other airports to provide information for future funding decisions. Further, for airports where in-line systems may not be economically justified because of the high cost of installing the systems, TSA has not conducted an analysis to determine whether it could achieve savings by making greater use of stand-alone EDS systems rather than relying on the use of more labor-intensive ETD machines. OMB has provided guidance for agencies to conduct these types of cost analyses to help build a business case for funding their programs. Moreover, Congress directed that TSA continue submitting plans for installing in-line baggage

³⁴The 9/11 Commission Report: *Final Report of the National Commission on Terrorist Attacks Upon the United States* (Washington, D.C.: July 2004).

³⁵The Intelligence Reform and Terrorism Prevention Act of 2004 requires the Secretary of Homeland Security to conduct a cost-sharing study that must include, among other things, a proposed formula for cost sharing among the federal, state, and local governments and the private sector for projects to install in-line baggage screening equipment that reflects the benefits that each such entity will derive from the projects, including national security benefits and labor and other cost savings.

screening systems. However, TSA has not yet provided Congress with all of the information requested.

TSA Applied Criteria to Award Initial LOIs to Fund In-line Systems but Has Not Systematically Determined Which Additional Airports Should Receive Future In-line Systems to Increase Efficiencies and Enhance Security

In October 2003, TSA reported to OMB criteria it used to prioritize airports eligible to receive LOI funds to install in-line EDS baggage screening systems. However, TSA did not systematically determine which airports could achieve long-term savings and improved security by installing in-line systems rather than continuing to rely on labor-intensive stand-alone EDS and ETD machines to screen checked baggage for explosives.

The criteria TSA established for prioritizing airport participation in the LOI program, as shown in figure 6, included airports that were not yet conducting 100 percent screening of checked baggage with EDS or ETD, and airports that would fall out of compliance with the requirement to screen checked baggage with EDS or ETD at peak load times. In July 2004, TSA officials reported that they had recently expanded these criteria to take into account additional security benefits that an in-line baggage screening system would provide an airport. Specifically, TSA officials stated that they compared airport operational needs with identified threats, based on information received from TSA's Transportation Security Intelligence Service, to consider security needs for specific airports. TSA officials further reported that an airport's circumstances, such as passenger load increases or decreases, may change how it is prioritized, given these criteria, and that an airport could qualify to receive LOI funding based on more than one criterion.

Figure 6: TSA Criteria for Prioritizing Letters of Intent

<p>Fulfilling basic requirements:</p> <ul style="list-style-type: none">(1) Airports not yet at 100 percent screening using explosive detection systems(2) Airports that will fall out of compliance at peak loads because of seasonal fluctuations, air carrier moves, additions, and changes <hr/> <p>DHS strategic investment projects:</p> <ul style="list-style-type: none">(3) Airports with highly disruptive implementations and high staffing levels(4) Airports with a heavy reliance on ETD machines that would benefit from improved operational efficiencies and cost reductions

Source: GAO analysis of TSA data.

TSA officials stated that they selected the first nine airports to receive LOIs to fund in-line baggage screening systems because, in general, they were the first to submit applications for an LOI, and they agreed to pay

25 percent of airport modification costs in accordance with the LOI requirements.³⁶ TSA officials also stated that the nine airports generally met their criteria even though seven of the airports had received LOIs in July and September 2003, before the TSA's promulgation of the criteria in October 2003.

In addition to the nine airports currently receiving LOI funds, TSA officials stated that, based on their criteria, in July 2004, they identified 27 additional airports that are potential candidates for 22 future LOIs.³⁷ TSA officials stated that an in-line screening system at each of these airports would provide enhanced security and efficiencies. More important, officials stated that if the 27 airports did not receive an LOI to install an in-line baggage system, these airports could fall out of compliance with the requirement to screen 100 percent of checked baggage using explosive detection systems during peak passenger traffic load periods or because of passenger load increases or new air carrier service—TSA's second prioritization criterion shown in figure 6. Although TSA officials asserted that in July 2004, 27 airports were good candidates for in-line systems, they would not identify the 27 airports. TSA officials also did not provide the analyses they conducted to determine that these airports would fall out of compliance with the mandate to screen all checked baggage using explosive detection systems or state why these airports were more at risk than other airports for not complying with this mandate. Rather, TSA officials stated that they identified these 27 airports as good candidates for LOIs based on their day-to-day working knowledge of airports and professional judgment about airport operations. TSA officials were also unable to provide information on what the associated costs, benefits, and time frames would be for installing in-line systems at these 27 airports.

Although TSA developed criteria to use as a guide for determining which airports should receive LOI funding for in-line EDS baggage screening systems, TSA has not yet conducted a systematic, prospective analysis of individual airports or groups of airports to determine at which airports installing in-line EDS systems would be cost-effective in terms of reducing long-term screening costs for the government and would improve security.

³⁶TSA did not have a formal, standardized process for soliciting or responding to requests for LOIs.

³⁷LOI agreements can include multiple airports, as was the case with one of the original eight LOIs including both the Los Angeles International and Ontario airports.

Such an analysis would enable TSA to determine at which airports it would be most beneficial to invest limited federal resources for in-line systems rather than continue to rely on the stand-alone EDS and ETD machines to screen checked baggage for explosives, and it would be consistent with best practices for preparing benefit-cost analysis of government programs or projects called for by OMB Circular A-94.³⁸ TSA officials stated that they have not conducted the analyses related to the installation of in-line systems at individual airports or groups of airports because they have used available staff and funding to ensure all airports have a sufficient number of EDS or ETD machines to meet the congressional mandate to screen all checked baggage with explosive detection systems. During the course of our review, in September 2004, TSA contracted for services through March 2005 to develop methodologies and criteria for assessing the effectiveness and suitability of airport screening solutions requiring significant capital investment, such as those projects associated with the LOI program. However, TSA officials could not provide us with information on how they plan to use the results of the effort in planning for the installation of in-line systems.

In October 2004, the conference report accompanying the 2005 Department of Homeland Security Appropriations Act directed that TSA continue submitting quarterly reports on its plans for the installation of in-line baggage screening systems. However, TSA has not yet provided Congress with all of the information requested. Specifically, the conference report directed that TSA provide information describing, among other things, the universe of airports that could benefit from an in-line EDS baggage screening system or other physical modifications; costs associated with each airport's project, along with a tentative timeline for award and completion; and information reflecting the anticipated cost savings—particularly personnel savings—that would be achieved through the use of in-line checked baggage systems instead of ETD and stand-alone EDS systems. TSA, directed to provide a report on September 1, 2003, and every quarter thereafter, provided two reports to Congress. However, TSA was asked to submit amended reports because the original reports lacked the requested information. As of January 2005, TSA had not submitted the amended reports or subsequent reports to Congress. The conference report further directed TSA to develop a comprehensive plan for

³⁸OMB Circular A-94 *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*, January 22, 2002. Agencies use this guidance to support government decisions to initiate, review, or expand programs that would result in measurable costs or benefits extending for 3 or more years into the future.

expediting the installation of in-line EDS baggage screening systems, including the formulation of detailed budget requirements to provide for both equipment acquisition and the capital costs of installing these system configurations at airports. In addition, the December 2004, Intelligence Reform and Terrorism Prevention Act, among other things, directs TSA to develop a schedule to expedite the installation of in-line explosive detection systems.

According to TSA officials, TSA recently began to conduct an analysis of alternatives to determine the best manner to acquire, deploy, and maintain EDS and ETD equipment for screening checked baggage as part of the Department of Homeland Security Investment Review process.³⁹ However, according to TSA officials who prepared the review, the Investment Review Board review did not include a prioritization of which airports should receive funding for in-line systems or an analysis of screening needs at individual airports. TSA would not provide us with the baggage screening program data and analysis that it provided to the Investment Review Board for the review that occurred in late October 2004.

The Installation of In-line EDS Baggage Screening Systems May Result in Significant Savings and Benefits

Although TSA has not conducted a systematic analysis of cost savings and other benefits that could be derived from the installation of in-line baggage screening systems, TSA's limited, retrospective cost-benefit analysis of in-line projects at the nine airports with signed LOI agreements found that significant savings and other benefits may be achieved through the installation of these systems. This analysis was conducted in May 2004—after the eight LOI agreements for the nine airports were signed in July and September 2003 and February 2004—to estimate potential future cost savings and other benefits that could be achieved from installing in-line systems instead of using stand-alone EDS systems. TSA estimated that in-line baggage screening systems at these airports would save the federal government \$1.3 billion⁴⁰ compared with stand-alone EDS systems and that

³⁹The Department of Homeland Security Investment Review Board reviews the department's capital asset programs with acquisition costs exceeding \$100 million to ensure that projects meet mission needs at the expected levels of cost and risk.

⁴⁰This figure refers to the net present value saved over 7 years if received up front.

TSA would recover its initial investment in a little over 1 year.⁴¹ TSA's analysis also provided data to estimate the cost savings for each airport over the 7-year period. According to TSA's data, federal cost savings varied from about \$50 million to over \$250 million at eight of the nine airports, while at one airport, there was an estimated \$90 million loss. The individual airport results are described in appendix IV.

According to TSA's analysis of the nine LOI airports, in-line cost savings critically depend on how much an airport's facilities have to be modified to accommodate the in-line configuration. Savings also depend on TSA's costs to buy, install, and network the EDS machines; subsequent maintenance cost; and the number of screeners needed to operate the machines in-line instead of using stand-alone EDS systems. In its analysis, TSA also found that a key factor driving many of these costs is throughput—how many bags an in-line EDS system can screen per hour compared with the rate for a stand-alone system. TSA used this factor to determine how many stand-alone EDS machines could be replaced by a single in-line EDS machine while achieving the same throughput. According to TSA's analysis, in-line EDS would reduce by 78 percent the number of TSA baggage screeners and supervisors required to screen checked baggage at these nine airports, from 6,645 to 1,477 screeners and supervisors. However, the actual number of TSA screeners and supervisor positions that could be eliminated would be dependent on the individual design and operating conditions at each airport.

TSA also reported that aside from increased efficiency and lower overall costs, there were a number of qualitative benefits that in-line systems would provide over stand-alone systems, including:

- fewer on-the-job injuries, since there is less lifting of baggage when EDS machines are integrated into the airport's baggage conveyor system;
- less lobby disruption because the stand-alone EDS and ETD machines would be removed from airport lobbies; and
- unbroken chain of custody of baggage because in-line systems are more secure, since the baggage handling is performed away from passengers.

⁴¹For a basis of comparison, Office of Management and Budget Circular A-94 stipulates using a 7 percent real discount rate to compute the present value of cost savings. TSA used a 4 percent real discount rate. Following Office of Management and Budget guidance, cost savings are \$1.14 billion. In addition, in TSA's analysis, the federal government does not pay for \$319 million, or 25 percent, of project costs. Accounting for these costs to reflect total costs, as recommended by Circular A-94, lowers overall savings to \$820 million.

TSA's retrospective analysis of these nine airports indicates the potential for cost savings through the installation of in-line EDS baggage screening systems at other airports, and it provides insights about key factors likely to influence potential cost savings from using in-line systems at other airports. This analysis also indicates the merit of conducting prospective analyses of other airports to provide information for future federal government funding decisions as required by the OMB guidance on cost-benefit analyses.⁴² This guidance describes best practices for preparing benefit-cost analysis of government programs or projects, one of which involves analyzing uncertainty. Given the diversity of airport designs and operations, TSA's analysis could be modified to account for uncertainties in the values of some of the key factors, such as how much it will cost to modify an airport to install an in-line system. Analyzing uncertainty in this manner is consistent with OMB guidance. Appendix IV illustrates how analyzing uncertainty in TSA's cost estimates can help identify which cost factors to focus on when determining the appropriateness of installing EDS baggage screening systems for a particular airport.

TSA Has Not Systematically Assessed Needs of Airports to Gain Efficiencies by Making Greater Use of Stand-alone EDS Systems

TSA also has not systematically analyzed which airports could benefit from the implementation of additional stand-alone EDS systems in lieu of labor-intensive ETD systems at more than 300 airports that rely on ETD machines, and where in-line EDS systems may not be appropriate or cost-effective. More specifically, TSA has not prepared a plan that prioritizes which airports should receive EDS machines (including machines that become surplus because of the installation of in-line systems) to balance short-term installation costs with future operational savings. Furthermore, TSA has not yet determined the potential long-term operating cost savings and the short-term costs of installing the systems, which are important factors to consider in conducting analyses to determine whether airports would benefit from the installation of EDS machines. TSA officials said that they had not yet had the opportunity to develop such analyses or plans, and they did not believe that such an exercise would necessarily be an efficient use of their resources, given the fluidity of baggage screening at various airports.

There is potential for TSA to benefit from the introduction of smaller stand-alone EDS machines—in terms of labor savings and added efficiencies—at some of the more than 300 airports where TSA relies on

⁴²OMB Circular A-94.

the use of ETD machines to screen checked baggage. Stand-alone EDS machines are able to screen a greater number of bags in an hour than the ETD used for primary screening while lessening reliance on screeners during the screening process. For example, TSA's analysis showed that an ETD machine can screen 36 bags per hour, while the stand-alone EDS machines can screen 120 to 180 bags per hour. As a result, it would take three to five ETD machines to screen the same number of bags that one stand-alone EDS machine could process. In addition, greater use of the stand-alone EDS machines could reduce staffing requirements. For example, one stand-alone EDS machine would potentially require 6 to 14 fewer screeners than would be required to screen the same number of bags at a screening station with three to five ETD machines. This calculation is based on TSA estimates that 4.1 screeners are required to support each primary screening ETD machine, while one stand-alone EDS machine requires 6.75 screeners—including staff needed to operate ETD machines required to provide secondary screening.

Without a Plan for Installing In-line Systems and EDS Equipment, It Is Unclear How TSA May Make Use of New Technologies to Screen Checked Baggage for Explosives

Without a plan for installing in-line EDS baggage screening systems, and for using additional stand-alone EDS systems in place of ETD machines at the nation's airports, it is unclear how TSA will make use of new technologies for screening checked baggage for explosives, such as the smaller and faster EDS machines that may become available through TSA's research and development programs. For example, TSA is working with private sector firms to enhance existing EDS systems and develop new screening technologies through its Phoenix project. As part of this project, in fiscal year 2003, TSA spent almost \$2.4 million to develop a new computer-aided tomography explosives detection system that is smaller and lighter than systems currently deployed in airport lobbies. The new system is intended to replace systems currently in use, including larger and heavier EDS machines and ETD equipment. The smaller size of the system creates opportunities for TSA to transfer screening operations to other locations such as airport check-in counters. TSA certified this equipment in December 2004 and will pilot the machine in the field to evaluate its operational efficiency. Also, the ARGUS program was initiated in 1999 to develop EDS equipment that would cost less to build and install—even though baggage throughput may be lower—in order to provide a more uniform level of security using EDS machines at U.S. airports. TSA's Transportation Security Laboratory has certified three varieties of these machines, though the machines have not been procured and deployed at U.S. airports.

Conclusions

TSA has made substantial progress in installing EDS and ETD systems at the nation's airports—mainly as part of interim lobby screening solutions—to provide the capability to screen all checked baggage for explosives, as mandated by Congress. With the objective of initially fielding this equipment largely accomplished, TSA needs to shift its focus from equipping airports with interim screening solutions to systematically planning for the more optimal deployment of checked baggage screening systems. The need for sound planning is also recognized by Congress through the Intelligence Reform and Terrorism Prevention Act of 2004 and through the fiscal year 2005 DHS Appropriations Act Conference Report, which, among other things, directs TSA to develop a comprehensive plan for expediting the installation of in-line explosive detection systems. Part of such planning should include analyzing which airports should receive federal support for in-line EDS baggage screening systems based on cost savings that could be achieved from more effective and efficient baggage screening operations and on other factors, including enhanced security. Also, for airports, where in-line systems may not be economically justified because of high investment costs, a cost effectiveness analysis could be used to determine the benefits of additional stand-alone EDS machines to screen checked baggage in place of the more labor-intensive ETD machines that are currently being used at the more than 300 airports. In addition, TSA should consider the costs and benefits of the new technologies being developed through its research and development efforts, which could provide smaller EDS machines that have the potential to reduce the costs associated with installing in-line EDS baggage screening systems or to replace ETD machines currently used as the primary method for screening. We believe that without such analyses, and without associated plans for the installation of in-line baggage screening systems and replacing stand-alone EDS machines, TSA cannot ensure that it is efficiently allocating its limited resources to maximize the effectiveness of its checked baggage screening operations.

An analysis of airport baggage screening needs would also help enable TSA to determine whether expected reduced staffing costs, higher baggage throughput, and increased security would justify the significant up-front investment required to install in-line baggage screening. TSA's retrospective analysis of nine airports installing in-line baggage screening systems with LOI funds, while limited, demonstrated that cost savings could be achieved through reduced staffing requirements for screeners and increased baggage throughput. In fact, the analysis showed that using in-line systems instead of stand-alone systems at these nine airports would save the federal government about \$1 billion over 7 years and that TSA's initial investment would be recovered in a little over 1 year. In considering

airports for in-line baggage screening systems or the continued use of stand-alone EDS and ETD machines, a systematic analysis of the costs and benefits of these systems would help TSA justify the appropriate screening for a particular airport, and such planning would help support funding requests by demonstrating enhanced security, improved operational efficiencies, and cost savings to both TSA and the affected airport.

In addition to identifying the most optimal baggage screening solutions at the nation's airports, a systematic analysis of baggage screening operations and solutions—including an estimate of savings that could be achieved through the installation of in-line EDS baggage screening systems—would assist the Administration and Congress in determining the appropriate role of the federal government and aviation industry in funding capital-intensive in-line baggage screening systems. By identifying efficiencies that could be achieved for both TSA—such as savings achieved through reduced TSA staffing needs for screeners—and the airports and airlines—such as increased security due to less crowding in airport lobbies and the faster processing of baggage and passengers—the Administration and Congress would have information identifying the costs and benefits of in-line baggage screening systems for all parties involved to assist in determining an appropriate cost-share between the federal government and aviation industry in funding these systems.

Recommendations for Executive Action

In developing the comprehensive plan for installing in-line EDS baggage screening systems, as directed by the fiscal year 2005 DHS Appropriation Act Conference Report, and in satisfying the requirements set forth in the Intelligence Reform and Terrorism Prevention Act of 2004, we recommend that the Secretary of the Department of Homeland Security direct the Administrator for the Transportation Security Administration to systematically assess the costs and benefits of deploying in-line baggage screening systems at airports that do not yet have in-line systems installed. As part of this assessment, the Administrator should take the following four actions:

- identify and prioritize the airports where the benefits—in terms of cost savings of baggage screening operations and improved security—of replacing stand-alone baggage screening systems with in-line systems are likely to exceed the costs of the systems, or the systems are needed to address security risks or related factors;
- consider the projected availability and costs of baggage screening equipment being developed through research and development efforts;

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- estimate total funds needed to install in-line systems where appropriate, including the federal funds needed given different assumptions regarding the federal government and airport cost-shares for funding the in-line systems; and
 - work collaboratively with airport operators, who are expected to share the costs and benefits of in-line systems, to collect data and prepare the analyses needed to develop plans for installing in-line systems.

We also recommend that the Administrator for the Transportation Security Administration assess the feasibility, expected benefits, and costs of replacing ETD machines with stand-alone EDS machines for primary screening at those airports where in-line systems would not be either economically justified or justified for other reasons. In conducting this assessment, the Administrator should consider the projected availability and costs for screening equipment being developed through research and development efforts.

We also made a recommendation to DHS addressing TSA's protocols for screeners using ETD systems and associated screener training, which is included in the restricted versions of this report.

Agency Comments and Our Evaluation

We provided a draft of this report to DHS for review and comment. On February 18, 2005, we received written comments on the draft report, which are reproduced in appendix V.⁴³ DHS generally concurred with our findings and recommendations, and agreed that efforts to implement the recommendations are critical to a successful checked baggage screening deployment program. Regarding our recommendation that TSA systematically assess the costs and benefits of deploying in-line baggage screening systems at airports that do not yet have in-line systems installed, DHS stated that TSA has initiated an analysis of deploying in-line checked baggage screening systems and is in the process of formulating criteria to use to identify those airports that would benefit from an in-line system. According to DHS, TSA believes that it can focus on approximately 40 airports that handle anywhere from 60 to 80 percent of all checked

⁴³ DHS's initial comments on our draft report were dated January 12, 2005, and we have included in the version of this report that contains classified and sensitive security information—GAO-05-135C—and in our report containing sensitive security information but not the classified information—GAO-05-302SU. In its February 18, 2005 letter, DHS removed comments considered by TSA to be security sensitive information.

baggage nationwide. Once TSA officials have finalized the criteria and determined those airports at which in-line systems should be installed, they plan to conduct an airport-specific analysis to determine the individual costs and operational benefits. We are encouraged that TSA is proceeding with this analysis, which should provide a sound business case to justify resource allocation decisions. It is important, however, that TSA establish milestones and time frames for completing the analysis and documenting and reporting the results, such that they are available in a timely manner for DHS and congressional budget decisions.

Concerning our recommendation that TSA assess the feasibility, expected benefits, and costs of replacing ETD machines with stand-alone EDS machines for primary screening at those airports where in-line systems would either not be economically justified or justified for other reasons, DHS stated that TSA has started conducting an analysis of the airports that rely on ETD machines as the primary checked baggage screening technology to identify those airports that would benefit from replacing ETDs with stand-alone EDS equipment. Again, we are pleased that TSA officials are conducting this analysis, which should provide them with the basis for optimizing the use of its EDS machines for screening checked baggage. Further, DHS stated that TSA continues to review and refine the protocols and training of all screening procedures including screening checked baggage, and are in the process of implementing the recommendations made by the DHS Inspector General regarding improved screener training and other improvements for both the passenger and checkpoint and checked baggage.

TSA also provided additional technical comments on our draft report, which we have incorporated where appropriate.

We will send copies of the report to the Secretary of the Department of Homeland Security, the TSA Administrator, and interested congressional committees as appropriate. We will also make copies available to others on request. In addition, the report will be available at no charge on GAO's Web site at <http://www.gao.gov>.

If you have any questions about this report, please contact me at (202) 512-3404, berrickc@gao.gov or Christine Fossett, Assistant Director at (202) 512-2956, fossettc@gao.gov. Key contributors to this report are listed in appendix VI.

A handwritten signature in black ink that reads "Cathleen A. Berrick". The signature is written in a cursive style with a large initial 'C' and a long, sweeping tail on the 'k'.

Cathleen A. Berrick, Director
Homeland Security and Justice Issues

Appendix I: Objectives, Scope, and Methodology

To assess efforts by the Transportation Security Administration (TSA) to screen checked baggage for explosives using explosives detection system (EDS) and explosives trace detection (ETD) equipment, we addressed the following questions: (1) How did TSA use the funds it initially budgeted to procure and install EDS and ETD systems and make associated airport modifications, and what was the impact of the initial deployment of EDS and ETD systems? (2) What actions are airports and TSA currently taking to install automated in-line EDS baggage screening systems,¹ and what are the federal resources that have been made available to fund these systems? (3) What actions, if any, is TSA taking to plan for the optimal deployment of in-line baggage screening systems in order to ensure the efficiency, cost effectiveness, and security of its checked baggage screening operations?

To determine how TSA used its funding for procuring and installing EDS and ETD systems and modifying airports, we obtained and analyzed relevant legislation and appropriate budget documents, contracts, and inventory reports from TSA related to checked baggage screening with EDS and ETD machines. We interviewed TSA officials from the Office of Budget and Performance, the Office of Acquisition, and TSA's Security Technology Deployment Office. We also obtained and reviewed funding and contractual documents from these locations. To determine what impact the initial deployment of EDS and ETD systems had on TSA and airport operations, we conducted a literature search to obtain information on the purpose and use of explosive detection screening equipment to screen checked baggage at airports for explosives. This search identified various TSA reports, Department of Homeland Security (DHS) Inspector General reports, Congressional Research Service reports, and aviation industry reports documenting TSA's use of this equipment for screening checked baggage. Also, we obtained and reviewed relevant documents from TSA and interviewed TSA headquarters officials from TSA's Office of Aviation Operations, Office of Chief Counsel, Office of Technology Deployment and Maintenance, and Office of Internal Affairs and Program Review. This documentation included information on staffing requirements and the number of bags per hour that can be screened by in-line EDS systems as compared with stand-alone EDS and ETD machines. We also interviewed officials from TSA, air carriers, airports, explosive

¹In-line EDS checked baggage screening systems typically involve checked baggage undergoing automated screening while on a conveyor belt that sorts and transports baggage to the proper location for its ultimate loading onto an aircraft.

detection systems equipment manufacturers, and airport industry associations to obtain information regarding TSA's efforts to improve checked baggage screening operations using EDS machines. Although we could not independently verify the reliability of all of this information, we compared it with other supporting documents, when available, to determine data consistency and reasonableness. Based on these efforts, we believe the information we obtained is sufficiently reliable for this report. Further, we reviewed the results from unannounced, undercover covert testing of checked baggage screening operations conducted by TSA's Office of Internal Affairs and Program Review and questioned TSA officials about the procedures used to ensure the reliability of the covert test data. On the basis of their answers, we believe that the covert test data are sufficiently reliable for the purposes of our review.

To address our second and third objectives—to determine what actions airports and TSA are taking to develop in-line EDS baggage screening systems and what resources are available for these systems; and to determine what TSA is doing to optimally deploy these systems in order to improve the efficiency, cost effectiveness, and security of its checked baggage screening operations—we obtained briefings and other documents related to the planned use and installation of in-line systems and interviewed officials from the Office of Chief Counsel and the Office of Security Technology. We also interviewed officials from the TSA's Transportation Security Laboratory in Atlantic City, New Jersey, to discuss the agency's efforts to examine future baggage screening technologies and the certification process for EDS and ETD equipment. We also used information related to checked baggage screening from a Web-based survey of all 155 federal security directors about 263 of the airports under their supervision. This survey is described below. We also followed up by telephone with airport officials from 70 of those airports to obtain additional information about their plans for in-line systems. These airports were selected primarily based on the responses from the federal security directors regarding whether the airport had or planned on installing in-line EDS checked baggage screening systems. In addition, GAO's Office of General Counsel formally requested that TSA describe its means for compliance with the baggage screening requirements of the Aviation and Transportation Security Act and the Homeland Security Act of 2002, and inquired how TSA would approach its letters of intent for funding in-line checked baggage screening systems in light of changes mandated by the

Vision 100—Century of Aviation Reauthorization Act.² Also, to assess potential savings, we reviewed a TSA cost model showing savings expected to be achieved with in-line rather than stand-alone EDS equipment at nine airports. We assessed the model's logic to ensure its completeness and correctness of calculations. Also, as discussed in appendix IV, we conducted a Monte Carlo simulation to: (1) illustrate sensitivity of potential cost savings of replacing stand-alone with in-line EDS systems to alternative values of key cost drivers and (2) to explore the variability in the key factors used by TSA in their model. Based on our review of TSA's cost model, we believe that it is sufficiently reliable for the analyses we conducted and the information included in this report.

In addition, in addressing all three objectives, we conducted site visits and a Web-based survey. Specifically, we conducted site visits at 22 airports (12 category X airports, 9 category I airports, and 1 category II airport) to observe airport security baggage screening procedures and discuss issues related to the baggage screening processes with TSA, airport, and airline officials. We chose these airports on the basis of one or more of the following factors: a large number of passenger boardings; the existence of an operational in-line system; whether the airport had received or requested TSA funding for an in-line system; whether the airport had begun screening all checked baggage using EDS or ETD; and the proximity to a larger airport being visited by GAO. The results from our airport visits provide examples of checked baggage screening operations and issues but cannot be generalized beyond the airports visited because we did not use statistical sampling techniques in selecting the airports. We administered a Web-based survey to all 155 federal security directors who oversee security at each of the airports falling under TSA's jurisdiction. The questionnaire contained questions related to the status of checked baggage screening operations and planning and implementation of in-line EDS checked baggage screening systems. A GAO survey specialist designed the questionnaire in combination with other GAO staff knowledgeable about airport security issues. We conducted pretest interviews with six federal security directors to ensure that the questions were clear, concise, and comprehensive. In addition, TSA managers and an independent GAO survey specialist reviewed the questionnaire.

²The fiscal year 2005 Department of Homeland Security Appropriations Act re-established the federal cost-share for letters of intent at the pre-Vision 100 level.

For this Web-based survey, each federal security director received one or two airport-specific questionnaires to complete, depending on the number of airports for which he or she was responsible. Where a federal security director was responsible for more than two airports, we selected the first airport based on the federal security director's location and the second airport to obtain a cross-section of all airports by size and geographic distribution. In all, we requested information on 265 airports. However, two airports were dropped from our initial selection because the airlines serving these airports suspended operations and TSA employees were redeployed to other airports. As a result, our sample size was reduced to 263 airports, which included all 21 category X airports, 60 category I airports, 49 category II airports, 73 category III airports, and 60 category IV airports. In that we did not use probability sampling methods to select the sample of airports, we cannot generalize our findings beyond the selected airports in these categories.

We conducted this Web-based survey from late March to mid-May 2004. We received completed questionnaires from all 155 federal security directors for all 263 separate airports for which we sought information for a 100 percent response rate. We called selected survey respondents, or other TSA officials designated to respond on the respondent's behalf, to obtain answers to key survey questions that may have been left blank, to look into situations where instructions were not followed and to investigate answers that looked suspicious or out of range. The survey results are not subject to sampling errors because all federal security directors were asked to participate in the survey and we did not use probability sampling techniques to select specific airports. However, the practical difficulties of conducting any survey may introduce errors, commonly referred to as non-sampling errors. For example, inconsistencies in how a particular question is interpreted, in the sources of information that are available to respondents, or in how the data are entered into a database or were analyzed can introduce unwanted variability in the survey results. We took steps in the development of the questionnaires, the data collection, and the data editing and analysis to minimize these non-sampling errors. Also, in that these were Web-based surveys whereby respondents entered their responses directly into our database, data entry or transcription errors were possible. In addition, all computer programs used to analyze the data were peer-reviewed and verified to ensure that the syntax was written and executed correctly.

We performed our work from September 2003 through January 2005 in accordance with generally accepted government auditing standards. Certain information we obtained and analyzed regarding explosive

detection technologies and their effectiveness in TSA's checked baggage screening operations are classified or are considered by TSA to be sensitive security information. Accordingly, the results of our review of this information have been removed from this report.³

³We issued two additional reports detailing the results of our review, which discuss results deemed to be classified or sensitive security information. The report that contains classified and sensitive security information is GAO, *Aviation Security: Systematic Planning Needed to Optimize the Deployment of Checked Baggage Screening Systems*, GAO-05-135C (Washington D.C.: February 4, 2005). The report containing sensitive security information but not the classified information is GAO, *Aviation Security: Systematic Planning Needed to Optimize the Deployment of Checked Baggage Screening Systems*, GAO-05-302SU (Washington D.C.: February 4, 2005).

Appendix II: Summary of Checked Baggage Screening Legislation

Table 9: Highlights of Authorizations in Laws Related to Checked Baggage Screening in Aviation Transportation Security since the Terrorist Attacks of September 11, 2001

Authorizations found in public laws	Key provisions
Aviation and Transportation Security Act (ATSA) , Pub. L. No. 107-71, 115 Stat. 597 (Nov. 19, 2001)	Established the Transportation Security Administration (TSA) as the agency responsible for security in all modes of transportation, including civil aviation
	Appointed federal security managers to oversee the screening of passengers and baggage at airports
	Deployment of federal personnel to screen all passengers and baggage at airports
	Mandated the screening of all checked baggage with explosive detection systems by December 31, 2002, and authorized alternative means to screen checked baggage (positive passenger bag match, manual search, canine search in combination with other means, other technology approved by TSA) where explosive detection systems are unavailable
	Mandated the imposition of passenger security fees (and authorized the imposition of air carrier fees, if necessary)
	Authorized use of Airport Improvement Program funds to replace baggage conveyor systems and reconfigure terminal baggage areas for installing bulk explosive detection systems; for other security-related activities required by law or the Secretary of Transportation from September 11, 2001, through October 1, 2002; and waived the local matching share for fiscal 2002 security related projects
	Required that the Computer-Assisted Passenger Prescreening System, or any successor system, evaluate all passengers before they board an aircraft and that procedures exist to ensure adequate screening of selected individuals and their checked baggage
	Authorized \$50 million for each of fiscal years 2002 through 2006 for research, development, testing and evaluation of technologies such as explosive detection systems
Homeland Security Act of 2002 , Pub. L. No. 107-296, 116 Stat. 2135 (Nov. 25, 2002)	Extended ATSA's mandate to screen all checked baggage using explosive detection systems to December 31, 2003, for noncompliant airports and required that all baggage at noncompliant airports be screened by alternative means until the mandate is fulfilled
	Requires the submission of a classified report describing TSA's progress toward meeting the baggage screening mandate every 30 days to the Senate Committee on Commerce, Science and Transportation and the House of Representatives Committee on Transportation and Infrastructure
	Requires the Secretary of Transportation to consult with the Secretary of Homeland Security before approving applications for Airport Improvement Program grants as they relate to security equipment or the installation of bulk explosive detection systems
Consolidated Appropriations Resolution, 2003 , Pub. L. No. 108-7, 117 Stat. 386 (Feb. 20, 2003)	Authorized \$500 million for each of fiscal years 2003 through 2007 for TSA to issue letters of intent (LOIs) to airports, with a government cost-share of 75 percent at airports with at least 0.25 percent of total passenger boardings each at all airports (90 percent at any other airport)
Emergency Wartime Supplemental Appropriations Act, 2003 , Pub. L. No. 108-11, 117 Stat. 559 (Apr. 16, 2003)	Authorized LOIs to assist in the installation of explosive detection systems at airports by December 31, 2003
Vision 100—Century of Aviation Reauthorization Act , Pub. L. No. 108-176, 117 Stat. 2490 (Dec. 12, 2003)	Limited the availability of Airport Improvement Program funds for replacing baggage conveyor systems and reconfiguring terminal baggage areas to install bulk explosive detection systems to entitlement funds

Appendix II: Summary of Checked Baggage Screening Legislation

Authorizations found in public laws	Key provisions
	Required the Secretary of Homeland Security to study the effectiveness of the aviation security system, including checked baggage, and to report that study within 6 months of the act's passage to the Senate Committee on Commerce, Science and Transportation and the House of Representatives Committee on Transportation and Infrastructure
	Authorized TSA to make grants for projects to replace baggage conveyer systems related to aviation security, to reconfigure terminal baggage areas as needed to install explosive detection systems, to enable TSA to deploy explosive detection systems behind the ticket counter, in the baggage sorting area, or in line with the baggage handling system, and for other airport security capital improvement projects TSA determines will improve security at an airport or improve the efficiency of the airport without lessening security
	<p>Authorized up to \$500 million for each of fiscal years 2004 through 2007 for TSA to make grants under 49 U.S.C. § 44923:</p> <p>\$250 million mandatory appropriation derived from passenger security fees to constitute the Aviation Security Capital Fund: \$125 million available on the basis of airport size and aviation security risks; \$125 million available for discretionary grants with priority to fulfilling LOIs</p> <p>\$250 million authorized appropriation for each of fiscal years 2004 through 2007: 50 percent available on the basis of airport size and aviation security risks; 50 percent available for discretionary grants with priority to fulfilling LOIs</p>
	Authorizes LOIs for airport security improvement projects at a 90 percent government cost-share at medium or large hub airports (95 percent at any other airport) and provides that TSA shall revise LOIs issued before the date of enactment to reflect the new cost-share with respect to grants made after September 30, 2003
<p>Intelligence Reform and Terrorism Prevention Act of 2004, Pub. L. No. 108-458, 118 Stat. 3638 (Dec. 17, 2004)</p>	Requires that TSA take action to expedite the installation and use of baggage screening equipment and requires that TSA submit schedules to the Senate Committee on Commerce, Science and Transportation and the House of Representatives Committee on Transportation and Infrastructure for expediting the installation and use of in-line baggage screening equipment that estimate the impact that such equipment, facility modification, and baggage conveyor placement will have on staffing needs and levels related to aviation security and for replacing trace detection equipment with explosive detection system equipment as soon as practicable and where appropriate, within 180 days of enactment
	Requires the Secretary of Homeland Security, in consultation with air carriers, airport operators, and other interested parties, to submit, in conjunction with its fiscal year 2006 budget proposal, a proposed formula for cost sharing among federal, state and local governments and the private sector for the installation of in-line baggage screening systems, recommendations for defraying the costs of in-line systems, and a review of innovative financing approaches and possible cost savings associated with installing in-line systems at airports
	Amends 49 U.S.C. § 44923(i) by increasing the authorized appropriations for each of fiscal years 2005 through 2007 to \$400 million
	Allows for a reimbursement period under any LOI to extend for a maximum of 10 years after issuance

Source: GAO analysis of public laws related to checked baggage screening since the Terrorist Attacks of September 11, 2001.

Table 10: Highlights of Appropriations in Laws Related to Checked Baggage Screening in Aviation Transportation Security since the Terrorist Attacks of September 11, 2001

Appropriations found in public laws	Funding appropriated and other key provisions
2002 Emergency Supplemental Appropriations Act for Recovery from and Response to Terrorist Attacks on the United States , Pub. L. No. 107-38, 115 Stat. 220 (Sept. 18, 2001)	\$40 billion (available until expended) for, among other things, the costs of providing increased transportation security; no specific baggage screening-related appropriation
Department of Transportation and Related Agencies Appropriations Act , Pub. L. No. 107-87, 115 Stat. 833 (Dec. 18, 2001)	\$1.25 billion (available until expended) for necessary expenses of TSA related to providing civil aviation security services pursuant to ATSA; no specific baggage screening-related appropriation H.R. Conf. Rep. No. 107-308 (2001) directed \$97.5 million from “FAA, Facilities and Equipment”: \$38 million for bulk explosive detection systems; \$12 million for trace detection equipment; \$12 million for threat image projection systems; \$2 million for computer-based training; \$33.5 million for system integration
Department of Defense Emergency Supplemental Appropriations for Recovery from and Response to Terrorist Attacks on the United States, 2002; Department of Defense Appropriations Act, 2002 , Pub. L. No. 107-117, 115 Stat. 2230 (Jan. 10, 2002)	Funds to be obligated from amounts made available in Public Law 107-38: \$108.5 million to “FAA Facilities and Equipment” (available until Sept. 30, 2004) for procurement and installation of explosive detection systems \$50 million to “FAA Research and Development” (available until Sept. 30, 2003), of which H.R. Conf. Rep. No. 107-350 (2001) directed \$2 million for a demonstration of 100 percent positive passenger bag match technology at DCA
2002 Supplemental Appropriations Act for Further Recovery from and Response to Terrorist Attacks on the United States , Pub. L. No. 107-206, 116 Stat. 820 (Aug. 2, 2002)	\$738 million (available until expended) for physical modifications to commercial service airports for installing checked baggage explosive detection systems
Consolidated Appropriations Resolution, 2003 , Pub. L. No. 108-7, 117 Stat. 386 (Feb. 20, 2003)	\$3.0379 billion (available until expended) for screening activities, of which H.R. Conf. Rep. No. 108-10 (2003) directed \$1.4159 billion for baggage screening activities: The Resolution earmarked \$265 million for the physical modification of commercial service airports to install, and \$174.5 million for the procurement of, checked baggage explosive detection systems The Conference Report directed \$900 million for baggage screeners, \$75 million for detection equipment maintenance, and \$1.4 million for a checked baggage data system
Emergency Wartime Supplemental Appropriations Act, 2003 , Pub. L. No. 108-11, 117 Stat. 559 (Apr. 16, 2003).	\$235 million (available until expended) for the physical modification of commercial service airports to install checked baggage explosive detection systems
Department of Homeland Security Appropriations Act, 2004 , Pub. L. No. 108-90, 117 Stat. 1137 (Oct. 1, 2003).	\$1.3187 billion (available until expended) for baggage screening activities: The act earmarked \$250 million for physical modification of commercial service airports to install, and \$150 million for the procurement of, checked baggage explosive detection systems. H.R. Conf. Rep. No. 108-280 (2003) directed \$774.2 million for personnel, compensation and benefits; \$69.5 for training and other purposes; and \$75 million for explosive detection system maintenance
	\$45 million (available until expended) for research and development of explosive detection devices

**Appendix II: Summary of Checked Baggage
Screening Legislation**

Appropriations found in public laws	Funding appropriated and other key provisions
Consolidated Appropriations Act, 2004 , Pub. L. No. 108-199, 118 Stat. 3 (Jan. 23, 2004)	Precludes the obligation or expenditure of funds appropriated or otherwise made available by this or any other act to carry out provisions of 49 U.S.C. § 44923(h)—the Aviation Security Capital Fund—during fiscal year 2004
Department of Homeland Security Appropriations Act, 2005 , Pub. L. No. 108-334, 118 Stat. 1298 (Oct. 18, 2004)	<p>\$1.45246 billion (available until expended) for baggage screening activities:</p> <p>The act earmarks \$180 million for procurement of, and \$45 million to install, checked baggage explosive detection systems.</p> <p>H.R. Conf. Rep. 108-774 (2004) directs \$848.86 million for personnel, compensation and benefits; \$203.66 million for training and other purposes; \$174.94 million for maintenance; and at least \$30 million of the \$180 procurement earmark to install next-generation explosive detection systems to permit more efficient handling of checked bags and reduce dependence on baggage screeners, particularly at medium-sized and small airports. It further recognizes the mandatory \$250 million mandatory appropriation to the Aviation Security Capital Fund.</p>
	\$54 million earmarked for research and development of next generation explosive detection devices, of which the Conference Report directs \$10 million for the Manhattan II project
	Reestablishes, for fiscal year 2005, the 75 percent government cost-share for the eight LOIs issued for the installation of in-line baggage screening systems
	<p>The Conference Report directs that TSA:</p> <p>comprehensively plan for expediting the installation of in-line explosive detection systems, including the formulation of detailed budget requirements to provide for both equipment acquisition and the capital costs of installing such system configurations at airports; continue submitting quarterly reports, consistent with the requirement of H.R. Rep. No. 108-169 (2003), on its plans for the installation of in-line systems</p>
Consolidated Appropriations Act, 2005 , Pub. L. No. 108-447, 118 Stat. 2809 (Dec. 8, 2004)	Precludes the availability of Airport Improvement Program funds for the replacement of baggage conveyor systems, reconfiguration of terminal baggage areas, and other improvements necessary to install bulk explosive detection systems

Source: GAO analysis of public laws related to checked baggage screening since the Terrorist Attacks of September 11, 2001.

Appendix III: Airports Receiving TSA Airport Modification and EDS/ETD Equipment Installation Funding for In-line Systems

Table 11: Listing of Airports Receiving Modification and EDS/ETD Equipment Installation Funding for Developing In-line EDS Baggage Screening Systems as of September 30, 2004

Name of airport	LOI funding for airport modification	Other transaction agreement funding for airport modification	Airport modification and EDS equipment installation work performed by Boeing Service Company, other contractors, or EDS manufacturers
13 Category X Airports			
Hartsfield Atlanta International	X		
Boston Logan International	X		X
Baltimore/Washington International			X
Chicago O'Hare International		X	
Denver International	X		X
Dallas-Fort Worth International	X	X	X
Detroit Metro Wayne County		X	
Houston George Bush Intercontinental			X
Los Angeles International	X		
Miami International			X
Orlando International			X
San Francisco International		X	X
Seattle-Tacoma International	X		X
Subtotal	6	4	9
16 Category I Airports			
Anchorage Ted Stevens International			X
Boise Air Terminal/Gowen Field			X
Burbank-Glendale-Pasadena			X
Santa Ana John Wayne			X
Las Vegas McCarran International	X		X
Metropolitan Oakland International Airport			X
Oklahoma City Will Rogers World			X
Ontario International	X		
Phoenix Sky Harbor International	X		
Greensboro Piedmont Triad International		X	
Pittsburgh International		X	X
Sacramento International		X	
Southwest Florida International			
Spokane International			X
Tampa International			X
Tulsa International			X

**Appendix III: Airports Receiving TSA Airport
Modification and EDS/ETD Equipment
Installation Funding for In-line Systems**

Name of airport	LOI funding for airport modification	Other transaction agreement funding for airport modification	Airport modification and EDS equipment installation work performed by Boeing Service Company, other contractors, or EDS manufacturers
Subtotal	3	3	12
3 Category II Airports			
Harrisburg International		X	X
Juneau International			X
Manchester			X
Subtotal		1	3
1 Category III Airport			
Okaloosa County Air Terminal			X
Subtotal			1
Total (33 Airports)	9	8	25

Source: GAO analysis of TSA obligation and commitment data and contract files.

Appendix IV: Analysis of TSA's Cost Savings Estimates for In-line EDS Checked Baggage Screening Systems

TSA estimated that baggage screening operations at the nine airports receiving letters of intent (LOIs) will result in a savings to the federal government of \$1.26 billion over 7 years—and would recover the initial investment in 1.07 years—as a result of installing in-line rather than stand-alone EDS systems.¹ To make these estimates, TSA made a variety of assumptions about in-line and stand-alone EDS systems, including how many bags can be processed per hour by both, how many screeners both would need, and how much it would cost to purchase, install, and operate these systems.² In addition, TSA used data on how much it cost to modify these nine airports to accommodate in-line systems. In considering the accuracy of TSA's estimates, uncertainties inherent in many of these assumptions should be considered. TSA could have analyzed uncertainty in their estimate by conducting sensitivity or other analyses to determine how variations in these assumptions would change its estimate of cost savings. Analyzing uncertainty in this way is consistent with best practices for preparing benefit-cost analysis of government programs or projects called for by OMB Circular A-94. Nonetheless, TSA's cost model for these nine airports offers insights about key factors likely to influence potential cost savings at other airports.

To illustrate taking uncertainty into account, we conducted a Monte Carlo analysis using TSA's cost model.³ We found that TSA's cost savings estimate of \$3.5 million per in-line EDS machine as compared to stand-alone could range from a loss of \$1.6 million to a savings of \$8.3 million per machine using generalized assumptions about cost uncertainty in TSA's model. The most important source of uncertainty causing this wide range in possible savings was the cost to modify an airport to accommodate an in-line EDS system. Variation in modification costs explained over 60 percent of the variation in potential cost savings from

¹This is the present value of cost savings over a seven-year period. Unless otherwise noted, all dollar figures cited are present values. As noted earlier, this estimate falls to \$1.14 billion after adjustments to the discount rate following Office of Management and Budget Circular A-94 guidance.

²Costs to install and multiplex in-line EDS systems were based on budget assumptions rather than true requirements.

³Our analysis was conducted using what is called Monte Carlo simulation, which uses random numbers to measure the effects of uncertainty. In the absence of additional information, our simulation is based on some general assumptions about the probability distributions characterizing values used by TSA for most of the cost factors. In the case of modification costs, we were able to use information on the variation of those costs across the nine airports.

in-line EDS as compared to stand-alone EDS. The next most important variable, the number of bags per hour that in-line and stand-alone machines can screen per hour, each accounted for about 15 percent of the variation in cost savings. In this way, Monte Carlo analysis can offer insights on factors to focus on when determining the appropriateness of an in-line EDS baggage screening system for a particular airport.⁴

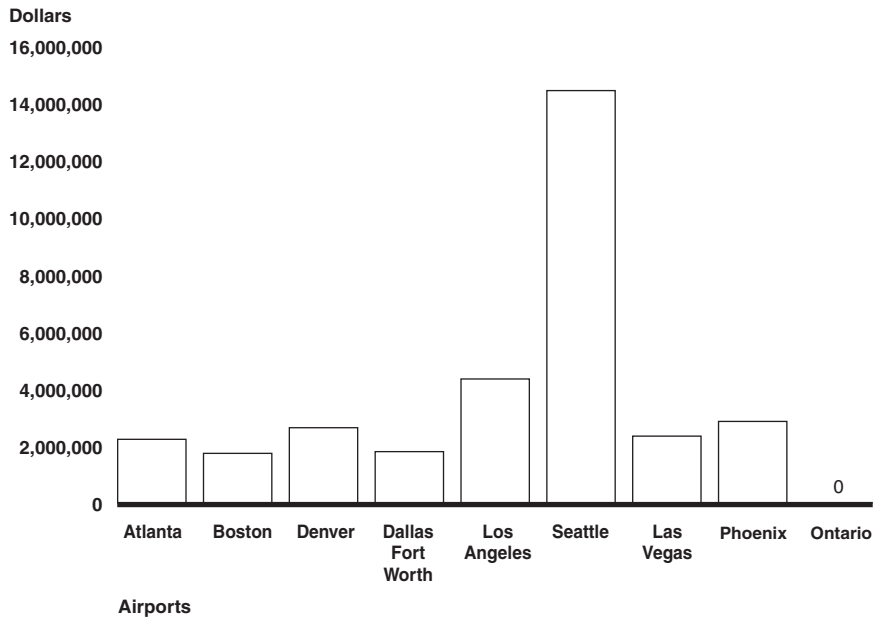
The analysis provided by TSA aggregated the nine airports to present a total estimate. Using TSA's analysis, we were able to determine the results for each of the nine airports. Figure 7 illustrates the variation in modification costs at the nine airports TSA studied, ranging from over \$14 million per in-line EDS machine at Seattle to less than \$2 million for Boston and Dallas-Fort Worth.⁵ Figure 8, which shows the cost savings from in-line EDS compared to stand-alone EDS, identifies that Seattle could end up spending more for an in-line EDS system than from using stand-alone EDS machines. Further, as shown in figure 9, at Seattle the relatively large costs for upfront in-line EDS are not offset by the estimated \$48 million in operation and maintenance cost savings; therefore, the in-line EDS system may be more costly than EDS stand-alone. By contrast, at Dallas-Fort Worth, the upfront costs of in-line EDS are lower than for stand-alone EDS, and there is an estimated \$252 million in operation and maintenance cost savings. Therefore, the in-line EDS system at Dallas-Fort Worth may be less costly than stand-alone EDS.

⁴TSA's model covers nine airports handling relatively large numbers of passengers, reflecting the fact that in-line EDS has been limited mostly to larger airports.

⁵TSA's data shows zero cost shown for Ontario, but it may be due to it being combined with Los Angeles.

**Appendix IV: Analysis of TSA's Cost Savings
Estimates for In-line EDS Checked Baggage
Screening Systems**

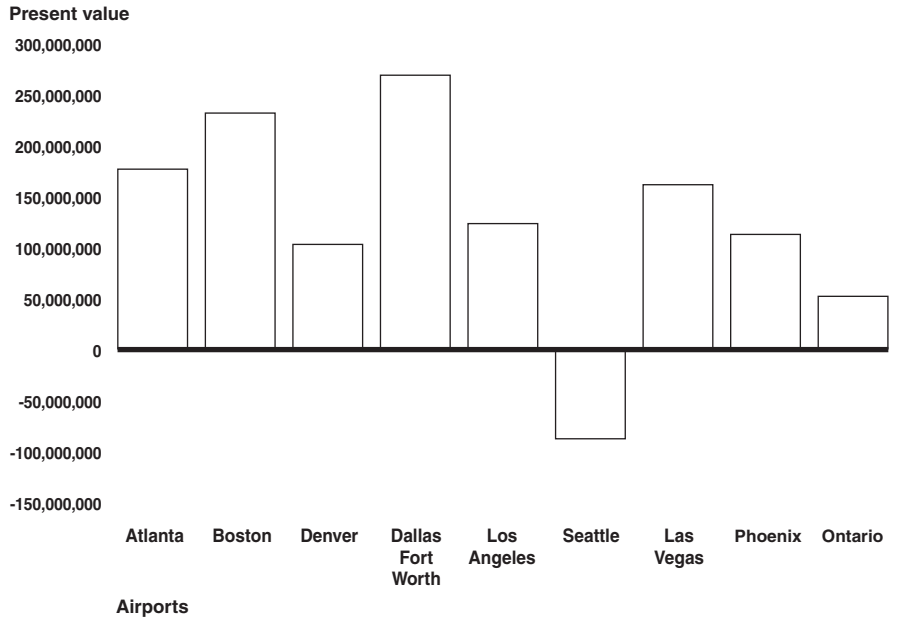
Figure 7: Airport Modification Costs Per In-line EDS Machine at Nine Airports



Source: Transportation Security Administration data.

**Appendix IV: Analysis of TSA's Cost Savings
Estimates for In-line EDS Checked Baggage
Screening Systems**

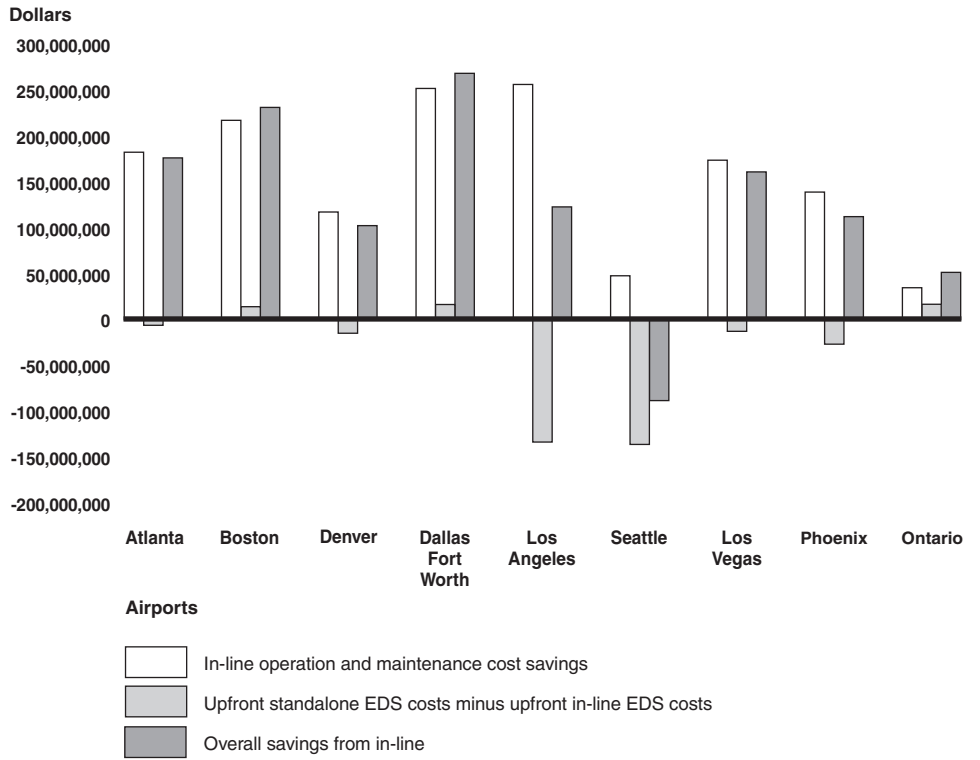
**Figure 8: Cost Savings from In-line EDS Systems Compared to Stand-alone EDS at
Nine Airports**



Source: Transportation Security Administration data.

Appendix IV: Analysis of TSA's Cost Savings Estimates for In-line EDS Checked Baggage Screening Systems

Figure 9: Costs and Savings at Nine Airports



Source: Transportation Security Administration data.

Appendix V: Comments from the Department of Homeland Security

U.S. Department of Homeland Security
Washington, DC 20528



**Homeland
Security**

February 18, 2005

Ms. Cathleen A. Berrick
Director, Homeland Security & Justice Issues
U.S. Government Accountability Office
441 G Street, N.W.
Washington, D.C. 20548

Dear Ms. Berrick:

RE: Draft Report GAO-05-365, Aviation Security: Systematic Planning Needed to Optimize the Deployment of Checked Baggage Screening Systems
(GAO Job Code 440386)

Thank you for the opportunity to comment on the subject draft report. The Department of Homeland Security (DHS) appreciates the work done to identify areas for improvement in the Transportation Security Administration's explosive detection systems (EDS) and explosive trace detection (ETD) checked baggage screening systems. We generally concur with the report and its recommendations and appreciate the discussion of challenges and next steps this report contains.

The report acknowledges the substantial progress the Transportation Security Administration (TSA) has made in installing EDS and ETD systems to provide the capability to screen all checked baggage for explosives, as required by Congress, and notes resource limitations and uncertainties associated with funding these capital-intensive systems on a large scale basis. However, there are areas within the report about which DHS would like to comment.

GAO made the following two recommendations regarding the deployment of checked baggage screening systems:

1. Systematically assess the costs and benefits of deploying in-line baggage screening systems at airports that do not yet have in-line systems installed.
 - a. Identify and prioritize the airports where the benefits, in terms of cost savings of baggage screening operations, of replacing stand-alone baggage screening systems with in-line systems are likely to exceed the costs of the systems;
 - b. Consider the projected availability and costs of baggage screening equipment being developed through research and development efforts;

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- c. Estimate total funds needed to install in-line systems where appropriate, including the federal funds needed given different assumptions regarding the federal government and airport cost shares for funding the in-line systems; and
 - d. Work collaboratively with airport operators, who are expected to share in the costs and benefits of in-line systems, to collect data and prepare the analyses needed to develop plans for installing in-line systems.
 2. Assess the feasibility, expected benefits, and costs to replace ETD machines with stand-alone EDS machines for primary screening at those airports where in-line systems would not be economically justified.

DHS agrees that efforts to implement these recommendations are critical to a successful checked baggage screening deployment program and has taken or is taking the following actions:

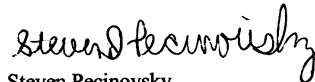
1. TSA is already in the process of conducting an analysis of deploying in-line checked baggage screening systems. Currently, TSA is evaluating the most effective criteria to use to determine the top airports that would benefit from an in-line system. TSA officials believe that they can focus on approximately 40 airports that handle anywhere from 60-80% of all checked baggage nationwide. Once TSA officials have finalized the criteria and determined the top airports, they will conduct an airport specific analysis to determine the individual cost and operational benefits. Additionally, TSA officials will strive to estimate the per airport cost to install an in-line system. This is a difficult task because there are numerous variables that cannot always be identified without developing a costly, very detailed design plan. TSA will continue to work closely with airports and all appropriate stakeholders in achieving the most cost and operationally effective checked baggage screening system.
2. TSA is currently conducting an analysis of the airports that rely heavily on ETD machines as the primary checked baggage screening technology. Officials will identify the airports that would benefit from replacing ETDs with stand-alone EDS equipment. The EDS equipment that is being considered will be surplus from the airports receiving in-line systems. Furthermore, the newly certified EDS is less expensive than currently deployed EDS equipment and has a throughput capacity that would be appropriate for smaller airports.

In addition, TSA officials are working towards development of a variety of automated technology solutions under the Research and Development Next Generation EDS program. TSA recognizes that any system that relies heavily on human interaction has vulnerabilities that are not as prevalent with an automated system. While new automated technologies are being developed, TSA continues to review and refine the protocols and training for all screening procedures to include primary ETD screening for checked baggage. Officials have implemented or are in the process of implementing all of the recommendations made by the DHS Inspector General regarding screener improvement for both the checkpoint and checked baggage. The recommendations include improved screener training, the development and deployment of innovations and improvements to aviation security technologies, revisions to the Checked

Baggage Standard Operating Procedures, and improvements to management and supervisory oversight of screeners.

In summary, DHS appreciates your review of the deployment of checked baggage screening systems and thanks you for the thorough analysis and discussion that comprises this report. We continue to be cognizant of the areas upon which we can improve.

Sincerely,



Steven Pecinovsky
Acting Director
Departmental GAO/OIG Liaison Office
Office of the Chief Financial Officer

Appendix VI: GAO Contacts and Staff Acknowledgments

GAO Contacts

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Staff Acknowledgments

In addition to those named above, David Alexander, Leo Barbour, Charles Bausell Jr., Kevin Copping, Katherine Davis, Kevin Dooley, David Hooper, Lemuel Jackson, Stuart Kaufman, Noel Lance, Thomas Lombardi, Jan Montgomery, Jobenia Odum, Jean Orland, Keith Rhodes, Minette Richardson, and Mark Tremba were key contributors to this report.

Glossary

Airport categories

TSA classifies the over 400 airports in the United States that require screening into one of five categories (X, I, II, III, and IV) based on various factors, such as the total number of take-offs and landings annually, the extent to which passengers are screened at the airport, and other special security considerations. In general, category X airports have the largest number of passenger boardings and category IV airports have the smallest. TSA periodically reviews airports in each category, and, if appropriate, changes an airport's categorization to reflect current operations.

Airport Improvement Program

The Airport Improvement Program has provided federal grants since the passage of the Airport and Airway Improvement Act of 1982, Pub. L. No. 97-248, 96 Stat. 324. Administered by the Federal Aviation Administration, Airport Improvement Program grants have supported airport planning and development. Grants are issued to maintain and enhance airport safety, preserve existing airport infrastructure, and expand capacity and efficiency throughout the airport system. Funds obligated for the Airport Improvement Program are drawn from the Airport and Airway Trust Fund, which is supported by user fees and fuel taxes.

Checked baggage

An individual's personal property offered to and accepted by an aircraft operator for transport, which will be inaccessible to the individual during flight.

Cost-effectiveness analysis

A program is cost effective if, on the basis of life cycle cost analysis of competing alternatives, it is determined to have the lowest costs expressed in present value terms for a given amount of benefits. Cost-effectiveness analysis is appropriate whenever it is unnecessary or impractical to consider the dollar value of the benefits provided by the alternatives under consideration. This is the case whenever (1) each alternative has the same annual benefits expressed in monetary terms; or (2) each alternative has the same annual affects but dollar values cannot be assigned to their benefits.

Explosives Detection System (EDS)

A TSA certified automated device that has the ability to detect in checked baggage, the amounts, types, and configurations of explosive material specified by the TSA. An EDS machine uses computer-aided tomography to automatically measure the density of objects in baggage to determine whether the objects have the same density as explosives. The system automatically triggers an alarm when objects with high densities characteristic of explosives are detected.

Explosives Trace Detection (ETD)

A device that has been certified by TSA for detecting explosive vapors and residues on objects intended to be transported aboard an aircraft. Explosives trace detection works by detecting vapors and residues of explosives. Human operators collect samples by rubbing bags with swabs, which are chemically analyzed to identify any traces of explosive materials. ETD is used both for primary screening of baggage and secondary screening to resolve alarms from EDS machines.

Interim lobby solutions

Solutions employed by TSA to initially deploy explosive detection systems to screen 100 percent of checked baggage for explosives, until more permanent solutions could be designed and constructed. Efforts involved designing and implementing facility modifications, such as new construction, infrastructure reinforcement, and modification of electrical systems required to install the EDS and ETD equipment; and developing and administering equipment training for baggage screeners.

In-line system (also known as integrated checked baggage screening system or integrated EDS system)

A baggage conveyor system with incorporated EDS machines. The EDS's baggage feed and output belts are directly connected to an airline's or airport's baggage belt system. The checked baggage undergoes automated screening in the EDS while on the conveyor belt system that sorts and transports baggage to the proper location for its ultimate loading on an aircraft. Baggage is introduced into the EDS without manual loading or unloading by TSA screeners.

Letters of intent (LOI)

The fiscal year 2003 Consolidated Appropriations Resolution, Pub. L. No. 108-7, 117 Stat. 11, authorized an LOI program for shared federal government and aviation industry funding to support facility modification costs associated with the installation of in-line EDS baggage screening systems. The Vision 100—Century of Aviation Reauthorization Act, Pub. L. No. 108-176, 117 Stat. 2490 (2003), also authorized the use of LOIs for this purpose.

Multiplex

EDS machines are networked together so that images from multiple EDS machines can be sent to a centralized location where screeners can resolve alarms by studying EDS generated images.

On-screen alarm resolution of EDS alarms

When an EDS machine alarms, indicating the possibility of explosives, TSA screeners, by reviewing computer generated images of the inside of the bag, attempt to determine whether or not a suspect item or items are in fact explosive materials. If the screener is unable to make this determination, the bag is diverted from the main conveyor belt into an area where it receives a secondary screening by a screener with an ETD machine.

Other Transaction Agreements

Other transaction agreements are administrative vehicles used by TSA to directly fund airport operators for smaller in-line airport modification projects without undertaking a long-term commitment. These transactions, which undertake many forms and are generally not required to comply with Federal laws and regulations that apply to contracts, grants, and/or cooperative agreements, enable the federal government and others entering into these agreements to freely negotiate provisions that are mutually agreeable.

Positive passenger bag match

An alternative means of screening checked baggage, conducted by the airline, which requires that the passenger be on the same aircraft as his or her checked baggage.

Stand-alone EDS machines

EDS machines that are placed in terminal lobbies, curbside or in baggage makeup areas, not integrated with baggage conveyor systems as part of in-line systems.

Throughput

Bags screened per hour as a measure of efficiency.

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