Advanced Integrated Passenger and Baggage Screening Technologies

February 13, 2018

Fiscal Year 2017 Report to Congress

Transportation Security Administration

Message from the Administrator

February 13, 2018

I am pleased to present the following report, "Advanced Integrated Passenger and Baggage Screening Technologies," prepared by the Transportation Security Administration (TSA).

This report was compiled pursuant to the Fiscal Year (FY) 2017 Department of Homeland Security (DHS) Appropriations Act (P.L. 115-31) and the accompanying Joint Explanatory Statement and Senate Report 114-264. The report provides updates on the Department's efforts and resources devoted to developing more advanced integrated passenger screening technologies for the most effective security of passengers and baggage at the lowest possible operating and acquisition costs; how TSA is deploying its existing screener workforce in the most cost-effective manner; the labor savings of improved technologies for passenger and baggage screening; and how those savings are being used to offset security costs or are being reinvested to address security vulnerabilities.

The report also includes projected funding levels for the next 5 fiscal years, or until project completion, for each technology discussed, and summarizes the FY 2017 efforts made to continue more fundamental transformation of aviation security. This transformation includes revising the staffing model, suitably rightsizing and resourcing operations to address passenger growth, and making necessary equipment investments to close vulnerabilities and improve system effectiveness.

Pursuant to congressional requirements, this report is being provided to the following Members of Congress:

The Honorable John R. Carter
Chairman, House Appropriations Subcommittee on Homeland Security

The Honorable Lucille Roybal-Allard
Ranking Member, House Appropriations Subcommittee on Homeland Security

The Honorable John Boozman
Chairman, Senate Appropriations Subcommittee on Homeland Security

The Honorable Jon Tester
Ranking Member, Senate Appropriations Subcommittee on Homeland Security

If you have any questions, please do not hesitate to contact me at (571) 227-2801 or the Department's Acting Chief Financial Officer, Stacy Marcott, at (202) 447-5751.

Sincerely yours,

David P. Pekoske

David P. Pekoske
Administrator

Executive Summary

The FY 2017 DHS Appropriations Act (P.L. 115-31) and accompanying Joint Explanatory Statement and Senate Report 114-264 require TSA to submit a detailed report to address the following:

- DHS efforts and resources that are devoted to developing more advanced integrated passenger screening technologies for the most effective security of passengers and baggage at the lowest possible operating and acquisition costs;
- TSA deployment of its existing passenger and baggage screener workforce in the most cost-effective manner; and
- Labor savings from the deployment of improved technologies for passenger and baggage screening, and how those savings are being used to offset security costs or are being reinvested to address security vulnerabilities.

The report also includes projected funding levels for the next 5 fiscal years, or until project completion, for each technology discussed.

Through FY 2017, TSA has continued to advance aviation security by enhancing existing technologies and acquiring and integrating new technologies to screen passengers and checked baggage more effectively and efficiently. Passenger volume increased 6.5 percent in calendar year 2016, in large part because of a rebound in the economy, lower fuel prices, and increased utilization of aircraft by the airline industry. Passenger volume growth is projected to increase by 3 percent through FY 2018. TSA actively is committed to identifying and implementing appropriate technology and workforce efficiencies to handle the record number of travelers and goods through our Nation's transportation system, while maintaining its focus on effective security.

TSA has undertaken a number of initiatives in FY 2017 to field mission capabilities that enhance the safety and security of the aviation system. This has included deployment of 161 Advanced Imaging Technology-2 systems to Category III and IV airports (including Great Falls International Airport and Helena Regional Airport), many of which previously had lacked advanced imaging capability, as well as 1,353 Explosives Trace Detectors to provide for increased need in the field and to replace systems that were unable to be upgraded to the latest detection standard.

Additionally, TSA continues to enhance existing checkpoint and checked baggage screening technologies to increase detection capabilities and efficiencies. TSA is working actively with government partners, industry, and other stakeholders to update detection standards for Advanced Imaging Technology, Explosives Trace Detectors, Advanced Technology X-rays, Bottle Liquid Scanners, and Enhanced Metal Detectors. TSA also is investing in new technologies, such as:

- Credential Authentication Technology, which will enhance TSA's security capabilities by improving the inspection of passenger identification documentation and confirming passengers' Secure Flight vetting status.
- Computed Tomography, which will offer an enhanced imaging platform at the checkpoint as compared with the presently deployed Advanced Technology X-ray systems and can be upgraded to a higher detection standard.

While enhancing existing technologies and acquiring new technologies, TSA continues to use a rigorous staff allocation process and enhanced staffing model to allocate its security workforce efficiently. As new technology, emerging threats, and changes in TSA's operating procedures occur, TSA actively adjusts its staffing process to match resources more closely to mission demands. Considerations in this past fiscal year have included ensuring a more comprehensive delivery of TSA Pre✓® and Automated Screening Lanes; addressing increases in annual leave for a maturing workforce; fully funding sick leave and training requirements; and identifying full-time equivalent (FTE) savings or efficiencies related to staffing small airports for which federal screening resources now are committed. TSA also continues to install labor-saving, improved technology to support operational efficiencies. In FY 2016, TSA realized savings of 93 FTEs from in-line Explosives Detection Systems for checked baggage screening, when compared to the staffing required for the stand-alone screening equipment configuration. TSA was able to redirect these savings to address passenger volume increases and staffing needs across the checkpoint system.

TSA operates in a complex environment with dynamic, evolving threats to our Nation's aviation system, coupled with year-over-year increases in passenger volumes. TSA is committed to continue working closely with Congress to resource the organization appropriately in order to deliver more effective security in a more efficient manner.

Advanced Integrated Passenger and Baggage Screening Technologies

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I. Legislative Language

This report is submitted pursuant to the Fiscal Year (FY) 2017 Department of Homeland Security (DHS) Appropriations Act (P.L. 115-31) and the accompanying Joint Explanatory Statement and Senate Report 114-264.

P.L. 115-31 states:

> SEC. 216. The reporting requirement in the ninth proviso under the heading "Transportation Security Administration—Aviation Security" in the Department of Homeland Security Appropriations Act, 2016 (Public Law 114–113), shall apply in fiscal year 2017, except that the reference to "this Act" shall be treated as referring to this Act.

The Joint Explanatory Statement includes the following provision:

> Section 216. A provision proposed by the House and Senate is continued that requires TSA to submit a report on TSA passenger and baggage screening.

Senate Report 114-264 states:

> ADVANCED INTEGRATED SCREENING TECHNOLOGIES
>
> Pursuant to a statutory requirement in the bill, TSA is to continue providing a report on advanced integrated passenger screening technologies for the most effective security of passengers and baggage not later than 90 days after the date of enactment of this act. The report provides a useful description of existing and emerging equipment capable of detecting threats concealed on passengers and in baggage as well as projected funding levels for the next 5 fiscal years for each technology discussed in the report.

As referenced in the FY 2016 DHS Appropriations Act (P.L. 114-113):

> *Provided further*, That not later than 90 days after the date of enactment of this Act, the Secretary of Homeland Security shall submit to the Committees on Appropriations of the Senate and the House of Representatives a detailed report on—
>
> (1) the Department of Homeland Security efforts and resources being devoted to develop more advanced integrated passenger screening technologies for the most effective security of passengers and baggage at the lowest possible operating and acquisition costs, including projected funding levels for each fiscal year for the next 5 years or until project completion, whichever is earlier;
>
> (2) how the Transportation Security Administration is deploying its existing passenger and baggage screener workforce in the most cost-effective manner; and

(3) labor savings from the deployment of improved technologies for passenger and baggage screening, including high-speed baggage screening, and how those savings are being used to offset security costs or reinvested to address security vulnerabilities…

II. Introduction

Since its creation following the terrorist attacks of September 11, 2001, the Transportation Security Administration (TSA) has made great strides in advancing aviation security through innovative technology investments and continuous evaluation of workforce efficiencies.

TSA's mission is to protect the Nation's transportation systems by staying ahead of evolving terrorist threats while protecting privacy and civil liberties, and facilitating the flow of legitimate travel and commerce. To achieve its mission, TSA employs risk-based, intelligence-driven operations to reduce the vulnerability of the Nation's transportation system to terrorism. TSA's security measures involve a range of capabilities designed to mitigate risk substantially. Moreover, to remain ahead of those who seek to do us harm, TSA continues to evolve its security approach by constantly evaluating the procedures and technologies that TSA uses, training its workforce, and regularly assessing specific security procedures.

TSA occupies the front lines of the Nation's transportation security responsibilities, to include security screening of passengers and baggage 365 days per year at approximately 440 airports in the United States. On any given day, TSA and its partners now secure 2.2 million passengers and 1.8 million checked bags on more than 25,000 flights. This represents 400,000 more passengers and 600,000 more checked bags, or 22- and 50-percent increases respectively, per day, than in 2015. On the basis of Department of Transportation passenger volume forecasts combined with TSA historical and forecasted passenger screening statistics, TSA anticipates that the number of passengers screened will grow by 3 percent in FY 2018. In short, TSA and the aviation industry have seen a steady uptick in daily travelers, and this growth will continue barring unexpected economic downturns.

Coupled with ever-evolving threats, the goal for TSA is clear when it comes to technology investment: identify and implement capabilities that can detect increasingly complex threats, secure those capabilities against cyber intrusions, and ensure that these capabilities can scale to handle the increasing number of travelers and goods.

III. Background

TSA technology acquisition programs operate within complex environmental realities and considerations that influence not only the solutions that are procured, but how they are procured. Current realities and considerations of the security technology environment include:

- ***Risk-Based Security (RBS):*** RBS requires an interoperable and dynamic system across the underlying analytical, technical, and human capital processes required in order to align TSA's resources to risk-based needs. Technologies that augment and enhance RBS are sought to increase the effectiveness and accuracy of the system.

- ***Security Effectiveness:*** Security effectiveness is a measure of integrated, real-world performance in security screening according to a defined set of criteria designed to selectively identify and mitigate threats within a protected area.

- ***Coordination with Stakeholders:*** TSA interacts with various stakeholders as partners in aviation security and recognizes the impact that TSA decisions can have on them. These stakeholders often have a variety of competing priorities that must be balanced in order to achieve maximum efficiency and effectiveness. Stakeholders include:

    - ***Passengers:*** Technology acquisitions are assessed against the Trade Space, an agency framework used to quantify decision tradeoffs, enabling comprehensive consideration of strategic alternatives across five objectives: security effectiveness, operational efficiency, fiscal/policy issues, passenger experience, and industry vitality. For example, checkpoint technology affects the overall passenger experience and is often the primary factor that influences public perception of TSA.

    - ***Airports:*** Because TSA does not own airport infrastructure, TSA must coordinate with airports and assess the impact of changes to integrate planned checkpoint and checked baggage technologies across varying physical layouts. Thus, when analyzing transportation security equipment for acquisition and deployment, TSA critically considers real estate footprint, existing infrastructure, and installation needs.

    - ***Airline and Air Cargo Carriers:*** TSA's actions affect the flying experience and customer perception as well as airline operations.

- ***User Adoption of Planned Technology:*** Technology must be suitable for integration in operational processes and enable or enhance security protocols. Technology design and development involves extensive consideration of the end user and weighing the benefits of the technology solution against operator implications.

- ***Diverse and Dynamic Adversaries:*** TSA faces a range of diverse adversaries that are intent on attacking commercial aviation. These adversaries exist along a wide spectrum of resources, skills, thoughtful planning, and knowledge of security measures.

- ***TSA Budget Constraints:*** TSA's funding for technology acquisition programs has been reduced by approximately one-third since FY 2012, and trends indicate that TSA will continue to experience budget constraints. However, even with budget constraints, TSA must continue to sustain and upgrade systems to ensure that TSA's suite of transportation security equipment continues to enable mission success.

- ***Evolving and Emerging Threats:*** TSA is subject to an evolving threat environment and must respond proactively to emerging threats to protect transportation security. The terrorist threat continues to evolve as terrorists have demonstrated the ability to take advantage of vulnerabilities in the transportation network around the world.

- ***Evolving Cybersecurity Threats:*** In addition to the exploitation of physical vulnerabilities, TSA also must guard against cybersecurity vulnerabilities. TSA proactively must protect against attacks to steal information or disrupt, destroy, or threaten the delivery of essential services. TSA understands that the protection of both transportation security equipment and the underlying network infrastructure against cybersecurity threats, either as part of the initial acquisition or as additional capability during upgrades, is a critical part of its mission.

On the basis of the threat environment described above, TSA prepared the tables in Section IV of this report, outlining transportation security equipment procurements for the checkpoint and checked baggage screening for FY 2017 and FY 2018 operations. These estimates are within the June 28, 2017, congressional spend plan briefings for the Electronic Baggage Screening Program (EBSP) and the Passenger Screening Program (PSP). For subsequent years, data are based on the latest available TSA cost models; these reflect TSA's initial responses to budgetary changes and are more up-to-date than the most recently approved lifecycle cost estimates (LCCE), which were finalized in July 2015 for EBSP[1] and in January 2017 for PSP. The current cost models will be incorporated in the next LCCEs, and TSA will provide those updated figures in the next iteration of this report.

To determine long-term budget implications related to operations and support, and in accordance with DHS policy, TSA actively uses LCCEs for its acquisition program to manage cost baselines and to balance affordability and requirement tradeoffs. The LCCEs that contribute to this report undergo continuous revision as priorities and funding profiles change. Actual purchase quantities are based on available funding and changing realities of the security environment. For example, because TSA expects continued annual passenger growth, TSA may look to purchase small quantities of currently qualified systems to respond to airport operations. TSA also may procure evaluation units of new commercial off-the-shelf transportation security equipment for demonstrations and developmental testing to assist in the development of future requirements.

[1] At the time of this report, the LCCE for EBSP is being updated. Revised numbers resulting from the update will be provided in subsequent reporting.

In addition to planned checkpoint and checked baggage transportation security equipment procurements, the subsequent tables also provide funding information for each fiscal year using the following definitions:

- Acquisition Cost reflects the costs of procuring transportation security equipment as well as the development of planned, incremental enhancements in support of threat detection capabilities.
- System Integration reflects the associated costs for newly purchased transportation security equipment.[2]
- Acceptance Testing reflects the associated costs for newly purchased transportation security equipment.
- Maintenance reflects the costs of sustaining all out-of-warranty transportation security equipment after deployment.[3]

[2] System integration and acceptance testing costs are associated with the fiscal year in which a unit is to be purchased.
[3] Maintenance for in-warranty transportation security equipment is reflected in the acquisition cost.

IV. Advancing Integrated Passenger and Baggage Screening Technologies

Threats to aviation security persist and continue to evolve. As a result, passenger and checked baggage security screening must continue to adapt to meet evolving threats and changes within the aviation industry. This section of the report addresses passenger screening technologies, baggage screening technologies, and the programs and initiatives that TSA is undertaking to integrate these technologies within the TSA network and other government agency networks.

A. Checkpoint Technologies

TSA is undertaking efforts to focus its resources and improve the effectiveness and efficiency of screening at security checkpoints by applying new intelligence-driven RBS procedures and enhanced technology.

To address the security challenges at passenger screening checkpoints, TSA employs a flexible and robust multicapability approach to detecting an evolving range of threats. TSA is investing in initiatives such as technology automation, including the installation of automated screening lanes and equipment integration, which will allow the use of risk-based algorithms to screen passengers more effectively and efficiently, improve the overall passenger experience, and promote cost savings.

TSA strives to automate technologies and detection processes to improve effectiveness while reducing scanning and image processing times and human error, and while rightsizing the number of personnel needed at the checkpoint. Threat detection algorithm software is designed to automatically detect threats or other anomalies concealed on passengers and in their carry-on baggage as they pass through the security checkpoint. The implementation of threat detection algorithms on new and existing transportation security equipment is expected to improve TSA's ability to detect and increase throughput at the checkpoint, decrease the probability of false alarms, bring consistency into the screening process, and reduce physical inspections.

To fulfill its security responsibilities for deploying and operating state-of-the-art security technology at approximately 440 airports across the Nation, TSA must be able to deploy technology to respond to changing threat information, or have equipment ready to deploy when airport facilities are modified. In addition, TSA must have the flexibility to stand up operations in locations affected by natural disasters and other crises. These factors, and others, require that TSA have a steady inventory of technology available to deploy to continue to strengthen aviation security. For technologies that require maturation before formal testing, TSA provides requirements to guide DHS Science &Technology Directorate (S&T) investment in research and development activities.

In addition, TSA uses a competitive procurement process for its checkpoint technologies. TSA makes a best-value decision to acquire technology, which either meets or exceeds agency requirements. Full-rate production delivery orders can be awarded to one or multiple vendors depending on the program acquisition strategies implemented.

B. Existing Checkpoint Technologies and Upgrades

TSA identifies, tests, procures, deploys, upgrades, and maintains a variety of equipment to screen passengers and their carry-on baggage at airports nationwide. Current checkpoint technologies include:

- Advanced Imaging Technology (AIT);
- Advanced Technology (AT) X-Ray;
- Boarding Pass Scanners (BPS);
- Bottled Liquid Scanners (BLS);
- Credential Authentication Technology (CAT);
- Enhanced Metal Detectors (EMD); and
- Explosives Trace Detectors (ETD).

The following sections outline TSA's current and planned initiatives for these existing technologies. TSA is currently reevaluating equipment requirements on the basis of the latest operational needs and threats. Therefore, the following initiatives are subject to change. Additionally, TSA monitors transportation security equipment detection capabilities and bases recapitalization and purchase decisions on the ability of fielded transportation security equipment to respond to changing threats and adhere to new detection standards. TSA plans to replace many of the technologies above with the next generation (NextGen) equipment outlined below in order to meet new capability needs. TSA continues to recapitalize technologies as needed while new equipment is developed and acquired.

Advanced Imaging Technology

AIT is designed to increase security by screening passengers safely for metallic and nonmetallic threats, including weapons, explosives, and other objects concealed under layers of clothing. This technology is used in standard checkpoint lanes as part of the RBS initiative.

The AIT fleet includes both the AIT-1 and second generation AIT-2 systems. The AIT-2 units have a smaller physical footprint at the checkpoint, and the AIT-2 systems also were standardized with Tier II detection capability. However, in FY 2014, TSA successfully tested the Tier II upgrade for the AIT-1 systems.

TSA began deploying the Tier II capability to AIT-1 systems in airports in November 2014. The Tier II deployment to all fielded units was completed by the end of March 2015, which brought the AIT-1 equipment to functional equivalency with the AIT-2 equipment.

AIT is an example of a checkpoint technology that is undergoing development efforts to enhance detection capabilities through the use of more advanced threat detection algorithm software. For example, in FY 2016, TSA began test and evaluation efforts with industry for a Tier III detection capability algorithm, which now has been deployed to selected airports with AIT-1 systems based on throughput considerations. Additionally, TSA is working to develop a similar detection algorithm for AIT-2 systems.

TSA continues to explore new algorithm techniques and additional technological advances, including the ability to conduct RBS through near-immediate changing of detection algorithms and the use of wideband imaging antennas to improve image processing and to address a variety of threats. TSA will assess NextGen AIT that are configured to alternative frequency bands, wideband antennas, walk-through AIT, and deep-learning algorithms.

Table 1: Advanced Imaging Technology Planned Purchases as of August 2017[4]

($ in thousands)

Advanced Imaging Technology	Planned Purchases with:							**Total**
	All Available Carryover Funds	**FY 2017 Funds**	**FY 2018 Funds**	**FY 2019 Funds**	**FY 2020 Funds**	**FY 2021 Funds**	**FY 2022 Funds**	
Units	0	1	0	0	0	0	0	1
Acquisition Costs	$0	$2,789	$2,735[5]	$2,790	$2,846	$2,903	$2,961	$17,024
System Integration	$0	$48	$0	$0	$0	$0	$0	$48
Acceptance Testing	$0	$2	$0	$0	$0	$0	$0	$2
Maintenance	$0	$14,974	$16,211	$21,327	$21,753	$22,188	$22,689	$119,142
Total	$0	$17,813	$18,946	$24,117	$24,599	$25,091	$25,650	$136,216

In FY 2016, TSA awarded two contracts for a total of 161 AIT-2 systems, 146 of which used FY 2016 reprogramming funds and were deployed as of September 2017 for operational use. The procurement of these additional AIT-2 systems has allowed TSA to deploy AIT equipment to many small airports that previously lacked advanced imaging capability. Deployment of AIT equipment to these smaller airports addresses the increased threat and specific direction from foreign terrorist organizations to use small airports as entry points to the aviation system and will increase security at these airports by safely screening passengers for metallic and nonmetallic threats, including weapons, explosives, and other objects potentially concealed under layers of clothing.

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[4] FY 2017 and FY 2018 planned purchase units were provided via the June 28, 2017, congressional spend plan briefing for PSP; FY 2019–FY 2022 reflect the 2017 PSP cost model.

[5] For fiscal years in which no transportation security equipment is planned to be purchased, any associated acquisition costs refer to planned, incremental enhancements per the definition at the end of Section II.

Advanced Technology X-Rays

TSA utilizes AT X-ray systems at the checkpoints to screen roughly 3 million carry-on bags for explosives each day. AT X-rays detect threats in carry-on baggage by providing enhanced detection capability, a higher resolution X-ray image, and two-dimensional visual screening of the contents in carry-on bags.

TSA purchased the first AT-1 systems in 2008, which was followed by the purchase and deployment of AT-2 systems in 2012. An upgrade was performed on the AT-1 fleet between 2011 and 2012, which updated software, added infrared operator sensors, added queueing conveyors, and added alternate viewing stations (secondary workstations), all of which brought the AT-1 equipment to functional equivalency with the AT-2 equipment.

As threats emerge and technical capabilities improve, enhancements to the AT X-ray systems at airports may include both software upgrades as well as procedural changes. TSA continues to work with vendors to develop and deploy enhanced detection capabilities. For example, TSA currently is assessing an enhanced Tier II algorithm for checkpoint X-ray image analysis. In addition to providing detection at a reduced threat mass and screening additional threat materials for an overall improved system detection, this algorithm will provide a screener-assist function with frames or other markers around selected items. These frames will alert Transportation Security Officers to potential threats in carry-on bags, therefore increasing their ability and efficiency to find prohibited items and ensuring greater consistency of applying resolution protocols. TSA plans to begin operational testing of the Tier II algorithms as funding is available.

To respond to emerging threats, TSA is studying the effects of current emerging threats known as Threat X and Threat Y. Such efforts are aimed to research and analyze the AT detection/false alarm trade space to meet AT operational performance objectives. TSA currently is working with vendors to analyze the potential effects of the new specific threats on their current algorithms, future detection, and false alarm requirements. Depending on the results of the ongoing threat study, new algorithms may need to be developed to be able to detect Threat X and Threat Y.

Another workstream will focus on algorithm development efforts for future systems in order to ensure that future system capabilities meet the Accessible Property Screening System (APSS) detection standard. The APSS detection standard is expected to advance checkpoint capability because it requires detection of a broader range of homemade explosives, reduced false alarm rates, automated detection for threats and prohibited items, remote image screening, detection of greatly reduced threat mass, and the potential ability for passengers to leave liquids and laptops in bags. TSA currently is pursuing algorithm development efforts in order to upgrade Computed Tomography (CT) to detect threats automatically within the APSS detection standard. TSA anticipates purchasing prototype CT systems under the current PSP. Purchases of CT systems have been included within Table 2. Additional information regarding CT is provided in section IV.C, "Emerging Checkpoint Technologies."

Table 2: Advanced Technology X-Ray Planned Purchases as of August 2017[6]

($ in thousands)

Advanced Technology X-Ray	Planned Purchases with: All Available Carryover Funds	FY 2017 Funds	FY 2018 Funds	FY 2019 Funds	FY 2020 Funds	FY 2021 Funds	FY 2022 Funds	Total
Units	0	78[7]	2[8]	2[9]	2	2	2	88
Acquisition Costs	$0	$16,510	$4,289	$4,363	$4,438	$4,515	$4,593	$38,708
System Integration	$0	$0	$3,972	$325	$331	$338	$345	$5,310
Acceptance Testing	$0	$0	$142	$4	$4	$4	$5	$160
Maintenance	$0	$39,220	$41,291	$42,826	$45,082	$46,107	$47,155	$261,681
Total	$0	$55,730	$49,694	$47,518	$49,856	$50,964	$52,097	$305,859

[6] FY 2017 and FY 2018 planned purchase units were provided via the June 28, 2017, congressional spend plan briefings for PSP; FY 2019–FY 2022 reflect the 2017 PSP cost model.

[7] The procurement of 66 AT units and 12 CT units in FY 2017 was not reflected in the June 28, 2017, congressional spend plan briefing because it was based on a recent, unanticipated need due to the federalization of new airports and CT development efforts, respectively.

[8] Two CT units for FY 2018 are planned to be purchased under current PSP funding for testing purposes. Additional information on CT is provided in section IV.C.

[9] The two CT units for FY 2019 – FY 2022 reflect a recurrence of money in support of airport expansion.

Boarding Pass Scanners

BPS is a device employed to read a passenger's boarding pass and display the passenger's name, flight information, and risk status to the Travel Document Checker. With this information, the Travel Document Checker is able to determine that a passenger should be admitted to and routed through the checkpoint to receive the appropriate level of security screening.

BPS systems reduce the need for manual verification of boarding passes and are the main tool for validating TSA Pre✓® passengers. The procurement of BPS allowed TSA to replace airline-owned systems and enabled TSA to control the configuration of all deployed BPS systems at airport security checkpoints nationwide. As more airlines use TSA Pre✓® and mobile boarding passes, BPS devices continue to be upgraded to accept these new forms of boarding passes.

Table 3: Boarding Pass Scanner Planned Purchases as of August 2017[10]
($ in thousands)

Boarding Pass Scanner	Planned Purchases with:							Total
	All Available Carryover Funds	FY 2017 Funds	FY 2018 Funds	FY 2019 Funds	FY 2020 Funds	FY 2021 Funds	FY 2022 Funds	
Units	0	500	0	0	0	0	0	500
Acquisition Costs	$0	$845	$0	$0	$0	$0	$0	$845
System Integration	$0	$0	$0	$0	$0	$0	$0	$0
Acceptance Testing	$0	$0	$0	$0	$0	$0	$0	$0
Maintenance	$0	$54	$60	$61	$62	$64	$65	$366
Total	$0	$899	$60	$61	$62	$64	$65	$1,211

[10] BPS was not reflected in the June 28, 2017, congressional spend plan briefing for PSP. However, per current TSA acquisition efforts, TSA planned to procure up to 500 BPS units in FY 2017. FY 2019–FY 2022 reflect the 2017 PSP cost model.

Bottled Liquid Scanners

BLS is used to differentiate explosive or flammable liquids from common, benign liquids carried by passengers. BLS units analyze substances within a container, measuring particular characteristics of a container's contents. The device can analyze substances within a container in seconds without having to open the container and also can be used to screen medically exempt liquids.

Deployed BLS units currently operate at the Tier I specification, which provides a primary resolution of liquids contained in clear or translucent bottles. BLS are deployed fully to airport checkpoints, and no future purchases are planned. However, airport security screening equipment needs and capabilities are assessed on an ongoing basis, and equipment purchases may be made on the basis of a validated need. TSA is working with industry to develop capabilities that are able to detect a broader range of threats, enable the screening of opaque containers, and detect smaller quantities of liquid explosives.

Table 4: Bottled Liquid Scanner Planned Purchases as of August 2017[11]

($ in thousands)

Bottled Liquid Scanner								
Units								0
Acquisition Costs		$0	$0	$0	$0	$0		$0
System Integration		$0	$0	$0	$0	$0		$0
Acceptance Testing		$0	$0	$0	$0	$0		$0
Maintenance		$2,223	$2,282	$2,332	$2,381	$2,447		
Total	$0	$2,223	$2,282	$2,332	$2,381	$2,447	$2,497	$14,162

[11] FY 2017 and FY 2018 planned purchase units were provided via the June 28, 2017, congressional spend plan briefing for PSP; FY 2019–FY 2022 reflect the 2017 PSP cost model.

Credential Authentication Technology

CAT will be used to verify the authenticity of passenger identification and to display a passenger's vetting status, which will be obtained through a network connection to Secure Flight through TSA's Security Technology Integration Program. Secure Flight is a program that enhances the security of domestic and international commercial air travel through the use of improved watchlist matching.

After the 2015 Office of Personnel Management cybersecurity breach, TSA disconnected CAT operational test units in the field until such time as cybersecurity mitigation strategies could be developed and implemented. The determination of cybersecurity mitigations and associated requirements, as well as subsequent development of secure CAT units, caused significant schedule delays. CAT is currently in testing, and TSA expects to be able to complete testing and begin fielding CAT units within the next 2 years.

Table 5: Credential Authentication Technology Planned Purchases as of August 2017[12]
($ in thousands)

Credential Authentication Technology								
Units								1,503
Acquisition Costs		$3,195	$1,729	$8,354	$8,544	$12,143		$46,351
System Integration		$120	$0	$1,176	$1,180	$1,768		$6,012
Acceptance Testing		$22	$0	$226	$231	$354		$1,194
Maintenance		$63	$112	$114	$599	$1,104		
Total	$0	$3,400	$1,841	$9,870	$10,554	$15,369	$16,395	$57,429

[12] FY 2017 and FY 2018 planned purchase units were provided via the June 28, 2017, congressional spend plan briefing for PSP; FY 2019–FY 2022 reflect the 2017 PSP cost model.

Enhanced Metal Detectors

Also referred to as walk-through metal detectors, EMDs serve as a primary screening device of airline passengers for prohibited metallic objects at fixed checkpoints at the Nation's airports. EMDs are collocated with AIT in standard lanes and are the primary passenger screening capability used in TSA Pre✓® lanes.

TSA, through the Engineering Change Proposal process, approved new EMD control heads, or processors, that provide an increased threat detection capability and extend the service life on existing walk-through metal detectors. As the control heads fail, TSA is replacing existing control heads. EMDs are deployed fully to airport checkpoints, and no future purchases are planned. However, airport security screening equipment needs and capabilities are assessed on an ongoing basis, and equipment purchases may be made on the basis of a validated need.

Table 6: Enhanced Metal Detector Planned Purchases as of August 2017[13]
($ in thousands)

Enhanced Metal Detector	Planned Purchases with: All Available Carryover Funds	FY 2017 Funds	FY 2018 Funds	FY 2019 Funds	FY 2020 Funds	FY 2021 Funds	FY 2022 Funds	Total
Units	0	0	0	0	0	0	0	0
Acquisition Costs	$0	$0	$0	$0	$0	$0	$0	$0
System Integration	$0	$0	$0	$0	$0	$0	$0	$0
Acceptance Testing	$0	$0	$0	$0	$0	$0	$0	$0
Maintenance	$0	$1,140	$1,153	$1,160	$1,167	$1,172	$1,179	$6,971
Total	$0	$1,140	$1,153	$1,160	$1,167	$1,172	$1,179	$6,971

[13] FY 2017 and FY 2018 planned purchase units were provided via the June 28, 2017, congressional spend plan briefing for PSP; FY 2019–FY 2022 reflect the 2017 PSP cost model.

Explosives Trace Detectors

ETDs are highly sensitive devices developed to detect various types of commercial and military explosives. They are designed to be used as stand-alone systems or in conjunction with other technologies, such as the Explosives Detection System (EDS), to provide a comprehensive program to screen for explosives. Currently TSA uses ETDs as both primary and secondary screening methods. The secondary use is to resolve EDS alarms.

In June 2017, TSA completed the deployment of 1,353 ETDs for passenger screening in order to meet an increased need in the field and to replace technically obsolete ETD systems, including the Morpho Detection DX, that were unable to be upgraded to the latest detection standard.

Furthermore, TSA plans to implement the new Detection Standard 6.2 in FY 2018 to increase security detection capabilities.

Table 7: Explosives Trace Detector Planned Purchases as of August 2017[14]
($ in thousands)

Explosives Trace Detector	Planned Purchases with:							Total
	All Available Carryover Funds	FY 2017 Funds	FY 2018 Funds	FY 2019 Funds	FY 2020 Funds	FY 2021 Funds	FY 2022 Funds	
Units	0	0	0	149	0	0	0	149
Acquisition Costs	$0	$3,048	$1,500	$5,760	$1,866	$1,500	$1,500	$15,174
System Integration	$0	$2	$0	$194	$0	$0	$0	$196
Acceptance Testing	$0	$0	$0	$27	$0	$0	$0	$27
Maintenance	$0	$5,370	$9,367	$13,390	$13,790	$14,776	$15,219	$71,912
Total	$0	$8,420	$10,867	$19,371	$15,656	$16,276	$16,719	$87,309

[14] The units in this table encompass ETD planned purchases for PSP; additional planned purchases for the EBSP can be found in Table 9. FY 2017 and FY 2018 planned purchase units were provided via the June 28, 2017, congressional spend plan briefing for PSP; FY 2019–FY 2022 reflect the 2017 PSP cost model.

C. Emerging Checkpoint Technologies

As technology and threats continue to advance, TSA intends to continue to invest in emerging technologies to elevate checkpoint screening capabilities. In early FY 2018, TSA will transition projects currently under PSP to standalone programs. Transitioning existing PSP projects to standalone programs will reduce acquisition dependencies and lower risk by allowing TSA to manage schedules and costs by individual programs versus one major program (i.e., PSP); TSA more easily can prioritize and make tradeoffs across programs regarding the capabilities needed to execute its mission successfully and mitigate any associated capability gaps. In addition, programs will have better linkage with other departmental decision processes, such as Requirements and Planning, Programming, Budgeting and Execution, which are important given the fiscally constrained operating environment. As expanded capabilities that enhance screening at the checkpoint are introduced, new independent programs also will be implemented. TSA is exploring the following capabilities as potential independent programs in the future. These currently are not funded programs and, as a result, are not reflected in the previous planned purchase tables.

- Automated Screening Lanes will adapt aspects of current baggage handling systems demonstrated by TSA's Innovation Task Force (ITF) to maintain positive bag control at the checkpoint and to isolate carry-on bags of interest. The first procurements are anticipated in FY 2020, but if funds are available and there is an identified need, TSA may procure earlier.

- Alarm Resolution devices to resolve identified areas of interest may include NextGen ETDs or other capabilities. First procurements are anticipated in FY 2020.

- Primary Passenger Screening may consist of Next Gen AIT and EMD enhancement and replacement capabilities. First possible procurements are anticipated in FY 2022.

- Next Gen AT X-Ray Systems and CT systems may be used for performing the primary screening of carry-on baggage. The first procurements for CT are dependent on funding availability and may occur as early as FY 2018 (additional information on CT is provided later in this section).

TSA's focus is on meeting capability needs, not on specific technology solutions. That means that the technologies mentioned above are representative of the technologies that TSA may acquire, but are not necessarily the exact technologies that TSA ultimately will purchase.

In addition, TSA is working in collaboration with DHS S&T and industry to develop these new capabilities. For many of the capabilities listed above, TSA currently is developing requirements and associated documentation to include the concept of operations, operational requirements, and functional requirements documents.

The section below reflects technology that TSA actively is pursuing; therefore, it is specifically detailed below for that reason.

Computed Tomography

To meet emerging and evolving threats related to the aviation transportation sector, CT systems offer an enhanced imaging platform as compared to the presently deployed AT X-ray systems and can be upgraded to automatically detect the full range of the APSS detection standard, described in section IV.B.

TSA was on a trajectory to invest in CT technology for airport checkpoints with planned purchases of two units in FY 2018 and 2019 for testing purposes and initial deployments under a standalone program in FY 2020. However, in response to emerging threats, TSA is pursuing an agile acquisition approach, contingent on funding availability.

In FY 2017, Congress approved a reprogramming of $15.3 million to fund initial CT development activities and the procurement, testing, and deployment of up to 12 CT prototypes. These prototypes are in addition to the units currently deployed for demonstrations at Logan International Airport and Phoenix Sky Harbor International Airport. TSA will use these prototypes, in the near term, to demonstrate CT systems with capabilities that include enhanced visual interpretation, image manipulation, improved detection of homemade explosives, reduced false alarm rates, and reduced threat mass detection compared to current AT systems.

TSA has drafted an acquisition plan to continue efforts initiated in FY 2017. Under this plan, TSA would test, procure, and deploy available CT systems rapidly via the existing PSP AT X-ray program by FY 2019 and, in parallel, invest in algorithm development efforts to enable CT systems to achieve the APSS detection standard by FY 2020. This approach, the timeline provided below, and TSA's deployment strategy are dependent on additional funding resources and the concerted effort from interagency and international partners.

In FY 2018, TSA intends to procure up to 16 additional prototype CT systems for Operational Assessment and to focus on algorithm development efforts aimed to enable CT systems to achieve the APSS detection standard by FY 2020. The funding requirement to support continued CT development (which includes activities to advance toward the APSS detection standard, operational assessments, and procurement of the 16 additional prototype CT systems) is $35.1 million.

In parallel, TSA will accelerate CT acquisition and deployment in the field by qualifying current CT systems under the AT Qualified Products List. Following successful qualification and operational testing as well as an Acquisition Decision Event, TSA will be able to procure and deploy CT systems to key locations.

The CT quantity need, as defined by the full operational capability, will be delineated during the Accessible Property Screening program of record acquisition effort, specifically when the Acquisition Program Baseline and Lifecycle Cost Estimate documents are developed and approved. If CT systems completely replace AT systems, where feasible, the full operational capability potentially could be up to 2,279 systems. Ultimately, the number of CT systems to be procured is dependent upon the amount of funding available, the number of CT systems needed to mitigate security risks by airport and by checkpoint, risk, and CT capability. Procurement and deployment decisions will be informed by testing results, operational throughput requirements, and operational procedures.

The anticipated deployment strategy to reach full operational capacity would include procuring and deploying up to 300 systems the first fiscal year. This quantity represents deploying systems to 39 high-risk airports. The funding requirement to deploy 300 systems is approximately $160 million, which would support operational test and evaluation (OT&E), procurement, and deployment. As an interim measure, TSA could deploy up to 143 systems to 14 high-risk airports that receive last point of departure flights. The funding requirement to deploy 143 systems is approximately $83 million, which also would support OT&E, procurement, and deployment. In subsequent years, TSA anticipates ramping up the procurement and deployment of systems to a maximum deployment capability of around 400 systems per year. To execute this quantity of systems successfully, the full cooperation of airlines, airport authorities, municipalities, and all other key stakeholders is necessary.

As funding is confirmed, TSA will work proactively to keep industry and key stakeholders aware of TSA's latest CT strategy and planned purchases.

D. Checked Baggage Screening Technologies

In accordance with the Aviation and Transportation Security Act of 2001 (P.L. 107-71), TSA screens 100 percent of checked baggage with EDS or a suitable alternative, such as an ETD. In FY 2016, TSA screened approximately 466 million checked bags. TSA accomplishes this mission by testing, acquiring, deploying, integrating, upgrading, and maintaining technology that screens checked baggage to deter, detect, mitigate, and prevent transportation of explosives or other prohibited items on commercial aircraft, while ensuring freedom of movement for people and commerce.

E. Existing Electronic Baggage Screening Technologies

TSA has deployed an advanced fleet of checked baggage screening equipment to meet the security needs of the Nation's aviation network. TSA continues to work with industry to apply spiral and incremental approaches to technology development. This allows TSA to procure technologies and upgrade existing machines as new capabilities arise, instead of requiring complete system replacements.

The initial EDS equipment that was deployed to airports by December 2003 to meet the mandate commonly was installed in airport terminal lobbies, thereby increasing congestion in already crowded public areas. The EDS machines generally were not integrated with the airport's baggage handling system. Instead, they were standalone installations requiring the manual loading and unloading of bags. These standalone EDS machines required high levels of Transportation Security Officer staffing and did not take advantage of high-throughput capabilities associated with integrated systems. Since then, TSA's checked baggage focus has expanded to ensure that all airports' checked baggage screening zones use the most efficient and effective technologies. This effort required the deployment of technology with improved performance and the integration of EDS equipment in line with airport baggage handling systems to improve the efficiency of checked baggage screening operations at many larger airports.

To ensure cost-efficient utilization, TSA has established a methodology to evaluate EDS installation requests. Typically, 1,000 bags per week or 100 bags in a peak hour are the minimum throughput requirements to qualify for an EDS. In the case of a request for an exception, the reasoning for the exception is evaluated and documented. In locations where an airport does not screen the minimum requirement to deem the EDS as being cost-effective, ETD screening is provided.

Explosives Detection Systems

EDS is the primary component of checked baggage screening and provides imaging, screening, and detection capabilities through CT X-ray technology to identify possible threats and create images of the bag contents. In FY 2010, TSA began a competitive procurement effort for EDS that involves rigorous processes for establishing requirements, testing and evaluating the products, and weighing the value of available options to determine which combination of factors provides the best solution to TSA. The competitive procurement effort is the primary tool for driving the technological changes necessary to achieve increased performance at a lower lifecycle cost. The procurement process is complex as a result of a number of variables, including the emergence of updated certification standards and a greater focus on reliability, maintainability, and availability characteristics.

EDS equipment can exist in two configurations:

- Standalone systems typically are found in lobby screening for small airports, or in larger airports with terminals that have low baggage volumes.

- In-line configurations integrate the EDS equipment into the baggage handling system that is customized for each airport. This type of automation improves working conditions for Transportation Security Officers because alarms can be resolved in quieter, dedicated spaces that are designed properly for the alarm resolution function. Also, in-line systems contribute to reduced injury rates.

The competitive procurement strategy to test and procure NextGen EDS has allowed TSA to deploy enhanced capabilities successfully to the field in support of its recapitalization efforts. To sustain recapitalization priorities and fulfill purchase requirements, TSA will continue to procure EDS models listed on the current EDS Competitive Procurement Qualified Product List. Although TSA closed the current EDS Competitive Procurement Qualified Products List to new entrants on February 13, 2015, it plans to open a new qualification window with updated requirements in late FY 2018, supporting a shift of focus to the enhanced capabilities mission.

TSA has implemented a robust plan for the recapitalization of EDS technologies reaching the end of useful life and for the upgrade of selected airport screening zones to realize efficiencies. The prioritization of recapitalization projects is based on various factors, including lifecycle support maintenance records and threat detection capabilities.

Table 9: Explosives Detection Systems Planned Purchases as of August 2017[15]

($ in thousands)

Explosives Detection Systems	Planned Purchases with: All Available Carryover Funds	FY 2017 Funds	FY 2018 Funds	FY 2019 Funds	FY 2020 Funds	FY 2021 Funds	FY 2022 Funds	Total
Units	0	100	190	83	73	78	16	540
Acquisition Costs	$0	$112,545	$208,546	$108,014	$94,330	$89,736	$31,558	$644,729
System Integration	$0	$71,897	$78,727	$86,598	$113,540	$126,735	$82,510	$560,007
Acceptance Testing	$0	$5,404	$2,521	$2,940	$4,792	$3,435	$4,095	$23,187
Maintenance	$0	$129,654	$125,909	$131,834	$145,865	$150,682	$161,631	$845,575
Total	$0	$319,500	$415,703	$329,386	$358,527	$370,588	$279,794	$2,073,498

[15] EDS planned procurement figures for FY 2017–FY 2019 are not reflected in the June 28, 2017, congressional spend plan briefing and 2017 EBSP cost model because of an emerging need to recapitalize high-throughput standalone EDS units, as well as deferred projects based on airport schedules. FY 2020–FY 2022 reflect the 2017 EBSP cost model. At the time of this report, the LCCEs for EBSP are being updated. Revised numbers resulting from the update will be provided in subsequent reporting.

Explosives Trace Detectors

In March 2016, TSA achieved full operational capability for NextGen ETDs in support of checked baggage recapitalization to replace technically obsolete legacy units; this enhances TSA's threat detection screening capabilities and improving operations. These ETD units have enhanced explosives detection sensitivity and the ability to detect a wider range of explosives threats.

As referenced earlier in this report, TSA awarded a contract in September 2016 for the purchase and deployment of ETDs for the checkpoint, but also included in this award the option to purchase an additional 1,898 ETDs for checked baggage screening. As of August 2017, TSA has chosen not to exercise this option because of technical challenges and anticipates procurement of units in FY 2018.

Table 10: Explosives Trace Detectors Planned Purchases as of August 2017[16]
($ in thousands)

Explosives Trace Detectors	Planned Purchases with:							Total
	All Available Carryover Funds	**FY 2017 Funds**	**FY 2018 Funds**	**FY 2019 Funds**	**FY 2020 Funds**	**FY 2021 Funds**	**FY 2022 Funds**	
Units	1,898[17]	0	0	10	10	10	10	1,938
Acquisition Costs	$30,748	$0	$0	$162	$162	$162	$162	$31,396
System Integration	$0	$0	$0	$0	$0	$0	$0	$0
Acceptance Testing	$0	$0	$0	$0	$0	$0	$0	$0
Maintenance	$0	$23,520	$3,839	$4,434	$15,827	$16,283	$16,751	$80,654
Total	$30,748	$23,520	$3,839	$4,596	$15,989	$16,445	$16,913	$112,050

[16] The units in this table encompass ETD planned purchases for EBSP; additional planned purchases for PSP can be found in Table 6. FY 2017 and FY 2018 planned purchase units were provided via the June 28, 2017, congressional spend plan briefing for EBSP; FY 2019–FY 2022 reflect the 2017 EBSP cost model. At the time of this report, the LCCEs for EBSP are being updated. Revised numbers resulting from the update will be provided in subsequent reporting.
[17] TSA anticipates procurement of these units in FY 2018.

F. New Electronic Baggage Screening Technologies

TSA is working continually to improve and expand on the aviation security screening capabilities that are deployed at the Nation's airports. Working in collaboration with DHS S&T and industry, TSA is pursuing new capabilities in the detection of explosive threats within checked baggage. These new capabilities include the ability to detect an expanded set of threat materials with higher detection probabilities, lower false-alarm rates, faster throughput rates, and at lower lifecycle costs, resulting in less impact to airport operations and the traveling public.

Areas of research and development in checked baggage screening technologies include: new means of data acquisition, data processing and management, detection algorithm development, and systems integration. Examples of potential new data acquisition techniques include efforts in the areas of CT image reconstruction and segmentation using powerful data processing solutions.

In the area of threat detection algorithm development, TSA expects new algorithms in the near term with the ability to detect homemade explosive formulations in checked baggage more reliably. The scientific and vendor communities are working on these challenges to deploy improved algorithms on both in-service EDS as well as new systems currently in development.

Systems integration also is drawing much attention from TSA and the research and development community. Improvements in data communications, systems compatibility, open standards-based designs, human factors, and system reliability, maintainability, and availability all lead to improved checked baggage screening effectiveness and efficiency. TSA is developing a Common Elements Architecture for airport security screening that will tie together the enabling technologies, processes, and concepts discussed in Section G below to help meet future aviation security challenges.

G. TSA Technology Integration – Passenger and Baggage Screening

TSA is working actively with DHS S&T, U.S. Customs and Border Protection (CBP), industry, and other stakeholders on a number of initiatives to further standardize and integrate equipment at the checkpoint and baggage screening areas.

Updated Detection Standards

TSA is pursuing updated detection standards for AIT, ETDs, AT X-rays, BLSs, and EMDs based on emerging intelligence-based threat streams and actual terrorist events. These updated standards also require a reduction in false alarm rates. Equipment meeting these new standards should provide improved security effectiveness while also providing for improved operational efficiency (i.e., throughput).

Open System Architecture Elements

TSA introduced open system architecture elements to increase efficiency and standardization across federalized airports secured by TSA. TSA continues to explore open architecture concepts through several initiatives, including incorporating requirements for common image formats and common Graphical User Interfaces for NextGen transportation security equipment. Through other initiatives such as the TSA Requirements Analysis Platform and the Open Threat Assessment Platform (OTAP), TSA is maturing requirements to allow the implementation of third-party algorithms. TSA will continue to define its system architecture requirements for industry over the next 2 years.

Sandia National Labs is developing the OTAP, a limited-scope prototype X-ray detection platform that utilizes an open Application Programming Interface, standard data formats, and potentially human-annotated images to aid machine learning and human factors experts in developing algorithms that assist Transportation Security Officers. TSA's continued engagement with the National Labs on the OTAP has the aim of providing a wider variety of vendors with the ability to support capability upgrades across the transportation security equipment fleet at lower cost. The desired business outcome is to reward innovation and sustain a healthy vendor market. Ongoing engagement with OTAP has allowed TSA to have the ability to integrate different screening capabilities into a "system of systems" to improve overall screening performance. For example, Sandia National Labs has collaborated with equipment manufacturers and TSA to demonstrate integration of third-party algorithms with existing transportation security equipment. TSA collaboration with OTAP also serves as a tactical step toward dynamic RBS by bridging the gap between TSA and adversary innovation cycles. To complement TSA's activities, DHS S&T also is investing in engaging additional algorithm developers, reducing barriers to technology transition, and improving software capabilities. Future OTAP development, managed in conjunction with DHS S&T, includes demonstration of third-party vendor software integrated with CT X-ray scanners, as well as AIT systems.

Automated Prohibited Item Screening

TSA is working on automated prohibited-item screening to enhance detection capabilities that can operate without image screeners. Alarms and images will continue to be used by operators to screen for threats. TSA also has been working to develop deep learning capabilities, a class of machine learning algorithms, and over the next 2 years, plans to demonstrate deep learning capabilities in the field to augment AT and AIT screening technologies for enhanced security at the checkpoint. Potential benefits include automated screening, reduced false alarm rates, and trend recognition in data. TSA also is exploring applications of deep learning for EDS to reduce false alarms, improve system efficiencies, and improve checked baggage explosives detection capabilities.

Apex Screening at Speed

Apex Screening at Speed (Apex SaS), a program led by DHS S&T in collaboration with TSA, was formed to develop solutions for TSA's capability gaps. Apex SaS is pursuing transformative research and development activities that support a future vision of a "curb-to-gate" aviation security solution with more effective risk reduction and improved passenger experience. Apex SaS is funding technology development toward a security architecture capable of screening 300 passengers and their carry-on belongings per lane, per hour, at a high detection level with no divestiture of liquids or electronics and dynamic threat adaptation. The technology development efforts under Apex SaS represent short-, mid-, and long-term investments. For example, walk-by screening at aviation-relevant threats is anticipated to take longer than 5 years, while efforts such as high-definition CT scanners with augmenting screening capabilities currently are being addressed, with algorithm deliverables anticipated in FY 2018. Apex SaS is working closely with TSA to coordinate technology development to TSA's recapitalization plans as well as with the ITF to pilot these emerging technologies. This coordination will ensure smooth, timely, and effective technology transitions.

Biometrics

Over the past 2 years, TSA has continued to explore the use of biometrics and began activities to drive forward the strategy for biometric implementation, which will align and complement existing DHS programs to mitigate the identity validation and vetting risk better. TSA initiated an operational proof-of-concept assessment to explore options for improving TSA's ability to verify passenger identity beyond traditional credential authentication measures. The Biometrics Authentication Technology proof-of-concept was completed on July 12, 2017, at the Hartsfield-Jackson Atlanta International Airport and on July 15, 2017, at the Denver International Airport. Key artifacts from the proof-of-concept will be used for requirements development.

Additionally, TSA is coordinating with CBP on piloting biometric authentication in the checkpoint to enhance the Travel Document Checker position. TSA is piloting the CBP traveler verification system in the fall of FY 2017 at the John F. Kennedy International Airport's international terminal. The initial phase of this pilot will be used for data collection with the intention of determining where synergies and opportunities for collaboration and expanding the pilot may exist.

Security Technology Integration Program

The Security Technology Integration Program (STIP) is focused on enhancing transportation security equipment capability by connecting them to a network to secure them from cyber threats. TSA has focused more of its efforts on the STIP in response to recent cyber-attacks.

TSA established STIP as a DHS Level II Information Technology (IT) Program, and by June 2015, STIP had networked 2,300 transportation security equipment through TSANet (TSA's regular enterprise IT network) and was on track to network 7,000 transportation security equipment by the end of calendar year 2016.

However, in July 2015, TSA determined that the networked equipment introduced unacceptable cybersecurity risks to TSANet, especially in light of the enhanced cybersecurity requirements imposed across the government in the aftermath of the Office of Personnel Management cybersecurity breach. Consequently, TSA disconnected all its equipment and indefinitely postponed all future equipment network connectivity until it could develop and implement appropriate cybersecurity solutions.

TSA is considering options to reconnect its equipment, but resolving this cybersecurity threat is more than just a matter of updating the equipment to the latest operating system patches and reconnecting them to the network. A new solution must address evolving governance and rapidly changing threat environments to be viable and effective. TSA currently is testing solutions to address both the network backend and transportation security equipment endpoint cybersecurity risks in order to finalize a comprehensive cybersecurity package to allow transportation security equipment to reconnect to STIP.[18]

Innovation Task Force

The ITF supports TSA in diversifying the industrial base while responding to industry and stakeholder requests to increase access to operational data to mature solutions and provide input on future transportation security capabilities. ITF establishes an integrated approach to address the imperatives for change, providing an environment and focused resources to collaborate on innovation efforts. Solutions may cover a breadth of concepts, from aesthetic solutions to new detection technologies, while supporting near-term and long-term progress toward the future TSA system architecture. ITF demonstrates selected innovative and systemic solutions to improve effectiveness, posture for future passenger growth, and evolve to deter and detect an adaptive enemy. It enables TSA and industry to refine potential emerging transportation security capabilities.

Since its standup in 2016, ITF launched its first operational demonstration and subsequently expanded Automated Screening Lanes to multiple airports around the country via an Urgent Operational Need. This demonstrated ITF's ability to capture lessons learned to inform

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[18] TSA currently reports risks through the monthly DHS Federal Information Security Management Act Scorecard, which includes STIP. TSA also has participated in industry days to help to educate vendors on the agency's security processes and requirements for TSA screening equipment.

requirements. ITF also identified additional solutions for demonstration and expanded the pool of interested stakeholders.

Several recently initiated or upcoming solution demonstrations for ITF are:

- CT demonstrations with multiple manufacturers;
- Biometrics Authentication Technology demonstrations;
- Passenger communication tools as TSA and airports identify tools and techniques for checkpoint enhancements; and
- Enhanced AIT demonstrations as they are available.

In addition to solution demonstrations, ITF also collaborates with partners (such as airlines, airports, and industry) to facilitate innovation through several projects, including:

- IT and Operations Collaboration: pilot an airport operations center;
- Large Mass Threat Detection: pilot portable mass casualty-focused employee and public area screening with potential for high throughput and reduced divestiture; and
- Biometric Bag Drop: pilot a self-checked bag drop solution with biometric validation of identity by airlines.

V. Cost-Effective Screener Workforce Development: Staffing Allocation Process

TSA employs staff at approximately 440 airports. Each airport is unique and requires its own technology and employee configuration. TSA determines the most cost-effective means of staffing through various methodologies, modeling, and optimization efforts to provide the greatest opportunity to maximize screening effectiveness while minimizing operational impacts due to passenger volume.

TSA utilizes a rigorous staff allocation process and Enhanced Staffing Model to allocate its security workforce effectively. The process considers each airport's flight schedule data, airport equipment, layout configuration, and unique operating characteristics to determine appropriate staffing. TSA refines and improves the tools for the staffing process and the Enhanced Staffing Model application on a continuous basis.

The model is centered on a proven, discrete-event simulation model with the following inputs:

- ***Airport Configurations*****:** Each airport's unique configuration is entered with details for operating hours, terminals, checkpoints, bag zones, screening equipment, and exit lanes. The configuration details are vetted with local airport scheduling operations officers.

- ***Passenger and Baggage Screening Work Demand*****:** TSA uses data provided directly from the airlines, the Bureau of Transportation Statistics, Federal Aviation Administration forecasts, and OAG Aviation[19] to project flight activity and subsequent passenger enplanements. This provides a means of accounting for planned growth in passenger loads, a variable that is monitored constantly and adjusted as needs mature. Each airport's unique flight schedules are loaded into TSA's simulation modeling software to reflect flight departure times, aircraft seat capacities, and other flight details.

- ***Processing Rates and Staffing Constants*****:** TSA uses data provided by the airlines and collected through time studies to determine appropriate staffing standards and expected processing rates. These rates and staffing standards are used for all airport staff modeling. In the case of airport deviation from these rates and standards, the reasoning for the deviation is documented.

The staffing requirements generated by the simulation model then are run through integrated schedule optimization software driven by a sophisticated mathematical problem-solving engine. In addition to the staffing demand generated by the simulation model, this schedule optimization engine considers several other variables that affect staffing requirements, including the requirements to utilize a mix of part- and full-time employees to cover the work demand and

[19] OAG Aviation is a UBM Aviation business (www.ubmaviation.com), providing aviation workflow data and analytics sourced from its comprehensive proprietary airline schedules, fleet, and maintenance repair & overhaul databases. UBM Aviation is a division of UBM plc.

minimize the number of start times for employees so that shift breaks can be scheduled effectively.

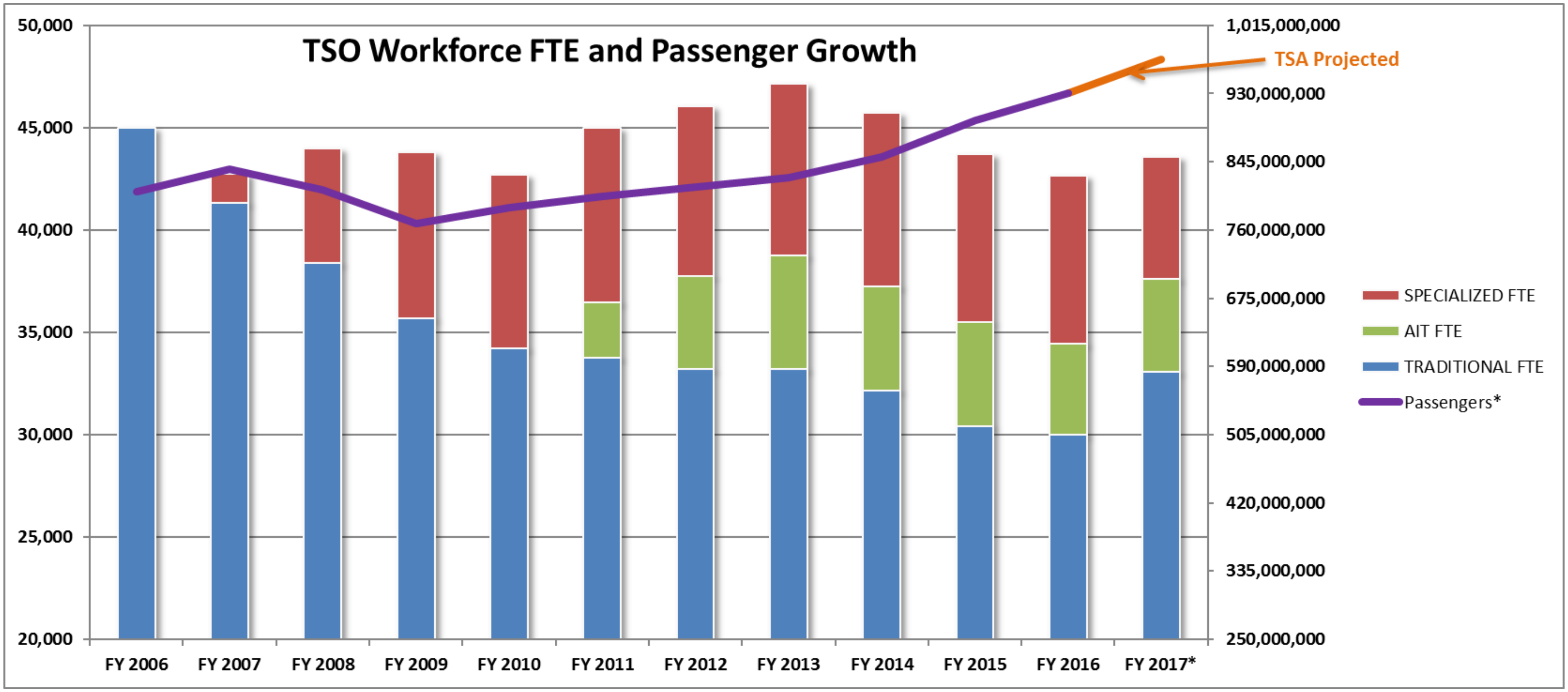
Following this step, TSA uses historical and projected requirements information to add funding for nonmodeled requirements, such as paid time off, overtime, and training. The result of all of these processes is an individual staffing goal for each airport, with a breakdown of the goal by screening type (baggage and passenger) and with recommended part- and full-time employee headcounts.

The staffing process has been used to establish airport staffing budgets since FY 2004. TSA has seen a decrease in staffing demand for checked baggage screening as in-line baggage screening systems have been installed. Conversely, there has been an even greater increase in staffing demand at checkpoints because of the increase in the number of carry-on bags; the complications that arise from screening liquids, aerosols, and gels; the increased number of electronics being screened individually; and the introduction of staffing-dependent technologies, such as AIT. Staffing resource requirements also have increased over recent years as a result of a substantial increase in passenger volume. Volume growth in 2016 was 6.5 percent and is expected to increase an additional 3 percent in 2018.[20] Because of this volume increase, TSA was able to halt the reduction of 1,660 personnel in FY 2016 and, through the reprogramming of funding, increase personnel by 2,000 in FY 2016.

The staffing process is adjusted periodically to account for new technology, emerging threats, and changes in TSA's operating procedures. TSA continues to strive for greater adaptability in its staffing process. TSA continually assesses potential adjustments to the existing model to match resources more closely to the demands of the screening environment. Considerations include ensuring a more comprehensive delivery of TSA Pre✓® and Automated Screening Lanes, addressing increases in annual leave for a maturing workforce, fully funding sick leave and training requirements, and identifying full-time equivalent (FTE) savings or efficiencies related to staffing small airports for which federal screening resources now are committed. These changes allow for a holistic adaptable staffing approach (see Figure 1 below).

[20] The Bureau of Transportation Statistics has not published passenger enplanement data past June 2017; therefore, a final percentage for FY 2017 is not provided.

Figure 1: Transportation Security Officer Workforce FTE and Passenger Growth



* Passenger Data are taken from the Bureau of Transportation Statistics T-100 Market Data. As of January 2018, the Bureau of Transportation Statistics has not published passenger enplanement data past June 2017; therefore, a projected count is provided for FY 2017 in Figure 1. Also note that passenger count ties to enplanements, not necessarily screening throughput.

VI. Savings and Reinvestment from Improved Technology Deployment

TSA continues to look for efficiencies by installing labor-saving, improved technology for both passenger and baggage screening. When these efficiencies are found, TSA reinvests its resources in other essential security capabilities to support staffing needs at the checkpoint.

TSA realized savings of 93 FTEs from in-line EDS in FY 2016, when compared to the staffing required for the stand-alone screening equipment configuration. Because of the increase in passenger volume that TSA experienced in FY 2016, resulting savings were redirected to address passenger volume increases across the system, with many of the larger airports experiencing double-digit increases in staffing requirements and an overall increase in frontline officers of 2,000 employees.

TSA estimates FY 2017 savings from in-line EDS installations to be 105 FTEs, and similarly, they will be reinvested in the screening checkpoint workforce because of passenger growth.

VII. Conclusion

To address the ever-evolving threats to aviation security, TSA continues to enhance existing technologies, acquire and integrate new technologies, and use intelligence- and risk-based processes to screen passengers and their baggage more effectively and efficiently. TSA is committed to using its workforce effectively, specifically by focusing on labor and cost savings to serve the public better and to secure the Nation's transportation system. As TSA moves forward with a renewed focus on security, revised alarm resolution procedures, new investments in technology, and a retrained workforce, it strives for a balance between effectiveness and efficiency as the system is tested continuously to identify gaps and measure system readiness and performance.

By working closely with Congress to resource the organization appropriately, TSA will continue to address passenger growth, improve checkpoint performance, and mitigate vulnerabilities across the aviation system. The initiatives outlined in this report will allow TSA to address the dynamic threat to aviation security and partner with industry to provide the capabilities and solutions needed.

VIII. Appendix: Abbreviations

Abbreviation	Definition
AIT	Advanced Imaging Technology
APSS	Accessible Property Screening System
Apex SaS	Apex Screening at Speed
AT	Advanced Technology
ATSA	Aviation and Transportation Security Act
BLS	Bottled Liquid Scanner
BPS	Boarding Pass Scanner
CAT	Credential Authentication Technology
CBP	U.S. Customs and Border Protection
CT	Computed Tomography
CY	Calendar Year
DHS	Department of Homeland Security
EBSP	Electronic Baggage Screening Program
EDS	Explosives Detection System
EMD	Enhanced Metal Detector
ETD	Explosives Trace Detector
FTE	Full-Time Equivalent
FY	Fiscal Year
IT	Information Technology
ITF	Innovation Task Force
LCCE	Lifecycle Cost Estimate
NextGen	Next Generation
OT&E	Operational Test and Evaluation
OTAP	Open Threat Assessment Platform
PSP	Passenger Screening Program
RBS	Risk-Based Security
S&T	Science and Technology Directorate
STIP	Security Technology Integrated Program
TSA	Transportation Security Administration