CRS Report for Congress

Aviation Security: Background and Policy Options for Screening and Securing Air Cargo

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Summary

The air cargo system is a complex, multi-faceted network that handles a vast amount of freight, express packages, and mail carried aboard passenger and all-cargo aircraft. The air cargo system is vulnerable to several security risks, including potential plots to place explosives aboard aircraft; illegal shipments of hazardous materials; criminal activities such as smuggling and theft; and potential hijackings and sabotage by persons with access to aircraft. Several procedural and technology-based initiatives to enhance air cargo security and deter terrorist and criminal threats have been put in place or are under consideration. Procedural initiatives include industry-wide consolidation of the "known shipper program"; increased cargo inspections; increased physical security of air cargo facilities; increased oversight of air cargo operations; security training for cargo workers; stricter controls over access to cargo aircraft and air cargo operations areas; improved tracking of cargo shipments along the entire supply chain; and expanded use of explosives detection canine teams for inspecting air cargo shipments. Technology being considered to improve air cargo security includes tamper-resistant and tamper-evident packaging and containers; explosive detection technologies adapted for use in the air cargo environment; blast-resistant cargo containers and aircraft hardening; and biometric systems for worker identification and access control.

The Aviation and Transportation Security Act (ATSA, P.L. 107-71) contains general provisions for cargo screening, inspection, and security measures. Cargo carried in passenger airplanes must be screened or its security otherwise ensured. In practice, the Transportation Security Administration (TSA) has relied heavily on known shipper protocols to prevent shipments of cargo from unknown sources on passenger aircraft. ATSA also mandated development of a security plan for all-cargo operations. The TSA's air cargo security plan has focused on risk-based methods for assessing cargo shipments and targeting physical inspections. The National Intelligence Reform Act of 2004 (P.L. 108-458) included provisions establishing a pilot program for evaluating the deployment of blast-resistant cargo containers; promoting the research, development, and deployment of enhanced air cargo security technology; evaluating international air cargo threats; and finalizing operational regulations of air cargo security. Those regulations, finalized by the TSA in 2006, require use of an industry-wide known shipper database, background checks of air cargo workers, and enhanced security measures at air cargo operations areas. In addition to these measures, Congress has provided appropriations to hire more canine teams and cargo inspectors to step up cargo screening and regulatory inspections.

Appropriations legislation over the past four years has called for continued increases to the amounts of air cargo placed on passenger airplanes that is physically screened. The Implementing Recommendations of the 9/11 Commission Act of 2007 (P.L. 110-53) requires the DHS to establish a system to physically screen 100% of all air cargo within three years, with an interim requirement of screening 50% of air cargo within 18 months of enactment. The act also directs the TSA to implement a program for deploying blast-resistant cargo containers for use by air carriers on a risk-managed basis. This report will be updated as needed.

Contents

List of Figures

Aviation Security:
Background and Policy Options
for Screening and Securing Air Cargo

Overview of the Air Cargo System

The air cargo system is a complex, multi-faceted network responsible for moving a vast amount of freight, express packages, and mail carried aboard passenger and all-cargo aircraft. The air cargo system consists of a large, complex distribution network linking manufacturers and shippers to freight forwarders and then on to airport sorting and cargo handling facilities where shipments are loaded and unloaded from aircraft. Business and consumer demand for the fast and efficient shipment of goods has fueled rapid growth in the air cargo industry over the past 25 years.

In FY2006, about 10.5 million tons of freight cargo were shipped by air within the United States, and another 8.5 million tons were shipped on international flights to and from the United States on both passenger and all-cargo aircraft.[1] In addition to this, over half a million tons of mail was carried on aircraft, roughly 460,000 tons on domestic flights and 140,000 tons on international flights to and from the United States. The combined weight of freight and mail enplaned on domestic and international flights from 2003 through 2006 is shown in **Figure 1**.

Since 1980, the growth in freight mileage for air cargo, measured in terms of ton-miles transported on an annual basis, has far outpaced growth in any other transportation mode.[2] While domestic growth in the volume of air cargo shipments has been relatively, and somewhat unexpectedly, flat over the past few years, it is estimated that domestic air cargo shipments, expressed in terms of revenue ton miles (RTMs), will continue their historic growth trends and increase another 58% by FY2020 compared to FY2006 levels. Internationally, cargo shipments have seen steady growth over the past few years and are anticipated to increase 135% by FY2020 compared to FY2006 levels. The volume of air cargo shipments since FY1999 and the forecast volume of air cargo through 2020 is shown in **Figure 2**.

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[1] CRS calculations based on Bureau of Transportation Statistics, *Air Carrier Statistics (Form 41 Traffic).*

[2] Bureau of Transportation Statistics. *Freight In America: A New National Picture.* January, 2006. Washington, DC: U.S. Department of Transportation.

Figure 1. Freight and Mail
Enplaned on Domestic and International Flights (2003-2006)
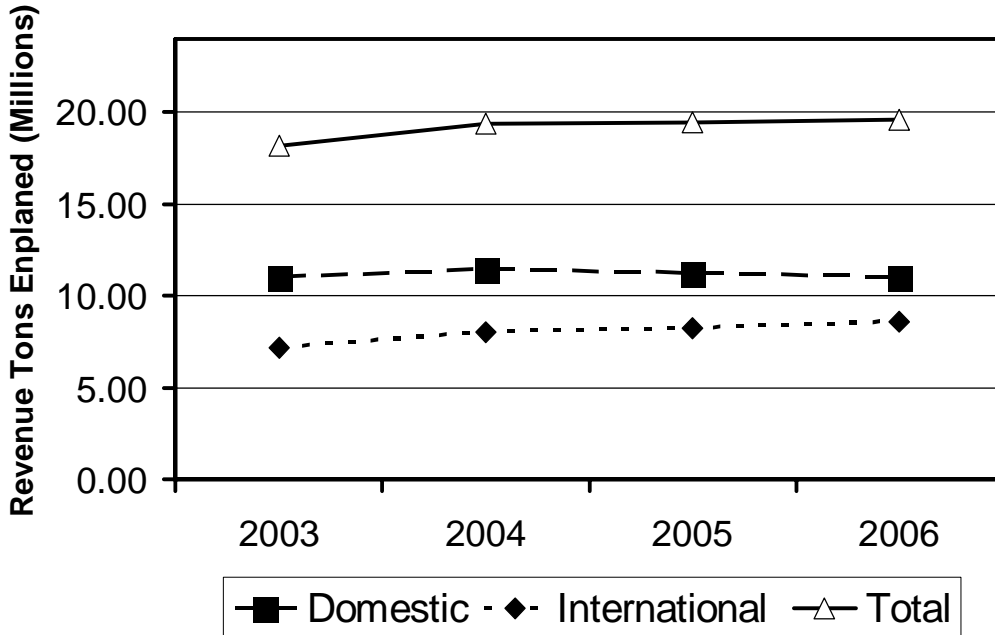
Source: CRS graphic based on Bureau of Transportation Statistics, *Air Carrier Statistics (Form 41 Traffic) — All Carriers, T-100 Domestic and International Market Data.*

Figure 2. Air Cargo Shipments: Historic Data and Forecasts
(FY1999-FY2020)
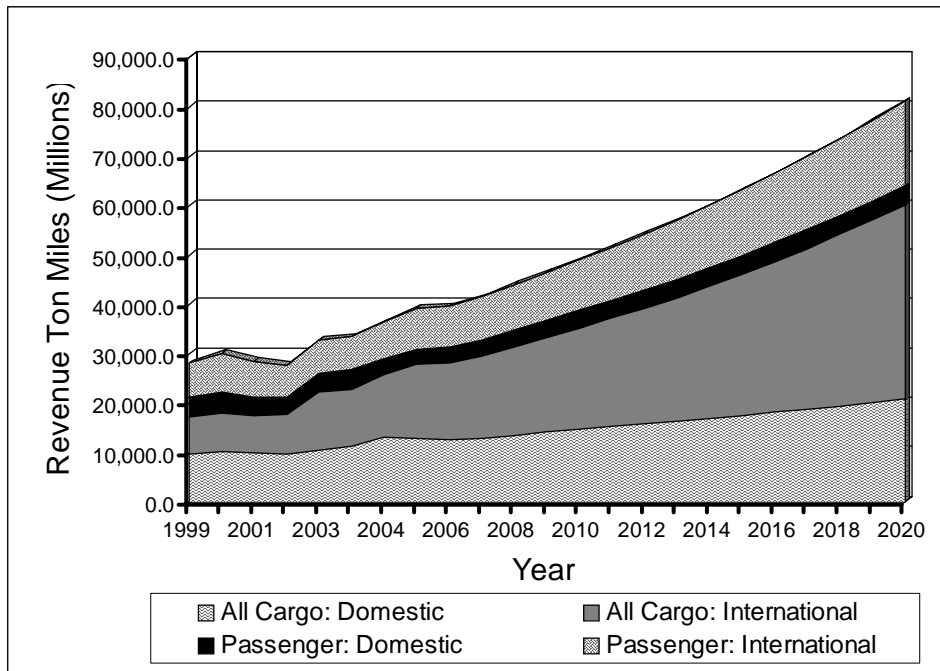
Source: Federal Aviation Administration. *FAA Aerospace Forecasts Fiscal Years 2005-2016, 2006-2017,* and *2007-2020.*

In 2005, air cargo comprised about 0.4% by weight of all freight movement in the United States.[3] While this percentage may seem small, it is much greater than the 0.07% percent of freight that traveled by air in 1965, indicating that not only is the volume of air cargo increasing significantly, but so is the percent of total freight movements that travel by air. Since 1980, the freight mileage of goods shipped by air has increased by 240%.[4] Air cargo shipments also make up a significant percent of the total value of cargo shipments. In 2002, while air freight movements accounted for only about 0.3% of total domestic freight shipments by weight, these shipments accounted for 4.3% of the total value of freight shipped within the United States.[5] In terms of global trade, air cargo accounted for 25.3% of the value of goods shipped to and from the United States, surpassed only by maritime shipping, which accounted for 43.5% of the import/export value of cargo in 2005.[6] However, by weight, nearly 78% of imports and exports travel by water, compared to just 0.4% by air. These statistics reflect the fact that international air cargo plays a major role in the transport of high-value, time-sensitive, light-weight imports and exports. Such items include consumer electronics, electronic components for industry and manufacturing, flowers, and other high-value perishable foods and goods, to name a few examples. The speed of delivery afforded by air cargo support just-in-time demand for such goods in a global marketplace, allowing far-away manufacturing and distribution sites to rapidly deliver items to businesses and end customers worldwide. These unique characteristic of the air cargo industry are important considerations for policymakers in addressing air cargo security needs without unduly impeding the flow of commerce that travels by air, particularly as the size and complexity of the air cargo system continues to expand.

Security Screening and Inspections of Air Cargo: Policy Debate and Operational Challenges

Given the sheer volume of cargo that must be expediently processed and loaded on aircraft, it has been generally argued that physical screening of all air cargo using explosives detection technologies, as is now required of checked passenger baggage, is likely to present significant logistic and operational challenges. In 2002, it was reported that TSA computer models estimated that, if full physical screening of cargo were implemented, only 4% of the daily volume of freight at airports could be processed due to the time that would be required to break down shipments, inspect them, and reassemble them for transport.[7] Since that time, considerable progress has been made to increase the amount of cargo placed on passenger airliners that is subject to physical screening and inspection. Also, the DHS has invested in several

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[3] Bureau of Transportation Statistics. *Pocket Guide to Transportation, 2007.* Washington, DC: U.S. Department of Transportation.

[4] *Ibid.*

[5] Bureau of Transportation Statistics. *Pocket Guide to Transportation, 2006.* Washington, DC: U.S. Department of Transportation.

[6] Bureau of Transportation Statistics. *Pocket Guide to Transportation, 2007.*

[7] Greg Schneider. "Terror Risk Cited for Cargo Carried on Passenger Jets; 2 Reports List Security Gaps." *The Washington Post*, June 10, 2002.

research and development initiatives to adapt explosives screening technologies for use in the air cargo environment. The results of these efforts are best described as a slow evolution of increasing inspections and screening of air cargo shipments placed on passenger aircraft since 2002, coupled with some promising opportunities to further increase cargo inspections and screening through an array of various techniques and technologies. This is in contrast to baggage screening, which relies predominantly on a single technology, Explosives Detection System (EDS), as was required under the Aviation and Transportation Security Act (ATSA; P.L. 107-71).

Over the next few years, there is likely to be a more intense focus on developing and tailoring technologies and procedures for screening and inspecting air cargo to meet a mandate in the Implementing Recommendations of the 9/11 Commission Act of 2007 (P.L. 110-53) that requires 100% screening of all cargo placed on passenger aircraft by August 2010, with an interim requirement of screening 50% of such cargo by February 2009. Unlike baggage screening operations which are, for the most part, conducted by TSA personnel, cargo inspections and screening operations are conducted largely by employees of the airlines and freight shippers, with the TSA responsible for oversight of these functions. In 2004, the National Intelligence Reform Act of 2004 (P.L. 108-458) required the TSA to pursue screening technologies and enhance security procedures to improve the inspection, screening, and tracking of air cargo on passenger aircraft as recommended by the 9/11 Commission. Since then, implementing increased oversight and inspections of air cargo operations coupled with more stringent regulations for air cargo carriers and freight forwarders has been a priority for the TSA.

Congressional appropriators have provided increased funding for inspections, screening, and tracking of air cargo, and for research, development, and pilot testing of various explosives screening techniques and technologies to increase the amount of air cargo that undergoes physical inspection. While the TSA does not divulge the percentage of cargo that undergoes physical inspection, language in the FY2005 Homeland Security Appropriations Act (P.L. 108-334) called for at least tripling the amount of cargo placed on passenger aircraft that was inspected at that time. FY2006 appropriations language (P.L. 109-90) directed the TSA to take all possible measures — including the certification, procurement, and deployment of screening systems — to inspect and screen air cargo on passenger aircraft and increase the percentage of cargo inspected beyond the level mandated in the FY2005 appropriations measure. FY2007 appropriations language (P.L. 109-295) directs the TSA to work with industry stakeholders to develop standards and protocols to increase the use of explosives detection equipment for screening air cargo. The FY2008 Omnibus Appropriations Act (P.L. 110-161) directed the DHS to research, develop and procure new technologies to screen and inspect air cargo loaded on passenger aircraft, and utilize existing checked baggage explosives detection equipment and screeners to the greatest extent practicable to screen air cargo until dedicated air cargo screening technologies can be developed and deployed. The act requires the DHS to work with air carriers and airports to ensure that the screening of cargo carried on passenger aircraft continually increases, and requires the DHS to submit quarterly reports detailing the incremental progress being made toward achieving the mandated 100% screening of cargo placed on passenger aircraft.

The mandate for 100% screening contained in P.L. 110-53 requires inspection of all air cargo placed on passenger aircraft in a manner that provides a level of security equivalent to the screening of passenger checked baggage. The legislative language specifically defines screening in this context to mean a physical examination or other non-intrusive methods of assessing whether cargo poses a threat to transportation security. The act identifies specific methods of screening that would be acceptable in meeting this requirement, including the use of x-ray systems, explosives detection systems, explosives trace detection, TSA-certified explosives detection canine teams, and physical searches conducted in conjunction with manifest verifications. Additional methods may be approved by the TSA. However, the provision specifically prohibits the use of cargo documents and known shipper verification by themselves as being acceptable screening methods. In other words, the provision clarifies that the screening of cargo is to involve some sort of inspection process that cannot be met solely by a records verification of shipment contents or shipper status. The language does, however, leave open the possibility that the TSA could implement some other non-intrusive methods for assessing whether cargo poses a risk that would not necessarily involve the use of physical screening technologies. It is, at this point, unclear what specific approach the TSA will take to meet this mandate. The TSA is required to promulgate regulations to meet these requirements and must provide justification for any exemptions to these air cargo screening requirements it may grant. Also, the GAO would be required to assess the methods used by the TSA in granting, modifying, or eliminating any exemptions to these requirements. The measure was generally opposed by various stakeholders in the air cargo industry who believe that its requirements are overly burdensome and costly.[8]

Policy Considerations for Securing All-Cargo Operations

While the primary policy focus of legislation to date has been on cargo carried aboard passenger aircraft, air cargo security also presents a challenge for all-cargo operators, there is some concern that heightened security measures for passenger aircraft may make all cargo aircraft a more attractive target to terrorists. However, unlike passenger operations where the threat from explosives introduced in air cargo represents the greatest perceived risk, the greatest perceived risk associated with air cargo operations is the potential for an individual or individuals with access to aircraft to hijack a large transport category aircraft to carry out a suicide attack against a ground target. Looking beyond aviation security, there is also a broader risk that terrorists may attempt to ship weapons, including possible weapons of mass destruction, into and within the United States using the global cargo distribution network. For example, various law enforcement and counterterrorism operations have shown how illegal sales and shipments of various weapons, such as shoulder-fired missiles, may be facilitated by falsified shipping documents allowing such items to potentially wind up in international and domestic air cargo shipments. Homeland security policies and strategies may need to further consider the potential risks that air cargo operations, as well as passenger airlines cargo operations, may be exploited to facilitate the movement of terrorist weapons.

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[8] "House To Consider Bill Today Requiring Additional Cargo Screening," *Transportation Weekly,* January 9, 2007, p. 7.

The largest all-cargo operators in the United States include FedEx, UPS, Atlas Air, Polar Air Cargo, Kallita Air, ABX Air, Evergreen International Airlines, Gemini Air Cargo, and World Airways.[9] In addition, some airlines with passenger service, such as Northwest Airlines and United, also have fleets of all-cargo aircraft. **Figure 3** shows the distribution of air freight shipments among passenger and all-cargo aircraft. Domestic operations make up about 57% of the total system-wide air cargo operations in the United States. However, in recent years, only about 10% of domestic air freight has been carried aboard passenger aircraft within the United States. Ninety percent is carried aboard all cargo aircraft. In international operations, passenger aircraft have played a bigger role, carrying roughly one third of air freight shipments to and from the United States. The rest is carried aboard all cargo aircraft which account for 67% of the international air freight volume.

Figure 3. Distribution of Enplaned Freight Cargo on Passenger and All-Cargo Aircraft on Domestic and International Flights (2003-2006)
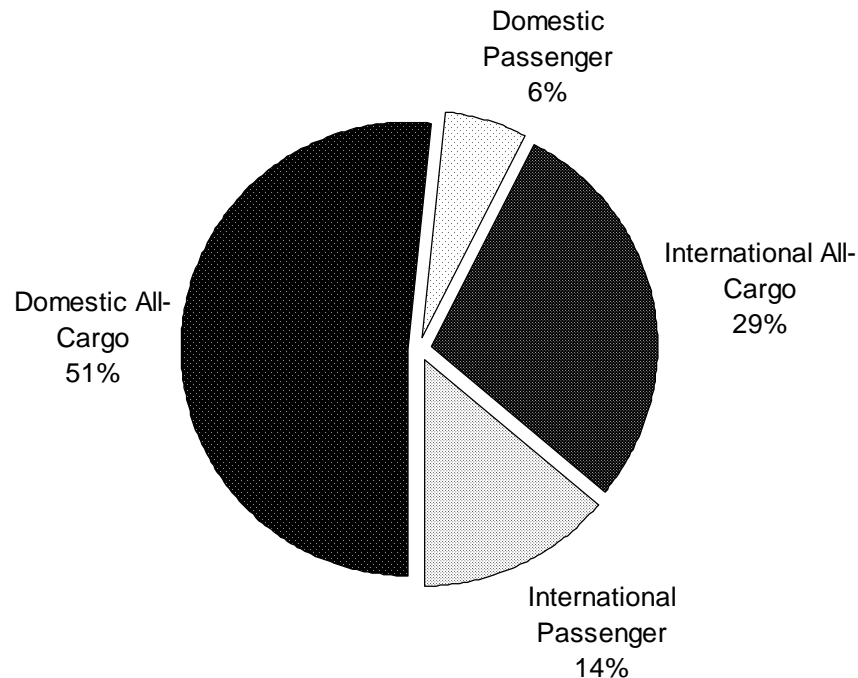
Source: CRS analysis of Bureau of Transportation Statistics, *Air Carrier Statistics, T-100 Domestic and International Market Data (All Carriers).*

While passenger airlines continue to play an important role in carrying air freight, the percentage of air cargo carried on passenger aircraft has continued to drop since September 11, 2001. Industry analysts expect that there will likely be a further decline in the proportion of freight carried on passenger aircraft as a result of new federal requirements to achieve 100% screening of all cargo placed on passenger aircraft by August 2010. This may have a greater impact on international air cargo operations which rely more heavily on the use of passenger aircraft. Experts note, however, that if effective security measures are not implemented and a passenger

[9] "The World's Top 50 Cargo Airlines," *Air Cargo World,* September 2006, pp. 22-26.

aircraft bomb introduced in air cargo were to take down an airplane, lawmakers and regulators may respond by imposing significant restrictions on passenger aircraft air cargo, possibly banning cargo on passenger aircraft altogether.[10] Regardless of whether passenger air cargo is specifically targeted or not, the long term outlook points to a continued shift toward increased reliance on all-cargo aircraft, both domestically and in international operations.

Since September 11, 2001, a variety of air cargo security measures have been put in place or are under consideration. The primary purpose of these security measures is to mitigate: (1) the potential risks associated with the contents of cargo placed on passenger as well as all-cargo aircraft; and (2) the risks associated with individuals given a high level of access to aircraft to carry out cargo operations. This report will examine the key security risks associated with air cargo operations and options for mitigating these risks.

Air Cargo Security Risks

Potential risks associated with air cargo shipments and operations include the possible introduction of explosives and incendiary devices in cargo placed aboard aircraft; shipment of undeclared or undetected hazardous materials aboard aircraft; cargo crime including theft and smuggling; and aircraft hijackings and sabotage by individuals with access to aircraft. As previously noted, the security risk associated with air cargo is believed to be considerably different for passenger airline operations, where the greatest perceived threat is the introduction of an explosive device through an air cargo shipment, and all cargo operations, where the greatest perceived threat is the potential hijacking of a large all cargo aircraft to carry out a suicide attack against a ground target.

Explosives and Incendiary Devices. Undetected explosive or incendiary devices placed in air cargo are potential threats to aircraft, particularly passenger aircraft that carry cargo consignments. Experts have warned that air cargo may be a potential target for terrorists because screening and inspection of air cargo is currently not as extensive as required screening of passengers and checked baggage. For this reason, Congress has pushed the TSA to increase screening and inspections of air cargo, and recently mandated 100% screening of all cargo placed on passenger aircraft by August 2010 (see P.L. 110-53).

Cargo carried aboard passenger aircraft may be at particular risk since passenger aircraft are generally regarded as highly attractive targets to terrorists and have been attacked in the past. However, some aviation security and counterterrorism experts regard placing explosives in air cargo as a less appealing option to terrorists because typically a specific flight cannot be targeted without the assistance of an individual with access to aircraft. Furthermore, experts generally believe that all-cargo aircraft are less appealing targets to terrorists because an attack against an all-cargo aircraft is not likely to result in mass casualties and generate the degree of public and media attention that a bombing of a commercial passenger aircraft would have.

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[10] Michael Fabey. "Cargo's Security Scare." *Traffic World,* December 17, 2007, p. 29.

Aircraft bombings remain a considerable concern, although recent aircraft bombings attempts and plots have not specifically involved the introduction of a bomb placed in air cargo. Rather, at present the specific aviation security focus has been in response to attempts to carry on or assemble improvised explosives devices in the passenger cabin. For example, the December 22, 2001, attempted shoe bombing aboard a American Airlines Boeing 767 on a trans-Atlantic Paris to Miami flight and the foiled plot to allegedly bomb U.S.-bound airliners from the United Kingdom in August 2006 has heightened concerns over possible terrorist bombings of passenger aircraft.

Historically, bombings of U.S. airliners have been rare and have mostly involved bombs placed in either the aircraft passenger cabin or in checked passenger baggage. The most catastrophic bombing of a U.S. airliner was the December 21, 1988 crash of Pan Am flight 103, a Boeing 747, over Lockerbie, Scotland that was attributed to an explosive device placed in a baggage container in the airplane's forward hold.[11] Investigation of the deadliest bombing of a passenger aircraft, the June 23, 1985 downing of Air India flight 182 off the coast of Ireland, similarly revealed evidence of an explosive device that was most likely introduced in checked baggage and placed in the aircraft's forward cargo hold.[12]

While the historic risk has been tied to passenger baggage, and the current aviation security policy emphasis is on improvised explosives in the passenger cabin, efforts to protect against these threats may make cargo a more attractive option for terrorists. The most notable event involving detonation of an explosive device transported as cargo aboard an airliner in the United States was the November 15, 1979 explosion aboard an American Airlines Boeing 727 that made a successful emergency landing at Dulles Airport following the incident. This event, while tied to an individual terrorist but not a terrorist organization, did not intend to target the aircraft. Rather, investigation revealed that the device was contained in a parcel shipped by U.S. mail that the Federal Bureau of Investigation (FBI) linked to convicted "Unabomber," Theodore Kaczynski.[13]

While using cargo as a means to place explosive or incendiary devices aboard aircraft has historically been rare, heightened screening of passengers, baggage, and aircraft may make cargo a more attractive means for terrorists to place these devices aboard aircraft, including all-cargo aircraft as well as passenger aircraft, in the future. Investigations have suggested that al Qaeda terrorists had an interest in bombing all-cargo aircraft prior to September 11, 2001, and were planning to bomb U.S.-bound

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[11] United Kingdom Air Accidents Investigation Branch. *Report on the accident to Boeing 747-121, N739PA at Lockerbie, Dumfriesshire, Scotland on 21 December 1988* (Aircraft Accident Report No 2/90 (EW/C1094)), July 1990.

[12] Canadian Aviation Bureau Safety Board. Aviation Occurrence, Air India Boeing 747-237B VT-EFO, Cork, Ireland 110 Miles West, June 23, 1985.

[13] Affidavit of Assistant Special Agent in Charge, Terry D. Turchie, Before the U.S. District Court, District of Montana, April 3, 1996.

cargo flights in an operation run out of the Philippines.[14] Given al Qaeda's continued interest in bombing aircraft and indications that they have already considered placing bombs in cargo, the specific vulnerability of air cargo is an issue of particular concern.

However, as previously noted, some terrorism experts believe that placing explosives or incendiary devices in cargo may be less appealing because it would be difficult to target specific flights without the cooperation of individuals with access to aircraft such as cargo workers. Thus, increased efforts to perform background checks of workers with access to aircraft and increased physical security around air cargo operations may further mitigate the threat of explosives and incendiary devices. In 2006, the TSA finalized rules requiring fingerprint-based criminal history records checks (CHRCs) and terrorist screening of individuals working in cargo operations areas, and workers at freight forwarding companies that handle the routing of air cargo. Additionally, the use of hardened cargo containers capable of withstanding internal bomb blasts are being evaluated and may also provide a means of mitigating the risks of explosives and incendiary devices. The 9/11 Commission specifically recommended the deployment of at least one hardened cargo container in each passenger aircraft to mitigate the potentially catastrophic consequences of a bomb carried in air cargo.[15] Under a provision in the National Intelligence Reform Act of 2004 (P.L. 108-458), a pilot program was established to evaluate this concept. A provision in the Implementing the 9/11 Commission Recommendations Act of 2007 (P.L. 110-53) directed the TSA to provide an evaluation of the pilot program and, based on its findings, implement a program to pay for, provide, and maintain blast-resistant cargo containers for use by air carriers on a risk-managed basis.

Hazardous Materials.[16] Despite increased Federal Aviation Administration (FAA) and Department of Transportation (DOT) oversight and enforcement efforts, undeclared and undetected shipments of hazardous materials continue to pose a significant safety problem for air carriers. Most explosives and gases are prohibited aboard aircraft, however many properly handled hazardous materials are permitted aboard passenger and all-cargo aircraft within specified quantity limitations.[17]

Risks are introduced when hazardous materials are not declared leading to the potential transport of prohibited materials by air or improper handling of hazardous goods during loading and while in transit. The dangers of undetected and improperly handled hazardous materials in air cargo shipments were highlighted by the May 11,

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[14] National Commission on Terrorist Attacks Upon the United States. *The 9/11 Commission Report.* New York, NY: W. W. Norton & Company.

[15] Ibid.

[16] Hazardous materials or dangerous goods include explosives; gases; flammable liquids and solids; oxidizers and organic peroxides; toxic materials and infectious substances; radioactive materials; corrosive materials; and other miscellaneous dangerous goods (e.g. asbestos).

[17] U.S. General Accounting Office (now the Government Accountability Office, or GAO). *Aviation Safety: Undeclared Air Shipments of Dangerous Goods and DOT's Enforcement Approach.* (GAO-03-22, January 2003).

1996 crash of a ValuJet DC-9 in the Florida Everglades. The National Transportation Safety Board (NTSB) determined that improperly carried oxygen generators ignited an intense fire in one of the airplane's cargo holds leading to the crash and issued several safety recommendations for improving the handling and tracking of hazardous materials to prevent improper carriage aboard passenger aircraft.[18]

While safety concerns regarding hazardous cargo shipments aboard passenger aircraft are of particular concern, preventing unauthorized shipments of hazardous materials is a challenge for all-cargo aircraft operators as well. About 75% of hazardous materials shipped by aircraft are carried aboard all-cargo aircraft, while the remaining 25% is shipped on passenger aircraft.[19] Enhanced air cargo security measures may also improve air cargo safety by increasing the detection of undeclared hazardous materials through screening and inspections of cargo shipments and related paperwork.

Cargo Crime. Cargo crimes include theft of goods transported as cargo, and shipment and smuggling of contraband, counterfeit, and pirated goods through the cargo distribution network. It has been estimated that direct losses due to cargo theft across all transportation modes total between $15 and $30 billion annually in the United States.[20] The large range in this estimate reflects the fact that cargo theft and other cargo crime has not historically been a specific designated crime category, and therefore reliable statistics on cargo theft are not available. A provision in the USA PATRIOT Improvement and Reauthorization Act (P.L. 109-177), however, required the Department of Justice to establish a separate category for cargo theft in the Uniform Crime Reporting System. The act also refines relevant statutes and increases criminal penalties for cargo theft and stowaways.

The large estimated level of cargo theft and other cargo crimes is indicative of potential weaknesses in cargo security, including air cargo security. Specific weaknesses in air cargo security have been highlighted in several high profile investigations of cargo theft. For example, major cargo and baggage theft rings have been uncovered at JFK International Airport in New York, Logan International Airport in Boston, and at Miami International Airport.[21] In addition to theft, smuggling has also been a problem for air cargo security. Smuggling of contraband, counterfeit, and pirated goods undermines legal markets and reduces government tax and tariff revenues. Smuggling operations are often linked to organized crime, and

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[18] National Transportation Safety Board. *Aircraft Accident Report: In-Flight Fire and Impact with Terrain, ValuJet Airlines, Flight 592, DC-9-32, N904VJ, Everglades, Near Miami, Florida, May 11, 1996* (AAR-97/06).

[19] U.S. General Accounting Office. *Aviation Safety: Undeclared Air Shipments of Dangerous Goods and DOT's Enforcement Approach.* GAO-03-22, January 2003.

[20] Federal Bureau of Investigation. "Cargo Theft's High Cost: Thieves Stealing Billions Annually." Washington, DC: July 21, 2006.

[21] U.S. General Accounting Office. *Ibid*; Department of Transportation, Office of the Inspector General. *Press Release: Six MIA Airport Employees Indicted for Stealing from Checked Passenger Bags.* December 11, 2002.

may provide support for terrorist activities.[22] A large portion of cargo crime is either committed by or with the assistance of cargo workers. Therefore, increased security measures such as conducting more stringent or more frequent background checks of cargo workers and enhancing physical security of cargo operations areas are likely to reduce cargo crimes and improve the capability to detect criminal activity in air cargo operations. A review of transportation security needs for combating cargo crime identified six key issues regarding cargo security:

- a lack of effective cargo theft reporting systems;
- weaknesses in current transportation crime laws and prosecution;
- a lack of understanding regarding the nature of cargo crime by governments and industry;
- inadequate support for cargo theft task forces;
- a need to improve local law enforcement expertise on cargo theft; and
- the need for more effective cargo security technology including cargo tracking systems, tamper-evident and tamper-resistant seals, high-speed screening devices, and integration of security technology into supply chain management systems.[23]

While some of these issues may be addressed through the Department of Justice's approach to meeting the mandate for uniformly reporting cargo crimes, concerns over the adequacy of law enforcement approaches to combating cargo crime and the implementation of cargo security technologies remain. Addressing these issues specific to cargo crime may also improve overall cargo security and could deter terrorist threats to cargo shipments. While these recommendations are directed toward cargo crime issues in all modes of transportation, they could also be particularly applicable to air cargo security where other security concerns such as explosive and incendiary device detection, hazardous materials detection, and deterring hijackings and sabotage may also be addressed through the implementation of tighter controls to deter cargo crime.

Aircraft Hijacking and Sabotage. Individuals with access to aircraft may pose a risk of potential hijackings and aircraft sabotage. Instances of hijackings by individuals with access to aircraft have been extremely rare, but include two examples of particularly violent incidents by disgruntled individuals who had access to aircraft that facilitated their plots. A particularly dramatic hijacking attempt by an individual with access to aircraft and cargo operations facilities occurred on April 7, 1994.[24] An off-duty Federal Express flight engineer attempted to hijack a FedEx DC-10 aircraft and crash it into the company's Memphis, Tennessee headquarters. The hijacker boarded the airplane in Memphis under the guise of seeking free transportation (a practice known in the industry as deadheading) to San Jose,

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[22] FIA International Research, Ltd. *Op. cit.*

[23] Ed Badolato. "Cargo Security: High-Tech Protection, High-Tech Threats." *TR News*, 211, November-December 2000, pp. 14-17.

[24] Dave Hirschman. *Hijacked: The True Story of the Heroes of Flight 705*. (New York: William Morrow & Co, 1997).

California. His only luggage was a guitar case that concealed hammers, mallets, a knife, and a spear gun. At the time there was no requirement or company procedure to screen or inspect personnel with access to cargo aircraft or their baggage. The flight crew thwarted the hijacker's attempt to take over the airplane by force and made a successful emergency landing in Memphis despite serious injuries to all three flight crew members.

Individuals have also used their access to aircraft credentials to bypass existing security measures in airport terminals to carry out crimes, including aircraft hijackings and sabotage. In a particularly tragic example, on December 7, 1987, a PSA regional jet crashed near San Luis Obispo, California killing all 43 people on board.[25] Investigation revealed that a disgruntled former USAir employee, recently fired for alleged theft, used his employee identification, which had not been returned, to bypass airport security with a loaded handgun. At altitude, he shot his former supervisor who was a passenger on the airplane. He then entered the flight deck, shot the two pilots, and then shot himself after putting the airplane into a crash dive. At the time, airline employees were allowed to bypass airport security checkpoints. At many airports today, employees with unescorted access privileges to security identification display areas (SIDAs) may access secured areas and aircraft without being subject to physical screening. Specific screening procedures for airport workers vary from airport to airport and are part of the airport's TSA security program, which is considered security sensitive. Collecting airport access credentials from terminated employees remains a problem to this day. However, a provision in the FY2008 Omnibus Appropriations Act (P.L. 110-161) establishes civil penalties for airport contractors and vendors that fail to collect access credentials and notify the airport of employee terminations within 24 hours.

Since these incidents, airport and air cargo security regulations have been tightened to establish better controls over aircraft access including background checks and, in some cases, routine or random physical screening of individuals with access to aircraft. Background checks are required for workers with unescorted access to both passenger and air cargo aircraft. However, without full screening of air cargo and airport personnel, the potential still exists for persons with access to aircraft to pass weapons inside the secured areas of airports. Under recently imposed regulations, all-cargo operators must take steps to prevent unauthorized individuals from accessing aircraft and to ensure that crewmembers and individuals carried aboard large all-cargo aircraft are prevented or deterred from carrying weapons, explosives, or other destructive items on board aircraft.[26]

As mentioned earlier, heightened security measures on passenger aircraft since September 11, 2001 could make all-cargo aircraft more attractive to terrorists seeking to hijack large airplanes. Currently, federal air marshals are not deployed on all-cargo aircraft, and cargo airplanes are not required to have hardened cockpit doors so long as alterative TSA-approved security measures are implemented to control access to aircraft and the flight deck while an airplane is on the ground. Vision 100

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[25] National Transportation Safety Board. Accident Brief, NTSB Identification: DCA88MA008. Available at [http://www.ntsb.gov].

[26] See 49 CFR §1544.202.

(P.L. 108-176) expanded the Federal Flight Deck Officer program to include pilots of all-cargo aircraft. This program trains and deputizes pilots to carry firearms to protect the flight deck against a terrorist attack. (See CRS Report RL31674, *Arming Pilots Against Terrorism: Implementation Issues for the Federal Flight Deck Officer Program*, by Bart Elias.)

Sabotage, such as tampering with, disabling, or destroying flight-critical systems and aircraft components, by individuals with access to aircraft is also a potential risk. Although, this is not generally considered a significant threat because of the level of knowledge regarding aircraft systems needed to sabotage flight critical systems, the degree of redundancy of flight critical systems on modern transport category airplanes[27], and the existing capabilities to detect sabotage attempts through aircraft systems checks, pre-flight inspections, and maintenance checks. While numerous cases of sabotage by disgruntled employees have been documented, these incidents of aircraft tampering have typically been discovered during pre-flight inspections resulting in aircraft groundings and delays and costly repairs, but have not resulted in catastrophes. Such incidents have not been linked to terrorism.

Cargo Screening and Inspection

Screening and inspection of air cargo may be an effective means for detecting explosives, incendiary devices, and hazardous materials in air cargo. The Aviation and Transportation Security Act (ATSA, P.L. 107-71) requires the screening of all property, including mail and cargo, carried aboard passenger aircraft in the United States. ATSA also specified that, as soon as practicable, a system must be implemented to screen, inspect, or otherwise ensure the security of all cargo transported in all-cargo aircraft. However, the GAO noted that the TSA lacked specific long-term goals and performance targets for cargo security.[28] In response, the TSA has developed an air cargo security strategic plan and has proposed comprehensive regulations designed to enhance air cargo security. The TSA's strategy centers on risk-based assessments and targeted physical screening of cargo based on risk as well as increased random inspections of shipments.

While ATSA established such a requirement, it is important to note that this has not been interpreted to require physical screening or inspection of cargo shipments carried aboard passenger aircraft. Rather, in implementing the security procedures for cargo carried aboard passenger airplanes, the TSA has relied extensively on the use of "known shipper" programs to prevent the shipment of cargo from unknown sources aboard passenger aircraft. Initially, air carriers and freight forwarders

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[27] Transport category airplanes include all jet-powered airplanes with 10 or more passenger seats or weighing more than 12,500 pounds maximum takeoff weight (MTOW), and all propeller-driven airplanes with 19 or more seats or weighing more than 19,000 pounds MTOW.

[28] U.S. General Accounting Office. *Post-September 11th Initiatives and Long-Term Challenges*. Statement of Gerald L. Dillingham, Testimony Before the National Commission on Terrorist Attacks Upon the United States, April 1, 2003 (GAO-03-616T); U.S. Government Accountability Office, *Aviation Security: Federal Action Needed to Strengthen Domestic Air Cargo Security,* October 2005, GAO-06-76.

maintained their own lists of shippers that had established known and trustworthy business relationships to screen shipments placed on passenger aircraft. However, under rules finalized in 2006, airlines and freight forwarders must now use an industry-wide database of known shippers to clear shipments before they can be placed on passenger aircraft. However, some Members of Congress have expressed continued concern over applying targeted risk-based screening to cargo shipments placed on passenger aircraft. Through appropriations legislation, Congress has continually pressed the TSA to increase the percentage of cargo carried on passenger aircraft that is inspected, and has directed the DHS to invest in the research, development, and deployment of explosives screening technologies tailored for air cargo. As previously noted, the Implementing the 9/11 Commission Recommendations Act of 2007 (P.L. 110-53) establishes specific requirements and a timetable for implementing 100% physical screening or inspection of air cargo carried aboard passenger aircraft.

Current aviation security regulations require each passenger aircraft operator and indirect air carrier[29] to develop a security program for acceptance and screening of cargo to prevent or deter the carriage of unauthorized explosives or incendiaries. However, the volume of air cargo handled and the distributed nature of the air cargo system presents significant challenges for screening and inspecting air cargo. Presently, in the United States, about 50 air carriers transport air cargo on passenger aircraft handling cargo from nearly 2 million shippers per day.[30] About 80% of these shippers use freight forwarders who operate about 10,000 facilities across the country.[31] Since the air cargo industry has contended that 100% screening of all air cargo is not a practical solution with currently available technology, up until now security programs have relied primarily on pre-screening of cargo to identify shipments for targeted physical screening and inspection. The TSA has adopted a risk-based strategy that relies heavily on the known shipper process. The TSA had planned to include other factors in its cargo risk assessment through the use of a freight assessment system that it has been developing, based in part on CBP's targeting methods However, given the new mandate for achieving 100% physical screening of passenger air cargo, the future plans for the risk-based freight assessment system seem somewhat uncertain. Nonetheless, risk-based approaches remain a cornerstone of the TSA approach to air cargo security, and more broadly aviation security in general.

The TSA is currently working toward fully implementing its Air Cargo Strategic Plan, which was released in November 2003.[32] In keeping with the risk-based

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[29] An indirect air carrier refers to an entity, such as a freight forwarder, that engages indirectly in the air transportation of property on passenger aircraft (See Title 49 Code of Federal Regulations, Chapter XII, Part 1544).

[30] See S.Rept. 108-38.

[31] U.S. General Accounting Office. *Aviation Security.*

[32] U.S. Department of Homeland Security, Transportation Security Administration. *Air Cargo Strategic Plan.* November 13, 2003; Department of Homeland Security, Transportation Security Administration, "Air Cargo Security Requirements, Final Rule,"

approach of implementing air cargo security measures typified in the known shipper concept, the core elements of this plan consist of: improving shipper and supply chain security through improved vetting of shippers and freight forwarders; enhancing cargo pre-screening processes; developing and deploying appropriate screening technologies to conduct targeted air cargo inspections; and implementing appropriate facility security measures. In addition to the known-shipper system, the TSA is also developing a more comprehensive targeting tool for air cargo, known as the "Freight Assessment System." While few details of this systems have been publicly disclosed, the TSA had indicated that it expected to fully deploy this system sometime in 2008, but as previously noted, the mandate for 100% screening of passenger air cargo may alter these plans.[33]

The Known Shipper Program. The principal means for pre-screening or profiling cargo has been through the use of air carrier and freight forwarder "known shipper" programs. In May 2006, the TSA issued a final rule establishing an industry-wide known shipper database for vetting all shipments placed on passenger aircraft.[34] Previously, some air carriers and indirect air carriers had voluntarily participated in a system using a central database of known shippers to vet cargo destined for passenger aircraft as required under ATSA. Other air carriers and freight forwarders relied on internal databases and security protocols approved by TSA for determining whether shipments bound for a passenger airplane come from known sources and that shippers have adequate security measures in place to protect the integrity of those shipments.

Known shipper programs were created to establish procedures for differentiating trusted shippers, known to a freight forwarder or air carrier through prior business dealings, from unknown shippers who have conducted limited or no prior business with a freight forwarder or air carrier. Using this system, packages from unknown shippers can then be identified for additional screening and inspection. Currently, shipments from unknown sources are prohibited from passenger aircraft. Additionally, air carriers and freight forwarders must refuse to transport any cargo from shippers, including known shippers, that refuse to give consent for searching and inspecting the cargo. ATSA provides for use of known shipper programs as an alternate means for ensuring the security of cargo carried aboard passenger aircraft in lieu of screening of property by federal government employees prior to aircraft boarding.

The development of known shipper programs was prompted by industry experts and Congress in the mid-1990s who recognized that increased controls over air cargo shipments were needed to better ensure air cargo safety and security. Key concerns included the need for increased compliance with guidelines for the shipment of

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[32] (...continued)
Federal Register, 71(102)*,* May 26, 2006, pp. 30477-30517; 49 CFR 1544.239.

[33] Executive Office of the President of the United States, Office of Management and Budget, *Program Assessment, Transportation Security Administration: Air Cargo Security Programs.* Washington, DC.

[34] Department of Homeland Security, Transportation Security Administration. "Air Cargo Security Requirements; Proposed Rule." *Federal Register*, (69) 217, 65258-65291.

hazardous materials and the need to deter terrorists from using cargo as a means to place explosives or incendiary devices on aircraft. In addition, congressional hearings on the 1996 Valujet accident concluded that air cargo safety could only be achieved through a comprehensive inspection program encompassing all components of the air cargo network.[35]

In December 1996, the FAA's Aviation Security Advisory Committee (ASAC) Security Baseline Working Group issued a series of recommendations that formed the basis for FAA's effort to strengthen air cargo safety and security. Recommendations issued by the working group regarding air cargo security included tightening the definition of a "known shipper"; using profiles to review the shipments of known shippers and apply additional security measures; and exploring technologies to develop a profile to be applied to cargo shipments. The White House Commission on Aviation Safety and Security, formed after the 1996 crash of TWA Flight 800 and commonly referred to as the Gore Commission, urged the adoption of the recommendations made by the FAA's Baseline Working Group regarding the profiling of "known" and "unknown" shippers.[36] As part of FAA's efforts in air cargo safety and security, a "known shipper" program was subsequently established, outlining procedures for freight forwarders and air carriers to review the security practices of known frequent customers and establish a cargo security plan for handling cargo from known and unknown shippers. With the passage of ATSA, oversight of cargo security measures was transferred from the FAA to the TSA. The TSA has continued to rely on known shipper programs as a principle means for pre-screening air cargo.

A review of aviation security after the September 11, 2001 terrorist attacks by the DOT Office of the Inspector General, drew attention to the vulnerabilities of air cargo and questioned the overall effectiveness of the known shipper program.[37] In Congressional testimony following the terrorist attacks of September 11, 2001, DOT Inspector General, Kenneth Mead, referenced a 1998 report by the DOT Office of the Inspector General documenting a high rate of non-compliance with hazardous materials regulations and cargo security requirements across the air cargo industry and a lack of industry oversight to ensure that security procedures were carried out by cargo workers.[38] In 1998, the DOT Inspector General noted that FAA was making progress toward improving the policies, procedures, and controls over air cargo safety

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[35] Department of Transportation, Office of the Inspector General. *Aviation Security: Federal Aviation Administration* (Report No. AV-1998-134, May 27, 1998).

[36] White House Commission on Aviation Safety and Security. *Final Report to President Clinton.* Vice President Al Gore, Chairman. February 12, 1997. Washington, DC: The White House.

[37] Ken Leiser. "Gaps in air cargo security may offer terrorism openings." *AEROTECH News and Review*, June 21, 2002, p. B2.

[38] Statement of The Honorable Kenneth M. Mead, Inspector General U.S. Department of Transportation. "Action Needed to Improve Aviation Security." Before the Committee on Governmental Affairs and the Subcommittee on Oversight of Government Management, Restructuring and the District of Columbia, United States Senate, September 25, 2001.

and security.[39] However, Mead testified that a follow-up audit revealed continued weaknesses in FAA's policy for allowing cargo on passenger aircraft. Several loopholes have been noted, including the relative ease of obtaining known shipper status, and the relative ease with which someone could pose as a known shipper by falsifying or counterfeiting shipping documents used to identify the source as a known shipper.[40]

Two central issues regarding the post-9/11 implementation of known shipper programs have been the adequacy of procedures for auditing and monitoring known shippers, and consideration of the potential need for a consolidated database of known shippers, as has now been created. Critics of known shipper programs have argued that relatively little investigation of known shippers is required to demonstrate that these shippers are trustworthy and have adequate security measures in place to ensure the integrity of their shipments.[41] Freight forwarders and air carriers have also questioned why extensive background checks and established relations with a particular customer are required to establish that the customer is a known shipper when that customer is already considered a known shipper to another air carrier or freight forwarder. Therefore, some had suggested a need for a standardized, centralized database of known shippers, as has now been created by the TSA. To address these concerns, the TSA initially instituted an industry-wide pilot program database of known shippers. This initiative poised the TSA to address congressional interest in establishing an industry-wide known shipper database that was included in language passed by the Senate during the 108th Congress (see S. 165, S. 2845 as passed by the Senate). The administration's subsequent initiatives in taking regulatory action to require an industry-wide known shipper database led Congress to ultimately drop the Senate-passed provision in the Intelligence Reform Act of 2004 (P.L. 108-458) that would have established a statutory requirement for establishing a standardized industry-wide known shipper program and database. Congress instead settled on including language calling for the TSA to finalize its rulemaking on air cargo security, including the proposed establishment of the industry-wide known shipper database, by September 2005. Those rules were not finalized until May 2006, but are now being implemented, including the provision to establish an industry-wide known shipper database. The Congressional Budget Office (CBO) estimates that it will cost about $10 million per year to maintain the industry-wide database of known shippers.[42]

Physical Screening and Inspection. Another issue for air cargo security is the adequacy of cargo inspection procedures and oversight of cargo inspections at air carrier and freight forwarder facilities. The debate over explosives screening of cargo has been around for more than ten years, but was significantly intensified following the 9/11 attacks. In 1997, the Gore Commission recommended that

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[39] Department Of Transportation, Office of the Inspector General. *Aviation Security: Federal Aviation Administration* (Report No. AV-1998-134, May 27, 1998).

[40] Greg Schneider. *Op. cit.*

[41] Ken Leiser, *Op. cit.*

[42] See S.Rept. 108-38. *Air Cargo Security Improvement Act: Report of the Committee on Commerce, Science, and Transportation on S. 165.* United States Senate, April 11, 2003.

unaccompanied express packages shipped on commercial passenger aircraft should be subject to examination by explosives detection systems.[43] Following the 9/11 attacks, ATSA established a requirement for screening and inspection of all individuals, goods, property, vehicles, and other equipment entering a secured area of a passenger airport. This requirement mandated the same level of protection as passenger and baggage screening, but did not explicitly require the use of any specific screening technologies or techniques.

ATSA did not establish specific requirements for the physical screening of air cargo. With regard to air cargo, current regulations specify that aircraft operators must use the procedures, facilities, and equipment described in their security program to prevent or deter the carriage of unauthorized explosives or incendiaries in cargo onboard a passenger aircraft and inspect cargo shipments for such devices before it is loaded onto passenger aircraft. With regard to all-cargo aircraft, ATSA mandates that a system to screen, inspect, or otherwise ensure the security of all-cargo aircraft is to be established as soon as practicable, but sets no specific deadlines or time frame for compliance. Additionally, aircraft operators must establish controls over cargo shipments, in accordance with their security program, that prevent the carriage of unauthorized explosive or incendiary devices aboard passenger aircraft and access by unauthorized individuals. Further, aircraft operators must refuse to transport any cargo presented by a shipper that refuses to consent to a search and inspection of their shipment.[44]

The Homeland Security Appropriations Act of 2005 (P.L. 108-334) called for tripling the amount of cargo placed on passenger airplanes that is screened or inspected; however the absolute number or percentage of cargo subject to inspection is considered security sensitive. FY2006 appropriations language (P.L. 109-90) directed the TSA to take all possible measures — including the certification, procurement, and deployment of screening systems — to inspect and screen air cargo on passenger aircraft and increase the percentage of cargo inspected beyond the level mandated in the FY2005 appropriations measure. Further, FY2007 appropriations language (P.L. 109-295) directed the TSA to work with industry stakeholders to develop standards and protocols to increase the use of explosives detection equipment for screening air cargo. Similarly the FY2008 Omnibus Appropriations Act (P.L. 110-161) directed the DHS to research, develop, and procure new technologies to screen air cargo, and in the interim utilize checked baggage explosives detection equipment to the maximum extent practicable to screen air cargo placed on passenger aircraft.

While the TSA has taken steps to increase physical inspections of cargo carried aboard passenger aircraft, 100% screening of all cargo placed on passenger aircraft remains a challenge. In August 2007, the Implementing the 9/11 Commission Recommendations Act of 2007 (P.L. 110-53) was enacted. Air cargo screening was a contentious issue during the legislative debate. In the end, the act included a provision requiring 100% physical screening and inspection of all cargo placed on passenger aircraft by August 2010, with an interim requirement to screen 50% of

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[43] White House Commission on Aviation Safety and Security. *Op. cit.*

[44] See Title 49, Code of Federal Regulations, Chapter XII, Part 1544.205

such cargo by February 2009. The act identifies specific methods of screening that would be acceptable in meeting this requirement, including the use of x-ray systems, explosives detection systems, explosives trace detection, TSA-certified explosives detection canine teams, and physical searches conducted in conjunction with manifest verifications. Additional methods may be approved by the TSA. However, the provision specifically prohibits the use of cargo documents and known shipper verification by themselves as being acceptable screening methods. Language in the FY2008 Omnibus Appropriations Act requires the TSA to continually increase the percent of passenger air cargo that is screened, and provide Congress with quarterly updates on the progress being made toward achieving 100% screening of all cargo placed on passenger aircraft. In January 2008, the Chairman of the House Committee on Homeland Security Bennie Thompson and Representative Ed Markey requested a GAO review of the TSA's approach and progress toward meeting the mandate for 100% screening of passenger air cargo, citing concerns that Congress has limited information regarding the TSA's implementation plans.[45]

During congressional debate, air cargo industry stakeholders voiced considerable opposition to requiring 100% screening of passenger air cargo, urging Congress instead to "... focus on realistic solutions based on a framework that identifies and prioritizes risks, works methodically to apply effective and practical security programs, and makes optimal use of federal and industry resources."[46] The industry has continually advocated for a risk-based screening system for cargo placed on passenger airlines that incorporates threat assessment and targeting capabilities, provides incentives for shippers to strengthen supply chain measures, and focuses increased inspections on cargo determined to be of elevated risk through risk assessment and targeting capabilities. This roughly parallels the TSA's strategic plan for air cargo security, which focuses on risk-based targeted screening of cargo. The industry has specifically recommended increased use of canine explosives detection teams; enhanced supply chain security; enhanced targeting of shipments based on the Customs and Border Protection (CBP) experience with its Automated Targeting System (ATS); expanded use of explosive trace detection (ETD) technology for targeted screening; and accelerated research and development of technologies that can more efficiently inspect elevated risk cargo.[47]

A significant ongoing challenge regarding cargo inspection is the feasibility of implementing inspection procedures that offer adequate assurances for security without unduly affecting cargo shipment schedules and processes. However, many in the air cargo industry have expressed continued concerns that current technology

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[45] Bennie G. Thompson and Edward J. Markey. Letter to the Honorable David M. Walker, Comptroller General of the United States, January 29, 2008.

[46] Air Carrier Association of America, Airforwarders Association, Air Transport Association, Cargo Network Services Corporation (CNS), High Tech Shippers Coalition, International Warehouse Logistics Association, National Air Carrier Association (NACA), National Customs Brokers and Forwarders Association of America, Inc., National Fisheries Institute, Regional Airline Association, Society of American Florists, and the U.S. Chamber of Commerce, *Letter to The Honorable Daniel Inouye and The Honorable Ted Stevens,* January 8, 2007, p. 1.

[47] *Ibid.*

does not offer a readily available, affordable solution for scanning cargo containers or bulk cargo in an expeditious manner that would not unduly affect the schedule of air cargo operations. Also, scanning or inspecting individual packages is considered infeasible by many experts due to the volume of cargo handled and the schedule demands of the air cargo business. Therefore, most experts have maintained that the most practical solution, using available technology, is the application of physical screening and inspections on selected shipments and the use of cargo profiling procedures such as known shipper programs coupled with canine explosives detection teams to identify shipments that may require additional screening and inspection.

The DHS Science and Technology Directorate, in coordination with the TSA, initiated an air cargo screening pilot program at three airports — San Francisco International (SFO), Seattle-Tacoma International (SEA) in FY2006 and Cincinnati/ Northern Kentucky International (CVG) in FY2007 — to test technologies and procedures for cargo screening.[48] The tests are looking at a combination of X-ray, explosives detection systems (EDS), and ETD screening technologies to determine the best fit for effectively screening air cargo and optimizing the flow and speed of cargo screening. It is anticipated that the results of these pilot tests will be provided to the TSA in FY2009 to aid in decisions regarding the technology approach to be taken to meet the 100% cargo screening mandate, along with guidance regarding the best insertion point for selected technologies in the supply chain to optimize security and efficiency. Additional research will focus on capabilities to better detect, and also to disable, improvised explosive devices (IEDs) in cargo.

Canine Explosives Detection Teams. Since the ability to screen and inspect cargo may be limited to some degree by available technology, flight schedules, and cargo processing demands, alternative measures for screening and inspection at cargo handling facilities have been suggested. The use of canine explosives detection teams has long been suggested as a possible means for screening cargo for explosives. In 1997, the Gore Commission recommended a significant expansion of the use of bomb-sniffing dogs. Similarly, as Congress began looking at options for addressing concerns over explosives placed in air cargo in 2003, former TSA head, Admiral James Loy, testified that increased use of canine teams may be an effective means for increasing inspections of cargo and mail.[49] Canine teams may offer a viable alternative means for screening air cargo at a relatively low cost. As previously noted, air cargo industry stakeholders are presently advocating the increased use of explosives detection canine teams as an integral part of a risk-based approach to air cargo targeting and screening. However, some believe that adequate assurances regarding the security of cargo placed upon passenger aircraft cannot be

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[48] Department of Homeland Security, Office of the Press Secretary. "Aircraft Cargo Screening Program to Begin at Cincinnati/Northern Kentucky Airport." March 26, 2007; David Hughes. "Airports Conducting Air Cargo Screening Trials." *Aviation Daily*, May 7, 2007.

[49] Statement of Admiral James M. Loy, Administrator, Transportation Security Administration, Before the Senate Committee on Commerce, Science, and Transportation, On Oversight of Transportation Security, September 9, 2003.

provided without 100% physical screening predominantly relying on explosives detection technology, as is currently required for all checked baggage.

Supplemental appropriations provided in FY2007 (see P.L. 110-28) provided a total of $80 million for air cargo, to be expended through FY2008, to carry out a variety of air cargo security initiatives including increasing the number of canine teams in the National Explosives Detection Canine Program by at least 170 new teams. All totaled, this will bring the number of TSA canine teams covering all transportation modes to about 600. A large percentage of these teams are involved in passenger air cargo screening activities. Also, the TSA is working with the DHS Science and Technology Directorate to study training techniques and operational procedures to improve canine detection capabilities. One technology being examined is Remote Air Sampling Canine Olfaction (RASCO) sensors, which can provide a concentrated sample from a container for a canine to inspect and has been used extensively in Europe.[50] The DHS project plans to expand this concept to include chemical sensors carried on jackets worn by the canine that will be capable of transmitting data to remote monitoring stations. This appears to address a provision in the FY2007 supplemental appropriations language directing the TSA to "pursue canine screening methods utilized internationally that focus on air samples."[51]

The Cost of Cargo Screening and Inspection. Despite considerable public policy discussion regarding the physical screening of air cargo placed on passenger airliners, there is relatively limited information regarding the estimated cost of carrying out proposals to conduct physical screening of 100% of cargo carried on passenger aircraft. This is, in part, attributable to the fact that there is not yet an agreed upon approach to meeting this mandate. It remains uncertain what role various technologies, such as X-ray, EDS, and ETD, along with canine explosives detection teams will play in meeting this requirement. A statement attributed to David Wirsing, Executive Director of the Airforwarders Association, asserted that implementing this proposal would cost "over $700 million in the first year alone."[52] The TSA has not publicly disclosed a formal cost estimate for screening all cargo placed on passenger aircraft. However, a statement attributed to TSA spokeswoman Andrea McCauley, indicated that screening cargo placed only on passenger aircraft "would cost an estimated $3.6 billion over 10 years."[53]

CRS analyzed the cost to screen all cargo carried on passenger aircraft. This analysis was based on a comparison to costs incurred to meet the mandate for 100% baggage screening and a comparison of the annual volume of cargo carried on passenger aircraft to the estimated annual volume of checked baggage. This

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[50] Wickens, B., "Remote Air Sampling for Canine Olfaction," *IEEE 35th International Carnahan Conference on Security Technology*, 2001, October 2001, pp. 100 - 102.

[51] P.L. 110-28, 121 Stat. 141.

[52] Matthew Yglesias, "$1.27 Trillion: The Price is Wrong," *The American* Prospect, *17*(7), July/August 2006, p. 28-32. See also, "Screening Air Cargo," *Air Safety Week*, May 9, 2005.

[53] Jeff Bliss, "Air-Cargo Screening 'A Disaster Waiting to Happen,' Critics Say," *Bloomberg.com*, November 29, 2005.

approach yielded a ten-year estimate of roughly $3.75 billion for meeting the proposed mandate to screen 100% of cargo placed on passenger aircraft, roughly in line with the estimate attributed to the TSA. However, additional complexities associated with air cargo, such as large sized and irregular shaped shipments, that were not taken into account in this analysis could further increase estimated costs by making the screening process more labor intensive, or by requiring the additional deployment of alternative technologies for screening. These and other factors may explain the larger anticipated initial year costs estimated by the Airforwarders Association, reflected in their estimate of $700 million in the first year of 100% screening. While these factors have generally been acknowledged by industry experts, it has not been fully determined how these unique factors may affect the overall cost of screening cargo. On the other hand, through leveraging technology development and applying operational efficiencies developed from experience with baggage screening as well as the ongoing air cargo screening pilot tests, the total cost of implementing cargo screening may be reduced to some degree.

The Congressional Budget Office (CBO), nonetheless, provided a somewhat higher cost estimate, indicating that it might cost $250 million in the first year and $650 million per year for the following five years, for a total of $3.5 billion over six years, to implement the mandate for 100% baggage screening.[54] The CBO, however, did not provide any specific details regarding how it arrived at this estimate. The CBO also noted that the insufficient information was available to determine whether this new mandate would impose costs on private-sector entities. With regard to who will carry out the mandated cargo screening and who will pay, P.L. 110-53 does not provide clear guidance. Therefore, it remains uncertain whether some or all of the costs for mandated cargo screening will be included in the TSA budget, or how much will have to be covered by the air cargo industry.

Regarding the costs for screening cargo, the potential for additional fees is a particular concern for air cargo industry stakeholders. While P.L. 110-53 included the mandate for 100% cargo screening, it did not include any provisions to establish air cargo security fees or identify any other new revenue sources to pay for this mandate. During legislative debate, House majority leadership has indicated that it would not propose new deficit spending to pay for cargo screening, and that "... airlines would be expected to pay for air cargo inspections."[55] Under such a scheme, it would be most likely that physical screening of air cargo would become an air carrier responsibility with TSA oversight to insure regulatory compliance. Under such an arrangement, airlines would incur the direct costs for meeting the 100% screening requirements. However, more recently House Homeland Security Chairman Bennie Thompson and House Transportation and Infrastructure Committee Chairman Jerry Costello both made statements indicating that cargo screening should

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[54] Congressional Budget Office. *H.R. 1 - Implementing the 9/11 Commission Recommendations Act of 2007*, February 2, 2007.

[55] Chris Strohm, "Democrats Look To Industry To Pay for Cargo," *Government Executive Daily Briefing,* January 9, 2007.

be a government responsibility, and that it was the intent of the legislation to have federal employees carrying out the cargo screening required under this mandate.[56]

The act, however, does not specify who is to conduct the screening, and the TSA has interpreted the language to allow airlines, freight forwarders, or even possibly shippers and manufacturers to conduct the screening so long as they can assure the security of the shipment through the supply chain until it is loaded onto an aircraft.[57] The TSA maintains that this is the only viable means for meeting the mandate, as the TSA does not currently have the resources to screen the volume of cargo placed on passenger aircraft, and such an inflexible approach would slow the flow of air cargo. The TSA remains confident that, so long as a flexible approach is permitted, it will meet the August 2010 deadline for 100% screening, noting that at several smaller airports, the requirement is already being met.[58] Under such an approach, it is likely that much of the operational costs associated with cargo screening and inspection will be borne by industry, including airlines, freight forwarders and shippers. The extent to which these screening costs can be absorbed by passing them along to shippers and consumers may be a particular issue of interest, particularly as airlines continue to deal with other rising costs, especially increased fuel costs.

Besides the impact of direct costs for screening, passenger airlines may be competitively disadvantaged compared to all-cargo airlines if these new mandates are implemented. Industry stakeholders have expressed concerns that additional security screening requirements could slow shipments on passenger aircraft, and certain routes may no longer be profitable if cargo revenues are reduced or eliminated as a result of new screening requirements.[59] Given that profit margins for most passenger airlines are relatively small, and most large passenger airlines have failed to achieve any consistent profitability in recent years, the additional burden of both direct and indirect costs associated with a mandate to screen all cargo placed on passenger aircraft may present particular fiscal challenges to the airlines. While estimated cargo revenues of about $4.7 billion[60] annually make up only about 5% of total industry-wide operating revenues among passenger air carriers, these additional revenues can make the difference between profit or loss in an industry that has seen net losses averaging 3.8% of total revenue during the period from 2003 through 2005, and saw a profit margin of just 1.9% in 2006, the first profitable year for the industry since 2000, when it similarly realized a 1.9% profit margin.[61]

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[56] Del Quentin Weber. "Democrats, TSA Scuffle On Who Inspects Cargo." *The Washington Post,* September 8, 2007, p. D1.

[57] Ibid.

[58] "TSA Says It Will Adhere to Cargo Screening Deadlines." *World Trade, 20*(12)*,* December 2007, p. 10.

[59] Thomas Frank, "Bill Would Order All Air Cargo Screened," *USA Today,* January 8, 2007.

[60] Air Transport Association, *ATA Issue Brief: Air Cargo Security — The Airlines View*, Washington, DC: Air Transport Association.

[61] CRS analysis of airline industry economic data presented in: Air Transport Association, *Smart Skies: A Blueprint for the Future, 2007 Economic Report,* Washington, DC: Air Transport Association.

U.S. Mail Carried on Aircraft. The transport of U.S. mail aboard aircraft introduces unique security challenges to prevent illegal hazardous material shipments and the introduction of explosive and incendiary devices. Inspecting first class, priority, and express mail prior to shipment by air is difficult because the Postal Service regards these items as private materials protected by the Fourth Amendment against search.[62] The Postal Service had implemented a screening process to prevent unauthorized shipments of hazardous substances that relies on customer screening by postal clerks who are trained to question individuals shipping packages weighing more than one pound by air. Following the September 11, 2001 terrorist attacks, however, mail weighing more than one pound was prohibited from being carried aboard passenger aircraft. As seen in **Figure 3**, there has been a precipitous decline in mail shipments by passenger airlines as a result of this restriction. While all-cargo air carriers have increased their mail carriage to some degree in response, most of the mail once carried aboard passenger aircraft is now being transported by other modes.

Items weighing less than one pound are not subject to any inquiry and can be deposited in mailboxes thereby precluding any questioning or screening of the sender. While these mail items may be shipped on passenger aircraft, only a relatively small percentage of U.S. mail is shipped by air. About 5 to 7.5 percent of all domestic mail shipments, regardless of weight, are transported by either passenger or all-cargo aircraft, and the amount of mail transported on aircraft has declined considerably since the prohibitions following the 9/11 terrorist attacks were put in place. Passenger air carriers have been pushing to have these restrictions lifted because of a significant loss of revenue from U.S. mail shipments. Federal Express is currently the largest carrier of U.S. mail and its all-cargo operations account for about half of the total volume of U.S. mail shipments by air.[63]

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[62] U.S. General Accounting Office. *Aviation Security.*

[63] "Northwest to drop U.S. mail; Canceled domestic routes to cost 250 ground jobs." *Detroit Free Press*, September 5, 2003.

Figure 4. Domestic Air Mail Enplaned (1998-2006)
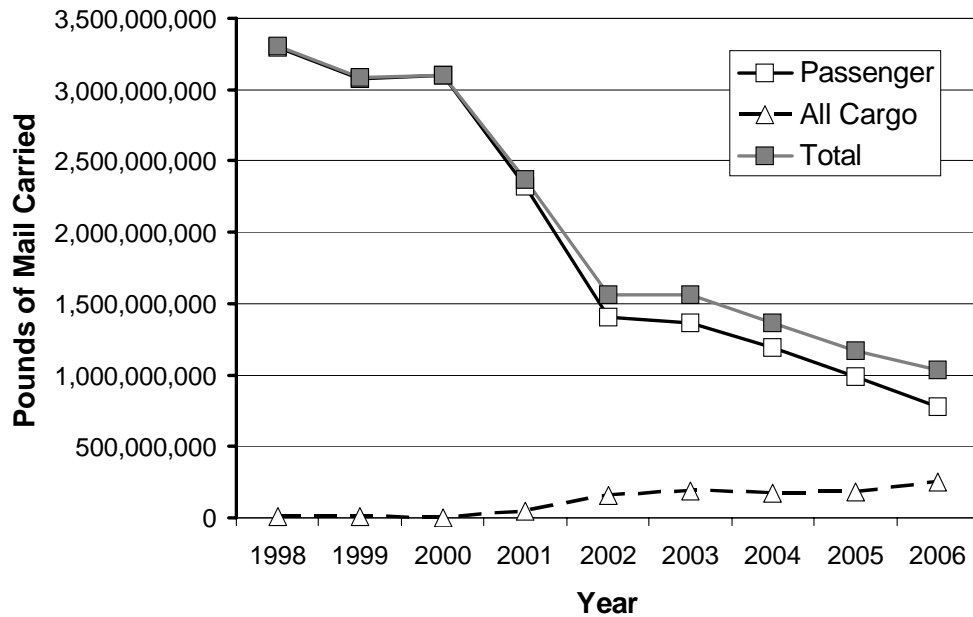
In 1997, the Gore Commission had recommended that the Postal Service obtain authorization from customers shipping mail weighing more than one pound allowing screening of shipments using explosive detection systems, and if necessary, seek appropriate legislation to accomplish this.[64] However, this recommendation has never been implemented, and physical inspection of mail shipments is still generally prohibited.

Canine teams, which have been advocated by industry for increased use in screening and inspecting air freight, have provided the only means approved by the TSA for screening mail weighing more than one pound that is put on passenger aircraft under a pilot program conducted at 11 airports.[65] Despite indications that the pilot program worked well, the TSA has not announced any plans to expand the use of canine teams or relax restrictions on air mail shipments.

Assuring the safety and security of U.S. mail transported by aircraft, and preventing the introduction of explosives or incendiaries in mail shipped by aircraft while maintaining privacy rights of postal patrons remains an important issue in the larger debate over air cargo security, although experts don't expect any significant changes to the restrictions on mail greater than one pound anytime soon.. Following the events of September 11, 2001 and the Postal Service anthrax incidents, the Technology Subcommittee of the President's Commission on the United States

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[64] White House Commission on Aviation Safety and Security. *Op. cit.*

[65] U.S. Department of Homeland Security, Transportation Security Administration. "TSA Canine Teams Screen U.S. Mail for Explosives - Pilot Program to Expand to Airports Across the Country." Press Release 03-34, May 29, 2003.

Postal Service recommended that the Postal Service, in coordination with the Department of Homeland Security, should explore technologies and procedures for utilizing unique sender identification on all mail.[66] While such procedures may provide a means of pre-screening all mail shipped by air, including packages weighing less than one pound, they introduce considerable concerns over the privacy of citizens using the U.S. mail system. Despite considerable policy discussion of implementing unique sender identification, and possibly mail tracking technologies as well, in the aftermath of the 2001 anthrax attacks, implementing these capabilities for all types of mail presents considerable legal and logistic challenges that are yet to be resolved.

Physical Security of Air Cargo Facilities

Air cargo facilities present unique challenges for physical security. The large physical size of these facilities and relatively continuous high-volume cargo operations introduce numerous individuals, vehicles, and shipments into secured access areas around aircraft. Key issues regarding physical security of these air cargo facilities include the adequacy of

- inspections and oversight of air cargo facilities to ensure compliance with aviation security regulations and procedures established in the approved security programs of air carriers and freight forwarders;
- training for air cargo personnel with regard to security procedures and guidelines; and
- access control requirements for personnel with access to air cargo facilities and aircraft.

These issues are presently being addressed through newly implemented air cargo security regulations issued by the TSA in May 2006 that are currently being implemented at air carrier and freight forwarder operations and logistics facilities.[67] Congressional oversight of industry implementation and compliance with these regulations may, therefore, continue to be an issue of particular interest during the 110th Congress.

Inspection and Oversight of Air Cargo Facilities. Current regulations specify that all air carriers and freight forwarders must allow the TSA to conduct inspections and to review and copy records in order to determine compliance with applicable laws and regulations pertaining to aviation security. The Homeland Security Appropriations Act for FY2005 provided the TSA with $40 million to hire an additional 100 inspectors to carry out oversight and enforcement activities related to air cargo security. The TSA has responded by launching focused inspections of air cargo operations and conducting monthly "blitz" audits or "strikes" of selected

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[66] President's Commission on the United States Postal Service. *Final Recommendations of the Technology Challenges and Opportunities Subcommittee.* Washington, DC: United States Department of the Treasury [http://www.ustreas.gov/offices/domestic-finance/usps/].

[67] Department of Homeland Security, Transportation Security Administration, "Air Cargo Security Requirements, Final Rule," *Federal Register, 71*(102), May 26, 2006, pp. 30477-30517; 49 CFR 1544.239.

air cargo facilities. In FY2006, Congress again provided the TSA with a $10 million set-aside to hire 100 more air cargo inspectors and for travel related to carrying out regulatory oversight and inspections of air cargo shipping and handling facilities, but the TSA has been slow to obligate these funds for air cargo security. For FY2007, appropriations report language directed the TSA to hire additional permanent staff to enhance TSA's analytic air cargo security capabilities.[68] In addition, an FY2007 supplemental appropriation (see P.L. 110-28) totaling $80 million was provided for air cargo security activities, including the hiring of an additional 150 compliance inspectors and cargo vulnerability assessments at the nation's busiest airports (i.e., Category X airports). Similarly, increased funding for air cargo security in FY2008 appropriations was provided for the hiring of additional air cargo inspectors and reducing reliance on contractors to carry out regulatory compliance activities related to air cargo security.

Increased oversight of air cargo facilities is likely to be highly dependent on the continued availability of resources and funding. The effectiveness of this oversight will also likely be highly dependent on the adequacy of available tools and procedures to track needed corrective actions and ensure compliance among air carriers and freight forwarders. Therefore, the adequacy of TSA's oversight of air cargo security could be a significant area of focus for congressional oversight during the 110th Congress.

Cargo Security Training. Currently, air cargo handlers are not required to receive any specific or formal training on security procedures or identification of suspicious activities. However, air cargo handlers may be considered the front line in protecting against security threats by adhering to procedures that would mitigate physical security breaches at cargo operations facilities, by increasing their awareness of suspicious activities, and by following proper procedures for reporting their observations. Security training for cargo workers may focus on security procedures for ensuring cargo integrity, protecting facilities, reporting suspicious activities, and so on. Under the TSA regulations imposed in 2006, workers for all-cargo carriers and for indirect air carriers with security-related duties — such as carrying out security inspections of shipments — are now required to receive specific training on the company's security program and their individual security-related responsibilities under that program. Similar training is already required of workers for passenger airlines that are assigned security-related duties.

Increased Control over Access to Aircraft and Cargo Facilities. Under ATSA, TSA was directed to work with airport operators to strengthen access control points in secured areas and was authorized to use biometric screening procedures to positively identify individuals with access to secure airport areas. ATSA contains provisions for TSA oversight of secured-area access control to assess and enforce compliance with access control requirements. These requirements include screening and inspection of individuals, goods, property, vehicles and other equipment seeking to access secure airport areas. Background checks for individuals having access to passenger aircraft are required and vendors with direct access to airfields where passenger operations take place are required to have a TSA-approved

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[68] See H.Rept. 109-699.

security program in place. Presently, background checks and displayed identification serve as the principal means for screening airport workers including cargo handlers.

There has been growing concern over the adequacy of these procedures for screening and monitoring airport workers. One particular concern is the integrity of airport worker credentials and the potential that unauthorized individuals could gain access to secure areas of the airport using stolen or fraudulent identification. The TSA has begun to implement a universal biometric Transportation Workers Identification Credential (TWIC) for the nation's seaports. Biometric technology has received considerable attention from Congress as a means to authenticate individuals, particularly airport workers, and improve access controls to secured areas of airports. While it is not expected that the TSA will incorporate airports into the TWIC program, it has been moving forward in developing specific guidelines for airports to incorporate biometrics into their airport credentialing and access control systems. These proposals are discussed in further detail below in the section titled "Biometric Screening Technology."

Another concern has been raised over the use of identification checks in lieu of physical screening of airport workers, including cargo handlers. Representative Peter DeFazio, for example, has expressed concern over this practice noting that workers who bypass physical screening could potentially carry threat objects into secured areas of the airport or on board aircraft.[69] These concerns were again raised in 2007 when airline workers in Orlando were arrested after using their airport access credentials to bypass security checkpoints and smuggle weapons on flights to Puerto Rico.[70] Congress may consider whether existing security procedures regarding airport worker access to secured airport areas meets the intent of ATSA with regard to providing at least the same level of protection of secured airport areas and passenger aircraft as screening passengers and their baggage. The FY2008 Consolidated Appropriations Act (P.L. 110-161) provides funding to the TSA to carry out a pilot program to assess physical screening of airport employees. The TSA intends to study the costs and risks associated with various full screening and random screening protocols for airport workers.

In addition to ongoing concerns over access controls around passenger aircraft, access control and monitoring of workers at all-cargo facilities remains a significant challenge. Regulations promulgated in 2006 establish an all-cargo security program detailing the physical security measures for air cargo operations areas, cargo placed aboard all-cargo aircraft, and background checks and screening of individuals having access to their aircraft on the ground or in flight. In addition, these new air cargo security rules require airports to designate cargo operations areas, including areas where all-cargo aircraft are loaded and unloaded, as security identification display areas (SIDAs). This effectively elevates the required security measures for these cargo handling areas and requires that workers with unescorted access to these areas be vetted through fingerprint-based criminal history records checks (CHRCs), as has

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[69] National Public Radio. "Some Members of Congress Raising Concerns about Potential Lapses at Airports," *Morning Edition*, May 22, 2003.

[70] Henry Pierson Curtis, "Orlando Airport's Efforts Fail to Prevent Gun, Drug Smuggling." *Orlando Sentinel*, January 28, 2008.

been required for workers having access to secured areas around passenger aircraft for some time.

Arming All-Cargo Pilots. During the 108th Congress, proponents for arming all-cargo pilots urged Congress to allow all-cargo pilots to join the ranks of passenger airline pilots who can volunteer for selection and training in the Federal Flight Deck Officers (FFDO) program. This program, established by the Homeland Security Act of 2002 (P.L. 107-296), trains and deputizes qualified pilots to carry firearms and use deadly force to protect the flight deck against terrorist attacks (see CRS Report RL31674, *Arming Pilots Against Terrorism: Implementation Issues for the Federal Flight Deck Officer Program*, by Bart Elias). While the plan was originally limited to only pilots of passenger airliners, Vision 100 (P.L. 108-176) expanded the program to allow all-cargo pilots and flight engineers to participate as well.

Proponents for including all-cargo pilots in the program point out that all-cargo aircraft lack hardened cockpit doors, federal air marshals, and passengers that may assist in thwarting a hijacking attempt.[71] They also point out that physical security and access control to cargo operations areas and all-cargo aircraft had not been held to the same standard as passenger airline operations prior to the implementation of tougher regulations for air cargo security. Proponents for arming all-cargo pilots also point out that the lack of screening of individuals and property at air cargo facilities could offer the opportunity for terrorists plotting to hijack an aircraft to board an all-cargo aircraft as stowaways and seize the cockpit in flight. All-cargo aircraft include more than 1,000 transport category jet airplanes, of which about half are wide-body jets similar to those used in the September 11, 2001 terrorist attacks.[72] Proponents for arming all-cargo pilots contend that the provision in Vision 100 that includes cargo pilots in the FFDO program will mitigate the risk of a hijacking aboard all-cargo aircraft. They further argue that training for cargo pilots is needed expediently given the limited measures currently in place to mitigate this risk.

Cargo airlines, on the other hand, had opposed allowing their pilots to join the FFDO program. Air carriers, in general, have been hesitant about the program because of liability concerns even though specific liability protections were extended to the airlines and pilot participants when the FFDO program was established under the Homeland Security Act of 2002 (P.L. 107-296). Proponents for the program and the inclusion of cargo pilots in the program have voiced concerns that the manner in which the program has been implemented and the remoteness of the training facilities have limited the program's overall effectiveness. The program, along with other flight crew security training initiatives, has received annual appropriations of about $25 million since it was fully implemented in FY2004. Few, if any, changes to the program are expected in the near term. Nonetheless, Congress may at some point address some lingering concerns over the program such as the convenience of training and requalification sites, the carriage of firearms outside the cockpit, which

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[71] See Statement of Captain Duane Woerth, President, Air Line Pilots Association, International. *The Status of the Federal Flight Deck Officer Program.* Before the Subcommittee on Aviation, Committee on Transportation and Infrastructure, U.S. House of Representatives. Washington, DC: May 8, 2003.

[72] Federal Aviation Administration. *FAA Aerospace Forecast Fiscal Years 2003-2014.*

is presently highly restricted, and program liability surrounding the role of the federal flight deck officer as both an airline pilot and a deputized federal officer.

Technology For Air Cargo Security

Because the capability of available technology is seen as a significant constraining factor on the ability to screen, inspect, and track cargo, initiatives to improve cargo screening technology have been a focus of recent legislation to enhance air cargo security.

In response to the 9/11 Commission recommendation that the TSA intensify its efforts to identify, track, and appropriately screen potentially dangerous cargo, the National Intelligence Reform Act of 2004 (P.L. 108-458) directed the TSA to develop technologies for this purpose and authorized $100 million annually in FY2005 through FY2007 for the research, development, and deployment of enhanced air cargo security technology. The act also established a competitive grant program to foster the development of advanced air cargo security technology.

Appropriations for research and development of technologies specifically tailored for air cargo security thereafter increased significantly, totaling $55 million in FY2004 and $75 million for FY2005. In FY2006, TSA research and development functions were realigned into the Department of Homeland Security's Science and Technology Directorate and research and development funding for air cargo was scaled back to $30 million, and specifically designated for conducting three cargo screening pilot programs testing different concepts of operation. In FY2007, the aviation security research and development functions were realigned within the TSA and appropriated a total of $92 million. The appropriations measure did not specify what portion of this would be allocated to air cargo-related research and development, but did urge the TSA to work with industry stakeholders to develop standards and protocols to increase the use of explosives detection equipment for screening air cargo.

Various technologies are under consideration for enhancing the security of air cargo operations. Tamper-evident and tamper resistant packaging and container seals may offer a relatively low cost means of protecting cargo integrity during shipping and handling. Cargo screening technology using X-rays, including X-ray backscatter systems, chemical element sensing ETD systems, computed tomography (CT) scan-based EDS, or possibly neutron beams or other techniques, such as millimeter wave imaging systems, may offer various means to screen cargo prior to placement aboard aircraft. Additionally, canine teams may be used to augment cargo screening technology or to screen cargo independently. Hardened cargo container technology may be used to mitigate the threat of in-flight explosions or incendiary fires aboard aircraft. Finally, biometric technologies are being evaluated and may be useful in authenticating cargo worker identification and improving access control to aircraft and cargo operations areas.

Tamper-Evident and Tamper-Resistant Seals. Various technologies exist for sealing cargo shipments and cargo containers to prevent tampering. Relatively low cost solutions such as tamper-evident tapes that provide visual indications of tampering are readily available and could easily be implemented during

packaging. Such technology could be used in combination with "known shipper" protocols to insure that known shippers provide sufficient security in their packaging facilities and to deter tampering and theft during shipping and handling. Tamper-evident tape can identify cargo during inspections processes for further screening and inspection to safeguard against the introduction of explosives and incendiary devices. Tamper-evident tape may also be an effective tool to deter cargo crime, including cargo theft and the introduction of contraband, counterfeit, and pirated goods during shipment.

At cargo handling facilities, tamper evident seals and locks can be utilized on cargo containers to prevent theft and the introduction of contraband or threat objects into air cargo shipments. Electronic seals may serve as an additional deterrent to terrorist and criminal activity by providing more immediate detection of tampering. Electronic seals have alarms, some triggered by fiber optic cable loops, that activate a transmitted signal when tampered with.[73] Electronic seals cost about $2,500 per unit, but are reusable. However, the utility of electronic seals in air cargo operations has been questioned by some experts because currently available electronic seals have a limited transmission range, which may make detecting and identifying seals that have been tampered with difficult. In addition, there is some concern that they may interfere with aircraft electronic systems.[74]

In addition to tamper-evident and tamper-resistant seals, technologies to better track cargo shipments are being considered to maintain better control and tracking of cargo shipments along the supply chain. Both global positioning system (GPS) and radio-frequency identification (RFID) technologies are seen as emerging technologies for improving the tracking of air cargo in the supply chain.

Cargo Screening Technology. Various technologies are available for detecting explosives, incendiary devices, and the presence of various chemical and biological agents and nuclear weapons in cargo. Key technologies under consideration for screening air cargo for threat objects include X-ray screening, CT scan-based explosive detection systems (EDS), chemical explosives trace detection (ETD) systems, and technologies based on neutron beams. Newer technologies under consideration for screening passengers at screening checkpoints, including X-ray backscatter and millimeter wave imaging technologies have the capability to penetrate various cargo container materials, and thus may also be adaptable for use in air cargo screening. In addition to these technological approaches, several experts and TSA officials have been advocating and pursuing an increased use of canine teams for screening cargo and mail. The main drawback to any of these screening techniques is that the screening process takes time and may significantly impact cargo delivery schedules. Another concern regarding these technologies is the cost associated with acquisition, operation, and maintenance of screening systems.

X-Ray Screening. The most common systems currently available for large-scale screening of cargo shipments utilize X-ray technology. These systems rely on well understood transmission and backscatter X-ray techniques to probe cargo containers. Many of these systems utilize low-dose X-ray sources that emit narrow

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[73] "Electronic cargo security seals" *Frontline Solutions, 3*(6), 42 (June 2002).

[74] U.S. General Accounting Office. *Aviation Security*.

X-ray beams thus virtually eliminating the need for shielding. These devices are compact and light weight, thus allowing them to be mounted on moving platforms that can scan over containers.[75] X-ray devices are becoming more common at major ports of entry, border crossings, and airports overseas as post-September 11th security concerns are spurring increased development and deployment of these devices. The systems are also being utilized to screen for drugs and other contraband as well as explosives in cargo shipments.

In addition to traditional X-ray systems, X-ray backscatter technology, which measures the scatter or reflections of the X-ray beam. The X-ray backscatter technology tends to do a much better job of differentiating organic materials because different chemical elements in these materials scatter the X-ray in quite different patterns. This makes X-ray backscatter a well suited technology for detecting organic explosives in either solid or liquid form. However, like traditional X-ray technology, current X-ray backscatter systems are extremely labor intensive and require considerable staffing and training requirements because these systems require human operators to control the system and interpret the backscatter images.

One of the most significant operational challenges in using X-ray screening devices, whether they be traditional X-ray systems or newer X-ray backscatter technologies, is the performance of the human operator. A variety of human factors considerations contribute to the operator's ability to detect threat objects when viewing X-ray images. These include the monotony of the task, fatigue, time pressure, the adequacy of training, and working conditions. These human factors are important to consider in fielding X-ray screening systems to ensure high detection rates of threat objects while minimizing false alarm rates that would unnecessarily slow the cargo inspection and handling process. Technologies such as threat image projection (TIP), that superimpose stored images of threat objects on X-ray scans can help keep operators alert and may be effective tools for training and performance monitoring. Additional technologies, such as computer algorithms for highlighting potential threat objects, may also be considered to aid human observers.

Explosive Detection Systems (EDS). Currently, EDS technologies are being used extensively in the aviation security environment, particularly in response to the mandate in ATSA requiring screening of all checked passenger baggage by EDS. These systems use X-ray computed tomography to scan objects, and computational algorithms that assess the probability of threat object detection based on object density characteristics. Certified EDS systems must meet acceptable detection and false alarm rates for bulk explosives detection. While most specific performance criteria of certified EDS systems are classified, EDS systems used for passenger checked baggage must meet or exceed a throughput rate of 450 bags per hour.

The TSA has gained considerable experience with the large scale deployment and use of EDS equipment to meet the mandate for full explosives detection screening of checked passenger bags. Many of the lessons learned by TSA from this

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[75] David S. De Moulpied and David Waters. "Cargo Screening Techniques Become More Widely Accepted." *Port Technology International, 10*, pp. 127-129.

experience will be useful for assessing the technical and operational challenges of applying large-scale EDS screening initiatives for air cargo operations. Efforts are also underway at TSA to improve the performance of EDS equipment and reduce its cost. However, air cargo operations are likely to present some of their own unique challenges for implementing large scale EDS screening of freight, express packages, and mail. Some of the potential operational challenges associated with effectively fielding existing EDS equipment for screening air cargo include

- the limited size of objects that can be placed in EDS machines, which would require objects to be screened before being placed in containers or on pallets;
- the distributed nature of the air cargo system often involves loading containers at remote sites, and EDS screening at these remote sites may leave the system vulnerable to possible introduction of explosives or incendiary devices at points along the supply chain beyond the screening site;
- reported high false alarm rates of current generation EDS systems may lead to high levels of secondary screening and detailed inspections that could impact the ability to meet the schedule demands of cargo operations; and
- the processing rate of EDS equipment may require the purchase of large numbers of EDS machines and investment in the research and development of alternative technologies, thus increasing program costs, to minimize the impact on cargo operations scheduling and meet desired security program goals, although the throughput of EDS equipment has markedly improved over the last few years.

Chemical Trace Detection Systems. Chemical trace detection systems, referred to commonly as ETD devices are being widely used as secondary screening tools for passenger carry-on and checked baggage. Items identified for closer scrutiny by initial screening methods or selected at random may undergo further examination using these systems. These systems use a variety of technical principles to analyze the chemical composition of sample residue wiped from suspect articles. These systems compare the chemical composition of such a sample to the signature of known explosive materials and signal an alarm to the operator if the probability of a match exceeds a specified threshold.

The use of chemical trace detection systems is now common practice in the screening of checked and carry-on bags. It has been reported that TSA is considering expanding the use of chemical trace detection systems for screening cargo carried aboard passenger aircraft.[76] However, screening procedures using these systems are very labor intensive and time consuming. Like the manner in which this technology is used to perform secondary screening of checked and carry on bags, chemical trace detection may be employed in air cargo operations to perform detailed screening of suspicious packages identified through known shipper databases, or can be used for detailed secondary screening in conjunction with primary screening performed by X-ray and EDS systems similar to procedures currently in use for checked baggage

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[76] Greg Schneider. _Op. cit._

screening. Random screening of cargo using chemical trace detection systems as a primary screening method is unlikely to be effective given the very low percentage of cargo that could be screened using this technique without significantly impacting cargo operations schedules. However, using chemical trace detection systems in conjunction with canine teams as a secondary screening tool appears to provide a possible option for increasing the proportion of cargo that can be effectively screened in a time efficient manner.

Neutron Beam Technologies. Another potential class of technologies for screening air cargo is based on neutron beams. These systems use a pulsed neutron generator to probe an object, initiating several low energy nuclear reactions with the chemical elements comprising the object. Detectors can then measure the nuclear signature of the transmitted neutrons and/or the gamma-rays emitted from the reactions. Since neutrons and gamma-rays have the ability to penetrate through various materials to large depths in a non-intrusive manner, neutron technologies may have advantages for cargo screening, and some of these technologies are currently being operationally evaluated for use in contraband and explosives detection.[77] However, the GAO noted that currently available neutron-based technologies cost about $10 million per machine and require about one hour per container for screening thus making this option very expensive and time consuming.[78]

In addition to the cost and time factors associated with neutron beam technologies, the National Research Council (NRC) has raised considerable doubts about performance capabilities for screening the full spectrum of cargo containers or pallets for explosives.[79] The NRC also expressed potential safety concerns over the use of radiation-producing particle accelerators, and expressed concerns over the practicality of using this technology in the aviation environment because of the size and weight of the equipment.

In 1999, the NRC advised the FAA against further funding for research, development, and deployment of a neutron-based explosive detection system known as pulsed fast/thermal neutron spectroscopy (PFTNS) for primary screening of carry-on baggage, checked baggage, or cargo citing low current explosive threat levels and inadequate performance. In 2002, the NRC concluded that another neutron-based technique, pulsed fast neutron analysis (PFNA), is not ready for airport deployment or testing. However, the NRC conceded that PFNA has greater potential for screening containerized cargo than any other technology currently under consideration at the time of their analysis.[80] Since this analysis, however, interest in

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[77] G. Vourvopoulos and P. C. Womble. "Pulsed Fast/Thermal Neutron Analysis: A Technique for Explosives Detection." *TALANTA (54)*, pp. 459-468, 2001.

[78] U.S. General Accounting Office. *Aviation Security.*

[79] National Research Council. *The Practicality of Pulsed Fast Neutron Transmission Spectroscopy for Aviation Security.* NMAB-482-6. Washington, DC: National Academy Press, 1999.

[80] National Research Council. *Assessment of the Practicality of Pulsed Fast Neutron*

neutron beam screening technologies has largely taken a back seat to EDS and ETD technologies, as well as other potential screening technologies, including X-ray backscatter and millimeter wave imaging systems. Because the perceived threat of explosives has increased since September 11, 2001, neutron-based detection technology continues to be mentioned as a possible means for screening air cargo. However, wide-scale deployment of this technology for air cargo security in the near term seems unlikely.

Millimeter Wave Imaging Systems. Millimeter wave screening technology refers to a wide array of screening devices capable of creating highly detailed images by measuring the reflections of ultra high frequency (i.e., in the 30-300 giga-Hertz frequency range) waves emitted by the system that are capable of passing through barriers that normally preclude visual inspection. Millimeter wave imaging systems are capable of penetrating many shipping container materials, and therefore potentially have a broad array of homeland security applications, including the screening of air cargo. While the TSA has been field testing millimeter wave imaging systems for passenger screening that are capable of penetrating clothing to detect concealed weapons and explosives, interest in the use of millimeter wave imaging systems for air cargo screening has been more limited at this point. Nonetheless, commercial products using millimeter wave imaging are currently available for application in standoff scanning of a wide variety of objects, including cargo, from a distance of several meters.[81] While images from multiple angles are typically required to get a complete picture of a container's contents, currently available millimeter wave imaging systems are capable of generating relatively high detail images of items held inside a cargo container. However, like X-ray screening technologies, millimeter wave imaging systems are labor intensive, and can be expensive to operate, because they require trained operators to interpret the images generated by the system and identify potential threats for further examination. While interest in millimeter wave technology for air cargo screening has thus far been somewhat limited, interest in this technology may be intensified by new screening requirements and searches for efficient technologies to meet the mandate for 100% screening of cargo placed on passenger airliners.

Blast-Resistant Cargo Containers. In addition to cargo screening technology, hardened cargo container technology is being considered as a means to mitigate the threat of an explosion or fire caused by a bomb or incendiary device that makes its way onto an aircraft undetected. The 9/11 Commission formally recommended the deployment of at least one hardened cargo container on every passenger aircraft that also hauls cargo to carry suspicious cargo. The National Intelligence Reform Act of 2004 (P.L. 108-248) requires the TSA to establish a pilot program to explore the feasibility of this concept and authorizes the use of incentives to airlines to offset added fuel, maintenance, and other operational costs associated with using hardened cargo containers in an effort to encourage voluntary participation in the pilot program. The act authorized $2 million for the pilot program. A

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[80] (...continued)
Analysis for Aviation Security. Washington, DC: National Academy Press, 2002.

[81] By Calvin Biesecker. "Rapiscan To Market Brijot's Stand-Off Millimeter Wave Body Scanner," *Defense Daily,* October 31, 2007.

provision in the Implementing the 9/11 Commission Recommendations Act of 2007 (P.L. 110-53) directed the TSA to provide an evaluation of the pilot program and, based on its findings, implement a program to pay for, provide, and maintain blast-resistant cargo containers for use by air carriers on a risk-managed basis.

This concept of deploying hardened cargo containers has been a topic of ongoing research for some time. Following the December 21, 1988 bombing of Pan Am flight 103 over Lockerbie, Scotland, the British Air Accident Investigation Branch recommended that regulatory authorities and airplane manufacturers study methods to mitigate the effects of in-flight explosions.[82] The FAA has had a active research program in blast-resistant containers for more than 10 years examining the airworthiness, ground handling, and blast resistance of hardened containers, which is now overseen by the TSA's Transportation Security Laboratory. These containers, or hardened unit-loading devices (HULDs), are seen as a potential means for mitigating the threat of explosives placed aboard passenger aircraft in either checked baggage or cargo. These containers must withhold an explosive blast of a specified magnitude without any rupturing or fragment penetration of the container wall or the aircraft structure, and must contain and "self-extinguish" any post-blast fire in order to meet the FAA-established test criteria.[83]

However, the increased weight of these containers could have significant operational impacts on airlines by increasing fuel costs and decreasing payload capacity for carrying revenue passengers and cargo. Challenges associated with deploying hardened cargo containers include

- increased weight affecting aircraft range and payload capacity;
- increased procurement cost for hardened containers;
- potentially higher maintenance costs for hardened container materials;
- potential reduction in cargo volume (in addition to reduced payload weight) due to thicker container walls; and
- possible design specifications, such as door hinging and positioning, that are not compatible with current airline baggage and cargo loading procedures and operations facilities.[84]

The National Research Council (NRC) estimated that the per unit cost for acquiring hardened cargo containers would be $10,000, and recommended that the FAA continue efforts to operationally test HULDs and establish more rigorous protocol for certifying HULDs, but should not deploy them unless deemed to be a necessary security measure based on the assessments of cost, operational, and deployment studies by FAA and other stakeholders.

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[82] United Kingdom Air Accidents Investigation Branch. *Op. cit.*

[83] National Research Council. *Assessment of Technologies Deployed to Improve Aviation Security: First Report*. Publication NMAB-482-5. Washington, DC: National Academy Press, 1999.

[84] Ibid.

The NRC panel also recommended further economic assessment of their proposed deployment plan for fielding one HULD per wide-body aircraft. The NRC panel also noted that research and development on the use of HULDs on narrow-body aircraft was lagging far behind the work done on wide-body aircraft, and recommended an increased emphasis on research in this area to assess the operational effectiveness of HULDs in narrow-body aircraft before any further recommendations could be made. The NRC panel estimated that the cost of deploying enough HULDS for airlines to carry at least one HULD per passenger flight would require an industry-wide procurement cost of $125 million, and would create an annual industry-wide economic impact of $11 million in increased fuel burn and reduced payload revenue.[85]

Given the recent increase in aviation jet fuel costs, the economic impact would likely be considerably higher than the NRC originally estimated nine years ago. Recognizing the continued concerns over the cost and weight associated with currently available blast-resistant container technology, the DHS has proposed a new research program in FY2009 to examine the potential of adapting composite container material development efforts for use in air cargo to provide tamper detection and intrusion resistance with possible blast-resistant capabilities.

The recommendation made by the 9/11 Commission also called for the deployment of at least one hardened cargo container on every passenger aircraft for carrying any suspect cargo.[86] This recommendation implies that a cargo pre-screening or risk evaluation process such as a known shipper program or the proposed freight assessment system would be used to determine what cargo should be loaded into the hardened container. Presently, ATSA requires shipments from unknown sources to travel on all-cargo aircraft. One strategic objective of the TSA's Air Cargo Strategic Plan is to develop a means for identifying elevated risk cargo through pre-screening.[87] Such a tool would likely be needed to assess risk and determine what cargo should be placed in a hardened container. Besides the need for a pre-screening process, the use of hardened cargo containers is likely to be opposed by the airline industry because of the direct costs of acquiring these units as well as the increased operational cost associated with increased fuel burn and lost payload capacity. The benefits of using hardened cargo containers would likely be highly dependent on the security of the pre-screening process and its ability to detect high risk cargo since the benefits of a hardened container would largely be negated if the pre-screening process could be circumvented by terrorists. A key policy issue that is likely to emerge as the feasibility of hardened cargo containers is further evaluated is the potential implications of allowing suspicious cargo to travel on passenger aircraft even if this cargo is secured in hardened cargo containers. In other words, policymakers may debate what the risks and benefits of loading suspicious cargo on

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[85] Ibid.

[86] National Commission on Terrorist Attacks Upon the United States. *The 9/11 Commission Report.*

[87] U.S. Department of Homeland Security, Transportation Security Administration. *Air Cargo Strategic Plan.*

passenger airplanes in hardened cargo containers is as compared to the alternative of offloading this suspicious cargo to all-cargo aircraft.

In any case, under a plan in which only one hardened cargo container is deployed per aircraft, it is likely that only a relatively small fraction of available cargo space will be reinforced. For example, a Boeing 747-400 passenger jet is capable of holding up to 13 full-width, or 26 half-width containers.[88] Thus, providing just one full sized hardened cargo container for a 747-400 would provide reinforcement for less than 10% of the available cargo storage area. While a greater percentage of available cargo space on smaller jets could be protected by hardened containers, any policy regarding the use of just one hardened container per aircraft will likely need to carefully evaluate the criteria and methods for vetting cargo to determine what cargo should be designated for carriage inside these hardened cargo containers.

In addition to hardened cargo containers, the FAA recently proposed rulemaking[89] that would require newly certified aircraft type to have improved fire suppression capabilities in their cargo holds to withstand and suppress a sudden intensive fire from an explosive or incendiary device. Additionally, the proposed rule would require each newly certified aircraft type to include a "least risk bomb location," an accessible location where crewmembers could place a suspected explosive device to minimize the potential for catastrophic damage to the aircraft if the item explodes. The proposal would also require aircraft designers to isolate flight critical systems and maximize separation of systems, to minimize the chances that a bomb detonation would render the aircraft unflyable. However, because these proposals would only be applied to newly certified aircraft types, these changes would not have a substantial operational impact on aviation safety and security for several years.

Biometric Screening Technology. Provisions of ATSA give the TSA authority to use biometric technology to verify the identity of employees entering the secured areas of airports and directed the TSA to review the effectiveness of biometrics systems currently used by airports such as San Francisco International Airport. Available biometric technologies such as fingerprint, retinal scan, and facial pattern recognition are being tested and implemented as part of a variety of transportation security programs, including the Transportation Worker Identification Credential smart cards and readers for access controls at seaports and the Registered Traveler program for airline passengers who voluntarily provide detailed background information in exchange for expedited processing through airport screening checkpoints.

The National Intelligence Reform Act of 2004 (P.L. 108-458) contains extensive provisions requiring the TSA to develop specific guidance for the use of biometric or other technologies for airport access control systems by March 31, 2005. The

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[88] Boeing Commercial Airplanes. *747-400 Airplane Characteristics for Airport Handling.* D6-58326-1, December 2002.

[89] Federal Aviation Administration, "Security Related Considerations in the Design and Operation of Transport Category Airplanes; Proposed Rule," *Federal Register*, January 5, 2007, pp. 630-639.

guidance is to include comprehensive technical and operating system requirements and performance standards for the use of biometric identifier technology in airport access control systems; a list of products and vendors meeting these specifications; and specific procedures for implementing biometric identifier systems; and a discussion of best practices for incorporating biometric identifier technologies into airport access control systems. The act also provides authorization for $20 million for the research and development of advanced biometric technology applications for aviation security. Pilot studies have been conducted to examine methods for incorporating biometrics into airport access control systems. Given the proposed regulatory changes to enhance access controls to all-cargo facilities and improve existing access controls around passenger aircraft, it is likely that the implementation of biometric identifier technology will play an increasingly important role in air cargo security policy.

Funding for Air Cargo Security

The cost of air cargo security options are significant to both the Federal government and the air cargo industry. Furthermore, the indirect costs of air cargo security on air cargo operations may pose significant long-term challenges. On the other hand, the potential costs of a terrorist attack, both in terms of the loss of life and property and the long term economic impacts would also be significant but are difficult to predict and quantify. An ongoing debate tied to air cargo appropriations and oversight of aviation security is the amount of physical screening and inspection of air cargo that is needed and achievable and whether risk-based pre-screening tools can provide an adequate means to ensure the security of air cargo by identifying at-risk cargo for targeted physical inspections. Besides the logistic complexities of inspecting large amounts, or 100%, of cargo on passenger flights, many are concerned that the cost of doing so may impose a significant burden on the aviation and air cargo industries.

While federal expenditures on air cargo security measures have been growing over the past two years, these efforts are a relatively small element (about 2%) of TSA's overall operating budget for aviation security. These expenditures could, continue to grow, however, if additional technology and resources are devoted to the tracking and screening of cargo shipments. In contrast to passenger and baggage screening, which are, with few exceptions, the operational responsibility of the TSA, under the current scheme, much of the cost of inspection and screening of cargo is borne by the airlines and shippers, while TSA only maintains oversight responsibility. As previously noted, to meet the mandate of 100% inspections of air cargo, the TSA estimates a cost of more than $650 million in the first year of implementation, and a total cost of roughly $3.6 billion over 10 years, while the CBO estimates these costs to total $3.5 billion over six year, $250 million in the first year and $650 million for the next five years.[90]

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[90] Department of Homeland Security, Transportation Security Administration. "Air Cargo Security Requirements; Proposed Rule;" and Jeff Bliss, "Air-Cargo Screening 'A Disaster Waiting to Happen,' Critics Say," *Bloomberg.com,* November 29, 2005; Congressional Budget Office. *H.R. 1 - Implementing the 9/11 Commission Recommendations Act of 2007,* February 2, 2007.

Options for Imposing Air Cargo Security Fees. P.L. 110-53 does not include an aviation security fee in connection with its mandate for 100% screening of cargo placed on passenger aircraft. This leaves open funding questions regarding who would be responsible for operationally carrying out the screening, the federal government or industry, and how these screening functions would be funded. As previously noted, the TSA intends to rely on industry, including the airlines, freight forwarders, and even shippers in some cases, to carry out much of the physical screening of cargo required under this mandate. The specific operational manner in which TSA technologies and canine explosives detection teams will be integrated into this process relying primarily on industry-operated cargo screening remains unclear and clouds the picture regarding funding requirements and funding sources for air cargo screening operations.

However, some past legislative proposals calling for the TSA to physically screen all cargo shipments bound for passenger aircraft incorporated a fee schedule for shippers to cover costs associated with screening cargo transported in passenger aircraft that is similar to the security fees imposed on airline passengers (see H.R. 2455 and H.R. 3798 introduced in the 108th Congress). Imposing a fee on air cargo shipments for security could provide offsetting collections for air cargo security costs incurred by the government, such as the cost of screening technology development and deployment and the training and deployment of canine explosives detection teams. Regardless of how such a fee might be collected — either through fees assessed to air carriers or freight forwarders or through direct fees applied to each shipment — the costs will ultimately be borne by shippers and ultimately passed on to the customers of their products.

The overall impact of such fees on air cargo would ultimately be dependent on the relative cost of the fee. Since air cargo shipments tend to consist of relatively high value goods, it is likely that the relative cost of a security fee in relation to the value of the shipment will be low, which could minimize the economic impact of imposing such a fee. However, if fees applied to air cargo carried on passenger aircraft are higher than fees for transporting that same cargo on all-cargo aircraft, a significant negative impact on passenger air carrier revenues from cargo may result. Equity in fee collections will likely be an important consideration in assessing if and how air cargo security fees should be collected.

Potential Impact on Manufacturers and Other Shippers. Another possible concern over the increased cost of cargo security associated with screening operations and other security enhancements is the potential that these actions will result in increased shipment costs for manufactured goods, particularly costs related to the distribution of time-critical parts. If unit shipping costs rise enough because of security-related costs and fees, it is possible that domestic manufacturing and assembly costs will not be able to remain competitive in a global market. For example, if the costs of shipping time-critical parts from Asia for final assembly in the United States rise because of security-related costs, it may become cost advantageous to manufacture the entire product overseas or within the United States. In the long term, this could result in a possible loss of manufacturing jobs in the United States, or in some cases, relocation of certain manufacturing facilities to the United States to eliminate dependence on air cargo. For this reason, the economic implications of any proposal to impose security-related fees on air cargo or impose

costly security requirements on air cargo operators and shippers will likely need to be carefully evaluated to avoid or minimize any unintended impacts on manufacturers and their suppliers.

Air Cargo Security Appropriations. While Congress continues to debate the needed level of physical screening and inspection of cargo, current appropriations figures are predicated on continuing and expanding the risk-based approach of pre-screening cargo and conducting targeted inspections of elevated-risk cargo and increasing random inspections of other shipments. In FY2003, the TSA received $20 million for cargo screening improvements. In FY2004, the TSA was appropriated $30 million for air cargo security operations. Additionally, research and development related to air cargo security was provided an appropriation of $55 million. For FY2005, the Administration recommended flat funding for air cargo, while the House and the Senate agreed to increases to both the air cargo operations and air cargo research and development accounts totaling $115 million. In FY2006, there was a shift in funding, and for the first time, a larger proportion of air cargo security funding was allocated for use in air cargo operations ($55 million) as compared to research and development ($30 million). Also, as previously noted, the FY2006 air cargo research and development funding has been more specifically directed to focus on three pilot projects, reflecting a maturation of air cargo screening technologies and procedures and a migration from purely a research activity to a testable operational concept. In FY2007, base appropriations for air cargo security operations were again set at $55 million. A specific funding amount for air cargo security-related research and development initiatives was not included in the FY2007 appropriations. However, the TSA and the DHS Science and Technology Directorate are continuing their efforts to adopt EDS technologies to the air cargo environment, and the TSA was directed to work with industry stakeholders to develop standards and protocols to increase the use of explosives detection equipment for screening air cargo.

With the start of the 110th Congress, a congressional focus on improving air cargo security resulted in an $80 million supplemental appropriation for air cargo security. This funding was made available through FY2009 and was specifically designated for hiring additional air cargo inspectors, conducting air cargo vulnerability assessments at all Category X airports, training and deploying additional canine teams, pursuing new methods for canine screening based on technologies and approaches used in other countries, and deploying various technologies, such as EDS and ETD, to screen air cargo. For FY2008, $73 million was appropriated for air cargo security, and the DHS estimates that roughly $2.3 million of its $122 million research budget for explosives detection will focus specifically on air cargo screening technologies and practices. Appropriations language directed the TSA to focus on air cargo screening technologies for meeting the 100% passenger air cargo screening requirements of P.L. 110-53, and in the interim utilize existing baggage screening technologies to the greatest extent practicable to screen air cargo shipments placed on passenger aircraft. For FY2009 the President's Budget Request seeks $86.3 million to continue ongoing initiatives for cargo screening, increase covert testing and inspections of air cargo operations, and develop a certified shipper program to enhance supply chain security. Also, the DHS S&T Directorate requests $3.5 million to continue air cargo and canine explosives detection projects under the air cargo security component of its explosives detection research thrust area.