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Explosives Detection Systems Based Aviation Security Screening



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**Washington D.C. 20004, 601 Pennsylvania Ave., NW Suite 900,
Tel: 202-455-0966, info@hsrc.biz, www.homelandsecurityresearch.com**

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1 EDS Based Aviation Security Screening

1.1 Scope

- ❑ Since the advent of modern terrorism, the aviation sector has been among the most frequent targets of terrorist attacks. For those determined to kill indiscriminately and in massive quantities to inflict mass casualties, economic disruption, world headlines, and psychological anxiety and fear among wider publics, aviation transportation in the form of airplanes and airports are ideal targets. Also making them ideal as potential targets is that they cannot easily be protected without interrupting the flow of passengers and goods which the general public takes for granted.
- ❑ The aviation sector is especially vulnerable because large numbers of people pass through airports on a daily basis. During holiday seasons, the volume of passengers increases exponentially, resulting in the issuance of heightened threat levels. On a tactical level, aviation transportation provides alluring targets for terrorism because of the high volumes of people located in a particular location at airports, such as ticket counters, the high concentration of people on large airliners and the potential for high death rates caused by blowing up such aircraft, and the utility of using a hijacked airplane as a lethal weapon to inflict additional catastrophic damages by flying them into physical structures on the ground

1.2 Checked Luggage Screening

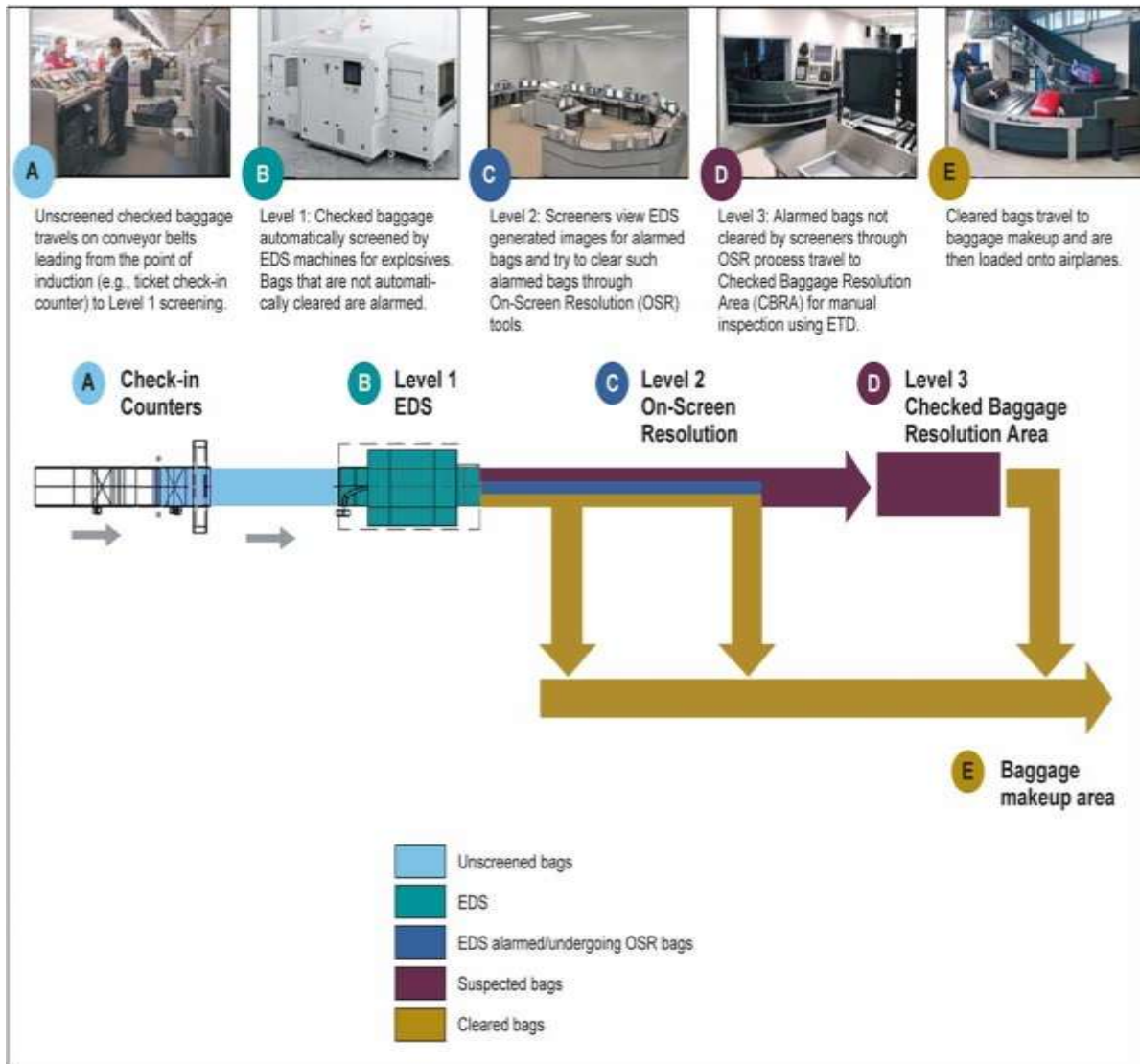
At airports with EDS, EDS machines are generally employed for primary screening of checked baggage while ETD machines are used for secondary screening to help resolve questions raised by EDS screening. At airports without EDS, ETD machines are used as the primary method for screening checked baggage.

Airport security agencies deployed EDS machines in stand-alone and in-line configurations. In a stand-alone configuration, checked baggage is manually loaded and unloaded by screeners. In contrast, an in-line configuration integrates EDS machines with a baggage handling system—a conveyor system that transports and sorts baggage from the ticket counter through the baggage screening system.

Generally, an in-line checked baggage inspection system employs three levels of screening. EDS machines perform automated (Level 1) screening. If the EDS machine is unable to clear a bag, it sends an alarm to a screener who performs a secondary (Level 2) inspection known as On-Screen Resolution by reviewing an

image of the contents of the bag via computer monitor. If the screener cannot resolve the alarm using on-screen resolution tools, the bag goes to the Checked Baggage Resolution Area (Level 3) where another screener will perform a manual inspection of the bag assisted by an ETD machine.

Figure 1 - Checked Baggage Inspection System & Three Levels of Screening



Source: TSA.

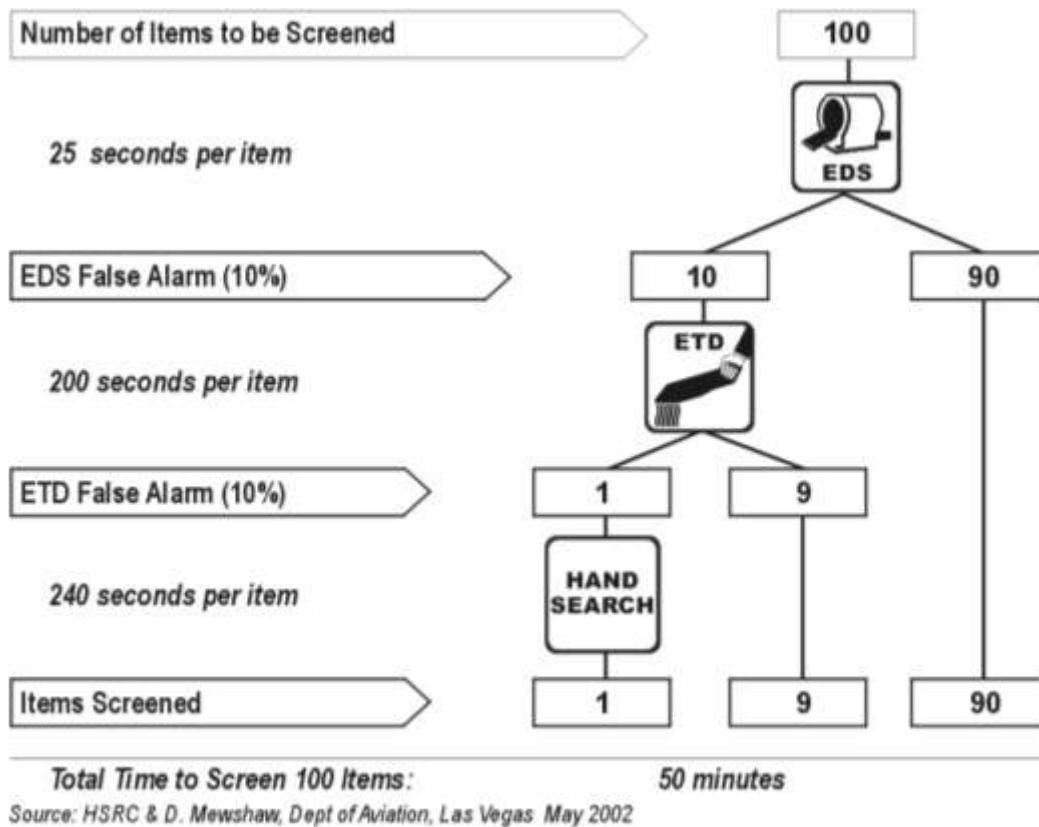
1.2.1 EDS based Screening Systems Deployment Strategy

In most Checked Luggage screening systems (i.e., airports), the screening is based on 2-4 layers (“levels”) of screening modalities. Each screening level clears a fraction of the items and the remaining items are sent to the next level for further screening.

The following figure shows a schematic design of a 100% EDS screening level followed by trace and hand search stages for suspected items.

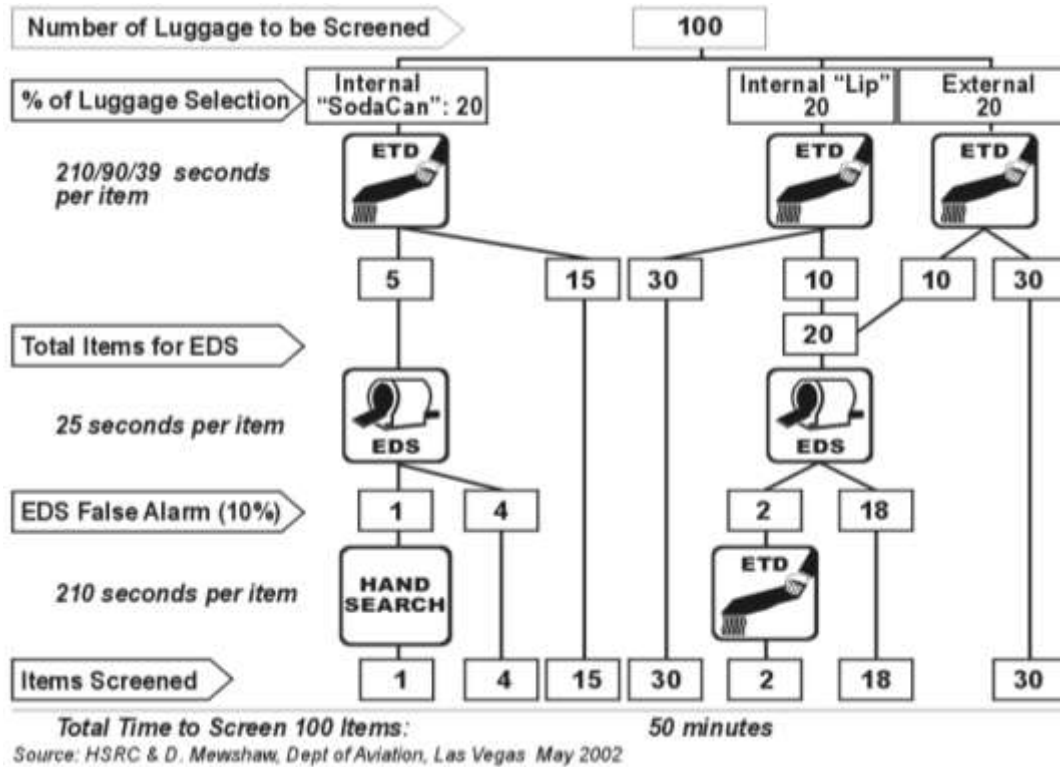
(**Note:** HSRC reprinted this figure as provided. HSRC does not fully endorse the forecast error rate and/or time schedules. The purpose is to illustrate how some security planners design such a system.)

Figure 2 - 100% Tomographic EDS & ETD Screening Flow Scheme



The following figure shows a less expensive screening scheme in which all Checked Luggage goes via ETD (Trace) screening pre-selected by the passenger classification. In this case, only 25% of the Checked Luggage is screened by tomographic EDS.

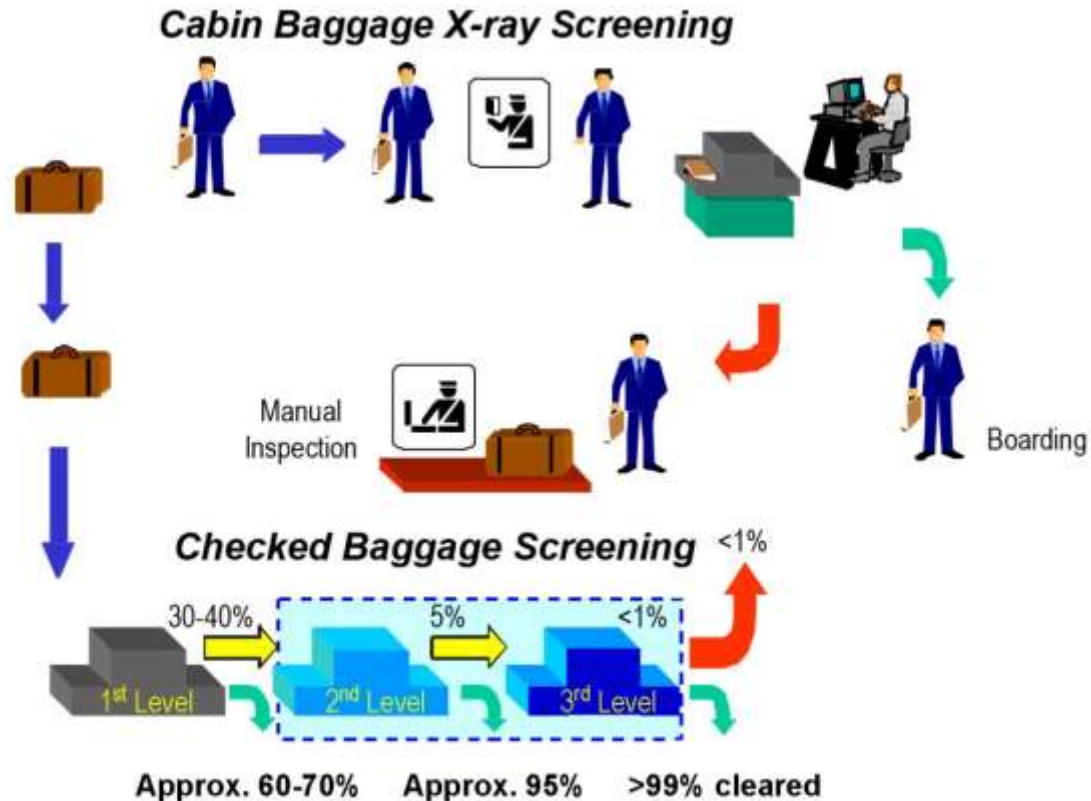
Figure 3 - “Fractional Tomographic EDS & ETS” Screening Flow Scheme



- ❑ There are multiple variations of these screening architectures, each designed to provide a solution that accommodates the many variables of an airport’s requirements, rules, development stage and budgets.
- ❑ Currently deployed EDS represent a “what-you-have-is-what-you-deploy” compromise.
- ❑ Deployed EDS screening methods are not perfect solutions which are not only because there are known ways to “design around” the equipment, it is safe to forecast that terrorists will develop new ways of fooling existing screening technologies. To overcome this security gap future EDS based screening systems will be augmented by a next tier screening based on.

1.2.2 Coherent X-ray Scatter Based Multi-Level Screening

Figure 4 - 100% Multi-Level (EDS, X-ray & Coherent X-ray Scatter) Screening



1.2.3 Checked Luggage Covert Testing Procedures

Covert tests are designed to measure how effectively TSOs utilize existing technologies.

In covert tests of checked luggage screening, an inspector poses as a passenger and checks luggage containing a simulated threat item at the airline ticket counter. The bag is then screened by TSOs using one of two checked luggage screening methods. At airports that have tomographic explosive detection systems, the TSO uses these machines to screen each bag. At airports that do not have EDS and at airports where certain screening stations do not have EDS such as curbside check-in stations, the TSOs use an Explosive Trace Detection (ETD) machine to screen checked luggage.

During the ETD screening process of both carry-on and checked luggage, TSOs attempt to detect explosives on passengers' luggage by swabbing the target area and submitting the swab into the ETD machine for chemical analysis. If an

explosive substance is detected, an alarm is triggered and a readout indicating the specific type of explosive detected. The TSO is then required to resolve the alarm by performing additional screening steps such as conducting a physical search of the bag or conducting further ETD testing on and X-raying of footwear. When testing EDS and ETD screening procedures, the Office of Investigations (OI) uses fully assembled objects such as laptop computers, books or packages.

Whether using EDS or ETD, if the TSO fails to identify the threat item, the inspectors immediately identify themselves to stop the checked luggage from being sent for loading onto the aircraft and the test is considered a failure. If the TSO identifies the threat item, the inspectors also identify themselves and the test is considered a pass. If the OI inspector determines that the failure was due to an equipment malfunction, the test is considered invalid. OI conducts two types of checked luggage covert tests:

- ❑ **Opaque object:** This test is designed to determine if a TSO will identify opaque objects on the X-ray screen and conduct a physical search of the checked bag. During these tests, OI inspectors conceal a threat item that cannot be penetrated by the X-ray and appears on the EDS screen as an opaque object among normal travel objects within checked luggage.
- ❑ **IED in bag:** This test is designed to determine if a TSO will identify an IED during a search of the bag and use proper ETD procedures to identify it as a threat. During these tests, OI inspectors conceal a simulated IED within checked luggage. In addition, the IED may be contained within other objects inside the bag.

More information can be found at:

[Tomographic Explosives Detection Systems - EDS & BHS: Industry, Technologies & Global Market - 2014-2020](#)