

Air Cargo Screening: A Multilayered Approach

by Jason Gash, Director of Technical Sales, Smiths Detection Inc.

Air freight volumes have continued their annual growth since the recession of 2009. The International Air Transport Association continues to forecast that economic growth and trade will accelerate, strengthening growth in air cargo volumes. Boeing reports that world air cargo traffic is forecast to continue this growth, at an average of 4.7 percent per year over the next 20 years, doubling the number of “revenue tonne-kilometers logged in 2013.” The number of airplanes in the worldwide freighter fleet will increase by more than double by 2035 as well.



As this market continues to grow, it becomes increasingly important to ensure an efficient yet comprehensive screening of all of the goods sent to and from all over the globe. The latest threat detection and identification technologies help screen for constantly evolving chemical, biological, radiological, nuclear and explosive (CBRNE) threats to help the air cargo community safeguard society, protect life and support the free flow of trade.

Challenges

Smiths Detection works with its customers to provide tailored solutions for their passenger, baggage, and cargo screening needs. Customers are always interested in smaller footprints, faster throughput to continue the flow of commerce, and in technological advances that will help them continue to meet the evolving threats they face. We work to help them meet their ever-changing demands and the evolving threats they face, many times through simple technological upgrades so they don't have to worry about buying a whole new machine. We also offer 24/7/365 global support, training, and maintenance to support them throughout the life of the machine.

Different Technologies for Different Challenges

While there are many iterations of products, there are a few key underlying technologies that run many of the screening machines today.

X-Rays

When a package is sent through an X-ray baggage screener, complex software algorithms, based on chemistry, help operators determine what the material is based on its atomic number, and whether it is organic, inorganic, or overlapping. This occurs when an object passes by a generator (one or more) which produce X-ray beams. A detector board sees that X-ray, and then a computer processes the image taking many variables into consideration. Then gives the operator an output image to evaluate. This whole process happens very quickly, and that total time is called ‘throughput.’ The images the computer displays after are easy enough to read that it does not take much time to train operators to know what to look for.

When multiple x-ray generators are used, better image characterization is achieved. For example: if you put three packages in a row and take one photo, from the top down, you might only see a single square. This is similar to what you gather from a single-view x-ray machine. But with additional cameras and views, you will be able to see from another angle that there are three boxes behind that, for example. In much the same way, two or more X-ray generators give a much more complete picture, including an object's density, volume, and atomic number. The atomic number of an element is directly proportional to how dense it is. When an X-ray goes through something, the more dense the object is the less X-ray goes through it. Denser materials look different. So, for example, since a piece of paper is organic, it will appear light orange, an item containing aluminum appears green, and steel will show up as blue. All of this information increases accuracy, reduces the occurrence of false alarms, and decreases the amount of time it takes to determine if an object is a threat or not.

Examples of this in action include Smiths' HI-SCAN series. The [HI-SCAN 180180-2is Pro](#) has been designed for the inspection of large-scale consolidated and palletized goods, including the maximum accepted skid size today thanks to its large tunnel dimensions. Its dual-view concept delivers better security due to more accurate and reliable image evaluation. Its two powerful X-ray generators are capable of penetrating even large and dense objects, reducing re-inspection times (as consolidated cargo does not usually need to be broken down into smaller items), ensuring high throughput and a fast & efficient inspection process. The bottom-up shooting of these generators significantly reduces their footprint size and offers better image quality. The optimized footprint minimises the required floor space, helping to keep the lifecycle costs low.

The [HI-SCAN 145180-2is](#) is a universal X-ray system for palletized items. It is equipped with two generators in a 90-degree opposition, providing a horizontal and vertical view of the object for shortened inspection time and high quality images. The large tunnel dimensions are especially suitable for the inspection of air cargo transported on standard Euro, British or US pallets.

The [HI-SCAN 100100V-2is](#) is specially designed to meet the requirements of airports, customs facilities, logistics companies and parcel services or whenever high security screening of a large variety of different sized packages is required. The HI-SCAN 100100V-2is equipped with two image generators, providing multiple views of the screened object. This particular screening method facilitates reliable inspections of tightly packed objects in one process, shortening inspection times. Its compact system design provides the highest performance with the smallest footprint. Additionally, the optimized conveyor load of 220 kg allows the fast screening of break bulk cargo.

Ion Mobility Spectrometry

Another explosives detection technology is ion mobility spectrometry (IMS). IMS is sensitive enough to detect parts per billion of material, or particles that are smaller than nano-grams. It works by electrically charging the molecules of a sample, and then pushing them through a drift tube. The time that it takes those molecules to reach the end of the tube, called "drift time," measures its atomic number, and a larger molecule will be slower than a smaller one. Because of this ability to test even tiny amounts of residue, screening locations like air cargo facilities use systems like Smiths Detection's IONSCAN, allowing swabs of hands, the seams of packages,

and other locations that might have been touched by the suspicious material to be analyzed. Even extensive cleaning might not rid a person or object of all of the traceable residue particles, so they will have a small chance of escaping this detection process.

These technologies come in desktop or portable versions and the later versions typically run off batteries. No matter the size, machines like the IONSCAN detect a wide range of threats and include a customizable library, depending on the customer's need.

Implementation and Innovation

While there is a lot of complicated science behind what may seem like a simple process to the user, the ease-of-operation of many of these machines is why they are so ubiquitous now. At Smiths Detection, we like to take the expertise of our R&D and market intelligence, and fit our solutions to the needs of our customers. What's more, we are leaders in taking complex technology and making it suitable for any level of user. We are constantly working with our customers to create systems that suit their needs, whether it is in size, flexibility, speed, or application. To do so, we anticipate the need of customers a few years forward, including emergent threat possibilities that may crop up in the next 5 to 10 years, and combine that with ground breaking engineering and technology.

While the methods and layers of security vary, modern multi-layered security systems require explosives detection. Fortunately, there are an array of precise methods which can be personalized and customized for the needs of the user to ensure they can deliver the innovative science, technology, and expertise of detection experts, in a cost-effective manner that will help keep people safe.

Future Developments

The threats our customers face are always changing, so we help them be flexible. The future developments are continued smaller sizes to lessen the footprint, and algorithms that mean we can help them customize their technologies to meet evolving threats without having to buy a new system. Our customers are always looking for some combination of smaller, faster, lighter, and/or more portable, as well as cost-effective, and we work every day to help evolve our technology to help them meet that. The developments our customers look for are ways to meet the constantly evolving threats they face.

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