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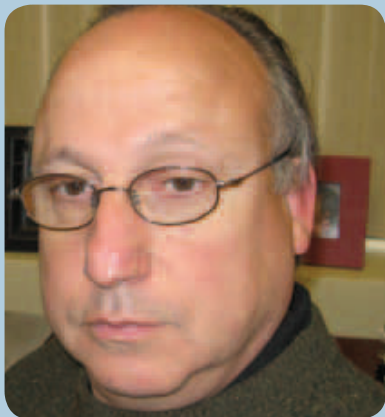
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Defining terms

*Gustavo L. Botta
of Passport Systems
argues that the industry
must have clear, and
commonly-shared,
definitions of terms such
as inspection, screening
and scanning in order to
form a coherent strategy
for cargo security*



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For those involved in transportation and logistics and who follow the evolving world of cargo inspection, it will not be a surprise to hear that there is significant confusion as to what is required to meet the evolving standards, mandates and goals for cargo inspection.

At a recent conference on port security, it became clear to me that most supply chain professionals remain puzzled by the various claims related to cargo inspection offered at the event. There are those who say that inspecting more than 2%-7% of the cargo containers at a seaport will paralyse it, while there are others who believe that 100% scanning can be achieved without adverse impact. In fact, some people say that 100% of containers are already being scanned in some ports.

This article attempts to shed light on some of the reasons for this confusion as well as to provide context for comparing seemingly inconsistent cargo inspection systems claims.

Confusing nomenclature

There are many reasons for this confusion, including the lack of a common understanding of the nomenclature used in this area. Inspecting, scanning and screening are not interchangeable words, yet they are liberally used in print and speech.

Recently enacted US laws, commonly referred to as the *SAFE Port Act of 2006* and the *9/11 Commission Act of 2007*, define some of these terms. There are however, differences in the terminology which may create confusion.

In the *SAFE Port Act*, 'inspection' is defined as the broad activity conducted by Customs to appraise goods for purposes of tariff collection, interdiction of prohibited items and compliance with applicable laws. The process may include screening, conducting an examination, or conducting a search. 'Screening' is defined as a visual or automated review of information about goods, including manifest or entry documentation accompanying a shipment being imported into the US, to determine the presence of misdeclared, restricted, or prohibited items and assess the level of threat posed by such cargo. 'Examination' is defined as the use of nonintrusive imaging and detection technology to inspect cargo to detect misdeclared, restricted, or prohibited items. 'Search' is defined as an intrusive examination in which a container is opened and its contents are removed and visually inspected for the presence of misdeclared, restricted, or prohibited items. A 'scan' is defined as the use of nonintrusive imaging equipment,

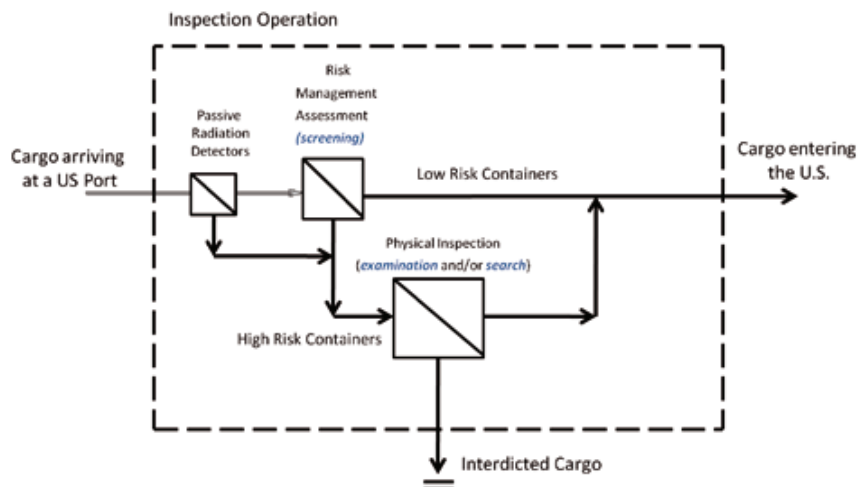


Figure 1: Author's interpretation of cargo inspection at US ports, according to the *SAFE Port Act of 2006*

radiation detection equipment, or both, to capture data, including images of a container. 'Radiation detection equipment' is further described as any technology capable of detecting or identifying nuclear and radiological material or nuclear and radiological explosive devices.

The SAFE Port Act focuses primarily on seaports and sea cargo containers. It requires 100% of the cargo containers originating outside the US and unloaded at a US seaport to undergo screening to identify high-risk containers. It also requires 100% of the containers identified as high risk to be scanned or searched before they leave a US seaport facility.

The recommendations of the **9/11 Commission** were captured in the law bearing its name which was signed on 3 August 2007. The implications of this Act are significant for the transportation and logistics community. The Act requires that 50% of air cargo transported on passenger aircraft from airports within the US be screened in a manner commensurate with that of passenger checked baggage within 18 months of the enactment of the law and 100% within three years of that date. In addition, the US Secretary of Transportation is authorised to assess the adequacy of security measures deployed at foreign airports used by air carriers serving the US or that pose a high risk of introducing danger to international air travel. If such assessment concludes that the standards are not adequate, a series of measures are available including the banning of air travel into the US.

The 9/11 Commission Act defines the term 'screening' for air cargo inspection to mean a physical examination or non-intrusive methods of assessing whether cargo poses a threat to air transportation security. Methods of screening include x-ray systems, explosives detection systems, explosives trace detection, explosives detection canine teams certified by the **Transportation Security Administration (TSA)**, or a

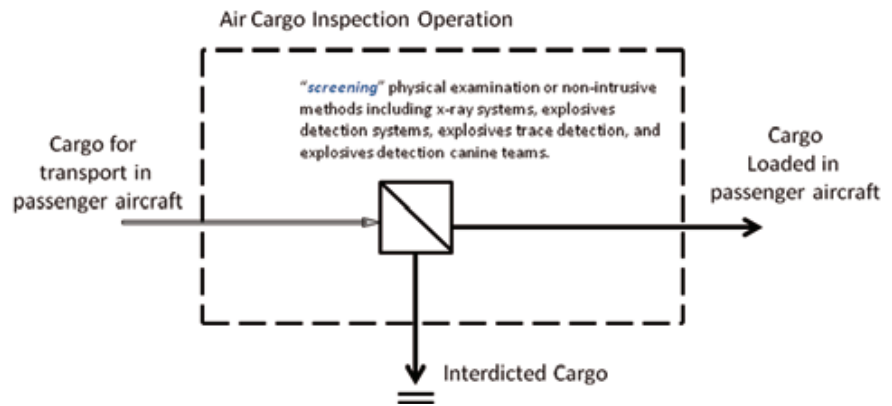


Figure 2: Author's interpretation of air cargo inspection, according to the 9/11 Commission Act

physical search together with manifest verification.

The SAFE Port Act screening timetable was amended by the 9/11 Commission Act to add a requirement that a container loaded on a vessel in a foreign port shall not enter the United States unless scanned by nonintrusive imaging (NII) equipment and radiation detection equipment on or after the 1 July 2012, or such other date as may be established by the Secretary of Homeland Security. It provides extensions for two years and the possibility to defer in additional two-years if certain conditions exist.

Physical inspection

It is easy to see why people are confused. In the SAFE Port Act, screening is not a physical inspection

(it is just an evaluation of information to categorise containers as high or low risk); but in the 9/11 Commission Act, screening for air cargo requires a physical examination or the use of non-intrusive methods of assessing whether cargo poses a threat to air transportation security.

In the SAFE Port Act, only those containers arriving in the US which are considered high risk are to be physically inspected (either through opening the container for a search or examined by NII and detection equipment). The 9/11 Commission Act amends this by requiring that all sea cargo containers bound for the US undergo inspection at the port of embarkation with radiation detection equipment and NII equipment.

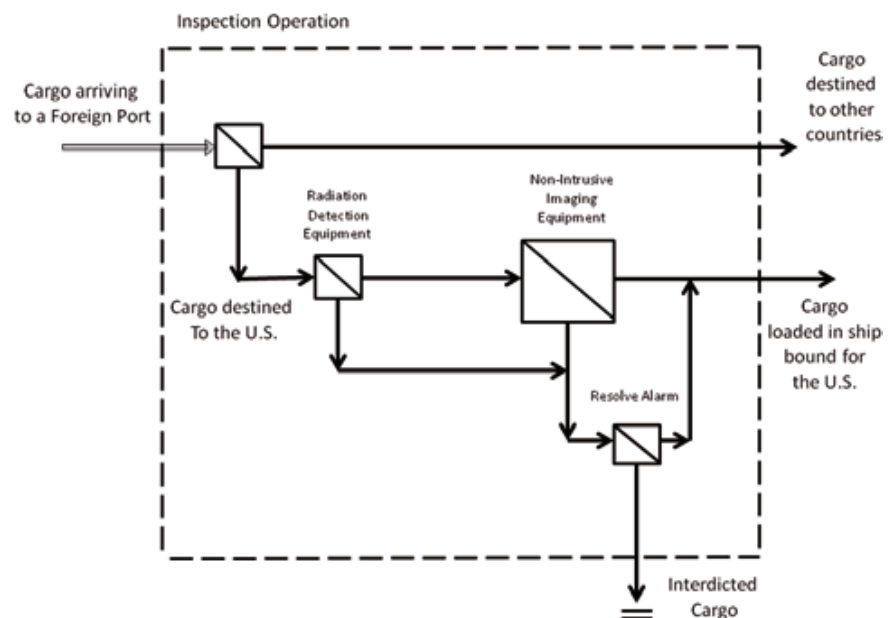


Figure 3: Author's interpretation of inspection of sea cargo at a foreign port bound for the US under the SAFE Port Act as amended by the 9/11 Commission Act which added the 100% inspection of US bound containers at overseas' ports

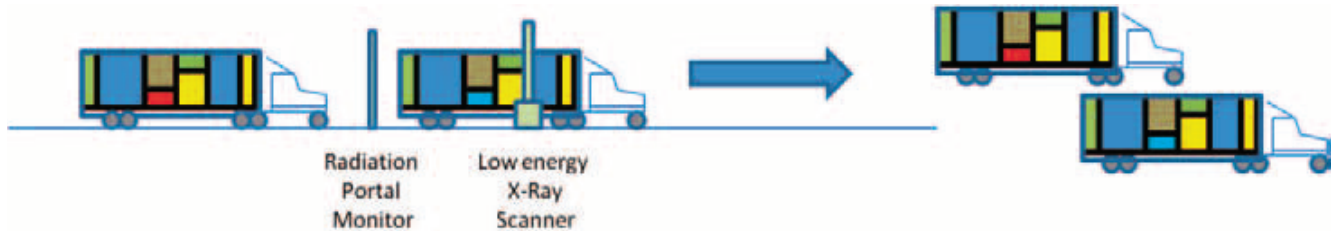


Figure 4: A sea cargo container screening or examination via a scan without search of cargo contents for interdiction

Evaluating inspection claims

The arguments advanced by several parties as to the throughput achieved by their cargo container inspection systems cannot be compared unless one defines the objectives of the inspection and what is meant by inspection. For example, consider a scenario where the objective is to make sure there are no explosives in a container capable of causing the destruction of an airplane, and the inspection method is a physical verification of the contents of the container (through manual

inspection, canine team, NII, etc.). In this case, the objective of avoiding the destruction of an aircraft would define the minimum size or amount of explosives to be detected and interdicted. This example's objective is limited to finding explosives, so the comparison has to be done on this parameter only. Obviously, the broader the detection objective, the more sophisticated the inspection has to be, and one technology or equipment may not meet all requirements, thereby requiring a systems approach.

Inspecting 100% of containers

What prompted this article was the confusion over nomenclature in the new cargo inspection laws and the difficulty this causes in fully evaluating and comparing the claims offered by competing inspection technology vendors. Even though certain claims can be correct, the implications or perception may be wrong.

Why is it that some experts in the field say that seaports, for example, may not be able to inspect more than 2%-7% of containers, while others

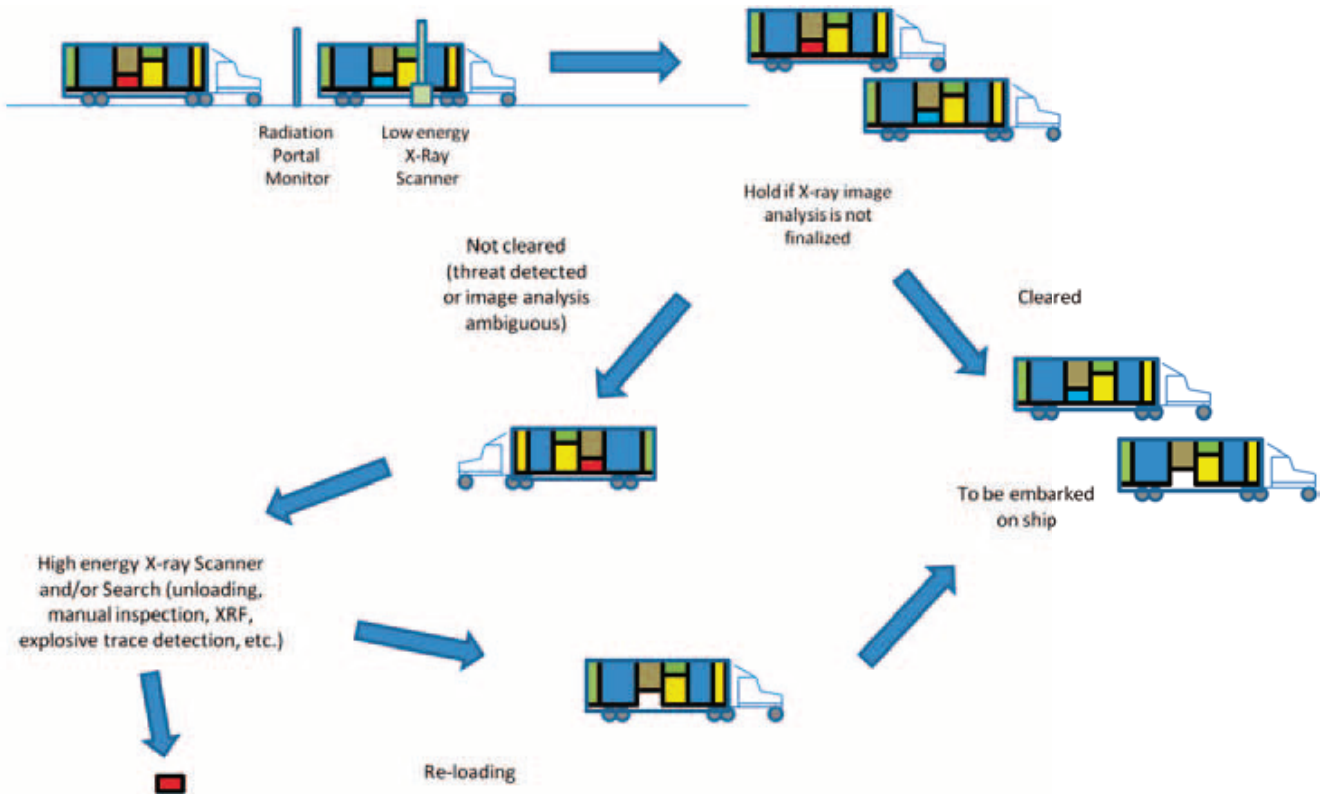


Figure 5: A sea cargo container screening or examination via a scan with search of cargo contents for interdiction

'In the SAFE Port Act, inspection is defined as the broad activity conducted by Customs to appraise goods for purposes of tariff collection, interdiction of prohibited items and complying with applicable laws. The process may include screening, conducting an examination, or conducting a search'

say they can scan 100% of containers without slowing down traffic? I believe both statements may be true – depending on what they mean by 'inspect' and 'scan'.

If an inspection at a seaport has the objective of inspecting all containers to be loaded onto a particular vessel for weapons of mass destruction, such as a shielded nuclear weapon, how would we reconcile the competing positions stated above?

The experts who say that a port would be brought to a halt if it sought to inspect more than 7% of its containers, probably base their assumptions on the current purposes and methods used by Customs agencies (finding drugs, contraband, validation of tariffs, etc.). These inspections require time to perform and even if done by x-ray machines, would require many minutes for each container (because of the need to analyse each image), making it impossible to inspect all containers without bringing the port to a halt.

Those who claim they achieve 100% scanning of sea cargo containers can also be correct. To understand why, the important thing is to be able to differentiate between inspecting for the purpose of interdicting certain cargo and the term scanning defined as a subset of the operation of examining or screening.

Low energy scanners

Obtaining an x-ray image where high penetration is not required (small containers, lightly loaded or low density cargo) can be done with low energy scanners on moving vehicles. Each x-ray image of a container may require little time to capture. If these images are stored in a database for future analysis, then the operation is deemed to be completed, i.e. there has been a scan performed on all containers which could be interpreted as being an examination according to the SAFE Port Act or screening according to the 9/11 Commission Act (see Figure 4). The problem with this approach is

that data capture only does not achieve the ultimate purpose of an inspection which is to remove cargo that should be separated from the stream of commerce (threats, prohibited items, etc.) or be treated differently (tariff violations, etc.).

Supply chain

Thus, it is important to assess this system in relation to where it fits in the supply chain. If the containers are arriving at a port by vessel (imports), then storing the images in a database may not be meaningful unless there are ample storage areas at the port or in nearby locations and there is plenty of time to retain the containers until the image analysis can be made.

Flow of commerce

If the containers arrive at a port to be loaded onto a vessel for a particular destination like the US, the operation depicted in Figure 4 could be portrayed as scanning 100% of containers awaiting shipment without impairing the flow of commerce, but it does not evaluate their contents until after the ship has sailed, if ever. Scanning in this sense does not accomplish an inspection until the images are analysed and no remedy is applicable until cargo can be separated or removed.

Probability of detection

If an inspection is to be performed before the containers are loaded on a vessel, then the throughput will be dependent on the efficiency of detection (probability of detection and false alarms) of the equipment used. Although the containers would go through the system quickly, if the inspection requires the highest probability of detection, the containers would have to wait before loading onto a vessel until the x-ray images can be properly analysed and the cargo cleared. It is difficult to conceive inspecting all containers using this approach without affecting cargo flows at a port. Clearing 100% of cargo also depends on minimising false alarms and resolving

ambiguities detected in the analysis of x-ray images, which would require a search of the containers thereby slowing throughput and raising the probability of delays in vessel departure or holding back containers for later shipment (Figure 5).

Summary

When comparing claims of performance in the inspection of cargo containers, it is imperative to (i) understand the objective of the inspection; (ii) have a clear definition of the meaning of terms like inspection, screening,

examination, scanning, or search; and (iii) only compare parameters such as cargo throughput, size, cost, etc. of the equipment or methods used, at the same or equivalent detection probability and for the same position in the supply chain.

Table 1: Terminology summary

Term	SAFE Port Act of 2006	9/11 Commission Act of 2007	Observations
Inspection	Yes		Defined as the broad activity of Customs to appraise goods for tariff collection, interdiction of prohibited items, and complying with applicable laws. Performed by screening, examination, or search
Examination	Yes		Defined as the use of nonintrusive imaging and detection technology to inspect cargo to detect wrongly-declared, restricted, or prohibited items
Screening	Yes (1)	Yes (for Air Cargo) (2)	(1) Defined as a visual or automated review of information related to the goods to determine the presence of wrongly declared or prohibited items and evaluate the risk of the cargo. (2) A physical examination or nonintrusive methods including x-ray systems, explosives detection systems, explosives trace detection, and explosives detection canine teams
Scan	Yes		Defined as the use of nonintrusive imaging equipment, radiation detection equipment, or both, to capture data, including images of a container. Radiation detection equipment is further described as any technology capable of detecting or identifying nuclear and radiological material or nuclear and radiological explosive devices
Search	Yes		Is considered an intrusive examination in which a container is opened and its contents are removed and visually inspected for the presence of improperly declared, restricted, or prohibited items
100% sea cargo containers	Yes (1)	Yes (2)	(1) 100% containers originating outside the US and unloaded at a US seaport to undergo screening to identify high-risk containers. 100% of high-risk containers to be scanned or searched before they can leave a US seaport facility. (2) Subject to change by the Homeland Security Secretary, by 1 July 2012, containers loaded on a vessel in a foreign port shall not enter the US unless scanned by nonintrusive imaging equipment and radiation detection equipment
100% Air Cargo		Yes	By 3 August 2010, 100% of cargo transported on passenger aircraft must be screened in a manner commensurate with that of passenger checked baggage (physical examination or nonintrusive methods including x-ray systems, explosives detection systems, explosives trace detection and explosives detection canine teams)

Table 2: Summary of observations regarding sea cargo container inspection systems

	Containers unloaded from a vessel	Containers to be loaded on a vessel	Observations
In the US	Custom's inspection requirements apply	If and when other countries will require pre-loading inspections	The inspection by Customs in the US is to appraise goods for purposes of tariff collection, interdiction of prohibited items and complying with applicable laws
Outside the US	Inspection requirements of each country (if any) apply	If bound for the US, container needs to meet the 9/11 Commission Act amendments to the SAFE Port Act	Although not the only one, the US main security objective (according to the author's interpretation) is to avoid having a weapon of mass destruction (WMD) in a ship bound for the US
100% scanning	Obtaining an image of the cargo without analysing it at the port defeats the purpose of inspecting cargo before leaving the port premises	Claims of 100% scanning may be correct but may not imply inspection before loading	Cargo that should have been removed before loading containers may be on its way to the US (even if eventually known before arrival, it defeats the intent of the inspection before loading – which is to interdict as early as possible in a supply chain)
100% inspection	May be possible if a systems approach is used (today's methods of operation would require change)	May be possible if a systems approach is used (today's methods of operation would require change)	2%-7% of containers are inspected by US Customs for a variety of purposes on arrival at a US port of entry. About 95% of containers arriving at a port in the US undergo passive radiation detection (only lightly shielded radioactive materials can be detected)