3.5 Advanced Inspection Technologies (AIT)

Before inspection technologies can be further discussed, a baseline definition must be established for the three types of inspections that are commonly used when discussing the container and its contents:

1. **Screening**: described as the targeting and risk management process. Customs should screen information on 100% of import containers (see ACI). Each and every container identified as high risk is subsequently scanned and, if needed, physically inspected.

2. **Cargo scanning or non-intrusive inspection (NII)** is a method of inspecting and identifying goods in transportation systems without a time intensive unloading process. It is often used for scanning of intermodal freight containers. NII and the physical inspection of a container’s contents are conducted in order to provide Customs officials with the ability to verify the accuracy of information provided by shippers on a container’s contents and the effectiveness of container integrity measures. Scanning is important because it can help identify dangerous cargo when the originating shipper, or the party responsible for stuffing and sealing the container, appears to be legitimate (AEO) but has actually been infiltrated by a criminal group. In these cases, other layers of security may provide a false sense of security because the shipments appear to be outwardly “legitimate” when in fact it is illegal.

3. **Physical Inspection**: Based on the results from screening and/or scanning the container is opened and unstuffed for a visual verification of contents. This generates extra-costs and delays.

Screening, scanning, and physical inspection of containers, while complementary, are not the same. 100% container screening is possible, should an administration choose to do so – 100% scanning and inspections, on the other hand, are not viable due to the backlog at Customs in ports, nor is it economically feasible for all countries. Screening can be improved with additional sensor-based or information-based inputs. Additional data, whether from the container, i.e. tamper indication, from the facility infrastructure, i.e. radiation detection portals, or from information systems, additional shipment detail, could be used to improve the screening/targeting processes.

3.5.1 AIT Methodology and practice

The following snapshot from case studies in East and West Africa provides insight in how screening, scanning, and inspection complement each other.

Box 3-1 AIT Case Study of AIT process of Ports in West and East Africa
Generally, two types of scanning variants can be distinguished:

Active scanning: A system making container images based on X-rays or Gamma ray beams.

Nuclear detection: A passive system detecting nuclear and other radioactive materials based on their radiation levels

### 3.5.2 Nuclear detection

In September 2006, an amendment was proposed for the US SAFE port act in which Nuclear Detection will become mandatory for US-bound containerized cargo. Many of the largest ports in Europe, Asia and the US are in the process of installing radiation detection portals. Almost all these programs take place under responsibility of Customs.

However, adding to the predicament of the decision-makers, recent tests of the new generation of radiation detection portals, the Advanced Spectroscopic Portal (ASP), developed under the aegis of the US Government, have cast doubts on its ability to detect radioactive material significantly better than the existing generation. On the other hand, the estimated lifecycle cost for one of the new generation ASP exceeds US$ 800,000 or almost the triple of the cost of existing radiation scanners.¹

While the continuous research and development of NII technologies are needed to detect hazardous cargo without interrupting the flow of goods, one technology cannot detect everything. Thus, the combination of technologies and attentive human operators is necessary. In order to justify the eventual installation of scanning devices, it can be noted that multiple benefits and objectives might result from a good scanning system. Improving scanning ability could serve not only to detect Nuclear or other WMD

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¹ US GAO report 09-655 “Combating Nuclear Smuggling”, June 2009
weapons but also to reduce smuggling, to improve tax collection and to earn the trade community’s trust to attract more trade.

3.5.3 **X-ray and Gamma-ray radiography**

Advanced Inspection Technologies (AIT) first gained prominence for manifest verification, allowing countries to better enforce import tariffs. Authorities also found that the image quality achieved with X-ray scanning allowed them to interdict contraband, including drugs, cash, weapons, and other illicit materials. X-ray radiography systems can penetrate up to 30-40 cm of steel in vehicles moving with velocities up to 13 km/h. They provide higher penetration but also cost more to buy and operate. During the last few years, attention has shifted to security concerns, where X-ray screening is expected to become a major tool in prohibiting the smuggling of weapons of mass destruction. X-ray inspection systems for cargo containers have now become a more familiar feature in numerous ports. This rapid adoption has been accelerated by the needs of port security, but made practical by the systems’ unique ability to penetrate entire containers and generate images of the contents in just a few seconds. Even at this large scale, the resulting images are comparable to those obtained through traditional baggage scanning at airports and capable of identifying objects smaller than a baseball.

The inspection layer also allows for Customs administrations of both the originating and importing ports to conduct inspections on the same container and can require the container to pass through different types and increasing levels of inspections. The following highlights the built-in layers of a scanning operation.

**Active scanning using Gamma-ray radiography**

Gamma-ray radiography is an alternative to X-ray but uses a radio-active source for the radiation.

Gamma-ray image of a truck with two stowaways in a container of Styrofoam trays entering US from Canada at Buffalo, N.Y. Image taken using 1.25 MeV photons.

As X-ray cargo scanning becomes more common at ports and border crossings, its impact on container traffic is frequently discussed. This is essentially a question of system throughput, which varies by the type of X-ray system chosen and how it is operated within a port facility. X-ray cargo screening has been
adopted at ports and border crossings throughout the world because this technology has solved a number of important problems. This is where the scanning debate lies: is it for revenue or security? All stakeholders should keep in mind the fact that, while container inspections are critical from both security and revenue perspectives, efficiency (throughput) and port operations cannot afford to slow down. However, as shown in Table 3-1 Customs continues to increase the rate of discrepancies that capture revenue that would have otherwise been lost to importer error or deception. From a security stand point one can imagine what some of these discrepancies revealed.

The human side of the scanning process should also be examined so that the inspectors are well trained to interpret the x-ray images and other indicators. Experts argue that better training of Customs staff on analyzing scanned images, the digital revolution and related efficiency gains, diffusion of innovation, as well as growth and specialization in the scanning manufacturing sector will enhance security and efficiency. When analyzing the data in Table 2-1, the trends between 2001 and 2008 show an increased age in the number of proven discrepancies. With this data it becomes evident that with more training the proficiency of the operator increases, thus indirectly resulting in a more secure supply chain.

In contrast to the efficiency argument is the adverse effect these technologies could possibly have on developing countries. The added burden for these countries to implement systematic scanning on exports, the possibility of smaller ports being marginalized, cargo diversion in favor of hub ports, loss of expertise, such as Risk Assessment techniques and some opportunity costs are all concerns.

### 3.5.4 The Dual Role of Scanning

Scanning can serve two clearly distinct purposes:

- Assist in detecting and counter illegal material movements by organized crime, be it contrabandist or terrorist in nature
- Assist Customs to protect and enhance tax collection against fraud and mis-declaration by the trade or their representatives.

The two functions sometimes overlap, often through the use of the same technology, facilities and/or operating personnel.

Having one scanner in one port to inspect imports to protect or enhance tax revenue should not normally be considered as fully addressing supply chain security per se. In fact, improved monitoring of
possible smuggling of weapons, explosives and similar, an important objective of SCS, is actually a collateral benefit of tax-related scanning.

There are examples of tax collection-related import cargo scanning operations in developing countries, particularly Africa. One of the implantation models is the following: a provider is granted a Build, Operate, and Transfer (BOT) concession to install and run import scanning operations. The concession often encompasses physical installations, supply and operation of one or more scanners and a risk management system, capacity building, transfer of know-how and training of the local Customs officers.

While the tax-collection improvement objectives are reportedly achieved and even exceeded in some cases, the physical insertion of the scanning procedures and sites have not always been well thought of, and the necessary consultation with the port and trade communities, as well as between concerned government agencies have sometimes been lacking. Complaints have been heard in some ports about the high costs being recouped from the logistics operators and cargo interests, as well as about the delays and interferences sometimes caused on the cargo flows and port operations. The effectiveness of the capacity building and know-how transfer components has also been questioned in some cases.

It is not the purpose of this guide to analyze in depth these tax-collection scanning schemes, but practical lessons might be drawn from these experiences.

3.5.5 Fast Scanning

One of the clear future directions of scanning is “fast scanning”. Fast Scanning implies that the shipment container could be scanned while in motion at a reduced speed in the port. It is in a way similar to the automated prepaid highway toll principle. This type of scanning is already undergoing investigation by a number of major ports due to their concern in addressing the US 100% scanning requirement as discussed in this document.

There are some limitations however to fast scanning. First, as the cargo is in movement and as conveyance vehicle operators are often involved, the scanning beams have to be of relatively low power and penetration. With this type of lower penetration scan, the images do not provide the same capability to discern the container contents to the full level of detail. Second, due to this less detailed image, secondary inspections will be required on a more frequent basis in order to address this weakness.

Fast scanning is in the early stages of development – early systems include road and rail portals that are either planned for testing or currently undergoing testing by ports that are “early adopters” of technology who want to ensure their competitiveness in the current and future supply chain security environment.

In general fast scanning consists of three integrated technology elements, more specifically:

- Identification of the goods/container (RFID, optical character recognition of the container number or other similar technologies)
- X-ray scanning of the container
Radioactive threat detection.

Once the scanning is complete the container needs to have a high security seal affixed (if not already the case), so that any tampering with the contents can be noted. And if the seal is found to be not intact at any point in the port process, a new scan will need to be done. It is also important to note that with fast scanning it is envisaged that not all images will be viewed and analyzed as there will be risk based decisions made using additional tools such as a risk management system and profiling.

Fast scanning cannot be implemented as a stand alone system as there will be requirements for secondary high penetration scans and even physical goods inspections if and when anomalies are found. Implementation of fast scanning is normally oriented solely toward outgoing shipping containers and will require re-thinking of port logistics for containers coming into the port by road and by rail. All incoming containers will need to be routed through the fast scanning systems, so this implies strictly controlled access, although in practice this has already been implemented in most ports. Many of the larger ports are already preparing for and testing fast scanning as an early implementation measure if and when the 100% scanning requirement is implemented.