Containerisation With 100% scanning

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Abstract

The purpose of this paper is to analyse the impact of 100 % scanning of containers before shipping:

- on port facilities and ports,

- on transport systems to and from ports;

- and finally also on international trade.

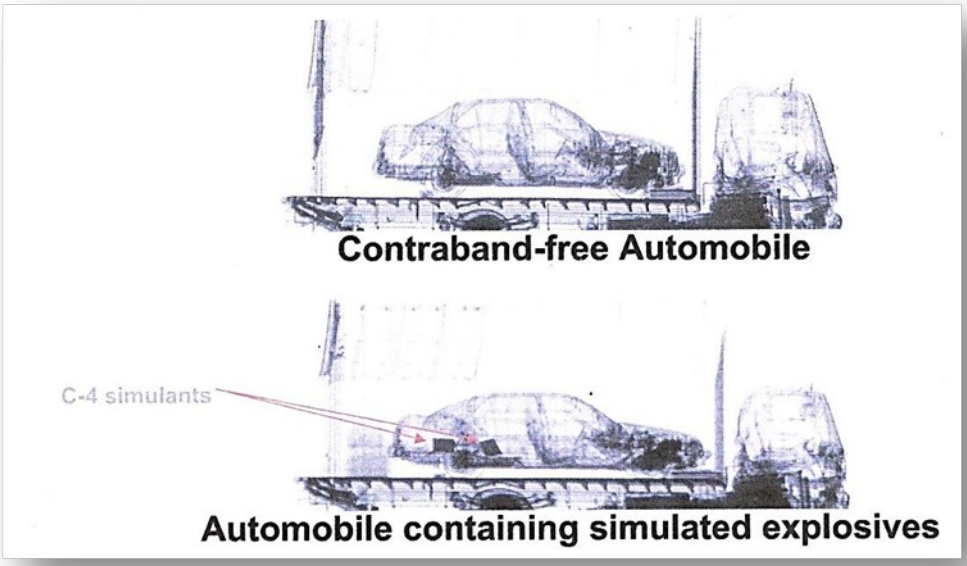
We will first consider the container scanning infrastructure already implemented in ports and then consider additional technical and administrative measures which would achieve 100% scanning and cost implications of such measures.

The paper will then examine the impact of scanning on port and terminal operations. Estimates of the additional cost of 100% scanning will be put forward and these will cover the cost for the actual transfers to and from the scanning site, anticipated indirect costs, external costs generated by additional transport and any costs or benefits resulting from changes in supply chain.

Key words

100% scanning, Megaports Initiative, Container Security Initiative, Secure Freight Initiative, ISPS Code

Introduction



An image of a scanned container

This paper has been compiled by taking into consideration the generic view of the ports around the world. Some ports have certain scanning equipment already in place while some do not have any equipment at all. In some ports certain initiatives have already been put into place while at other ports they are still at an experimental level. This paper aims at discussing what these measures are and what additional measures need to be implemented to ensure 100% scanning of containers and hence ensure enhanced security. The cost and other administrative implications of such scanning have also been discussed along with the general measures which need to put into place to ensure additional security for containers.

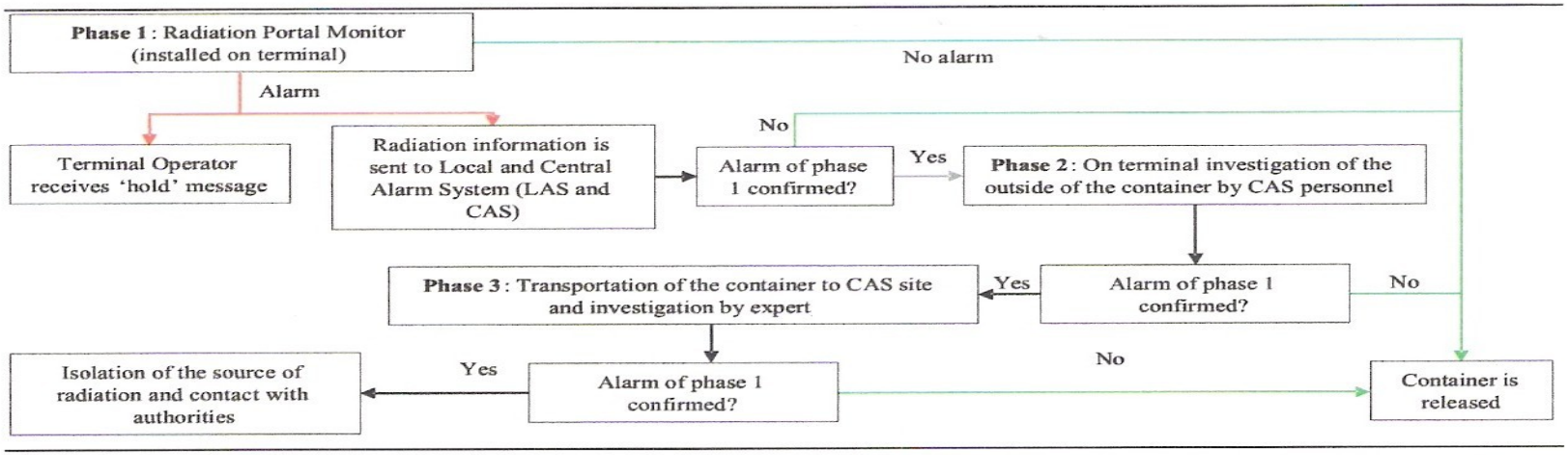
Measures already in place to scan containers at ports

Majority of the big ports today are a part of the container security programmes implemented worldwide, these are –

1. Megaports Initiative
2. Container Security Initiative
3. Secure Freight Initiative
4. ISPS Code

Megaports Initiative

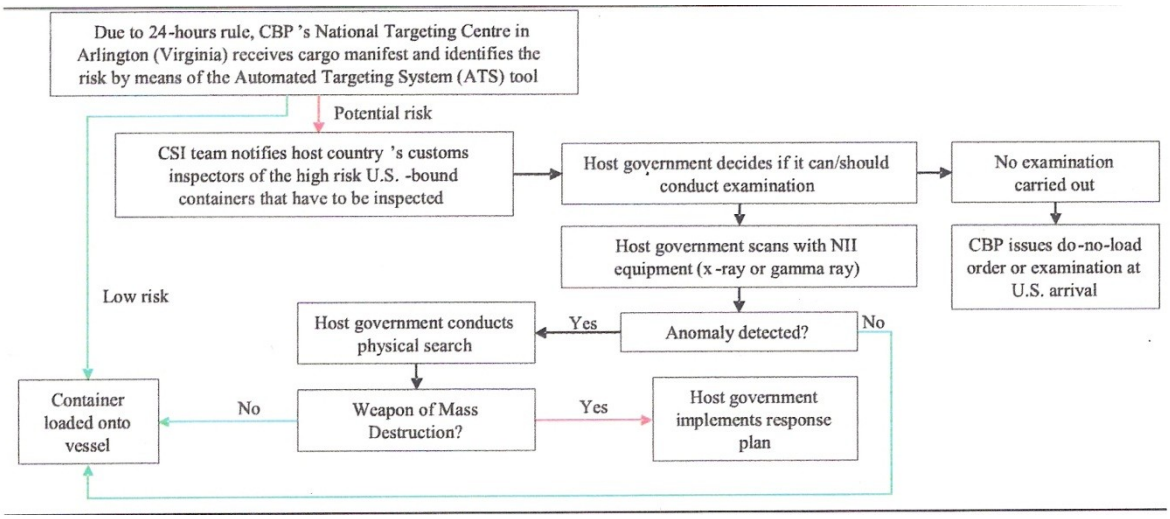
The Megaports Initiative (MI) was introduced in 2003 by the National Nuclear Security Administration (NNSA) of the U.S. Department of Energy. The initiative is a key component of a layered, multi-agency approach designed to prevent terrorists from acquiring, smuggling and using dangerous nuclear materials to develop a weapon of mass destruction or a radiological dispersion device in an attack. To achieve its mission the Megaports Initiative works with partner countries to equip ports with state-of-the-art radiation detection equipment, sophisticated software packages and communications systems that operate in concert to indicate the presence of special nuclear material or other radioactive material in cargo containers as they move through a port. In total the NNSA identified 70 ports of interest in 35 countries, based on the volume of containers being handled and considering the regional threat. The Megaports Initiative is presently operational in following EU countries: Belgium, Greece, The Netherlands, Spain and the United Kingdom. Implementation is underway in Portugal and in additional ports in Belgium, and Spain. Figure below shows the different phases of the process in the Megaports Initiative and underlines the fact that both in-and outbound containers are screened on radiation.



The Phases of the Megaports Initiative

Container security initiative

In 2002 the Container Security Initiative (CSI) was implemented as an initiative to push port security back into the supply chain, to the port of origin. Thus, CSI proposes a security regime to ensure that all containers that pose a potential risk for terrorism are identified and inspected at foreign ports before they are placed on vessels destined for their origin. The mission is to target and pre-screen containers based on risk analysis, radiation scan and Non-Intrusive Inspection (NII) and to develop additional investigative leads related to the terrorist threats. Once high-risk containers are inspected at CSI ports, they are not ordinarily inspected again upon arrival. This means that containers inspected at CSI ports actually should move faster, more predictably and efficiently. In 2008 CSI was operational in 58 foreign ports and a total of 35 customs administrations had committed to join CSI. Some 86 % of all maritime containerized cargo is now covered by CSI.



An example of the implementation of CSI

Secure Freight Initiative (SFI)

The Secure Freight Initiative (SFI) is a part of the International Container Security scanning project. It is built on the model between that of the Container Security Initiative and the Megaports initiative. SFI expands the use of scanning and imaging equipment to examine more containers, not just those determined to be high risk. Launched in December 2006 it tested the feasibility of using integrated technology which includes radiation portal monitors, non-intrusive inspection equipment and optical character recognition.

International Ship and Port Facility Security (ISPS) Code

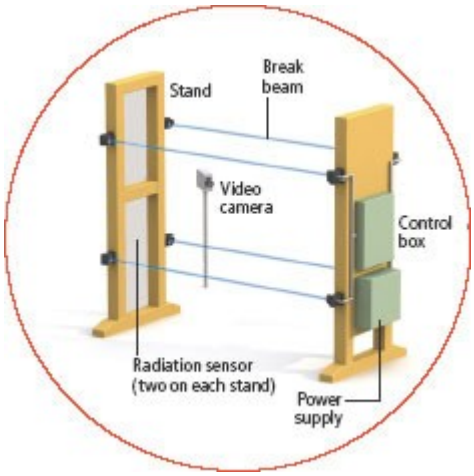
The Diplomatic Conference of the International Maritime Organisation in December 2002 amended the SOLAS (Safety of Life at Sea) Convention 1974/1988 on minimum security arrangements for ships, ports and government agencies and established the International Ship and Port Facility Security Code (ISPS Code). The measures agreed under the Code came into force on 1st July 2004 and prescribe responsibilities of governments, shipping companies, shipboard personnel and port/facility personnel to detect security threats and take preventive measures against security incidents affecting ships or port facilities used in international trade. The requirements for ships and for port facilities include the monitoring and controlling of access, the monitoring of the activities of people and cargo and ensuring that security communications are readily available.

Additional measures to ensure 100% scanning of containers

It can be deduced that all containers must be screened and scanned in three ways: by non-intrusive inspection (NII) equipment (X-ray or Gamma ray), by radiation detection equipment and by Optical Character Reading.

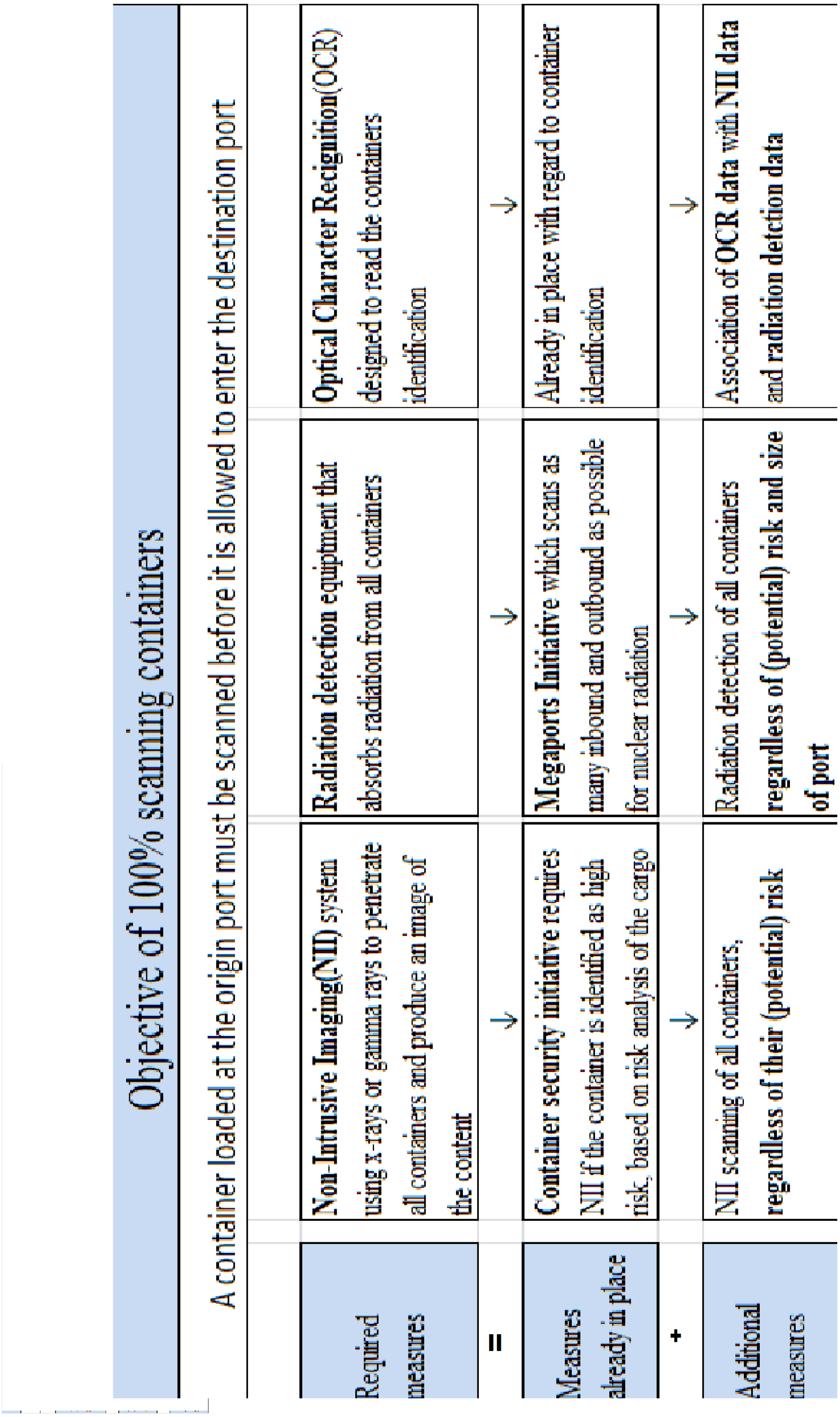
When considering the measures already in place, Non-Intrusive Inspection is carried out under the Container Security Initiative, based on risk analysis of the container's manifest information, if identified as high risk. Where the Megaports Initiative is in place, the intention is to screen as many inbound and outbound containers as is possible.

The 100% screening and scanning obligation of containers implies the deployment of radiation and Non-Intrusive Inspection scanners. The radiation scanners are of the portal monitor type or can be hand-held detection devices. In the case where ports participate in the Megaports Initiative the radiation scanners are provided by the Department of Energy/NNSA. One of the key problems with the current generation of radiation detection equipment that must be resolved urgently is the need for this equipment to detect shielded radiation (i.e. to detect dirty bombs and nuclear material in containers that is transported in special containments with a certain thickness of steel which are shielding the radiating substances completely).



Portal type radiation scanner installed at ports

Hand-held type radiation scanners



Objective of 100% scanning containers

A container loaded at the origin port must be scanned before it is allowed to enter the destination port

Required measures	**Non-Intrusive Imaging(NII)** system using x-rays or gamma rays to penetrate all containers and produce an image of the content	**Radiation detection** equipment that absorbs radiation from all containers	**Optical Character Recignition(OCR)** designed to read the containers identification
=	↓	↓	↓
Measures already in place	**Container security initiative** requires NII if the container is identified as high risk, based on risk analysis of the cargo	**Megaports Initiative** which scans as many inbound and outbound as possible for nuclear radiation	Already in place with regard to container identification
+	↓	↓	↓
Additional measures	NII scanning of all containers; **regardless of their (potential) risk**	Radiation detection of all containers **regardless of (potential) risk and size of port**	Association of **OCR** data with **NII data** and **radiation detction data**

Chart diagram showing the additional measures that need to be implemented in various ports around the world

Impacts of implementing 100% scanning in ports

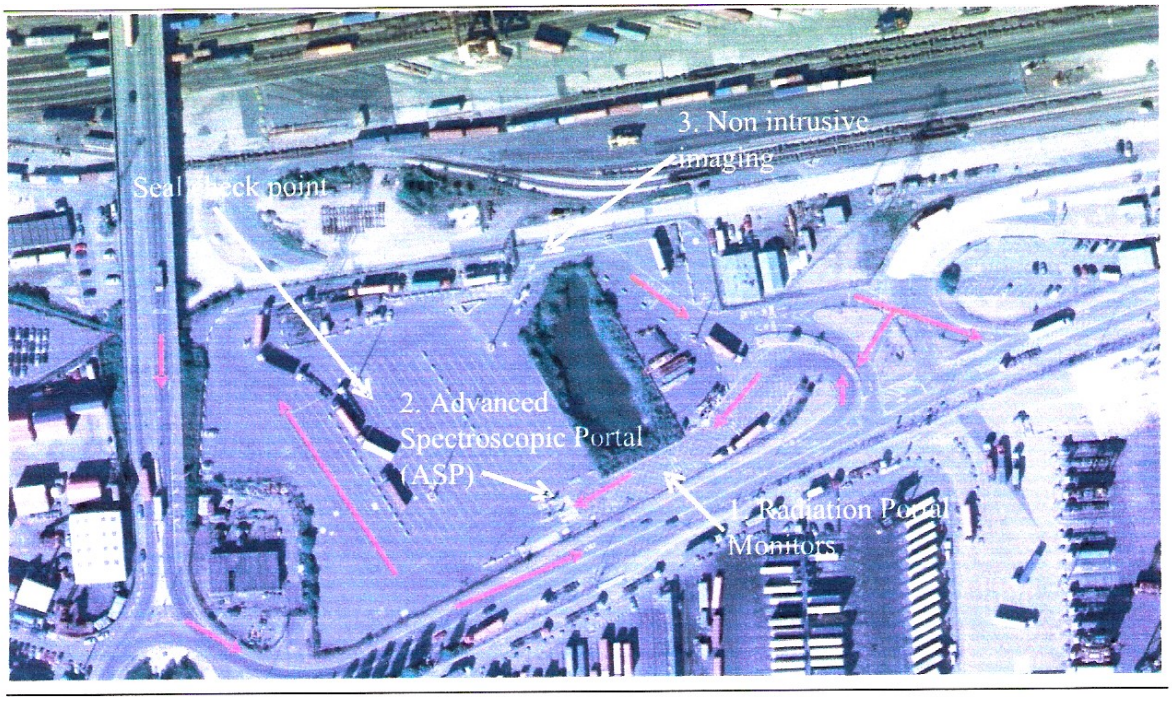
This study on the impact of implementing the 100% scanning rule on port and terminal operations and on hinterland transport has revealed the impossibility to come with a uniform assessment of general validity for all ports. The potential impact of scanning all containers is to a very large extent decided by local conditions such as:

- the lay-out of the port and container terminal;
- the split between the various transport modes from the hinterland to the port;
- the number, profile and location of the road and rail accesses to the port;
- the volume of containers handled;
- the prevailing liability regime and labour laws.

As an example, according to the experimental project conducted at the port of Southampton, England in an attempt to implement 100% scanning of all containers dispatched from the port, bound for the United States of America, the following conclusions were drawn:

- scanning of U.S.-bound containers is presently only possible on a limited scale, based on a risk-analysis;
- the installation of (extra) scanning equipment could be difficult to achieve due to the inherent space constraints in ports and on terminals;
- 100% scanning of feeder and barge traffic will be a major challenge; also scanning of containers delivered by rail could pose problems;
- if scanning takes place outside the terminal, 100% scanning of U.S.-bound containers will require additional movements for the transfer of containers from the terminal to the scanning site and vice versa, which could result in inflated transfer costs;

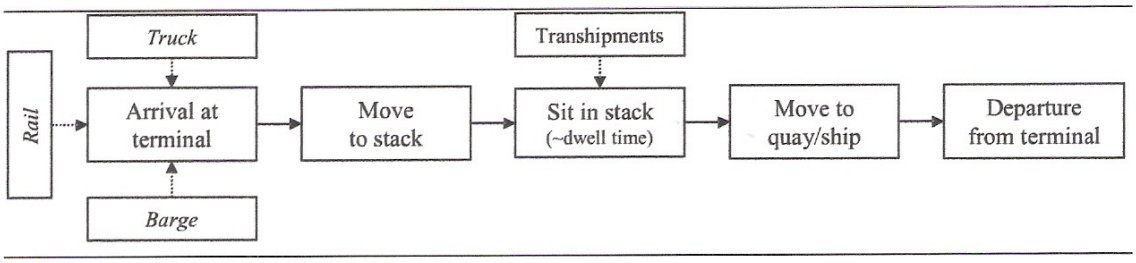
- if scanning takes place at the terminal gate or on the terminal, valuable terminal area will be taken up which in turn will reduce the terminal's throughput capacity;
- scanning at extended gateways is an alternative that could be considered for barge and rail traffic, but operational and legal questions would then arise regarding the container's integrity;
- because some European ports facing inherent congestion problems, particularly regarding their road accesses, the situation would significantly be worsened by the full application of the 100% scanning rule.



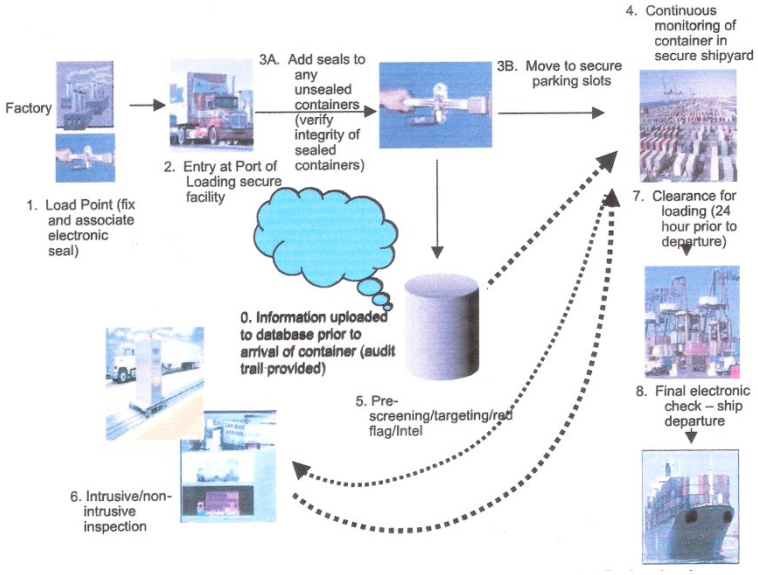
Google earth image of the port of Southampton, where the experimental project was implemented

Additional impacts

Scanning of containers in ports, regardless of their destination is bound to create disruptions to the supply chain. The main challenge when implementing 100% scanning in ports is to minimize the consequences of such disruptions. Their consequences can be significant and are much influenced by factors such as the location, the size and the lay-out of the port and of the terminals. To allow for a better appreciation of the significance of these three factors, it is useful to consider first the typical container flow through a terminal when no scanning is required. Figure below illustrates the various phases of such a flow through a container terminal which is being served by all three modes of inland transport. This flow chart would remain valid with the implementation of the 100% scanning, but a number of additions and supplementary steps would be required. What these are, where and when they take place very much depends on the lay-out of the port and its terminals.



Phases of the flow of the container in a port



An example of the 100% scanning model implemented

Three major and interrelated questions arise regarding the implementation of 100 % scanning :

- Which authority will be responsible for the scanning?
- Which parties will make the necessary investments needed to allow for 100% scanning?
- Where will the scanning and possibly the tertiary inspection of the containers physically take place?

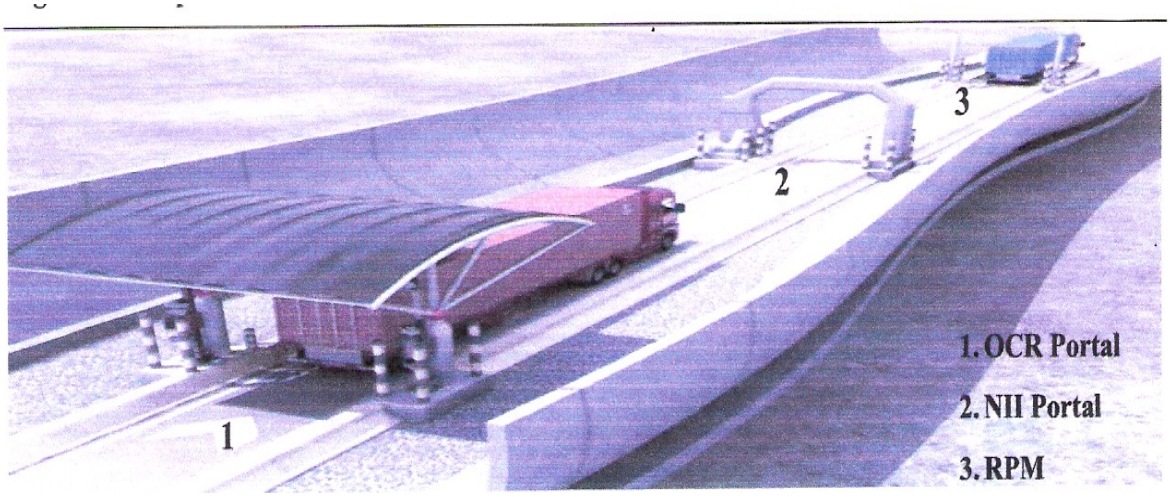
The Authority that should logically be responsible for the scanning can be expected to be a public authority because 100% scanning is basically a security-related and non-commercial issue specifically targeting exports. Thus, the most obvious party to be made responsible for the scanning of all containers at the port of loading would be the national Customs of the exporting country. The activity could be sub-contracted to a specialized operator but would anyway remain under the full supervision of the Customs. It is probable though, that most governments will prefer their own Customs personnel to be fully in charge of the scanning and of all the physical and documentary tasks. If the answer to the first question is that the national customs authorities will be in charge, then it would seem natural to expect them also to invest in the required infrastructure, equipment, I.T. hardware and software. In the real world, this question may receive a somewhat more complex and qualified answer. For example the infrastructure could be provided either by the Port Authority or the Terminal Operator. The I.T. hardware and software would no doubt have to be acquired by the party that is made responsible on the national level for carrying out the scanning.

The answers to the first two questions will help to give the appropriate answer to the third question regarding the physical location of the scanners. Possible scanning sites are:

- Outside the port gates on a specially developed area;

- At the port's gate(s) which need to be suitably laid-out and equipped with sufficient scanners to avoid queuing and long truck waiting times;
- On a specially developed area inside the port but outside the container terminal;
- At the terminal gate(s) which need to be properly modified and extended to avoid queuing and long truck waiting times ;
- Inside the terminal on a specially reserved and developed site.

A factor that will play a significant role in the choice of location for the scanning equipment is the availability of the necessary space needed for such scanning facilities. This raises the more general question of space availability in the port area in general and on container terminals in particular.



An example of the scanning lane to be implemented in ports

THE ECONOMIC COST IMPACT OF 100% SCANNING

The imposition of 100% scanning carries economic cost consequences. These are of two types. First there is the direct transport related costs which is ultimately borne by the consumer. Secondly, there are the indirect costs resulting from the less than optimal functioning of the supply chain (delays, congestion, claims and poorer resource utilization resulting in capacity loss) and which will burden national economies and make the supply chain less robust and reliable.

THE DIRECT TRANSPORT COSTS OF 100% SCANNING

The elements that are included in the direct transport costs for a shipment of a container from point of origin to point of destination are determined by a set of factors. The most obvious of these are the distance to be covered by both maritime and inland transport means, the choice of inland transport mode, the applicable and applied tariffs and the specific requirements of shippers and receivers.

Moreover, the nominal and relative cost of each individual cost element incurred in the supply chain tends to fluctuate over time and varies significantly from service provider to service provider, from transport mode to transport mode, from port to port and from terminal operator to terminal operator.

Expenses	Cost (USD)
Scanning equipment	$380 million
Port infrastructure upgrades	$204 million
Additional staff & operations	$245 million
Total	**$829 million**

Approximate cost analysis to implement 100% scanning of containers

INDIRECT ECONOMIC COSTS

These are often hidden and hence far more difficult to identify and quantify. The supply chain can be expected to be hampered in various ways by the introduction of 100% scanning and each of these impediments would generate indirect economic costs. The more apparent and significant of these would be the following:

- A reduction of the handling capacity of the container terminals as a consequence of increased container dwell times;
- An increase in the turnaround time of the inland transport means (trucks, trains, barges) delivering containers to the port terminals;
- An increase of the external costs consequential to a shift from rail and barge to truck mode;
- An increased cargo inventory cost as a consequence of the extended transit times of the goods.

A major aspect attributed to the indirect cost of the implementation of 100% scanning of containers is the dwell time of the containers in the container terminals

Additional measures to ensure security of containers

"Smart-Box" Container Security Device (CSD)

It detects the opening and closing of the container door and registers an alarm if the door is opened while the device is armed. It may also capable of storing Bill of Lading, Seal ID and Container ID data.

- Affixed to the container with a magnet
- Easily affixed and removed – no tools

Device is easily attached to the door of the container

Electronic seals for containers

The electronic seals as shown below are highly durable and trigger an alarm at the alarm unit if the seal is tampered with.

Electronic Seal

Radio Frequency Identification(RFID)

The position of the container can be easily tracked anywhere in the world with the help of this device installed on the container. This helps to reduce the risk of theft of the containers and the chances of the containers going missing.

RFID tags attached to containers for easy identification

Shared Intermodal Container Information System(SICIS)

The different modes of integration under the SICIS model

The core element of the programme is a data exchange platform, which is designed to "allow authorised companies and authorities to access planning and status information about selected (container) transports". Specifically, the system is designed to match logistics data with security information – for example, from electronic seals, CSDs (container security devices) and scanning equipment.

Conclusion

The imposition of 100 % scanning is considered a major restraint on international trade mainly due to the high economic costs involved and also due to the additional administrative requirements. The imposition of the 100% scanning rule on ports and terminals depends to a large extent on the specific lay-out of a given port and or a given terminal and on the particular conditions prevailing there. At some ports and terminals the implementation of 100% scanning will not unduly upset the operations, whilst at others it may be

completely unworkable and highly detrimental to the functioning of the facilities. The implementation of 100% scanning is accompanied by direct costs, which are borne by the end user and the indirect cost which result due to the improper implementation of the system. Thus, proving that 100% scanning of containers is not feasible at every port in the world, but can be implemented at select ports in the world where the government is concerned about the security of the nation. If such strict scanning can be carried out at every airport in the world, it can easily be implemented at every port for every container.

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