Thwarting Nuclear Terrorism Through Container Inspections

By Nitin Bakshi, Stephen Flynn, and Noah Gans★

Each year, ocean-going vessels transport millions of shipping containers to the United States. These containers provide terrorists with a potentially attractive way to hide a nuclear device destined for U.S. shores. The successful smuggling and detonation of such a device would be disastrous. In addition to lives lost, the detonation of a nuclear device in a port could lead to losses in the range of $55-$220 billion. Even if it were not detonated, the successful smuggling of a nuclear device into a U.S. port has the potential to disrupt global supply chains: anxiety that other containers may contain nuclear devices would result in stepped-up inspections that would cause congestion throughout the global intermodal transportation system.

U.S. Security Initiatives in Place at International Ports

To counter this threat of nuclear terrorism, the United States has initiated various security measures at both domestic and foreign ports. Two important security measures implemented at international ports, the Container Security Initiative (CSI) and the Secure Freight Initiative (SFI), seek to detect the presence of nuclear devices in shipping containers at overseas ports, *before* such containers are loaded onto a vessel bound for the U.S.

CSI, a program administered by U.S. Customs and Border Protection (CBP), uses an automated targeting system that employs rules-based software to identify containers that are at risk of being tampered with by terrorists. A key input to this system is the container's shipping manifest, which contains information about the container's sender, recipient, and contents. CBP mandates that an ocean carrier transporting a container to the U.S. provide manifest information to CSI officials at least 24 hours prior to the container's lading onto a vessel that will call on a U.S. port. Manifests and other data are analyzed at CBP's National Targeting Center in Arlington, Virginia, and containers that are identified as suspect are flagged to be inspected by the local customs authority at the port of origin before they are shipped to U.S. ports. These customs officials typically use gamma or high-energy x-ray radiography and either hand-held mobile or stationary radiation detection technology to screen the high-risk containers and ensure that they do not contain a nuclear weapon or radiation dispersal device.

SFI is a joint initiative of CBP, the U.S. Department of Energy, and the U.S. Department of State. Its purpose is to leverage learning from other port security initiatives, such as Operation Safe Commerce, and to serve as a pilot for a system that might be capable of scanning 100 percent of U.S.-bound containers. Under SFI, all U.S.-bound containers arriving at participating overseas seaports are scanned with both non-intrusive radiographic imaging and passive radiation detection equipment placed at terminal entrance gates. Optical character recognition is used to identify containers and classify them by destination. Sensor and image data gathered through this primary inspection is then transmitted in near real time to the National Targeting Center in Virginia. There, CBP officials incorporate these data into their overall scoring of the risk posed by containers and target high-risk containers for further scrutiny overseas. Any container that triggers an alarm during primary inspection is automatically deemed to be high-risk and undergoes a more sensitive inspection.

One-Hundred Percent Scanning Requirement

A 2007 U.S. law, "Implementing Recommendations of the 9/11 Commission Act of 2007," popularly called the 9/11 Commission Act, requires that before *any* cargo bound for the United States is loaded onto a ship at an international port, it must be scanned to detect radiological contraband. The deadline for compliance with this law is July 1, 2012, unless the Secretary of Homeland Security grants an extension, which can be offered in two-year increments. This law is a significant deviation from CBP's CSI approach of scanning only cargo it identifies as being high-risk, and the operational feasibility of 100 percent scanning has been questioned by a wide range of participants in the maritime supply chain: CBP and European customs officials, trade associations such as the U.S. Chamber of Commerce and the National Association of Manufacturers, and corporate leaders. The most commonly expressed concern is that this security requirement will generate congestion that will increase the cost of doing business and hurt commerce. In the face of this resistance to the legislative protocol, DHS Secretary Janet Napolitano has already indicated that she intends to grant a two-year extension.

Benefits and Costs of 100 Percent Scanning

An obvious goal of 100 percent container scanning is to detect and neutralize any nuclear weapons and to curb the illegal movement of radiological material. A stringent security regime also serves to deter terrorists from attempting to infiltrate the maritime supply chain in the first place. A less obvious benefit is

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associated with disaster recovery. In the event that an unfortunate event were to occur, it would be imperative to identify the stage in the global supply chain at which the security breach occurred in order to contain losses and resume port operations quickly. The images and scan information gathered through 100 percent scanning would provide vital information to facilitate this task.

At the same time, there are three broad ways in which the 100 percent scanning requirement may be detrimental to trade. First, if there is limited scanning and radiation detection capacity, then delays resulting from waiting in inspection queues could require containers to sit idle at ports. Second, even with adequate equipment, the scheme could generate more alarms than there is human inspection capacity to resolve, and the result would again be delays as containers wait in inspection queues. Finally, the diversion of containers from their usual movements within terminals to a centrally managed government inspection facility has the potential to engender significant terminal congestion. No matter what the source of the problem, these extra delays would lead to increases in transportation lead times, higher inventory levels in supply chains, and ultimately higher costs for consumers.

Evaluating the Impact of 100 Percent Scanning on Terminal Operations

Given the economic importance of maritime trade, a rigorous quantitative analysis of the impact of 100 percent scanning on container terminal operations is critical for policy makers, as well as for companies with an economic interest in the efficient movement of containers within the international supply chain. Our 2011 *Management Science* article, "Estimating the Operational Impact of Container Inspections at International Ports," reports the results of just such an analysis.

Our study is based on detailed data on the movement of individual containers, collected from two of the world's largest international container terminals. Among other features, these datasets mark the entry and exit times of every container passing through each of the terminals over the course of one month, along with an indication of whether or not the container is bound for the U.S. The database includes records for more than 900,000 containers.

We use these historical records as the basis for a simulation analysis that estimates the effect of a number of inspection protocols on terminal operations. The simulations provide us with insights into the impact each protocol may have on three key attributes of the inspection schemes: the transit delays that would be incurred by inspected containers, the additional real estate the terminals would need to stage in-process containers, and the average handling cost per container.

Results and Implications

Our simulation results suggest that a variant of the SFI inspection scheme, that we refer to as an "Industry-Centric" inspection scheme, is capable of being scaled up to satisfy the scanning and radiation detection requirement mandated by the 2007 U.S. law. Its use of rapid screening by relatively low-cost drive-through portals allows it to handle 100 percent of *all* container traffic—bound for the U.S., as well as other destinations—on a cost-effective basis. In turn, the relatively small percentage of containers that fail this rapid primary inspection can be scanned in a cost-effective manner by more sensitive drive-through equipment. In contrast, the current CSI protocol would face significant hurdles were it to be scaled up to scan more than a small fraction of U.S.-bound container traffic.

The economy and robustness with which the Industry-Centric scheme operates follows, in large measure, from the type of equipment used. The current CSI protocol relies on highly sensitive high-energy x-ray radiography to scan containers that are thought to pose a potential threat. This is a time-consuming procedure. In contrast, the Industry-Centric inspection scheme performs a rapid initial scan of 100 percent of inbound traffic with lower-cost drive-through radiation and medium-energy x-ray radiographic portals. While this equipment is less sensitive than that used under CSI, it is precise enough to verify the safety of the vast majority of containers, thereby reducing the demand on more sensitive inspection equipment. Our simulation results clearly imply that the equipment and inspection protocol used in the Industry-Centric scheme are relevant in guiding the choice of the appropriate inspection regime for international ports.

Furthermore, a qualitative analysis of the two schemes' logistical requirements also suggests that disruptions to terminal operations would be much more severe under CSI than the Industry-Centric approach. Under the CSI scheme, containers targeted for inspection must be pulled from a terminal's storage stacks only hours before the time at which they normally would be retrieved for their vessel loadings. This disrupts the highly optimized sequence in which terminals order yard crane movements within the stacks. Under the Industry-Centric scheme, in contrast, targeted containers undergo inspection upon arrival at the terminal before they are placed in the stacks. Thus, the Industry-Centric inspection regime avoids the disruptions and delays that would follow from the early removal of even a small fraction of containers from the terminal's stacks.