

TESTIMONY  
CALIFORNIA STATE ASSEMBLY  
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Good morning, Assembly Member Karnette, and the Members of the Assembly Select Committee on Ports. I am honored to appear before you today.

I am the Paul E. Holden Professor of Management Science at the Graduate School of Business, Stanford University. Since September 11, 2001, I have used mathematics to analyze a variety of homeland security problems in bioterrorism (effective responses to terrorist attacks using smallpox, anthrax or botulinum toxin) and in border security (identifying ways to improve the biometric aspects of the US-VISIT Program and the detention and removal operations of the Bureau of Immigration and Customs Enforcement). These analyses have led to policy recommendations, several of which the U.S. Government have adopted.

Today, I am here to discuss the results of two port security studies conducted with Stephen Flynn from the Council on Foreign Relations and three Ph.D. students at Stanford University, Alex Wilkins, Manas Baveja and Zheng Cao. The detonation of a nuclear weapon on U.S. soil is the most feared type of terrorist attack. With aggressive post-9/11 engagement strategies over U.S. airspace in place, and the difficulty of traversing the Atlantic or Pacific Oceans in a pleasure or fishing vessel in an undetected fashion, the most obvious vehicle for smuggling a nuclear weapon into the U.S. is the maritime shipping container industry. This avenue appears to be quite vulnerable, as evidenced by two successful attempts by an ABC investigative news team to smuggle depleted uranium, which should be easier to detect than highly enriched uranium, into the country in 40-foot containers.

I will discuss two issues. First, I will outline the type of layered security system that I think is needed to secure our ports, and what the State of California can do to enhance the nation's security in this regard. Second, I will offer my frank assessment of the detection capabilities of the equipment deployed at ports.

On the surface, a multi-layered security system appears to be in place. The Customs-Trade Partnership Against Terrorism (C-TPAT) program allows shippers satisfying certain security standards to gain status as a certified shipper. Mechanical seals are placed on containers. Custom and Border Protection's Automated Targeting System (ATS) identifies suspicious containers at overseas ports, based on manifest and customs entry documents and intelligence information. At overseas and domestic ports, sensors measure neutron and gamma ray emissions as containers pass through portals, and imaging

equipment take scans of container contents to look for heavy material that shields the emissions. And Customs inspectors can open a container and inspect its contents.

However, when one scratches below this surface, the security system is not all that it seems. The C-TPAT program is essentially a self-certification program, and there are not sufficient resources to process the applications, let alone monitor or enforce the standards. Mechanical seals can be defeated within several minutes. Manifest information fed into the ATS can be changed up to 60 days after the container enters the U.S. The ATS flags approximately 6% of containers, and most ports barely have the inspection resources to test these containers, giving nearly all of the remaining 94% of containers a free ride through the inspection process after clearing the ATS. Given our yield rate in the war on drugs, the sophistication and patience of Al Qaeda's 9/11 operations, and the lax security of the foreign short-haul trucking industry, it would be foolhardy to presume that a terrorist cell posing as a legal shipping company or a terrorist truck driver hauling goods of a well-known shipper could not successfully bypass the ATS.

But this is precisely the approach that Customs and Border Protection (CBP) has taken: they have put all their eggs in one basket, thereby reducing a multi-layer security system into a one-layer system. Even if a new Manhattan project developed the perfect nuclear detection equipment, if it was only used to inspect the 5% of containers that CBP thinks pose the greatest threat, then our ports would not be much safer. So my first main point is that the current bottleneck that prevents improvement in this system lies not in unsatisfactory radiation detection by the portal monitors, but in CBP's excessive reliance on the ATS. In other words, the way forward is to inspect containers that are not deemed risky. Fortunately, this can be done: results from a pilot project sponsored by the Container Terminal Operators Association (CTOA) of Hong Kong has shown that 100% of containers can pass through a radiation portal monitor and a gamma ray imaging system without increasing port congestion.

However, this is not enough. To deter terrorists, who will be reluctant to put their precious nuclear material "in the mail" if there is a nontrivial chance of getting caught, we need to analyze the scan and do follow-up inspections of any suspicious results, of a nontrivial fraction of trusted containers, e.g., 20-30%, so that a five-fold increase in downstream testing resources would be required. That is, we put 100% of containers through radiation portal monitors, and all ATS-flagged containers, all containers that have suspicious radiation results, and 20% of trusted containers also have their gamma-ray scans analyzed. In addition, suspicious scans need to be further investigated, which may require manually opening up containers.

Now, ideally, all of this testing should be done in Hong Kong and Singapore, well before the container arrives to Long Beach. Terrorists can use Radio Shack-level technology to remotely detonate a container once it gets to Long Beach. However, given that the Federal Government has dragged their feet on this critical issue for four and one-half years, and has failed to embrace promising private-sector initiatives such as the Hong Kong CTOA project, I believe it is time for the State of California, as it has done on automobile emissions and stem cells, to take the lead on this issue. The ports of Long

Beach, LA and Oakland, along with Seattle, are the last line of defense for preventing a nuclear weapon from being smuggled into our country from the Asia-Pacific region. We would not only be making the rest of the nation safer, but we would be helping ourselves: as we learned from Hurricane Katrina, the Federal Government will not necessarily be there to clean up any catastrophes, such as a nuclear bomb going off in a port, that are inflicted upon us, and the most prudent approach is to do what we can to prevent this from happening.

The cost of inspecting a container has been estimated to be in the range of \$6-\$25, which is dwarfed by the average trans-Pacific voyage cost of \$1850, and is significantly less than the cost-differential of shipping through Seattle rather than Long Beach. I do not think that charging a modest fee to partially offset this cost would have deleterious economic consequences. In addition, it would be in the US's best interests to agree to inspect all outgoing containers if other countries request us to do so. This would level the playing field and should not be very costly because many of these containers are empty.

Now I will turn to my assessment of the detection technology. Radiation portal monitors measure neutrons and gamma rays. Uranium and plutonium, which are the two possible sources for a nuclear weapon, emit both neutrons and gamma rays, and are among the only substances that emit neutrons. Hence, there are very few nuisance alarms related to neutrons. Current systems can detect the neutrons in unshielded or moderately-shielded plutonium, but are incapable of detecting neutrons in unshielded highly-enriched uranium.

In contrast, radiological dispersion devices, so-called dirty bombs, along with many other legal items (e.g., kitty litter, ceramic tiles, bananas) emit gamma rays. Currently-deployed technologies aggregate gamma emissions rather than look at the emissions along the entire energy spectrum, leading to a very high nuisance alarm rate. Within the next several years, there should be spectroscopic gamma-ray detectors that are capable of looking at the entire energy spectrum. This should not only greatly reduce the number of nuisance alarms by being able to distinguish between cesium and ceramic tiles, but might also be able to detect the unique signature emitted from former Soviet nuclear warheads containing Uranium 232 from reprocessed reactor fuel.

The effectiveness of radiography machines, which take a two-dimensional scan of the contents of a container, is highly-dependent on the people analyzing the scans. The Department of Homeland Security has yet to apply basic principles of quality management to this process: they discard old scans rather than building a database of scans that could enable process improvement, learning and training. Moreover, for security reasons the Department of Energy refuses to tell Customs inspectors what a nuclear weapon looks like, and so the inspectors are essentially running blind.

In conclusion, the performance of radiation portal monitors depends critically on how they are operated within the context of an entire layered testing system. This technology will offer almost no security if we continue to test only containers that CBP thinks pose a threat. The Hong Kong pilot project shows that 100% of containers can pass through a

radiation portal monitor and submit to a gamma-ray scan without affecting port congestion. A nontrivial but modest fraction of these scans needs to be analyzed to provide a credible deterrent to terrorists. If the Federal Government continues to flounder on port security, the State of California is in a unique situation to improve national security by testing incoming containers for radiation emissions and heavy shielding. Although current radiation portal monitors can only reliably detect moderately-shielded plutonium, the next generation of detectors should be able to detect dirty bombs and depleted uranium.

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