USC University of Southern California

USC Viterbi
School of Engineering

ADMISSION | STUDENTS | ALUMNI & PARENTS | ACADEMICS | INNOVATION | RESEARCH | OUTREACH | GIVING | ABOUT | NEWS | ENGINEERING+
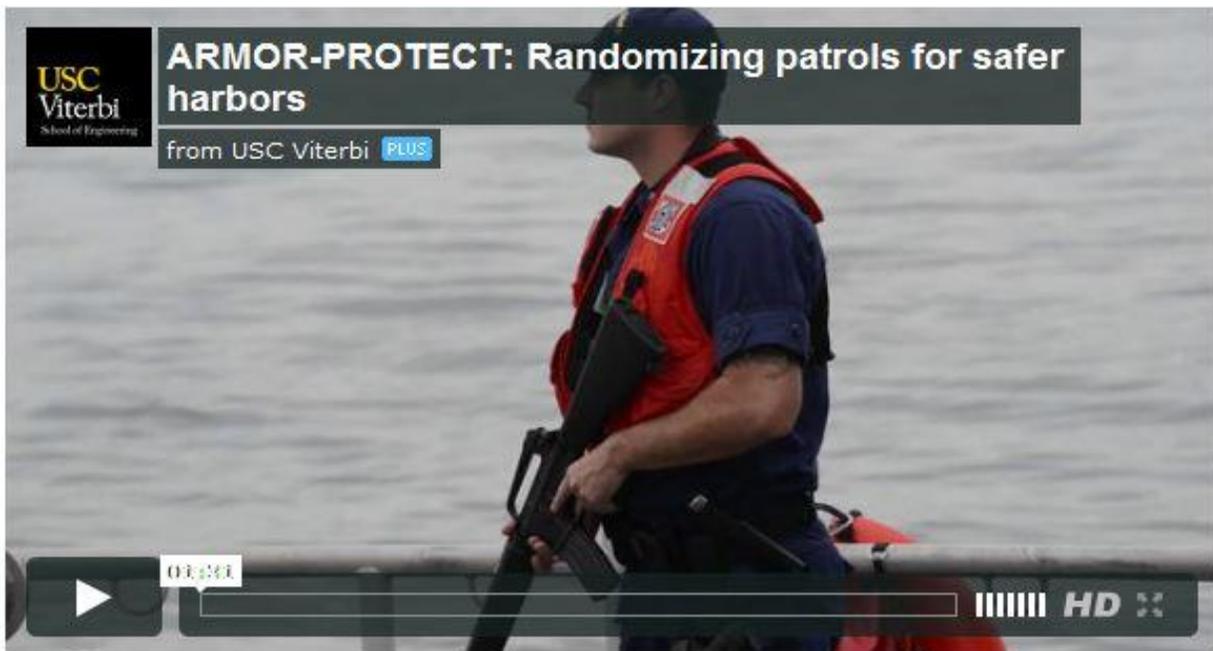
A SAFE HARBOR

A Software Program Created by USC Viterbi Computer Scientist Milind Tambe Protects U.S. Ports from Terrorists

BY MARC BALLON
February 27, 2013 —

[ARMOR-PROTECT: Randomizing patrols for safer harbors](#) from [USC Viterbi](#) on [Vimeo](#).

Scene: Dining alone at a popular bistro at the end of a pier, a nondescript man takes in the glorious Southern California sunshine, the comings and goings of ships, and ocean views that stretch forever. He spends this and other days sipping white wine, sampling hors d'oeuvres and writing on his iPad.

The young man, appearances notwithstanding, is anything but a typical 30-something with time on his hands. Instead, he is an American member of a terrorist organization, casing the area to identify potential vulnerabilities in the port's security network. His mission: to wreak as much havoc as possible.

The militant's surveillance uncovers that the Coast Guard only conducts patrols in the area Tuesdays and Fridays between 11 a.m. and 2:30 p.m., with random ship inspections taking place Sunday afternoons.

A Coast Guard boat on patrol

Armed with that information, the operative and two associates board a small boat early one Saturday morning and make their way to the ferry terminal. They time their arrival to coincide with the departure of a particularly crowded ferry to Catalina Island. Pulling up alongside the boat, the terrorists detonate an improvised explosive device, or IED. Chaos and pandemonium ensue.

Such a catastrophic scenario keeps presidents up at night. That's why USC Viterbi computer scientist and CREATE researcher Milind Tambe and his team designed the ARMOR-PROTECT system, which aims to greatly increase port security. Over the past two years, the ports of Boston and New York have employed the system, which uses algorithms to randomize Coast Guard patrols to confuse would-be terrorists and make it impossible to identify exploitable patterns. In early February, the ARMOR-PROTECT system was introduced at the ports of Los Angeles and Long Beach, which together rank No. 8 in the world by container traffic.

"Coast Guard men and women work throughout the ports performing maritime safety and security, law enforcement, emergency response, environmental protection and regulatory duties," said Capt. Jim Jenkins, commander of Sector Los Angeles - Long Beach. "With these tremendous responsibilities, we welcome the PROTECT model, which is designed to better optimize the use of Coast Guard and partner resources, thereby, strengthening our overall security operations."

The Coast Guard is currently vetting the software program with the hope of eventually rolling it out nationally, said Craig Baldwin, the Coast Guard's program manager for ARMOR-PROTECT. The U.S. has 361 ports.

Milind Tambe's ARMOR-PROTECT software system makes U.S. ports safer

The ARMOR-PROTECT software creates "intelligently" randomized schedules for Coast Guard patrols with complex algorithms. Randomization optimizes the use of limited security patrols by making it impossible for would-be attackers to determine when a particular target will be protected. Intelligent randomization, a core ARMOR-PROTECT feature, means that software programs ensure that ferry terminals, crowded piers, bridges and other high value targets are visited more often.

Tambe's research is rooted in mathematical game theory, which tries to predict how conflict might play out between adversaries. According to the Bavesian Stackelberg game theory, the offense, in this instance the bad guys, observes the defense, or the Coast Guard, to identify and exploit any possible security weaknesses. ARMOR-PROTECT's rigorous game-theoretic modeling and algorithms stymie militants by creating randomized schedules with no discernible patrol patterns.

Lt. Garrett Meyer of the US Coast Guard in Boston says ARMOR-PROTECT "makes us safer."

Tambe got into the security field almost by accident. In the early 2000s, he and a graduate student began working on a game-theory algorithm to optimize interactions between robots. They found that randomized interactions were the most effective. "What do you do with this?" Tambe wondered.

A couple years later, he had an answer. At the inaugural meeting of CREATE, USC's national research counterterrorism center, Tambe heard a speaker discuss how militants could "use our highly functioning, on-time country against us." Intelligent randomization, he reasoned, could thwart them.

In 2007, Tambe and his team's research led to the implementation of ARMOR, a randomized scheduling of police checkpoints for the six inbound roads to LAX. The project's success led to the creation of the ARMOR-IRIS software system to randomize schedules for the Federal Air Marshalls. The Transportation Security Administration also has

deployed a Tambe-created system of intelligently randomized airport patrols, ARMOR-GUARDS, at an unidentified airport.

More recently, Tambe and his CREATE team worked with the Los Angeles County Sheriff and L.A. Metro system to create randomized police transit patrols to thwart fare evasion. Preliminary results suggest that deputies have nabbed an increasing number of fare jumpers. The plan is to extend Tambe's software on the rail system to deter crime and terrorism.

That's not all. A former Tambe graduate student is creating a software program based on his algorithms that randomizes train patrol schedules in Singapore. A colleague has adopted the technology to audit hospital records in Pittsburgh.

Future applications for Tambe's ever evolving game-theory algorithms are limited only by the imagination. For instance, he recently talked to World Bank officials about using his system to protect Laotian forests from poachers and thieves.

To commercialize the technology, Tambe and others launched in early February a new company named Armorway Inc. The firm will create new algorithms for randomized schedules for interested businesses. USC will receive an ownership stake and future royalties, says Isaac Maya, Armorway's senior vice president of business development and director of research at CREATE, where much future of the research will take place.

"This is technology that seems to be spreading out into many different areas," says Tambe, recipient of the 2012 Wagner Prize for ARMOR-PROTECT and the Columbus Foundation 2010 Homeland Security Award for Border and Transportation Security. "There are so many tremendous possibilities for this technology. It's really very exciting."

- See more at: http://viterbi.usc.edu/news/news/2013/a-safe-harbor.htm#sthash.EeZOsFP3.dpuf