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The Role of Persistent Surveillance in Securing the Homeland of Hawaii and the U.S.

Hawaii, the 50th state in the nation, maintains a unique heritage and history and a beauty that is unrivaled anywhere in the United States. However, what makes Hawaii unique in its beauty also makes it unique in its vulnerabilities to natural disasters and terrorist events. Hawaii maintains over 800 miles of unprotected coastline with no neighboring state to aid in defense. The task of the military, civil defense, and business to sustain its domain has been strained by its proportions. This conference and the role of persistent surveillance is providing hope to both the public and private sectors for safe and secure waters around the great state of Hawaii and the entire United States, thereby helping to secure the state's borders and trade. The Coast Guards will also benefit significantly from enhanced capabilities for search and rescue operations. Small satellite alternatives, over-the-horizon high frequency (HF) radar, and unmanned underwater vehicles are poised to provide the means by which the public and private sector may vastly increase their presence and effectiveness in securing the homeland. However, much work remains to be done and the needs of the military are not always properly synchronized with the abilities and the goals of the scientific community.

Persistent surveillance of the ocean surface, (presented by Dr. Scott Glenn of Rutgers, Dr. Pierre Flament of the University of Hawaii, and Captain David Swatland of

the 14th Coast Guard District) focused on HF radar technology. The presentation in this breakout session demonstrated possible uses, competing technology, the challenges, and made small mention of the developmental level achieved so far in this technology. HF radar uses radio waves and measures the backscatter and Doppler shift of the returned signal to determine the speed and direction of ocean currents. Multiple antennas work to precisely triangulate and confirm positions, velocity, and other details of these currents. This same technology can be used to find ships and low-flying aircraft, perhaps monitoring traffic entering and exiting a port or tracking that traffic as far out to sea as possible, as demonstrated by Dr. Flament.

CODAR, the particular type of HF radar employed by Dr. Glenn's Coastal Ocean Observation Lab, has been able to map ocean currents all along the east coast and could potentially provide for early warning from storms, efficient and easily tracking port and illicit traffic, and narrowing the search area of Coast Guard rescue patrols by accurately displaying up-to-date current mapping. Competing technologies such as microwave satellite radar, sky wave radar, and line-of-sight radar are too slow, too expensive, or too limited to be practically useful. The presence of HF radar stations or buoys requires a small power source (5-10 watts for 150-250km range), limited maintenance and technology, and an allowance for bandwidth from the FCC that will permit sufficient resolution and range without interfering with communications. However, getting sufficient bandwidth for maximum range and resolution requires frequency in megahertz range whereas voice transmits at 3 kilohertz, something that does not seem economically feasible, especially for the range at which the Coast Guard would like.

Captain Swatland's perspective on the challenges faced by the Coast Guard HF was most enlightening for the impact it would have for the future of HF radar in military and civil defense applications. Representing the 14th Coast Guard District, the biggest single district in their jurisdiction, he faces challenges with regard to a manned presence that protects key islands, states, and exclusive economic zones (EEZ) with the minimal physical presence. Key factors for which the Coast Guard is looking in the application of HF radar is detecting illegal fishing boats in the EEZ and in search and rescue operations. In meeting with officials in the civil defense capacity, focus remained on being able to properly survey Hawaii's unprotected coast to guard against illegal entry as well as early warning systems for natural disasters and environmental monitoring of Hawaii's ecosystem. A large focus for civil and military defense since 9/11 has been moving from a firefighter response to a police patrol mentality whereby persistent surveillance is crucial. However, at this stage, the user interface is lacking, integration of systems with current technology is an avenue that has not been considered, and coordinated technology within the Center for Island, Maritime & Extreme Environment Security has reached a stage where their various technological pursuits are being integrated as a "for sale package" to the biggest consumers—our state and national defenders. This technology does show great promise on its merits; low-cost, low-intrusion technology for all-purpose monitoring is the future 'border fence' for Hawaii and the U.S.

The advancements in persistent surveillance at the surface level are admirable, but it is also worth highlighting the advancements in the areas of satellite and underwater surveillance. Drs. Graber, Wright, and Velez-Reyes presented perspectives on maritime, extreme environment, and island surveillance using small satellite alternatives. Small

satellites could provide an inexpensive alternative to large, multimillion dollar satellites under the control of NASA or large corporations. Launching multiple satellites in the price range of ~$10M is more economical than one for many hundreds of millions of dollars. This multiple satellite advantage allows for greater coverage of the target area to provide updated data and can cover larger areas with direct imaging than can surface or underwater technologies. Graber's emphasis was on detection, identification, classification, and tracking of ships moving across the ocean. Synthetic Aperture Radar (SAR), presented by Dr. Graber would allow for day and night imaging and up to 1 meter resolution (sharp enough to identify ground targets). These satellites can aid at the level where HF radar loses resolution, range over the horizon and where underwater surveillance is distorted in near coastal waters — although the level of development has not seen integration of this technology to that benefit yet. This small satellite technology can cover areas every four hours with sixty minute delay from downlink to intelligence ready images. These satellites are also somewhat limited in their usage as their technology does not allow for a variety of unanticipated mission types. Ultimately, the ability to inexpensively put these satellites into space means their technological limitations are overshadowed by the possibility of the sheer number of 'eyes on target'. It is no wonder that during the conference, this type of surveillance generated the highest level of excitement among scientific and intelligence consumer communities.

Underwater surveillance focused hydrophone technology and unmanned underwater vehicles (UUV) from Dr. Nosal and Dr. Bruno, respectively. Hydrophone technology was presented primarily as a way to monitor the movement of aquatic life off the coast off Hawaii. Dr. Nosal also presented the challenges of near coastal water where

sounds waves reflect off the surface and bottom, distorting the 'image'. Dr. Bruno offered an insightful way to monitor port traffic and detect anomalies as small as a single diver with UUV's that follow automated paths through ports, taking advantage of currents for power and surfacing long enough to transmit data to surface stations for interpretation. Both technologies show promise for automated detection systems that require little or no human monitoring until an anomaly is flagged.

There is a true urgency on the part of the Department of Homeland Security, the Coast Guard, the military, civil defense, and even business community to arm themselves with the most up-to-date and effective technology in a package that is usable, cost effective, and sustainable. If there is one glaring oversight in the entire process, it is a scale of time. Scientific research takes twenty years or more to go from pencil and paper to installation on the Coast Guard cutter. Technology presented at the 2008 Asia-Pacific Homeland Security Summit & Exposition is not necessarily cutting edge in terms of its capabilities, but it attempts to bridge the gap between technology that is effective and cost efficient. On the other end of the spectrum, the consumers are starving for the technological capacity to attack their challenges of monitoring, detection, classification and threat assessment; however, there is no silver bullet. What made this conference so crucial was that it brings the develops and the consumers of this technology together in a way that allows them to directly communicate their wants, needs, and capabilities. Understanding the environmental effects in geographic areas as diverse as the Arctic Circle and the NW Hawaiian Islands is also a critical component of this effort. It is important for the consumers to understand what technology is available and the direction in which it is heading. However, it is equally important that the developers understand

the requirements and challenges of those charged with the defense of the American people. For our future security, it is crucial for these groups to come together to ask the tough questions and work at the personal level.