



NRL Press Release  
30-09r  
4/20/2009

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## NRL Scientists Demonstrate Emerging MCM Technologies in MIW Exercise CLEAR HORIZON 08



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Naval Research Laboratory scientists recently participated in mine warfare (MIW) exercise CLEAR HORIZON 08 in Chinhae, Republic of Korea (ROK). This was a joint exercise between U.S. Navy and ROK forces headed by Mine Countermeasures Division Eleven (MCMDIV ELEVEN) and by ROK Naval Mine Warfare Squadron, was conducted November 10-14, 2008. U.S. forces were commanded by Commodore MCMDIV ELEVEN, CDR Barry Bakos. The NRL researchers from the Marine Geosciences Division were Dr. L. Dale Bibee, Dr. Paul Elmore, and Mr. David Lalejini.

The goal of the exercise was to demonstrate the effectiveness of emerging mine countermeasures (MCM) technologies as a means to eliminate or minimize both MCM and naval oceanography capability gaps in conducting and supporting MIW operations. Scientists from the Naval Oceanographic Office (NAVOCEANO) and the Office of Naval Research (ONR) joined NRL scientists as civilian participants.

NRL's Mr. Lalejini, along with Mr. Marty Doody from NAVOCEANO, analyzed electro-optical motion imagery from a P-3C AIP aircraft. While on station, the aircrew successfully detected the surface contacts and provided them to the MCM Commander's (MCMC) Tactical Action Officer watch in real time. Unfortunately, a recorder system failure onboard did not allow for high resolution analysis of the images; however, NAVOCEANO and NRL analysts were able to download the lower resolution imagery that was recorded and fused it with satellite imagery, crew logs and voice reports to provide an annotated post mission product to the MCMC shortly after completion of the mission. This event successfully demonstrated the P-3C AIP's on-scene contributions to MCM Intelligence Surveillance and Reconnaissance (ISR) cueing, and imagery capabilities for post-mission ISR analysis and Intelligent Preparation of the Operational Environment (IPOE) production.

Drs. Bibee and Elmore demonstrated, for the first time, use of the UQN-4 Bottom Sediment Classifier (BSC) on USS *Patriot* (MCM 7) to provide input to the Mine Burial Expert System (MBES) for mine burial predictions. The MBES, developed by the Applied Physics Laboratory - Johns Hopkins University, ONR, and NRL, uses probabilities of environmental conditions, physics-based model training, and rules of statistics to determine burial probabilities for both impact burial and subsequent burial due to scour. Fifteen hours of UQN-4 survey data were collected in two exercise areas. These data were processed through the BSC and MBES to provide the MCMC and supporting units with predictions of likely burial, worst case burial, and the percentage of undetectable mines. This allowed MCM planners to quantifiably assess time and risk, fundamental elements in MCM planning doctrine. Results were provided in as little as 45 minutes after receiving the data. The exercise participation highlighted the BSC and MBES as

effective force multipliers in providing risk mitigation and mine clearance efficiency by using through-the-sensor capabilities integrated with emerging technology for rapid and actionable IPOE, i.e., UQN 4/BSC provided on-scene environmental knowledge translated by MBES into burial predictions that led to selection of optimal routes and shortened clearance timelines, cutting clearance time in half for one operational area in accordance with MCM doctrine.

In addition to MCMDIV ELEVEN and USS *Patriot*, other participating U.S. Navy units included Helicopter Mine Countermeasures Squadron 14 Detachment One and the Naval Oceanography Mine Warfare Center (NOMWC). NOMWC, augmented by ONR vehicles and technical representatives, brought four unmanned underwater vehicles and two NAVOCEANO SLOCUM gliders. NOMWC successfully demonstrated that they added significant confined water characterization and mine detection and classification capabilities in the Mine Threat Area, critical to MCM planning and operations in the challenging and confined waters of Korean Ports. Korean units participating included the ROK Naval Mine Warfare Squadron and six Mine Counter Measures and Mine Hunting ships.

CLEAR HORIZON 08 provided both U.S. and ROK forces a chance to enhance interoperability for the defense of the ROK and provided both nations with exposure to new MCM technologies. Commodore Bakos was very pleased with these results; in his words for participating scientists, "Your efforts were critical in integrating cutting edge technology that has the potential to significantly reduce MIW timelines and risk as well as increase our overall MIW effectiveness. We look forward to your increased future exercise participation."