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Compact Radar at Empire Challenge 2011

by John T. Clark

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14. ABSTRACT
An exercise requiring the surveillance of a littoral scene was executed in May 2011 at Camp Lejeune, NC. Many unattended ground sensors (UGS) were deployed. Among these UGSs was the Compact Radar, which provided real-time streaming of target track data. This report describes the events surrounding the Compact Radar's emplacement and the results of this exercise.

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1. Introduction

The Compact Radar was tasked to provide littoral surveillance of dock areas at Camp Lejeune, NC, during the Empire Challenge 2011 exercise. The purpose was to cue other surveillance systems to provide intelligence products regarding covert and/or illicit activities involving watercraft approaching the area, and shore personnel rendezvousing with the watercraft personnel and offloading contraband and/or transporting known enemy combatants. The Compact Radar is specifically designed to detect dismount and vehicle targets at ranges up to 800 m and 2 km, respectively. The unit is further outfitted to stream its real-time tracks over a radio network for integration into a Cursor on Target (COT) display system.

2. Procedures

For this exercise, two Compact Radars were to be used at two key strategic docks within the area of operation (AO). However, a significant challenge arose when the radio system with which the Compact Radar was designed to interface was not authorized to be used in this exercise. One alternate solution required using an approved tactical radio; however, due to the sensitive nature of the hardware, constant supervision would have been required at the radar site. Another solution dictated using a commercial wireless network bridge. Further research on the site layout showed that using it would require an investment of twice the current inventory to complete the communications link. Several pre-tests were performed to verify that these bridges would connect across the distances required (6 mi, in one case) and all tests were positive. Therefore, the wireless bridge solution was chosen.

Upon arrival, the Tactical Operations Center (TOC) was set up in a location, shown in figure 1, which enabled a fiber-optic connection to the intelligence network, thus allowing the TOC to send its data via satellite to the main event screens at Fort Huachuca, AZ. However, this site was determined to be unfavorable for erecting a radio tower due to the number of large obstructions (mostly high buildings) between the TOC and the radar/relay sites. Also, we found that the trees at the radar/relay sites were up to 15 ft higher than expected, which caused the towers to remain enclosed within the tree canopy. After several days of unsuccessfully attempting to connect the links, an executive decision was made to change the tactical scenario to have the Compact Radar cover a littoral choke point into the AO. This setup meant that all watercraft that entered the AO from the Atlantic Ocean would have to pass through the radar's beams and risk detection. Communication links were established between this new location, which was technically outside the AO, and the TOC, as shown in figures 2 and 3.

Figure 1. TOC location with the wireless links installed on a 45-ft tower.

Figure 2. First relay point installed on a telephone pole.

Figure 3. Second relay point installed on a tripod.

3. Results

The Compact Radar, shown emplaced in figure 4, performed as expected by capturing all water targets ranging from fishermen wading waist deep in the water to U.S. Marine Corps (USMC) amphibious assault gunships. The optional attached camera provided real-time video "water truth" of the targets reported. While not fully functional, the video classification portion of the software did yield on a few occasions events where the camera "chased" the targets. One such track and its corresponding image, annotated by an intelligence analyst, are shown in figures 5 and 6, respectively.

Figure 4. Emplacement of the Compact Radar, showing it at 1.8 km from the opposite shoreline in the left view and showing that the target in right view is still within the radar's starboard beams.

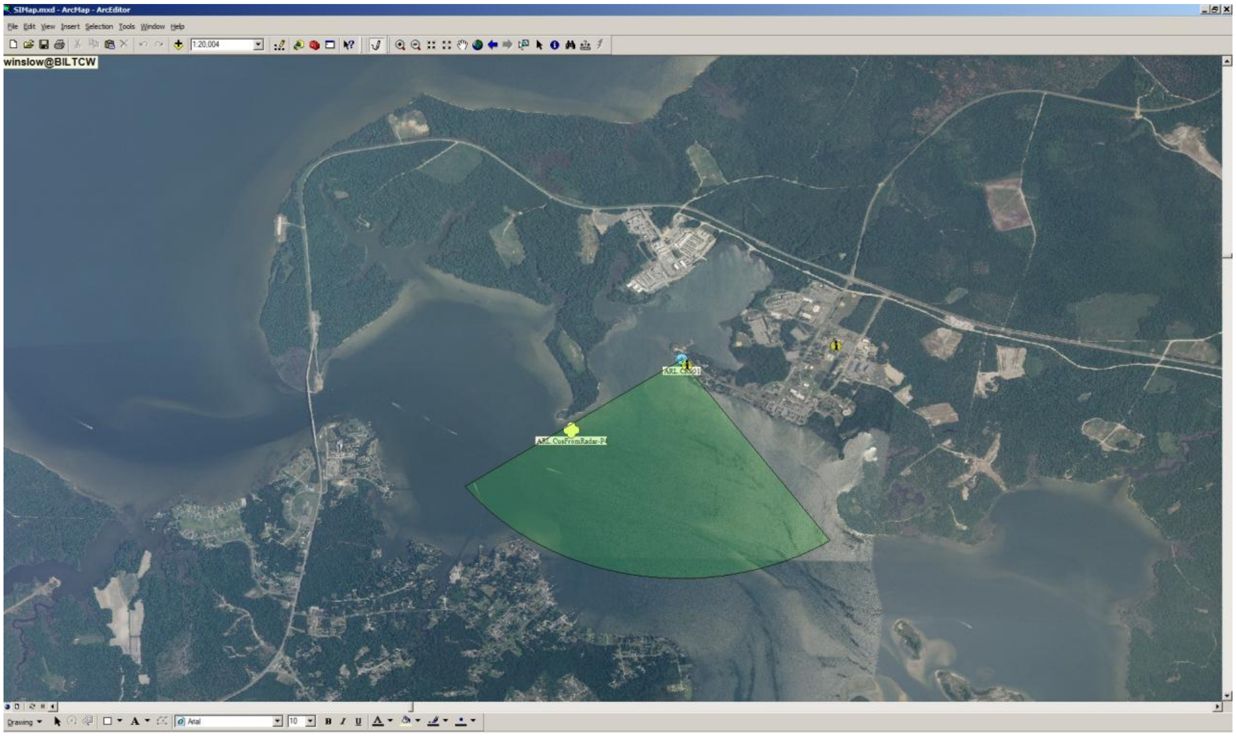

Figure 5. COT display showing the Compact Radar detecting a target entering the AO. Note that the entire choke point is monitored by the unit.

Figure 6. Real-time image sent from the Compact Radar's camera to COT server. The image was subsequently annotated by an intelligence analyst (in red).

Many analysts commented that once the communication problem was solved, the Compact Radar performed very well, had a longer range than expected, and had tremendous potential in a littoral environment. Further, if it could have been emplaced in the desired strategic areas within the AO, it would most likely had been the preeminent cueing system in their toolbox due to its near-real-time reports, high detection rate, and extremely low false alarm rate.

4. Conclusion

In conclusion, the exercise was a success for the Compact Radar as it was able to demonstrate its persistent littoral surveillance capability. The largest regret was that it could not be placed within the actual AO to observe the strategic dock areas.

Future efforts need to include an advance site visit to establish connectivity (such as was done at Empire Challenge 2010). If a return to this location was called for, either the Common Sensor Radio (CSR) should be approved or the U.S. Army Research Laboratory (ARL) should invest in more advanced (and also more expensive) radio technology such as the Wave Relay™ radio system, which is used by the Special Operations Command for missions of this type.

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