REAL-TIME MULTI-SENSOR DATA FUSION FOR TARGET DETECTION, CLASSIFICATION, TRACKING, COUNTING AND RANGE ESTIMATES

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ABSTRACT

The Objective Force of the future will need to extend its reach into tactical areas to see and hear without eyes on the target. Advanced sensor technology provides the promise of intelligently extending the Force into inaccessible areas and maximizing force projection. With the break-through of advanced algorithms in sensors and signal processing technology during the past decade, our ability to integrate and develop next generation systems for homeland security, surveillance, and future combat systems has moved forward with enormous speed. Accompanied by advances in battery technology, wireless communications and miniaturization of sensor components, the opportunities for a system of systems has opened the door to further advancement in small but smart weapons. Nowhere is this opportunity more visible than in the areas of Mine-Countermine weapons systems development. This paper addresses the current TACOM-ARDEC Anti-Personnel Landmine Alternatives (APLA) programs with focus on the Advanced Minefield Sensors (AMS), and potential solutions, associated with low cost, real-time field demonstration and evaluation of sensor fusion performance. Three pertinent topics are presented:

1. Principal issues facing the APLA developers relative to different sensor fusion, wireless communication and remote control, tracking, identification and counting algorithms.

2. Examination of current TACOM-ARDEC Acoustics laboratory modeling capabilities to support advanced algorithms development for analytical agencies and the APLA developer.

3. Integration and use of distributed Internet technologies to build and demonstrate fieldable prototype system that greatly advances multi-spectral and IR sensing and tracking.

Tactical decisions of the future must be based on reliable knowledge of threats, including target identification, location, direction, and intent (friend or foe). This knowledge needs to be derived based on physical characteristics which can be derived 24/7, coordinated over a large area, and correlated among sensors over large areas. A common coordinated communications link must transmit the information back to command and control centers where the information is displayed in a form where it is easily and reliably understood and used. Ultimately, imagery is by far the most reliable source of information, but also presents the greatest challenges in size, cost, complexity, and power.

This paper will address important new technology developed at TACOM-ARDEC and McQ Associates as a part of the Advanced Minefield Sensor program, including multiple sensing modes for detection and classification of targets, 360 degree day/night imaging, target location and tracking at and between sensors, fusion of information across targets and sensors, and transmission and presentation of information. A practical sensor system will be presented which incorporates the latest practical low power operation, miniaturized technology and promise of reasonable size and cost. The development of advanced acoustic, seismic, and magnetic algorithms will be discussed. The implementation of all aspects of integrated sensor system design will be described. Finally, the integration of target designation devices into the sensor platform will be covered.