Transportable Electronic Warfare Module (TEWM)

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Introduction: Traditionally, the incorporation of advanced electronic warfare (EW) capabilities, either as existing payload upgrades or as new system installations, has required extensive timelines and platform-specific integration planning. Research efforts have often targeted specific EW applications and operational environments to facilitate the transition of the technology, rather than develop cross-domain functionality. Often these separate EW systems address the same threats or frequency bands but are each platform-centric.

Under an Office of Naval Research (ONR) funded Future Naval Capability (FNC) program, research was performed by the Tactical Electronic Warfare Division (TEWD) at NRL to develop an advanced EW capability for use on unmanned platforms. The primary thrusts were in the areas of antiship missile defense (ASMD) and countersurveillance. The ASMD and counter-surveillance missions are not platform-specific, nor are they limited to unmanned vehicles. Scientists at NRL continued to evolve the initial unmanned vehicle EW concept[1] into a platform-independent payload applicable to both manned and unmanned assets. This evolution resulted in the Transportable EW Module (TEWM), a platform-agnostic EW payload, shown in Fig. 5, which is capable of being rapidly transferred from vessel to vessel, aircraft, vehicle, or fixed site, or vice versa.

Development of a common EW core for application across a variety of military operations not only avoids the platform-centric payload approach, it also allows for distributed EW payloads that can easily be networked. The TEWM system was designed from the start to support TEWM-to-TEWM communication and data sharing. Future network interfaces will allow TEWM to connect to available communication links in order to either passively or actively tie into available situational awareness data streams, as well as coordinate distributed EW operations.

TEWM System Overview: Like its unmanned vehicle predecessor, the TEWM design incorporated an electronic support (ES) receiver integrated with a wideband digital radio frequency memory (DRFM) based electronic attack (EA) capability. DRFM-based payloads have the capability to apply standard noise jamming techniques, as well as generate high-resolution false targets with realistic amplitude

FIGURE 5
TEWM being operated by NRL scientists.

and Doppler modulation, engage multiple threats simultaneously, and generate multicomponent wave forms that combine false targets with obscuration jamming. DRFM flexibility allowed TEWM to be designed from the start as an EW hardware core that supports a variety of potential operations. High-power transmission is achieved through high-gain antennas and high-power modules developed for tactical aircraft and equally applicable to surface use. Electronic components are air-cooled, unlike the original unmanned vehicle payload, which relied on forced convection cooling.

Although not demonstrated during at-sea prototype testing, TEWM and networks of TEWM systems are designed to be controlled by as few as one Jammer Control Station (JCS). JCS is a graphical user interface developed using the NRL SIMDIS visualization tool, which provides users with a real-time 3D situational awareness picture, including platform positions and motions, and payloads' status and activities, as well as RF detections and bearings with threat, neutral, and friendly assignment. As shown in Fig. 6, JCS operators can specify search and threat parameters, operate payloads manually, and point and click RF beams for interrogation or to activate jamming across any networked and available TEWM. Single or multipayload networked control and coordination can be managed by a single JCS operator.

RIMPAC 2008 Experimentation: During FY08, the TEWM system was demonstrated as part of a large-scale EW experiment during the international Rim of the Pacific (RIMPAC) 2008 exercises in July. RIMPAC is a biannual, international maritime exercise that takes place in the Pacific Ocean near Honolulu, Hawaii, under the direction of the United States Pacific Command (PACOM). NRL scientists installed the TEWM hardware onboard the DDG 93 *Chung Hoon*, as
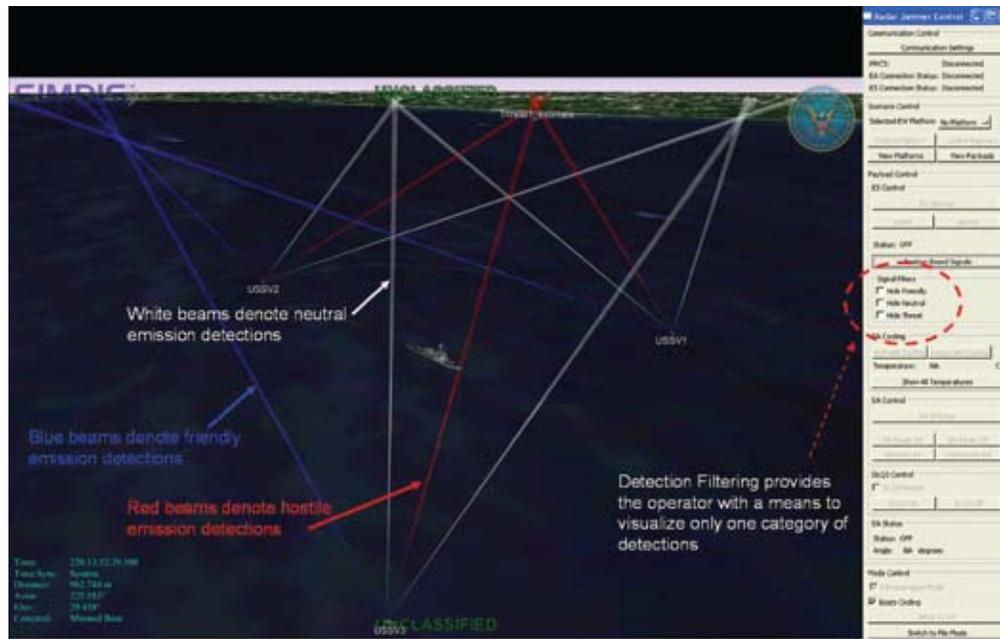
FIGURE 6
Distributed EW control demonstrated by JCS.

shown in Fig. 7, for RIMPAC 2008 in order to demon-strate the system's capabilities in ASMD and counter-surveillance applications. Hardware was installed on the deck of the *Chung Hoon* in 30 minutes. Bringing TEWM up to full operation took less than 2 hours. Directional transmit and receive antennas limited the interference between TEWM and onboard emitters.

The RIMPAC at-sea experiment demonstrated TEWM's capability to generate advanced EA waveform concepts for area defense and self-protection against maritime patrol aircraft, multirole fighters, and cap-tive-carry ASM simulators. Additional experiments are planned for 2009 aimed at controlling TEWM across an existing military network, as well as coordinating the operation of two networked TEWM systems.

Summary: Traditional EW development has fol-lowed a platform-centric approach leading to costly and lengthy planning and integration. The TEWD at NRL is actively pursuing a compact, low-cost, capabil-ity-centric EW payload in order to support the rapid transfer of sophisticated capabilities between platforms and domains. This platform-agnostic approach will facilitate the integration of distributed and coordinated EW concepts into military operations currently not found in the Fleet.

[Sponsored by ONR]

Reference
[1] D. Tremper and J. Heyer, "Unmanned Sea Surface Vehicle Electronic Warfare," *2007 NRL Review*, p. 159–161.

FIGURE 7
TEWM installed on the
DDG 93 *Chung Hoon.*