"Electromagnetic Operational Environment Emulator"

Introduction

The aerial platform developed by MORE enhances the ability to simulate complex threat environments, providing valuable insights into electromagnetic spectrum warfare. This innovation strengthens the military's operational readiness by offering realistic and adaptable testing and training environments across multiple domains.

Overview

Naval vessels are equipped with multiple sensors to ensure comprehensive situational awareness and threat detection. These include:

- Radar systems for detection and tracking are employed for long-range target detection, surface surveillance, and missile guidance. Examples include 3D surveillance radars and fire control Radars.
- Electronic Support Measures (ESM) detect and analyze radar signals from enemy threats, offering early warning.
- Electronic Attack (EA) systems are employed to jam or deceive incoming missiles and radar systems by generating false targets or disrupting guidance systems.

The complexity of the Multi-Layered Sensor Suite presents challenges in testing the systems through realistic simulation.

Challenges in Simulating Realistic Threats

- Simulating various missiles or aircraft approaching from different directions, each with distinct flight profiles and radar signatures.
- Simulating low-probability-of-intercept (LPI) radars or stealth-guided munitions poses challenges for detection systems, testing the vessel's Electronic Support System (ESS) sensitivity and accuracy.
- Jamming and Deception Simulations. To test the vessel's EA systems against various jamming scenarios, ensuring their ability to block enemy signals and protect the platform.

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EMOE Emulator

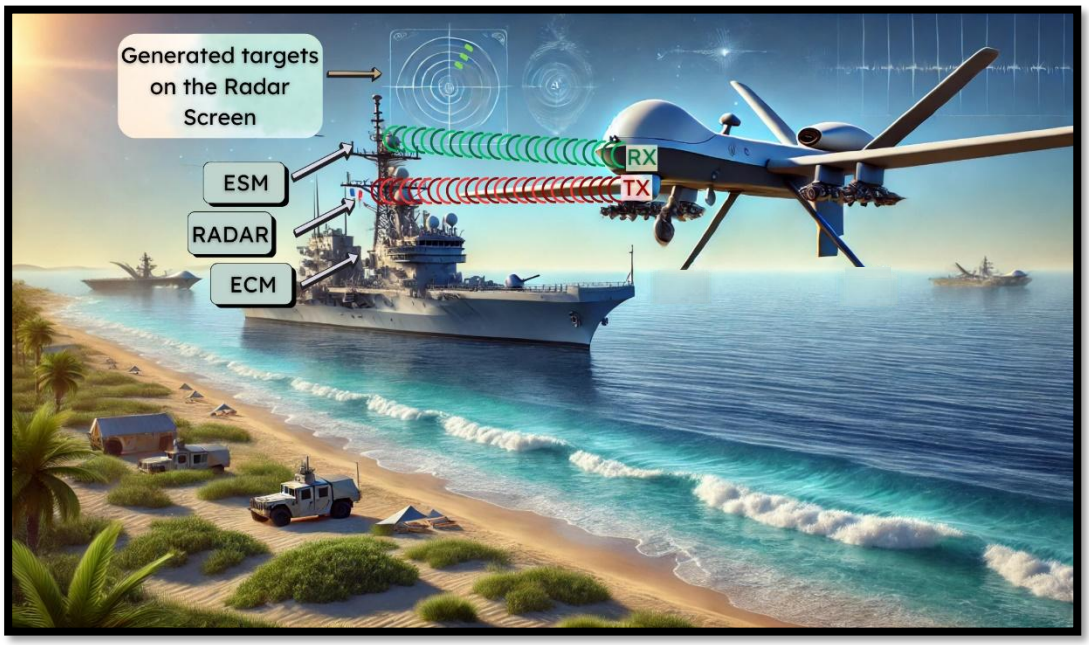
MORE's integrated solution is based on an "Electromagnetic Operational Environment Emulator" (EMOE Emulator) product mounted on a drone.

The EMOE Emulator is testing equipment that simulates various operating scenarios. It evaluates the operational efficiency of radar, RWR, ESM, ELINT, and EA systems.

The EMOE Emulator creates an Electromagnetic dense operational scenario based on the generation of multisource emitters, including HRR and FMCW Radars, using an arbitrary waveform generator (AWG) or playback from a Digital RF Memory (DRFM). The playback is based on a high-bandwidth, high-resolution recorded file of a real operational arena that includes a mixture of electromagnetic signals, including Radars and communication links.

The EMOE Emulator creates a realistic operational scenario for testing RWR, ESM, and ELINT systems. Additionally, EA systems can be evaluated against various synthetic radar signals generated by an arbitrary waveform generator (AWG) or against actual operational radars through the playback of recorded files in a digital radio frequency memory (DRFM). The EMOE Emulator provides a real-time radar processing chain, which includes cross-correlation of the original radar signal with the electronic attack techniques offered by the tested systems, Doppler processing, and Constant False Alarm Rate (CFAR) processing.

The EMOE Emulator outputs include Range and Doppler profiles and a Range-Doppler map.



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The Electromagnetic Operational Environment Emulator is integrated into a drone platform, enabling dynamic and flexible simulation of electromagnetic threats from the air. The following sections describe the key aspects of the solution:

- **Versatile Threat Emulation**
  The solution can emulate various Radar signatures, mimicking threats such as enemy aircraft, cruise missiles, and low-flying drones. In addition, the solution enhanced capabilities to replicate different Radar bands and signal characteristics, providing a realistic and challenging training environment.

- **Adaptive Flight Profiles**
  The system simulates low-altitude sea-skimming missiles and high-speed aerial threats. It supports multi-axis threat simulations, with targets approaching from various heights and azimuths.

- **Electronic Warfare (EW) Testing**
  The EMOE Emulator can test the performance of ESM (Electronic Support Measures), RWR (Radar Warning Receivers), and EA (Electronic Attack) systems by emitting signals that represent real-world threats.

- **Cost-Effective and Scalable**
  The drone platform reduces the cost of large-scale exercises by providing an affordable, reusable system for repeated simulations. It is scalable for use in naval, air, and land-based defense applications.

- **Operational Benefits**
  Realistic Training: Crews can train to detect, track, and respond to simulated Radar threats in real-time.

  Enhanced Sensor Validation: Tests the performance of Radar and EW systems under diverse scenarios, ensuring platforms are battle-ready.

  Mobility and Flexibility: The drone can deploy rapidly and simulate threats in different operational environments, enhancing the scope of testing and training exercises.

  By leveraging drone technology, MORE's Electromagnetic Operational Environment Emulator offers military forces a cutting-edge tool to prepare for the complexities of modern electromagnetic warfare.

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Emulator Capabilities

The following provides a detailed description of the capabilities and parameters that can be evaluated during the scenario.

Radar operational parameters

- Effective Radiated Power (ERP).
- Detection and tracking capability of sea-skimming targets with varying Radar Cross-Sections (RCS).
- Missile flight data verification, including range, speed, and incoming direction.
- Target discrimination ability between multiple closely spaced targets approaching from the same direction.
- ECCM (Electronic Counter-Countermeasures) mechanisms.

Electronic Support (ES) system parameters

- Detection capability of LPI (Low Probability of Intercept) seekers.
- ES system sensitivity.
- Measuring the accuracy of the seeker parameters (PDW).
- De-interleaving of multiple seekers.
- Resolution and accuracy in determining the missile's incoming direction.

Electronic Attack (EA) effectiveness validation

The seeker emulator will evaluate the quality and effectiveness of the EA system's jamming. The emulator will utilize LPI techniques, including intra-pulse modulation, to achieve high processing gain, frequency hopping, and low transmission power.

The seeker emulator replicates the entire Radar processing sequence, including cross-correlation, real-time generation of a Range Doppler map, and additional mechanisms such as CFAR (Constant False Alarm Rate).

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