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Responding to Uncertain or Adaptive Threats in Electronic Warfare Study

Abstract

Increasing signal density and highly variable or real-time adaptive waveforms and modalities will challenge the ability of Air Force systems to identify source and intent of signals in the RF spectrum. Proliferation of software defined architectures and advanced digital signal processing in adversary systems will make it increasingly likely that the first time a threat signal is detected may be in an operational environment in support of an ongoing adversary kill chain. As a result, the traditional process of collecting, assessing, developing, and testing countermeasures before fielding them is likely to become inadequate for the A2/AD environment.

To conduct electronic protection, attack, and support, blue systems will need to adaptively probe, sense, and respond in real time utilizing machine-learning algorithms in what has been described as Cognitive Electronic Warfare. However, it is unclear to what extent the current and foreseeable state-of-the-art in machine learning and adaptive decision-making algorithms are suitably mature to fully enable this new approach to electronic warfare. Potential red countermeasures and the likelihood of blue fratricide are also poorly understood. There is a need to clarify what is realistically possible to support the probe-sense-respond paradigm in the near term and over the foreseeable future, what the performance of such adaptive approaches will likely be, and what approaches offer the most promise for developing cognitive electronic warfare capabilities.

The study will:

1) Define current and likely future threat system characteristics that complicate or prevent traditional *a priori* development of effective electronic countermeasures.

2) Survey the current state-of-the-art in machine learning and adaptive decision-making algorithms and assess the likely rate of progress in key areas over the foreseeable future.

3) Determine the performance that will be realistically achievable in the near, mid, and far term from various technical approaches to implementing the probe-sense-respond paradigm.

4) Identify the most promising avenues along which development of cognitive electronic warfare should be focused and provide realistic timelines and milestones for each of these paths.

5) Determine key research and development efforts that should be undertaken to accelerate progress in essential technical areas for enabling probe-sense-respond approaches.

6) Recommend integrated demonstrations and transition opportunities for near, mid and far-term implementations of cognitive electronic warfare.

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