

## Electromagnetic Spectrum Dominance - An Autonomous and Efficient Spectrum Management System

Dr. Syed A. Shah<sup>1</sup>, Joseph Molnar<sup>2</sup>, Raymond Cole<sup>2</sup>, Trang Mai<sup>2</sup>

<sup>1</sup>Office of the Secretary of Defense (OSD)  
DDR&E/Research Directorate  
1777 N. Kent Street  
Rosslyn, VA 22209

<sup>2</sup>Naval Research Laboratory  
Networks and Communication Systems Branch  
4555 Overlook Ave., SW  
Washington DC, 20375

### ABSTRACT

Modern warfare is not just about air, sea, and land dominance, it is also about electromagnetic spectrum dominance [1]. Spectrum dominance is the ability to control how the Electromagnetic Spectrum (EMS) is utilized. This implies the ability for the military to conduct an operation and be able to allow or deny, exploit, deceive, disrupt, degrade, and/or destroy adversary’s ability to use the EMS, while preserving their own ability to use the EMS as mission and policy dictates with minimal disruption to civilian use. Spectrum dominance is often a pre-requisite for information dominance, which is key to the success of any military operation. Spectrum, however, is a finite resource and its use must be effectively and efficiently managed to ensure military superiority and readiness. It is challenging to have adequate spectrum management in place to achieve spectrum dominance.

This paper discusses the need of an agile and efficient spectrum management system to achieve spectrum dominance in military operation. The growing problems associated with increased demand for the DoD RF spectrum is presented. Spectrum scarcity due to increasing commercial spectrum requirements and spectrum reallocation, e.g. 2010 Presidential Memorandum, are discussed. Spectrum usages conflicts between civilians, friendly forces and adversarial forces are discussed. Challenges in spectrum management for land, maritime, aerial and space environments are presented. Military operations have become joint by nature. Problems associated with the increasing demand of interoperability between the US military and coalition forces are discussed. Spectrum management needs to evolve from inefficient preplanned and static frequency assignment methodology. There is a need for an autonomous, real-time, accurate spectral awareness and dynamic spectrum reallocation mechanism to support modern warfare. A fractionated architecture to support a hierarchy that allows for the distribution of authority across the multiplicity of domains to achieve automated spectrum management is introduced, as shown in Fig. 1. Research threads to achieve spectrum dominance goal are identified. Information Assurance (IA) challenges in spectral information sharing and policy adaptation are presented. The role of Dynamic Spectrum Access (DSA) technology in enabling spectrum dominance is discussed. This paper provides a perspective on the technology challenges associated with a vision to provide warfighters the ability to effectively manage the electromagnetic battlespace.

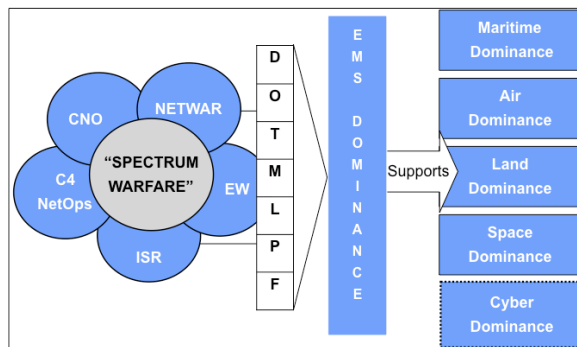


Fig. 1 - Coordinated approach of spectral management to achieve mission objectives. [doctrine, organization, training, materiel, leadership and education, personnel and facilities (DOTMLPF)]

[1] Dr. Santanu Das, Program Manager – Communications & Networks, Office of Naval Research; 8th Annual Software Radio Communications Summit, March 22, 2010