

**“Electromagnetic Maneuver Command and Control”  
Indefinite Delivery Indefinite Quantity  
Statement of Work**

## **1.0 BACKGROUND**

The concept, component, and system development research leading to the technology to be implemented in the Electromagnetic Maneuver Command and Control (EMC<sup>2</sup>) program are derived from prior and ongoing Science and Technology (S&T) efforts by the Office of Naval Research (ONR). ONR, through its Future Naval Capabilities (FNC) program, related Discovery and Invention (D&I) and Innovative Naval Prototype (INP) efforts, has been aggressively researching advanced technology for future Navy radio frequency (RF) system requirements.

Current U.S. Navy airborne and seaborne combatants employ a large number of federated RF apertures to perform Electronic Warfare, Communication, Radar and Information Operations functions. Historically, each function (and hence system) has its own aperture, electronics, logistics/maintenance tail and in multiple cases its own operator. This classic stand-alone RF systems approach results in Electromagnetic Interference/Compatibility (EMI/EMC) problems that degrade system performance and increase life-cycle cost for the combatant. RF signature and radar cross section are also difficult to reduce when restricted to stand-alone RF aperture/antenna approaches. Additionally, new communications and radar requirements are increasing space, weight and power demands on the topsides and masts of new platforms. Similar complexities are evident in airborne systems. This problem of new requirements and limited space is even more critical on submarines with periscope/mast-mounted systems as well as on aircraft where flying qualities can be compromised by excessive onboard systems.

In order to address these issues of RF signature, size, weight, and system performance and life cycle cost, ONR has sponsored research for new electronics components, RF apertures, and sensor and communications capabilities using broadband, multifunction, RF designs and advanced technologies. In particular, ONR completed the Advanced Multi-Function Radio Frequency Concept (AMRFC) Program, an ONR Future Naval Capability initiative. The FNC Multifunction Electronic Warfare (MFEW) program successfully applied the multifunction concept to EW systems and the current INP InTop Program is addressing various challenges of shipboard topside Radio Frequency (RF) functions. Current InTop development/acquisitions include: Submarine Wideband Satellite Communication Antenna Subsystem; Electronic Warfare/Information Operations/Line-Of-Sight Communication Advanced Development Model; Low Level Resource Allocation and Infrastructure; Low Cost Multi-beam Arrays; Flexible Distributed Array Radar (FlexDAR) System; and Low Band Radio Frequency Intelligent Distribution Resource. Previous development and concept demonstration efforts were installed and tested at the Naval Research Laboratory's (NRL) Chesapeake Bay Detachment (CBD) site in Maryland. InTop systems currently in acquisition or development will also be installed and demonstrated at this or other Navy test sites.

## **2.0 OVERARCHING OBJECTIVE**

EMC<sup>2</sup> will develop hardware and software intensive systems that provide the capability to monitor the RF spectrum across a wide range of frequencies and reallocate functions to the best frequencies and resources to respond to changes in the electromagnetic environment and warfighter requirements. The general areas of expertise are:

1. Providing real time spectrum control and optimization across Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR), Sensors and Weapon Systems;
2. Ability to maximize all warfighting performance by coordinating and synchronizing RF operations across a battle force; and
3. Reduction in Total Ownership Cost (TOC)

## **3.0 SCOPE**

This Statement of Work (SOW) identifies the study, design, fabrication, integration, and test & evaluation (T&E) tasks anticipated for the development and demonstration of a set of prototypes, and their component subsystems, that integrate RF functionality (Electronic Warfare (EW), Radar, Communications (Comms), Information Operations (IO)) into a common set of multi-function apertures, electronics and software/firmware through an architecture that is modular, scalable across platforms and open at the RF, electronics and software/firmware levels. These prototypes will be capable of providing multiple, simultaneous, independent beams which can together perform any of the above functions. In addition, these open RF systems will be integrated with previously developed Integrated Topside (InTop) or other RF systems, and with combat and Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) systems. These integrated systems will enable Resource Allocation (RA), Real Time Spectrum Operations (RTSO), Emissions CONTROL (EMCON) and ElectroMagnetic (EM) Maneuver to improve the U.S. Navy's ability to achieve Information Dominance (ID).

This solicitation supports the Technology Maturation & Risk Reduction (TM&RR) Phase of Navy acquisition programs for RF systems. The program will develop TM&RR phase prototypes for proof of concept. Further it will allow acquisition commands to purchase limited Development Test (DT) units to provide a means for seamless transition of EM systems technology to combat weapon and C4ISR systems. It will provide open architecture (OA) system capabilities that can be scaled for the size and mission of the targeted platform and incorporate a Resource Allocation Manager (RAM) and a Spectrum Manager that will adapt the systems in real time to enable the U.S. Navy to achieve agility across the entire RF spectrum.

Efforts under this program will include integration with combat and C4ISR systems to efficiently manage available resources, optimize the use of available resources and reduce the predictability of, vulnerability of and interference between RF systems. The efforts will develop the ability of Navy RF systems to work cooperatively both within and across platforms to allow decision makers to maintain Situational Awareness (SA) even while in an EMCON posture. The

electromagnetic (EM) systems effort, along with the RTSO will enable the capability to monitor the RF spectrum across a wide range of frequencies and reallocate functions to the best frequency in response to changes in the electromagnetic environment and warfighter requirements. EM systems will revolutionize RF systems and provide the operational basis for the Navy to remain pre-eminent in the fields of intelligence, cyber-warfare, Command and Control (C2), EW and battle and knowledge management.

#### **4.0 SYSTEM DESCRIPTION**

The EMC<sup>2</sup> prototypes as standalone systems, and specifically when integrated with InTop and other EM systems will support RF multi-functionality and resource management in order to enable greater flexibility to adapt platform capabilities to rapidly changing tactical and strategic environments. These systems shall also be capable of integrating additional functionality through modularity, open interfaces, and the addition/deletion (scaling) of hardware and/or software without impacting the fundamental system design.

Under any resulting task orders for system development or limited DT units, the contractor will be required to deliver systems based on a Modular Open Systems Approach (MOSA). The contractor will be required to make recommendations regarding key interfaces where "Open" interface standards (those standards developed and controlled by a recognized industry standards organization) should be used and/or established in order to support future spiral developments, enhanced performance and/or mitigation of component obsolescence. Because the total cost of ownership of the system is a predominant factor of program success, the contractor may be required to provide recommendations, with supporting rationale, regarding the appropriate acquisition approach and systems design to achieve the lowest possible life cycle costs. The contractor may also be required to make recommendations, with appropriate rationale, regarding the level of systems design beyond which industry should retain intellectual property rights and the resulting impact on affordability.

Critical operational requirements, technical performance parameters and open interfaces will be Key Performance Factors (KPFs) for demonstration and evaluation. Affordability and Supportability requirements including acquisition cost, reliability, maintainability, logistics support, and system availability will also be important evaluation factors.

The goals for the TM&RR phase of the program are as follows:

- Develop and investigate system architectures as they apply to various platform design and performance parameters, and mitigate acquisition and Life Cycle Cost.
- Establish Open Interfaces between appropriately selected system Software/firmware and Hardware Configuration items
- Develop, build and test prototypes of selected systems including but not limited to surface ship, airborne and submarine applications.

- Develop, build and test critical elements and/or subassemblies which may be expected to further the objectives of the program.
- Establish and maintain a Systems Engineering Master Plan for the EM system of systems.
- Establish a capability (Navy/Contractor) to integrate new EM systems with existing systems.
- Conduct system of systems integration and testing as necessary and appropriate for the TM&RR phase.
- Conduct prototype testing that satisfies TM&RR Phase requirements to enable a smooth of the technology to combat/C4ISR fleet systems.

## **5.0 REQUIREMENTS**

The Contractor shall provide program management, engineering, and test & evaluation efforts, and deliver hardware, software and documents as specified under each task order contract issued under the IDIQ contract. This will include: (1) efforts related to prototype development, to include requirements definition, trade studies, system and subsystem designs, threat analysis, development, fabrication, system integration, and test demonstration; (2) efforts needed to produce and test limited quantities of DT units for combat/C4ISR systems and test sites when required by acquisition commands.

Requirements will be identified in each task order for the specific scope of work identified by the government.

Also, under any resulting task order award, contractors may be required to enter into Interface Working Agreements (IWAs) (with other contractors) to ensure that all contractors have an unobstructed means of communication to share information required to assure the development, integration and interoperability of the system.