Joint Doctrine Note 3-16

Joint Electromagnetic Spectrum Operations

20 October 2016

Unclassified

PREFACE

1. Scope

This joint doctrine note (JDN) describes how the joint force is critically dependent on the electromagnetic spectrum (EMS) across all joint functions and domains and further develops joint electromagnetic spectrum operations' (JEMSO) organization, planning, and processes.

2. Purpose

A JDN is a publication that is intended to facilitate information-sharing on problems and potential solutions as a supporting effort of formal joint doctrine development and revision. It provides a short term bridging solution to doctrine gaps. This JDN is the "next step" in the evolution of JEMSO to establish a comprehensive doctrinal authority, with joint standards and processes and with the detail required to effectively integrate and synchronize the activities to achieve EMS superiority. This JDN endeavors to further refine the term "JEMSO" in joint doctrine and to standardize JEMSO lexicon and operational framework. It also provides guidance on how to organize, plan, conduct, and assess JEMSO. This document was developed using current joint doctrine and policy, extant procedures from the different combatant commands, exercises, lessons learned, and multiple other JEMSO publications (e.g., Chairman of the Joint Chiefs of Staff's [CJCS] Joint Concept for Electromagnetic Spectrum Operations, Operational Concept for Electromagnetic Battle Management, the National Military Strategic Plan for Electronic Warfare, and the Department of Defense [DOD] EMS Strategy with a major goal of integrating all DOD JEMSO across the range of military operations).

3. Application

The guidance in this JDN is not authoritative. If conflicts arise between the contents of this JDN and the contents of a joint publication (JP), the JP will take precedence for the activities of joint forces, unless the CJCS provides more current and specific guidance. This JDN will, at a minimum, assist in the development and revision of other JPs, specifically JP 3-13.1, *Electronic Warfare,* and JP 6-01, *Joint Electromagnetic Spectrum Management Operations,* and may become a stand-alone replacement publication for them, when determined by the joint doctrine development community and approved by the CJCS.

KEVIN D. SCOTT
Vice Admiral, USN
Director, Joint Force Development

Intentionally Blank

TABLE OF CONTENTS

GLOSSARY

FIGURE

EXECUTIVE SUMMARY
COMMANDER'S OVERVIEW

- **Gives an Overview of Joint Electromagnetic Spectrum Operations (JEMSO)**
- **Describes Organizing for JEMSO**
- **Explains Planning JEMSO**
- **Discusses Conducting JEMSO**

Overview of Joint Electromagnetic Spectrum Operations

Joint Electromagnetic Spectrum Operations (JEMSO)

The joint force is critically dependent on the electromagnetic spectrum (EMS) across all joint functions and domains. To prevail in the next conflict, a joint force must win the fight for EMS superiority.

Joint electromagnetic spectrum operations (JEMSO) are military actions undertaken by two or more Services operating in concert to exploit, attack, protect, and manage the electromagnetic operational environment (EMOE). These actions include all joint force transmissions and receptions of electromagnetic (EM) energy. The electromagnetic spectrum (EMS) is the range of all frequencies of EM radiation. EMS superiority is that degree of dominance in the EMS that permits the conduct of operations at a given time and place without prohibitive interference, while affecting an adversary's ability to do the same. The EMOE is a complex composite of the EM conditions, circumstances, and influences that affect the employment of capabilities and the decisions of the commander (CDR).

Principal JEMSO Actions and Related Mission Areas

JEMSO actions to exploit, attack, protect, and manage the EMOE rely on personnel and systems from the legacy EMS-related mission areas (e.g., signals intelligence, EMS management, electronic warfare [EW]). Instead of these mission areas being planned and executed in a minimally-coordinated stovepiped fashion, JEMSO guidance and processes prioritize, integrate, synchronize, and deconflict all joint force actions in the EMOE, enhancing unity of effort.

Role of JEMSO Across the Joint Functions

Operations within the air, maritime, and land domains are similar in their EMS-dependence

through the execution of the joint functions. Since the EMS overlaps all the physical domains and the information environment simultaneously, JEMSO provides the processes to effectively prioritize, integrate, synchronize, and deconflict the EMS aspects of operations throughout the operational environment. Many cyberspace operations (CO) occur through the EMS, especially at the tactical level, and require close coordination with other JEMSO through electromagnetic battle management (EMBM) processes.

Organizing for Joint Electromagnetic Spectrum Operations

Responsibilities

It is the responsibility of the unified combatant commander (CCDR) to establish and promulgate command-specific policy and guidance for electromagnetic spectrum operations (EMSO) planning and execution. This can be divided among multiple directorates of a joint staff based on long-, mid-, and near term functionality and availability of trained EMSO personnel. The joint force commander (JFC) designates an electromagnetic spectrum control authority (EMSCA) to assume overall responsibility for JEMSO. The EMSCA will have primary staff responsibility for planning, coordinating, monitoring, assessing, and prioritizing execution of JEMSO. The EMSCA provides centralized direction through the electromagnetic spectrum control plan (EMSCP) and electromagnetic spectrum control order (EMSCO), supplemented by EMS coordination measures; all coupled with an EMBM system. CCDRs and subordinate JFCs establish a standing joint electromagnetic spectrum operations cell (JEMSOC) to support joint planning, coordination, and control of the EMS for assigned forces. EMS users provide the JEMSOC prioritized EMS-use requirements through their component EMSO element and obtain frequency authorization through their component EMSO element for each transmission in the EMS.

Organization

The JFC normally will establish a JEMSOC as the primary staff element responsible for planning, coordinating, executing, and assessing JEMSO in

order to achieve and maintain EMS superiority. EMSCA is usually delegated to the JEMSOC director which, when coupled with the JEMSOC's organizational responsibilities, allows the JFC to exercise unity of command in the EMS.

Service Support

The **Army** organizes to conduct JEMSO primarily through the cyber electromagnetic activities (CEMA) element. CEMA are activities leveraged to seize, retain, and exploit an advantage over adversaries and enemies in both cyberspace and the EMS, while simultaneously denying and degrading adversary and enemy use of the same and protecting the mission command system. **Headquarters, United States Marine Corps** Combat Development and Integration is responsible for coordinating with the operating forces, supporting establishments, and mission partners in order to identify, prioritize, and integrate expeditionary cyberspace and EW capability solutions across the pillars of doctrine, organization, training, materiel, leadership and education, personnel, and facilities; battlespace functions; and joint requirements. The **Navy** EMSO element works in conjunction with subordinate cells to convey across the force and up the chain of command the joint force maritime component CDR's plan for achieving EMS superiority within the maritime domain. The CDR, **Air Force** forces provides EW and EMS management support to the JFC through the air component communications directorate and electronic warfare coordination cell (EWCC). United States Coast Guard JEMSO operational activities, such as EM maneuver warfare, currently only include monitoring, assessing, and providing intelligence products.

Multinational Force Organization

The multinational force CDR provides guidance for planning and conducting JEMSO to the MNF through the operations directorate of a joint staff's combined EWCC. Note: North Atlantic Treaty Organization (NATO)/multinational terminology still references the EWCC. Therefore, EWCC, not JEMSOC, will be used when discussing NATO/multinational operations.

Planning Joint Electromagnetic Spectrum Operations

JEMSO Planning Process

During mission analysis, JEMSO planners develop a staff estimate which forms the basis for an EMS superiority strategy. The JEMSO staff estimate is used during course of action (COA) development and analysis to determine EMS supportability. When a COA is chosen, it becomes the basis to develop the JEMSO annex which outlines JEMSO missions, priorities, policies, processes, and procedures across all phases of the operation. The joint force components will develop component EMSO plans and submit them to the JEMSOC for integration into the JEMSO appendix. During planning and execution, the JEMSOC consolidates component EMSO plans and attendant requirements, prioritizes, integrates, and synchronizes them, and produces an EMSCP. An updated EMSCP begins the JEMSO execution cycle resulting in an EMSCO directing joint force EMS use. The JEMSO appendix establishes procedures for EMBM system use in the joint operations area and includes EMS coordination measures, specifying procedures and rules of engagement for joint force EMS use.

JEMSO Coordination

Some areas where JESMO coordination in needed are intelligence, surveillance, and reconnaissance; CO; positioning, navigation, and timing operations; information operations; military information support operations; operations security; military deception; cybersecurity; chemical, biological, radiological, and nuclear environments; targeting and fire support; physical security; and civil-military operations.

National and International Coordination

Host nation coordination (HNC) is the activity to obtain authorization to operate EMS-dependent systems within a sovereign nation. HNC agreements are normally established by geographic combatant commanders (GCCs). The joint frequency management office (JFMO) normally has standing EMS coordination channels with the nations in the GCC's area of responsibility (AOR). The JEMSOC must be prepared to integrate joint EMS-use requirements into a multinational EMS-

use plan to support the mission. The development of specific procedures to support this requirement is made more difficult because of concise security guidance, differences in the level of training, different automation tools, and some language and terminology barriers.

Interagency Coordination for Homeland Defense and Defense Support of Civil Authorities

Homeland defense (HD) and defense support of civil authorities (DSCA) missions are likely to affect operations being conducted by other EMS users. JFMO NORTH is the designated office within the United States Northern Command AOR responsible for planning and execution of EMS management for HD and DSCA assigned forces.

Conducting Joint Electromagnetic Spectrum Operations

Execution

The EMSCA approves the EMSCO which the JEMSOC will publish and provide timely updates. The JEMSOC establishes the battle rhythm for JEMSO planning and operations in accordance with the JEMSO appendix. The JEMSOC will participate in key joint force battle rhythm processes throughout the entire JEMSO cycle, to ensure effective and efficient production, dissemination and execution of each assigned EMSCO.

Assessment

At the end of an EMSCO cycle, the JEMSOC collates component feedback and assesses JEMSO using the measures of effectiveness/measures of performance established during planning in the JEMSO appendix and observed during the EMSCO period.

CONCLUSION

This joint doctrine note describes how the joint force is critically dependent on the EMS across all joint functions and domains and further develops JEMSO organization, planning, and processes.

Intentionally Blank

CHAPTER I
OVERVIEW OF JOINT ELECTROMAGNETIC SPECTRUM OPERATIONS

1. Introduction

This joint doctrine note (JDN) describes how to manage and execute joint electromagnetic spectrum operations (JEMSO). The rapid advances in electromagnetic spectrum (EMS) technologies over the last few decades have led to an exponential increase in commercial and military EMS-enabled/dependent capabilities. This proliferation, coupled with the US military's heavy reliance on the EMS and the low entry costs for adversaries, poses significant military challenges to the joint force commander (JFC). Integrated electromagnetic spectrum operations (EMSO) are required to achieve EMS superiority, which is an essential and potentially decisive aspect of all joint operations.

DEFINITIONS

Electromagnetic Spectrum (EMS) Superiority. That degree of dominance in the electromagnetic spectrum that permits the conduct of operations at a given time and place without prohibitive interference, while affecting an adversary's ability to do the same.

Electromagnetic Spectrum Operations (EMSO). Coordinated military actions to exploit, attack, protect, and manage the electromagnetic environment. (Joint Concept for Electromagnetic Spectrum Operations [JCEMSO])

Joint Electromagnetic Spectrum Operations (JEMSO). Military actions undertaken by two or more Services operating in concert to exploit, attack, protect, and manage the electromagnetic environment. (JCEMSO)

2. Military Operations and the Electromagnetic Spectrum

The joint force is critically dependent on the EMS across all joint functions and domains. To prevail in the next conflict, a joint force must win the fight for EMS superiority. Achieving this superiority is complicated by increasing joint EMS-use requirements, electromagnetic operational environment (EMOE) congestion, and growth of EMS threats. A joint force conducts integrated JEMSO in order to achieve unity of effort, resulting in EMS superiority.

For further information on EMS superiority, see the National Military Strategic Plan for Electronic Warfare, *and the* Joint Concept for Electromagnetic Spectrum Operations (JCEMSO).

a. **JEMSO.** JEMSO are military actions undertaken by two or more Services operating in concert to exploit, attack, protect, and manage the EMOE. These actions include all joint force transmissions and receptions of electromagnetic (EM) energy. JEMSO provides the guidance and processes to prioritize, integrate, synchronize, and deconflict all EMS actions across the joint force, enabling unity of effort. A JFC designates an electromagnetic spectrum control authority (EMSCA) and exercises unity of command in the EMS through a

joint electromagnetic spectrum operations cell (JEMSOC), facilitated by electromagnetic battle management (EMBM) to integrate and synchronize component EMS use and to allow decentralized execution of EMS activity. JEMSO is employed in both an offensive and defensive manner in support of the commander's (CDR's) objectives.

(1) **Offensive JEMSO.** Offensive JEMSO are intended to project power by the application of force in and through the EMS. Offensive JEMSO are authorized like offensive operations, via an electromagnetic spectrum control order (EMSCO). Offensive JEMSO are planned, prioritized, integrated, synchronized, and deconflicted along with all other forms of offensive operations.

(2) **Defensive JEMSO.** Defensive JEMSO are employed in and through the EMS to either protect US and multinational forces (MNFs) from physical attack or defend friendly EMS capabilities from enemy electronic attack (EA). Defensive JEMSO respond to unauthorized activity or alerts/threat information and leverages intelligence, counterintelligence, law enforcement, and other military capabilities as required. Defensive JEMSO is accomplished using a layered, adaptive, defense in-depth approach, incorporating emission control (EMCON) and mutually supporting elements of digital and physical protection.

b. **EMS.** The EMS is the range of all frequencies of EM radiation (see Figure I-1). EM radiation consists of oscillating electric and magnetic fields characterized by frequency and wavelength. The EMS is usually subdivided into frequency bands based on certain physical

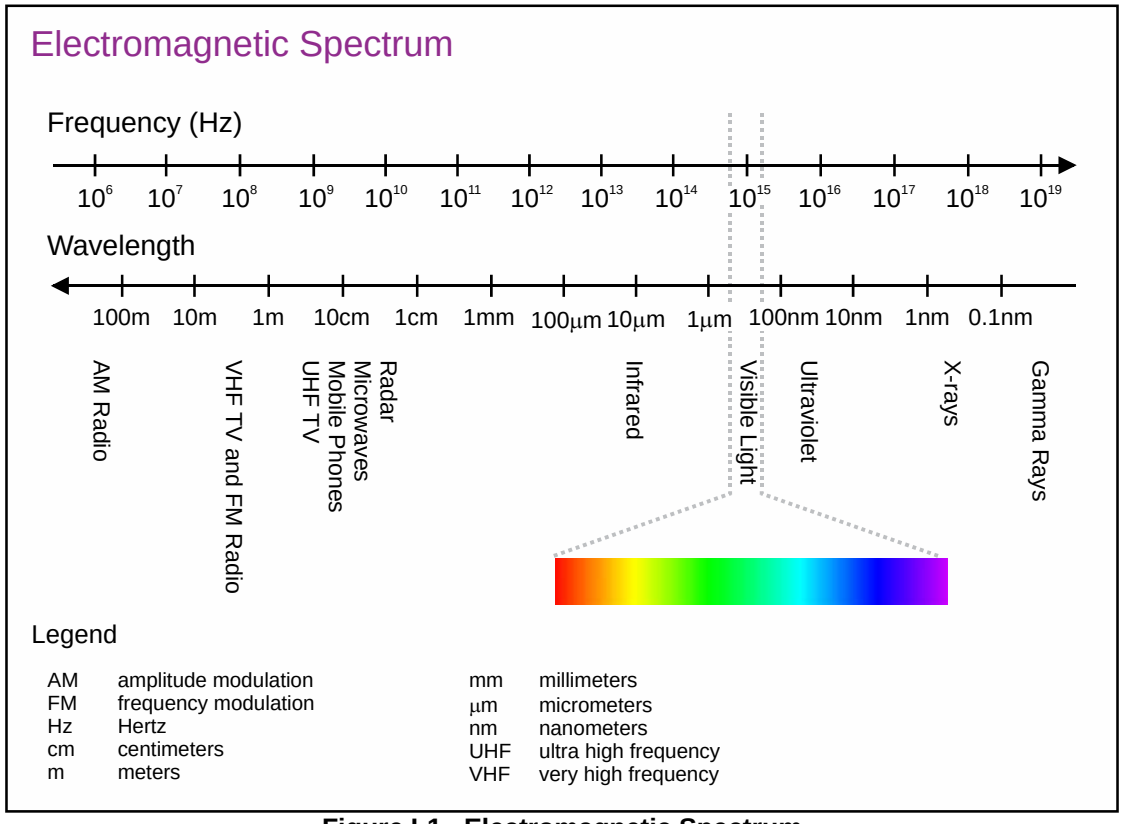

Figure I-1. Electromagnetic Spectrum

characteristics and includes radio waves, microwaves, millimeter waves, infrared (IR) radiation, visible light, ultraviolet radiation, x-rays, and gamma rays. The EMS is:

(1) **Physical.** It is part of the physical environment characterized by frequency, energy, and time. It can be managed, occupied, and selectively controlled like the air, land, maritime, space physical domains, and cyberspace. Natural and man-made factors affect actions in and through the EMS just as in the air, on land, at sea, in space, and in cyberspace.

(2) **Pervasive.** The EMS is pervasive, permeating, and linking all domains. The wide range of effects that can be created through EMS operations makes it a potent force multiplier.

(3) **Constrained.** Physics, policy, and technology frame the use of the EMS. Each type of EM radiation has unique physical properties that dictate its use (e.g., short or long-range communications, sensing). Use of the EMS is subject to international law, as well as domestic law and policy. Technology bounds those portions of the EMS that are accessible and exploitable.

(4) **Dynamic.** The potential speed of JEMSO may provide a decisive advantage by enabling CDRs to make decisions, conduct operations, and create effects more rapidly than the enemy.

c. **EMS Superiority.** EMS superiority is that degree of dominance in the EMS that permits the conduct of operations at a given time and place without prohibitive interference, while affecting an adversary's ability to do the same. EMS superiority is the critical enabler to superiority in all other domains and must be considered the first among equals in this regard.

d. **Eletromagnetic Environment** (**EME).** EME is the resulting product of the power and time distribution, in various frequency ranges, of the radiated or conducted EM emission levels encountered by a military force, system, or platform when performing its assigned mission in its intended operational environment (OE). Not all EM radiation encountered by joint forces will impact operations.

e. **EMOE.** The background EM radiation and the friendly, neutral, and adversarial electromagnetic orders of battle (EOBs) within the EM area of influence associated with a given operational area (OA). The EMOE is a complex composite of the EM conditions, circumstances, and influences that affect the employment of capabilities and the decisions of the CDR. This includes systems which are currently radiating as well as those that may radiate (i.e., systems on the EOB that have not been observed radiating but are identified by other means) potentially affecting joint operations. Success in the EMOE is often a precursor to success in the other environments and may itself be sufficient to create a desired effect. Figure I-2 depicts the relationship between the EME and EMOE.

(1) **Electromagnetic Environmental Effects (E3).** The impact of the EMOE upon the operational capability of military forces, equipment, systems, and platforms is referred to as E3. All systems that operate in the EMS are susceptible to E3. The EME experienced by

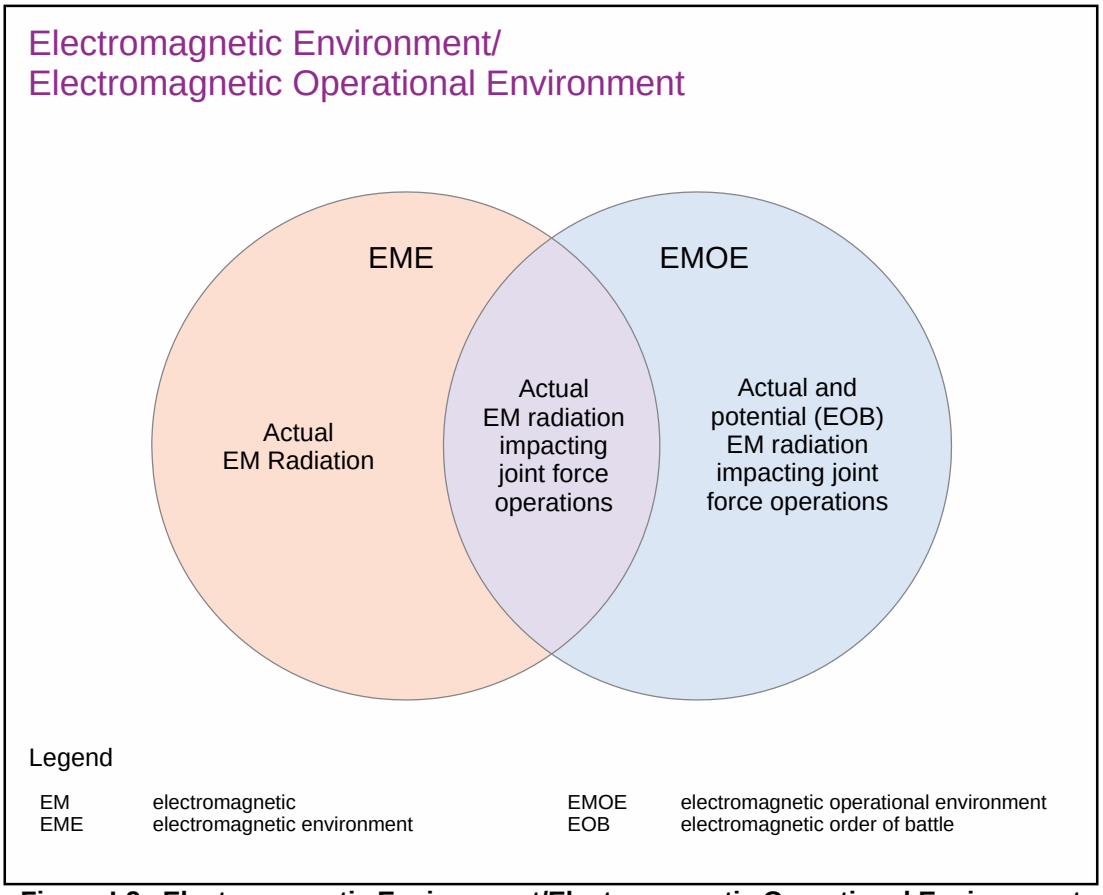

Figure I-2. Electromagnetic Environment/Electromagnetic Operational Environment

the joint force is continuously changing as existing systems are modified, new systems are installed, units change proximity, adversaries transmit, or natural phenomena occur. When platforms, associated systems, and equipment (e.g., avionics, ordnance, fuel) are exposed to an EME different from those for which they were designed and tested, the potential for safety, interoperability, and reliability problems increases. Joint force planning for E3 is critical to address E3 issues such as hazards of EM radiation in joint operations. These include EM compatibility, EM vulnerability, electromagnetic interference (EMI), electromagnetic pulse (EMP), hazards of electromagnetic radiation to personnel (HERP), hazards of electromagnetic radiation to ordnance (HERO), hazards of electromagnetic radiation to fuels (HERF), and natural phenomena effects such as lightning and precipitation static. JEMSO planners review joint EMS-dependent systems for EM vulnerability, compatibility, and interoperability to identify/quantify the potential impact of E3. Critical system failure during execution can result from failing to account for E3 in planning and mitigating potential EMI. For further information on E3, see Joint Publication (JP) 3-13.1, *Electronic Warfare*, and JP 6-01, *Joint Electronic Spectrum Management Operations.*

(2) **EMS Congestion.** The EMOE typically encountered by joint forces today is congested due to the increasing density of EM emitters. Myriad interests (such as cell phone and wireless internet providers, media) continue to expand their EMS footprint, reducing the open EM areas conducive to joint force maneuver.

(3) **The EM Threat.** Worldwide, tens of thousands of EMS-dependent weapons systems exist and are constantly being proliferated and enhanced. Current EMS threats include systems that can detect, exploit, deny, disrupt, and deceive virtually all multinational operational capabilities, including navigation, communications, and sensors. Destructive EM weapons that directly attack personnel, sensors, platforms, command and control (C2), and infrastructure have been fielded or are under development. Concurrently, adversaries seek access to secure communications and use navigational and sensing systems to facilitate their attacks. Adversaries also have access to off-the-shelf systems, and are prepared to use them, potentially without regard to legal constraints. All these threats to freedom of action in the EMS must be accounted and planned for in order to support and achieve the CDR's objectives. The worldwide proliferation of weapon systems, designed to counter US and multinational EMS-dependent capabilities (e.g., weapon seekers, navigation, communications), impact joint functions and overall mission success. Additionally, the operational viability of low cost directed energy (DE) weapon systems is growing, further complicating risk assessments and mission success by holding personnel, platforms, and infrastructure at risk. Enemy use of commercial-off-the-shelf systems to hide among civilians increases the targeting difficulty of US and multinational planners.

3. Principal Joint Electromagnetic Spectrum Operations Actions and Related Mission Areas

JEMSO actions to exploit, attack, protect, and manage the EMOE rely on personnel and systems from the legacy EMS-related mission areas (e.g., signals intelligence [SIGINT], EMS management, electronic warfare [EW]). Instead of these mission areas being planned and executed in a minimally-coordinated stovepiped fashion, JEMSO guidance and processes prioritize, integrate, synchronize, and deconflict all joint force actions in the EMOE, enhancing unity of effort. For example, the EW divisions of EA, electronic protection (EP), and electronic warfare support (ES) attack, protect, and exploit the EMS respectively. JEMSO processes ensure these EW actions are closely coordinated both with like actions (e.g., ES and SIGINT to exploit, EP and joint spectrum interference resolution [JSIR] to protect), as well as across all actions as a whole (e.g., exploit with attack to prevent friendly EMI). The result is a fully integrated scheme of maneuver in the EMOE to achieve EMS superiority and accomplish JFC objectives.

a. **Exploitation.** Most modern military systems, from support systems to weapons systems, exploit the EMOE to function optimally by sensing the EME and/or using EM energy to communicate through it. Sensing systems support intelligence collections, situational awareness, targeting, etc. EMS sensors can be active (e.g., air-to-air radars, laser target designators) or passive (e.g., radar warning receivers, IR weapons seekers). Communications systems support joint force C2, weapons control links, information dissemination, etc.

(1) **SIGINT.** SIGINT is a category of intelligence comprising either individually or in combination with all communications intelligence, electronic intelligence and foreign instrumentation SIGINT, however transmitted. SIGINT collection and dissemination are highly dependent on the EMS. SIGINT provides the basis for characterizing the EME to include those frequencies associated with radio, radar, IR equipment, and DE systems. Joint

intelligence preparation of the operational environment (JIPOE) analysts evaluate how the EME will affect military operations in a specific OA and collaborate with intelligence planners to deliver tailored JEMSO mission support products. For additional information on EME characterization and intelligence community (IC) coordination see Chapter III, "Planning Joint Electromagnetic Spectrum Operations."

(2) **ES**

(a) ES refers to the division of EW involving actions tasked by, or under direct control of, an operational CDR to search for, intercept, identify, and locate or localize sources of intentional and unintentional EM radiation for the purpose of immediate threat recognition, targeting, planning, and conduct of future operations. ES is closely related to, but separate from, SIGINT based primarily on the intent for which the data or information is to be used. The JEMSOC synchronizes and integrates the planning and operational use of ES sensors, assets, and processes within a specific OA to reduce uncertainties concerning the adversary, environment, time, and terrain. ES data can be used to produce SIGINT, provide targeting for EA or other fires, and produce measurement and SIGINT.

(b) **ES and SIGINT.** The distinction between ES and SIGINT is delineated by purpose, scope, and context. ES assets are tasked by operational CDRs to search for, intercept, identify, and locate or localize sources of intentional or unintentional EM radiation. In contrast, SIGINT assets are tasked by Director, National Security Agency (NSA)/Chief, Central Security Service (CSS), or by an operational CDR under SIGINT operational tasking authority delegated by the Director, NSA/Chief, CSS. The purpose of ES tasking is immediate threat recognition, planning, and conduct of future operations, and other tactical actions such as threat avoidance, targeting, and homing. ES is intended to respond to an immediate operational requirement. ES and SIGINT operations often share the same or similar assets and resources, and may be tasked to simultaneously collect information that meets both requirements. For example, data collected for intelligence purposes can meet immediate operational requirements as well as data collected for ES purposes can be processed by the IC for further exploitation after the operational CDR's ES requirements are met.

For further information on the SIGINT and ES relationship, see Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 3320.01, Joint Electromagnetic Spectrum Operations (JEMSO).

For further information on JIPOE, see JP 2-01.3, Joint Intelligence Preparation of the Operational Environment.

b. **Management.** All joint force actions must be managed to ensure unity of effort within the planned scheme of maneuver in the EMOE. EMS management, supported by EMBM processes, ensure joint force EMOE exploitation, attack, and protection actions are fully integrated in the most effective and efficient manner possible in a congested and contested EMOE.

(1) **EMS Management.** EMS management is planning, coordinating, and managing use of the EMS through operational, engineering, and administrative procedures. EMS management includes frequency management (FM), host nation coordination (HNC), and JSIR. EMS management's objective is to enable EMS-dependent capabilities and systems to perform their functions as designed without causing or suffering unacceptable EM interference. EMS management provides the framework to utilize the EMS in the most effective and efficient manner through policy and procedure. EMS management is analogous to the airspace management function in air operations, coordinating and integrating joint EMS use in terms of time, space, and frequency.

(a) **FM.** FM is the division of EMS management responsible for requesting, nominating, coordinating, assigning, and promulgating frequencies for EMS-dependent capabilities and systems. FM is also responsible for conducting interference analysis and resolution activities. It authorizes non-EA EM transmissions and protects capabilities from harmful interference. FM is a key component for developing EMSCOs and EMS coordination measures. FM examples include assigning frequencies to radios on specific platforms, datalinks on unmanned aerial systems and satellites, radars and weapon sensors, and networked information/communications systems.

(b) **HNC**

1. HNC is the division of EMS management for obtaining authorization to operate EMS-dependent systems within a sovereign nation. It pertains to foreign nations as well as the US and its territories. Granting approval to transmit EM energy within a country is a sovereign right.

2. HNC is normally accomplished through procedures established by geographic combatant command (CCMD) agreements with host nations (HNs). It should be conducted, when appropriate, with all countries in the area of interest. Unauthorized EMS use within an HN may be considered a violation of international treaty or local laws and regulations, and the JFC, subordinate CDRs, or operators may be held criminally or financially liable for violations and may have equipment confiscated.

(2) **EMBM.** EMBM consists of the dynamic monitoring, assessing, planning, and directing of EMSO in support of the CDR's scheme of maneuver. EMBM guidance and processes provide JEMSO situational awareness, decision support, and C2 support, underpinned by common architecture, standards, and data. The EMSCA establishes and enforces EMBM guidance and processes to orchestrate the EM actions of all land, maritime, air, space, and cyberspace component EMS capabilities into an integrated, coherent whole. This integration of JEMSO processes and capabilities with other operations enables freedom of action across all domains and joint functions.

For further information on EMBM, see Joint Concept for Electromagnetic Spectrum Operations.

c. **Attack.** JEMSO capabilities can directly produce effects in the EMOE. EW refers to military action involving the use of EM energy and DE to control the EMS or to attack the

enemy. JEMSO integrates EW with other capabilities such as cyberspace operations (CO) to produce coordinated effects in the EMOE.

For further information on detailed EW planning and operations, see JP 3-13.1, Electronic Warfare.

(1) **EA**

(a) EA refers to the division of EW involving the use of EM energy, DE, or antiradiation weapons to attack personnel, facilities, or equipment with the intent of degrading, neutralizing, or destroying enemy combat capability and is considered a form of fires (see JP 3-09, *Joint Fire Support*). EA includes both active EA, in which EA systems or weapons radiate in the EMS, as well as passive EA (non-radiating/reradiating) such as chaff. Examples of EA systems that use radiated EM energy (to include DE) as their primary disruptive or destructive mechanism include lasers, electro-optical, IR, and radio frequency (RF) weapons such as high-power microwave (HPM) or those employing an EMP. JEMSO planners integrate EA through the joint targeting coordination board (JTCB), coordinating effects and incorporating risk mitigation strategies to reduce collateral damage.

(b) EA used for defensive purposes in support of force protection or self-protection is often mistaken as EP. Although defensive EA actions and EP both protect personnel, facilities, and equipment, EP protects from the effects of EA or EMI, while defensive EA is primarily used to protect against lethal attacks by denying enemy use of the EMS to target, guide, and/or trigger weapons.

(2) **Navigation Warfare (NAVWAR).** NAVWAR refers to deliberate defensive and offensive action to assure friendly use and prevent adversary use of positioning, navigation, and timing (PNT) information through coordinated space, cyberspace, and EW operations.

d. **Protection.** As joint forces are critically dependent on exploiting the EMOE, JEMSO must ensure the necessary EMS access by minimizing EMI from friendly, neutral, and enemy actions. JEMSO integrates EW and EMS management protection actions throughout planning and execution, allowing joint force EMS-dependent systems to operate in the EMOE as intended.

(1) **EP.** EP refers to the division of EW involving actions taken to protect personnel, facilities, and equipment from any effects of friendly, neutral, or enemy use of the EMS, as well as naturally occurring phenomena that degrade, neutralize, or destroy friendly combat capability. EP focuses on system or process attributes, or capabilities that eliminate or mitigate the impact of EMI. These inherent hardware features, processes, and dedicated tactics, techniques, and procedures (TTP) combine to allow friendly capabilities to continue to function, as intended, in contested and congested EMOEs. Examples of EP include:

(a) Frequency agility in a radio for anti-jam.

(b) Variable pulse repetition frequency in a radar.

(c) Receiver/signal processing.

(d) Spread spectrum technology.

(e) Multi-spectral low observability (stealth).

(f) EM capability hardening against effects of high-energy EA (e.g., laser, HPM, EMP).

(g) Use of wartime reserve modes (WARMs).

(h) IR missile flare rejection logic.

(i) Selective opacity (i.e., the phenomenon of not permitting the passage of EM radiation) through optical apertures.

(j) Global Positioning System (GPS) signal protection measures.

(k) EMS management processes to include:

1. EMS coordination measures (e.g., joint restricted frequency list [JRFL]).

2. EMCON procedures.

(2) **JSIR.** JSIR is the division of EMS management that identifies, reports, analyzes, and mitigates or resolves incidents of EMI. JSIR uses a systematic process to report and diagnose the cause or source of all EMI (intentional/unintentional). JSIR is a continuous process that is implemented once forces have deployed, and is not part of the planning process. Incidents of EMI should be reported immediately and resolved or mitigated at the lowest possible level within the command structure. EMI can be induced intentionally, as in EA, or unintentionally, as a result of spurious emissions and responses, intermodulation products, improper operation, or inadequate EMS management.

For further information on JSIR, see CJCSI 3320.02, Joint Spectrum Interference Resolution (JSIR), *and Chairman of the Joint Chiefs of Staff Manual (CJCSM) 3320.02,* Joint Spectrum Interference Resolution (JSIR) Procedures.

4. Role of Joint Electromagnetic Spectrum Operations Across the Joint Functions

Joint functions are related capabilities and activities grouped together to help JFCs integrate, synchronize, and direct joint operations.

For further information on joint functions, see JP 3-0, Joint Operations.

a. **C2.** For C2 of forces, CDRs are highly dependent on the EMS, especially the radio, microwave, and optical frequency bands. These bands are increasingly congested by civil/commercial use and potentially contested by adversaries. JEMSO deconflicts joint

force communications from civil/commercial/enemy use, prioritizes and synchronizes communications across components, and protects joint force communications from enemy EA. JEMSO and CO mission areas integrate closely to enable assured C2 of assigned and attached forces. Assured C2 requires gaining and maintaining EMS superiority during all phases of military operations.

b. **Intelligence.** Understanding the OE is fundamental to joint operations. EMS-dependent sensors, both active (e.g., synthetic aperture radars) and passive (e.g., radio scanners, IR cameras), provide much of the information necessary for JIPOE. By prioritizing, integrating, and synchronizing joint EMS-use, JEMSO enhances intelligence activities with assured sensor C2, data dissemination, and optimized target collection. JEMSO deconflict joint force sensors from civil/commercial/enemy use, prioritizes and integrates them with other JEMSO (e.g., communications, fires), and protects them from enemy EA.

c. **Fires.** JEMSO are critical enablers in supporting fires and are themselves (as EA) a form of fires. EA capabilities can produce a full range of scalable effects including disruption, deception, denial, and destruction. Many fires systems have EMS-dependent targeting sensors, PNT requirements, seekers, and C2 datalinks. JEMSO deconflicts these systems from civil/commercial/enemy EMS use, prioritizes and integrates them with other JEMSO (e.g., communications, sensing), and protects them from enemy EMSO. JEMSO, especially the EW mission area, and CO mission areas integrate closely to produce synergistic effects on targets. As a form of fires, EA is capable of creating either lethal or nonlethal effects on a target, while ES and SIGINT provide targeting and weaponeering information for EA as well as other forms of fires.

d. **Movement and Maneuver.** As a physical space, joint forces can maneuver in the EMOE to achieve a position of advantage over an enemy. Joint forces can employ EA to occupy key frequency bands for channeling or denying enemy EMS use to enable lethal and nonlethal effects against that enemy. JEMSO provides maneuver forces assured access to the C2, intelligence, fires, protection, and sustainment functions necessary for effective combined arms operations.

e. **Protection.** JEMSO protects friendly forces through defensive EA, ES, and EP. Defensive EA (e.g., counter-radio controlled improvised explosive device [IED] systems, aircraft survivability systems) denies enemy sensing and targeting systems the information necessary to attack joint forces while ES systems (e.g., radar warning receivers) provide indications and warning of enemy attacks. DE systems are employed to deny or destroy attacking munitions while built-in EP features provide inherent protection against enemy EA. EP and JSIR processes identify, minimize and mitigate the enemy EA and EMI experienced by joint forces. JEMSO also deconflicts joint force combat identification systems from civil/commercial/enemy use, prioritizes and integrates them with other JEMSO (e.g., communications, fires), and protects them from enemy EA.

f. **Sustainment.** JEMSO deconflicts joint force logistics communications from civil/commercial/enemy use, prioritizes and synchronizes communications across components, and protects joint force communications from enemy EA. JEMSO supported

sustainment activities ensure freedom of action, extend operational reach, and prolong combat endurance.

5. Role of Joint Electromagnetic Spectrum Operations Across the Domains

a. **Air, Maritime, and Land Domains.** Operations within the air, maritime, and land domains are similar in their EMS-dependence through the execution of the joint functions as described in the previous section. Since the EMS overlaps all the physical domains and the information environment simultaneously, JEMSO provides the processes to effectively prioritize, integrate, synchronize, and deconflict the EMS aspects of operations throughout the OE.

b. **Cyberspace**

(1) The majority of military systems contain both cyberspace- and EMS-dependent components, requiring forces to employ JEMSO and CO capabilities in close integration. Many CO occur through the EMS, especially at the tactical level, and require close coordination with other JEMSO through EMBM processes. Capabilities the JFC may employ in conjunction with, or to enable CO, include EW, EMS management, SIGINT, and NAVWAR.

(2) **EA and Cyberspace Attack.** EA can be used to facilitate cyberspace attack objectives and, conversely, cyberspace attack can be used to facilitate EA objectives. When combined, EA is used for injection of an autonomous or interactive executable CO payload into a system. This combination is characterized by deterministic effects within data-based components.

c. **Space.** The majority of space operations rely on the EMS for asset C2, sensing, and information distribution. The vital nature of space operations to overall joint operations requires close coordination with other JEMSO to ensure proper prioritization, integration, synchronization, and deconfliction.

Intentionally Blank

CHAPTER II
ORGANIZING FOR JOINT ELECTROMAGNETIC SPECTRUM OPERATIONS

1. Introduction

How joint staffs are organized to plan and execute JEMSO is a prerogative of the JFC. The size of the CDR's staff, the mission(s) the joint force is tasked to accomplish, and the time allocated to accomplish the mission or missions are just some of the factors that affect the organization of the staff. This chapter discusses nominal requirements, organizations, and staff functions to plan and execute EMSO in joint operations. A brief introduction to how each of the five Services is organized to plan and execute EMSO is included in order to provide background on how JFC staff EMSO functions interact with Service/functional components.

2. Responsibilities

a. It is the responsibility of the unified combatant commander (CCDR) to establish and promulgate command-specific policy and guidance for EMSO planning and execution. This can be divided among multiple directorates of a joint staff based on long-, mid-, and near-term functionality and availability of trained EMSO personnel. Processes and directives (e.g., JRFL process, the joint communication-electronics operating instructions [JCEOI], software defined radio [SDR] waveform implementation and sharing) should also be determined as necessary for operations specific to the area of responsibility (AOR). All aspects of EMSO should be coordinated closely with JFCs and their components.

b. **EMSCA**

(1) EMS control is the coordinated execution of JEMSO with lethal and nonlethal operations that enable freedom of action in the EMOE. The JFC designates an EMSCA to assume overall responsibility for JEMSO. The EMSCA will have primary staff responsibility for planning, coordinating, monitoring, assessing, and prioritizing execution of JEMSO. The EMSCA directs the planning, developing, and publishing of the electromagnetic spectrum control plan (EMSCP) and EMSCO, as well as conducting EMBM. The EMSCA establishes procedural EMS control methods based on the military operation and level of conflict. Authority for directing/ordering of specific EMS operations in, around (posturing), and through the EMS for the purposes of achieving EMS superiority resides with the JFC or as delegated. The EMSCA plans these JEMSO and tasks supporting CDRs, through the EMSCP and EMSCO, who incorporate them in their respective plans and orders.

(2) **EMSCA Responsibilities.** The EMSCA provides centralized direction through the EMSCP and EMSCO, supplemented by EMS coordination measures; all coupled with an EMBM system. The EMSCA will normally coordinate with component EMSO cells prior to commencement of operations in order to integrate and coordinate all component EMS-use requirements. The EMSCA does not have the authority to approve or disapprove combat operations. That authority is vested only in operational CDRs. The EMSCA assumes

responsibility for EMBM in the designated joint operations area (JOA). Subject to the authority and approval of the JFC, the broad responsibilities of the EMSCA include:

(a) Prioritize, integrate, synchronize, direct, and deconflict the use of the EMS.

(b) Develop broad policies and procedures for EMS control and for the coordination required among all joint EMS users.

(c) Establish EMBM that provides for integration of HN and other affected nations' constraints and requirements.

(d) Promulgate EMSO policies and procedures via the JFC-approved EMSCP.

For further information on EMSCP and EMSCO, see Chapter II, "Organizing for Joint Electromagnetic Spectrum Operations," and Chapter III, "Planning Joint Electromagnetic Spectrum Operations."

(e) **Authorize Joint EM Energy Transmission.** While no authorization is required to receive EM energy, EMSCA authorization is required to transmit EM energy. The JEMSOC prepares the orders that authorize joint forces to transmit EM energy. The two authorities for transmitting EM energy are:

1. **Electronic Attack Control Authority (EACA).** EACA is the authority to conduct EA in the JOA. EACA can either be retained by the EMSCA or executed by the EMSCA's designated representative. Routine execution of EACA responsibilities will normally be delegated to the JEMSOC director and may be temporarily delegated to components for the purpose of local/tactical mission refinement and interference remediation. EACA responsibilities include:

a. Participating in EMS coordination measures development (e.g., JRFL).

b. Ensuring compliance with the approved EMS coordination measures.

c. Gaining and maintaining situational awareness of all EA-capable systems and related operational parameters in the OA.

d. Resolving EMSO prioritization recommendation issues.

e. Coordinating introduction of new EMS-dependent systems in the OA.

f. Coordinating with components on EA requirements.

g. Developing, coordinating, updating, and promulgating EACA guidance and directives (e.g., instructions, rules of engagement [ROE], EMSCP, EMSCO, special instructions).

h. Monitoring and assessing joint force EA activity for EACA compliance and determining corrective action when necessary.

2. **Frequency Assignment Authority.** This is the authority to transmit EM energy (other than for EA) in the JOA. Frequency assignment authority can either be retained by the JFC or assigned to the JFC's designated representative. Routine frequency assignment authority responsibilities will normally be delegated to the JEMSOC director and may be delegated to components for the purpose of local/tactical mission refinement and flexibility. Frequency assignment authority responsibilities include:

a. Participating in EMS coordination measures development (e.g., JRFL).

b. Ensuring compliance with the approved EMS coordination measures.

c. Gaining and maintaining situational awareness of all EM energy (other than for EA) in the JOA.

d. Resolving EMSO prioritization recommendation issues.

e. Coordinating introduction of new EMS-dependent systems in the JOA.

f. Coordinating with components on EM transmission (other than for EA) requirements.

g. Monitoring joint force EM transmission (other than for EA) activity for frequency compliance and determining corrective action when necessary.

(3) **Electromagnetic Spectrum Control (EMSC) Considerations.** The JFC exercises EMSC, facilitated by EMBM processes, to reduce the risk of friendly EMI, enhance EP, and permit greater flexibility of operations. The JFC will determine the degree of EMSC required in the JOA, depending on mission, ROE, transmission patterns, etc. The JFC may require all EMS activity, including transmitters and receivers of all components, to appear on the appropriate EMSCO. Typically, these procedures are promulgated by the JEMSOC in the EMS coordination measures annex of the EMSCP and are activated in the EMSCO. The mix of friendly, adversary, and neutral EM emitters and mission constraints may require the JFC to strictly control EMS transmissions in the JOA.

c. **CCDR**

(1) CCDRs and subordinate JFCs establish a standing JEMSOC to support joint planning, coordination, and control of the EMS for assigned forces. Every supported CCDR establishes a command policy on how the EMS will be used in their functional area or AOR as appropriate, obtains EMS clearance (or approval) from HNs (through existing coordination procedures), and authorizes EMS use by assigned military forces to execute

their designated missions. Every supported CCDR conveys to its subordinates how to conceptualize achieving EMS superiority within the JOA through the respective concept of operations (CONOPS). Part of this planning includes development and approval of an operational approach, mission statement, CDR's planning guidance, CDR's intent, commander's critical information requirements (CCIRs), and CONOPS, at a minimum.

(2) It is the responsibility of the CCDR to establish and promulgate command specific policy and guidance for JEMSO planning and execution.

(3) CCDR duties include establishing a standing JEMSO organizational structure (to include a JEMSOC) and the procedures to support planning and operations. Specific actions should be taken to:

(a) Ensure all plans address JEMSO coordination among forces operating in the EMOE to enable data exchange, eliminate duplication of effort, achieve mutual support, and minimize friendly EMI.

(b) Ensure plans address any necessary augmentation of the JEMSOC to support JEMSO.

(c) Resolve EMS user prioritization issues not resolved at a lower level.

(d) Maintain close contact with appropriate foreign military forces and civil administrations to ensure that mutual EMS support is considered in combined planning, operations, training, and exercises.

(e) Function as controlling authority for the JCEOI in the EMSCO.

(f) Function as controlling authority for EMS policy.

(g) Ensure procedures and policies are in place for the safeguarding, use and transfer of reprogrammable EMS-dependent system waveforms.

(h) Establish policy and guidance for EMS coordination measures (e.g., JRFL).

d. **JFC Staff.** The functional areas of the JFC's staff have duties as follows:

(1) **Manpower and Personnel Directorate of a Joint Staff.** Coordinate all personnel augmentation for the JEMSOC to fill all billets with qualified and experienced personnel and request augmentees.

(2) **Intelligence Directorate of a Joint Staff (J-2).** Duties are to:

(a) Designate a JEMSOC core member to represent the J-2 in joint force EMS-use planning, prioritization, integration, synchronization, direction, and deconfliction.

(b) Provide the JEMSOC with prioritized EMS-use requirements for intelligence operations and collections, to include JRFL inputs and collection plans.

(c) Provide the JEMSOC with EMOE characterization information including EOB and adversary EMS-use data in accordance with (IAW) applicable releasability constraints.

(d) Assist the JEMSOC with JSIR.

(e) Integrate the appropriate intelligence systems into the JFC's EMBM architecture.

(f) Provide the JEMSOC with EA targeting information.

(g) Provide the JEMSOC with EMOE characterization information of HN or "gray" EMS use data IAW applicable releasability constraints.

(3) **Operations Directorate of a Joint Staff (J-3).** Duties are to:

(a) Designate the JEMSOC director to lead joint force EMS-use planning, prioritization, integration, synchronization, direction, and deconfliction.

(b) Provide EMS staff estimate and associated EMS superiority strategy.

(c) Approve the EMSCP and associated documents (e.g., JRFL, JCEOI).

(d) Approve the EMSCO.

(e) Prioritize available EMSO capabilities when there are insufficient required resources.

(f) Provide EMS-use prioritization guidance for joint EMS-use conflict resolution.

(g) Approve and enforce HERO, HERP, and HERF guidelines.

(h) Ensure that joint force EM capabilities requirements are communicated to higher headquarters (HHQ) for sourcing, if the joint force does not have a force structure, resource, and assessment directorate of a joint staff (J-8).

(i) Delegate day-to-day authorities for execution of JEMSO responsibilities to the JEMSOC director as required, unless expressly restricted or otherwise specified.

(j) Provide the J-2 with prioritized JEMSO intelligence requirements.

(k) Incorporate JEMSO into planning.

(4) **Logistics Directorate of a Joint Staff.** Coordinate distribution of critical EM-related equipment to priority units as defined by the JEMSOC to support optimal force employment.

(5) **Plans Directorate of a Joint Staff (J-5).** Duties are to:

(a) Coordinate with the JEMSOC and ensure JEMSO are incorporated into future plans.

(b) Establish preplanned coordination channels, as required, for the communications system directorate of a joint staff (J-6) to negotiate military EMS use with HN and multinational partner EMS organizations where procedures do not already exist.

(6) **J-6.** Duties are to:

(a) Designate a JEMSOC core member to represent the J-6 in joint force EMS-use planning, prioritization, integration, synchronization, direction, and deconfliction.

(b) Coordinate with the JEMSOC to identify joint force communications network EMS-use requirements to be included in the EMSCO.

(c) Assist the JEMSOC with resolution of reported instances of interference or disruption.

(d) Assist JEMSOC with development and maintenance of EMS database(s).

(e) Through the CCMD J-6, negotiate military EMS use with HN EMS organizations.

(f) Provide the J-2 with prioritized intelligence requirements.

(g) Serve as single control agency for the management and operational direction of the joint communications network.

(h) Provide communications EMS-use requirements to the JEMSOC.

(i) Manage and exercise control over all communications systems deployed during joint operations and exercises.

(7) **J-8.** Coordinate with the JEMSOC to determine capability shortfalls and requirements as well as to initiate requests of the appropriate urgency to HHQ or continental United States (CONUS)-based organizations for sourcing or acquisition.

(8) **Meteorological and Oceanographic (METOC) Cell.** Provide the JEMSOC with atmospheric and space weather information affecting the EMOE (e.g., ducting, ionosphere, solar effects).

e. **Functional/Service Component CDRs.** Responsibilities include:

(1) Establish an EMSO element to coordinate with the JEMSOC on functional/Service component EMSO operational plans.

(2) Prioritize, consolidate, validate, and report component EMS-use requirements to the JEMSOC.

(3) Receive reports, identify, and attempt to resolve component-specific EMI.

(4) Make recommendations for best force contributions and utilization to gain and maintain EMS superiority within the JOA.

f. **EMS Users.** The duties are to:

(1) Provide the JEMSOC prioritized EMS-use requirements through their component EMSO element. Inputs will include receive-only systems to ensure prioritization and integration with joint force EM transmissions (e.g., sensing, communications, EA).

(2) Obtain frequency authorization through their component EMSO element for each transmission in the EMS. EA users must ensure compliance with applicable EACA processes and ROE.

(3) Operate systems IAW parameters authorized by the frequency assignment process (e.g., frequency, bandwidth, power, waveform).

(4) Ensure EMS-dependent equipment is properly maintained to preclude unintentional violation of authorized EMS-use parameters.

(5) Make recommendations for best force contributions and utilization to gain and maintain EMS superiority within the JOA.

(6) Use JSIR procedures to report adverse EMS effects on operations.

3. Organization

a. **JEMSOC**

(1) The JFC normally will establish a JEMSOC as the primary staff element responsible for planning, coordinating, executing, and assessing JEMSO in order to achieve and maintain EMS superiority. EMSCA is usually delegated to the JEMSOC director which, when coupled with the JEMSOC's organizational responsibilities, allows the JFC to exercise unity of command in the EMS. Joint force unity of effort in the EMS derives from the JEMSOC's integration of all joint force EMS actions across both the joint force's functional staff elements (e.g., SIGINT, EMS management, EW, CO, fires) and the joint force's components. The JEMSOC augments existing joint force C2 lines of authority with reporting and data structures that accelerate the flow of information required for EMSO integration. It assists supported CDRs in identifying EMSO priorities, communicating intent, and integrating supporting CDR capabilities into operations. It assists supporting CDRs by integrating their individual EMSO efforts and incorporating the priorities of the supported CDR. The JEMSOC maintains habitual relationships with key individuals (e.g., component liaison officers [LNOs]) and enabling organizations such as Service, functional, and multinational EW/EMS management cells, and other Department of Defense (DOD) EMSO-related organizations. The relationships are refined during training and exercises and optimized via a network of collaboration throughout planning, execution, and assessment.

For more information on external EMSO support organizations, see Appendix E, "Organizations Supporting Joint Electronic Warfare."

(2) **JEMSOC Organization.** The JEMSOC is the permanent organization within a joint force responsible for JEMSO with a core membership comprised of experts in EMS sensing (e.g., SIGINT collection management, ES), communications (e.g., EMS management, frequency assignment), attack (e.g., EA), and management (e.g., EMS database management, EM modeling). JEMSOC membership should be a long-term assignment for continuity/expertise, and members should be designated spokespersons for their respective organizations. The JEMSOC should also coordinate with representatives from joint force components (Service and/or functional) and other supporting organizations or agencies. A notional JEMSOC organization structure is depicted in Figure II-1.

(a) **JEMSOC Organization by Joint Force Level.** While unified CCMD and subordinate unified command JEMSOCs may choose to carry out all JEMSOC

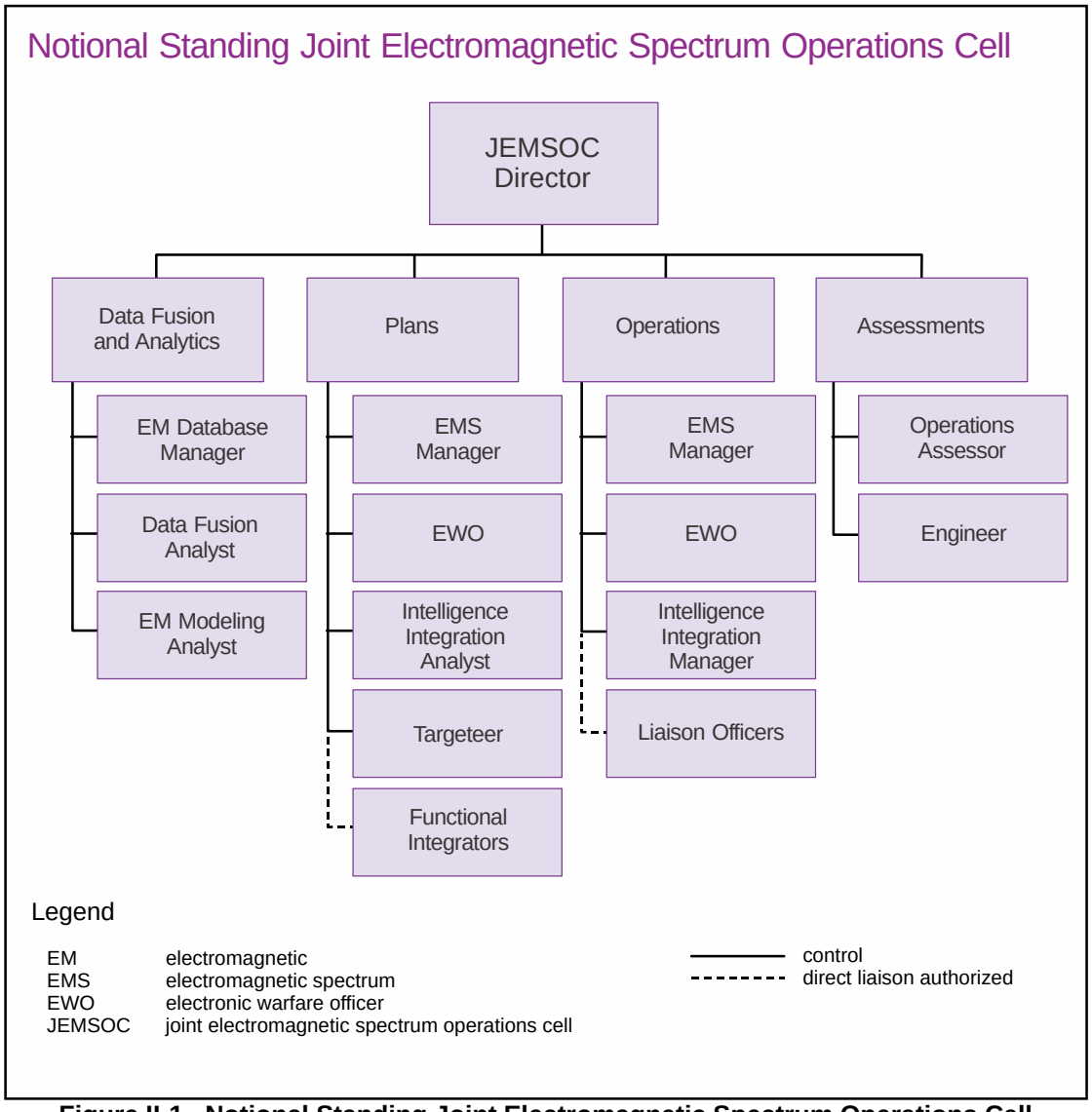

Figure II-1. Notional Standing Joint Electromagnetic Spectrum Operations Cell

responsibilities, operational planning and execution responsibilities are normally delegated to the JEMSOCs at the subordinate joint commands (i.e., joint task forces [JTFs]). In this case, JEMSOC manning will vary by echelon with the unified CCMD JEMSOC organized for theater level steady state JEMSO planning, coordination, and guidance. Subordinate JEMSOCs will be organized for continuous operational planning and execution. At all joint force levels, the JEMSOC will maintain the appropriate skill sets (e.g., SIGINT collection managers, EMS managers, electronic warfare officers [EWOs], EMS database managers) to carry out assigned tasks and missions.

1. **JEMSOC Relationship to Joint Frequency Management Office (JFMO) and Joint Force Commander's Electronic Warfare Staff (JCEWS).** At the unified CCMD and subordinate unified command levels, the JEMSOC subsumes all the responsibilities of the JCEWS and the EMS management/frequency assignment responsibilities of the JFMO to include joint force EMS-use planning and guidance. The JFMO retains responsibility for coordinating joint force EMS-use with US and HN authorities.

2. **JEMSOC Relationship to Joint Spectrum Management Element (JSME) and Electronic Warfare Cell (EWC).** At the JTF level, the JEMSOC subsumes all the responsibilities of the JSME and EWC.

(b) **Notional JEMSOC**

1. **JEMSOC Director.** The JEMSOC director serves as the CDR's primary advisor on EMS-related issues. When delegated EMSCA, the JEMSOC director provides the JFC unity of command in the EMS. The director is normally assigned based on core expertise (e.g., EMS management, EW, SIGINT collections management) and the joint force's assigned mission. If the mission/tasking requires a JEMSOC deputy director, personnel with complementary core expertise should be assigned.

2. **Data Fusion and Analytics Section.** Provides the processes, data management, and analysis functions to synchronize EMS-related data across the joint force staff, components, and external agencies.

3. **Plans Section.** Provides the core JEMSO planning expertise (EMS management, EW, intelligence) and integrates JEMSO requirements into the joint planning cycle. Integrates principle JEMSO EMS-use requirements (e.g., sensing, communications, attack) with other mission area (e.g., space operations, information operations [IO], CO) and component EMS-use requirements. Prepares target nominations for EMS-related target elements.

4. **Operations Section.** Provides the core JEMSO operations expertise and integrates JEMSO requirements into the joint operations cycle. This section may also contain component and capability LNOs (to include multinational personnel) to coordinate current operations and support planning as required.

5. **Assessment Section.** Collates and analyzes JEMSO-related operational data to inform the JEMSO planning and operations cycles.

(c) Members of a fully staffed JEMSOC should fulfill the functions of:

1. Director.

2. EMBM database manager.

3. Data fusion analyst(s).

4. EM modeling analyst.

5. EMS manager(s).

6. EWO(s).

7. Intelligence integration analyst.

8. Targeteer.

9. Intelligence integration manager(s).

10. Operations assessor.

11. Engineer.

(d) JEMSOC networked representation should include:

1. NAVWAR representative.

2. Electro-optical-infrared (EO-IR) representative.

3. Space control representative.

4. DE representative.

5. CO representative.

6. Counter-IED representative.

7. Joint interface control officer.

8. Communications planner.

9. Satellite communications (SATCOM) planner.

10. Military information support operations (MISO)/military deception (MILDEC) representative.

11. Component LNO(s).

12. Capability LNO(s).

(3) **EMSO Element.** Component-level JEMSO support activities are referred to as EMSO elements. A component EMSO element may be tasked with JEMSO integration responsibilities until a JEMSOC can be designated and sufficiently manned. As soon as practical, the JEMSOC should be aligned organizationally and, if possible, geographically co-located with the JFC. A notional joint force JEMSO organization structure is depicted in Figure II-2.

b. **JEMSOC Responsibilities and Functions**

Note: The JEMSOC director serves as the CDR's primary advisor on EMS-related issues.

(1) Maintains JEMSO support to current plans.

(2) Prepares JEMSO portion of estimates and tabs to joint force operation plans (OPLANs), concept plans (CONPLANs), operation orders (OPORDs), and identifies the necessary OPORD implementation authorities.

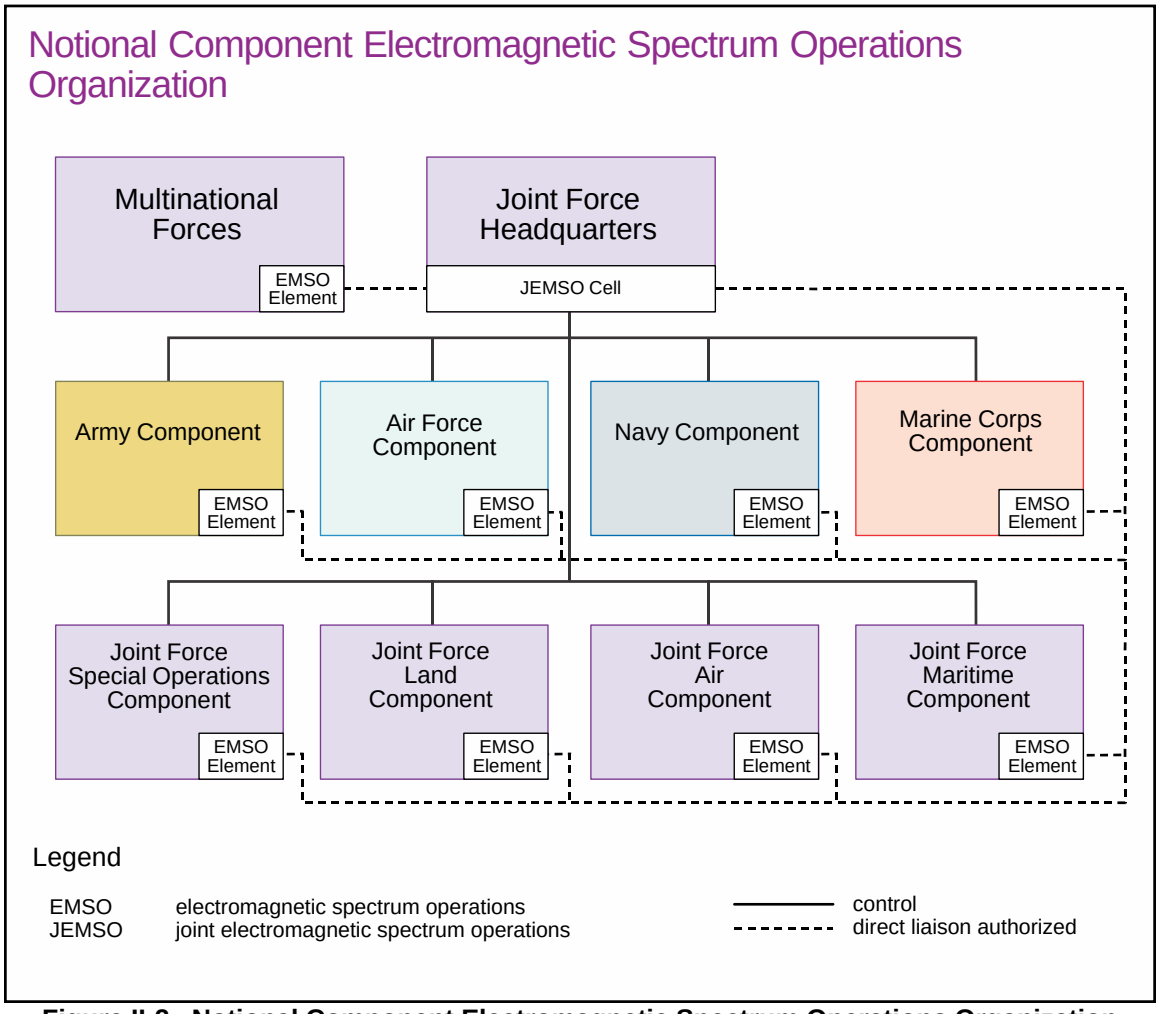

Figure II-2. Notional Component Electromagnetic Spectrum Operations Organization

(3) Develops an EMS superiority strategy enabling JFC objectives.

(4) Identifies, recommends, and develops EMS target elements to support the JFC's objectives.

(5) Implements and manages JEMSO policies and orders.

(6) Develops and maintains contingency/JEMSO requirements and resource options/courses of action (COAs).

(7) Coordinates EMS-use requirements with J-5 and J-6 for HNC.

(8) Provides JEMSO planning, execution, and assessment coordination expertise to the JFC with an associated JEMSO battle rhythm.

(9) Defines and develops intelligence requirements to support JEMSO.

(10) Coordinates with J-2 to weigh intelligence gain/loss of EA to include physical destruction of targets and makes EMS-use prioritization recommendations to the J-3.

(11) Maintains current assessment of EW resources available to the JFC (to include number, type, and status of EW assets) and analyzes what resources are necessary to accomplish the JFC's objectives.

(12) Represents JEMSO within the joint force staff battle rhythm and appropriate cross functional staff organizations.

(13) Predicts effects of friendly and adversary JEMSO activity on joint and multinational operations using applicable modeling, simulation, and analysis tools.

(14) Coordinates joint urgent operational needs statements that affect the EMS.

(15) Coordinates entry of EMS-dependent systems into the JOA.

(16) Directs and coordinates activities to resolve EMS-use conflicts.

(17) Executes frequency assignment authorities on behalf of the EMSCA.

(18) Coordinates and monitors EW reprogramming.

(19) Compiles and coordinates EMS-use requests from all components according to the priorities set by the JFC.

(20) References lessons learned information systems during the planning process, archives JEMSO planning and execution data, and documents JEMSO lessons learned IAW the joint lessons learned program. The Joint Lessons Learned Information System (JLLIS) Web site can be found at https://www.jllis.mil or http://www.jllis.smil.mil.

(21) Coordinates, plans, and oversees execution of JEMSO.

(22) Develops, coordinates, and publishes EMS coordination measures (e.g., JRFL).

(23) Performs JSIR functions IAW CJCSM 3320.02, *Joint Spectrum Interference Resolution (JSIR) Procedures;* and CJCSI 3320.02, *Joint Spectrum Interference Resolution (JSIR).*

(24) Maintains the common EMS-use database necessary for planning, coordinating, and controlling joint force EMS use.

(25) Develops, coordinates, and publishes the EMSCP and EMSCO.

(26) Provides guidance and procedures for post-conflict JEMSO transitions.

(27) Establishes and promulgates JFC's EMBM standards and processes.

(28) Defines and characterizes the EMOE as needed during planning and continuously throughout execution.

c. **JEMSOC Security Requirements.** The JEMSOC should be located in, or have access to, a sensitive compartmented information facility to allow for appropriate security. Optimal JEMSOC staffing will include special technical operations (STO) cleared personnel in order to coordinate and deconflict STO issues and capabilities. The JEMSOC will also require access to the administrative, intelligence, logistics, legal, communications/network, and partner nation systems support made available to the J-3 staff.

For further information on JEMSOC, see CJCSI 3320.01, Joint Electromagnetic Spectrum Operations (JEMSO).

4. Service Support

Each Service has a different approach to organizing its forces. Therefore, the information below is provided to supply a basic understanding of how each Service's EMSO facilitate planning and coordination of EMSO at the joint level.

a. **Army**

(1) The Army organizes to conduct JEMSO primarily through the cyber electromagnetic activities (CEMA) element. CEMA are activities leveraged to seize, retain, and exploit an advantage over adversaries and enemies in both cyberspace and the EMS, while simultaneously denying and degrading adversary and enemy use of the same and protecting the mission command system (Army Doctrine Reference Publication [ADRP] 3-0). CEMA consist of CO, EW, and spectrum management operations (SMO) (Field Manual 3-38, *Cyber Electromagnetic Activities*). The Army will rely on the CEMA staff element to interface with all joint and multinational EW staffs and nonorganic EW capability providers, and perform all JEMSO responsibilities when designated a JTF headquarters (HQ) or land component HQ.

(2) The CEMA staff element is responsible for planning, integrating, and synchronizing CO, EW, and SMO to support the CDR's mission and desired end state within cyberspace and the EMS. During execution, the CEMA element is responsible for synchronizing CEMA to best facilitate mission accomplishment.

(a) The CEMA element is led by the EWO and provides staffs expertise for the planning, integration, and synchronization of CO, EW, and SMO. CDRs organize their staffs based on mission requirements, strengths, and weaknesses. When the mission dictates, the CEMA element can leverage other additional skill sets of the CEMA working group as needed to conduct both joint and unified land operations. When operating in a joint, multinational, or intergovernmental environment, CDRs may reorganize their staffs to better align with HHQ. The CEMA element is an organic organization in brigade, division, corps, and theater Army staffs.

(b) There are several key personnel involved in the planning and coordination of CEMA in and with the CEMA element. They are the:

1. EW staff.

2. Spectrum manager.

3. Assistant chief of staff, intelligence (G-2 [S-2]) staff.

4. Assistant chief of staff, signal (G-6 [S-6]) staff.

5. Cyberspace planner.

(3) The CEMA working group, when established, is accountable for integrating CEMA and related actions into the CONOPs. CEMA working groups do not add additional structure to an existing organization. The CEMA working group is a collaborative staff meeting led by the EWO to analyze, coordinate, and provide recommendations for a particular purpose, event, or function. The CEMA working group is responsible for coordinating horizontally and vertically to support unified land operations and will primarily deconflict detection and delivery assets through the planning and targeting processes. Staff representation within the CEMA working group may include the G-2 (S-2), G-6 (S-6), G-7 (S-7), G-9 (S-9), fire support officer, space support element, judge advocate general representative (or appropriate legal adviser), and a joint terminal attack controller when assigned. The CEMA working group augments the function of the permanently established CEMA element. When scheduled, the CEMA working group is a critical planning event integrated into the staff's battle rhythm.

For more information on Army CEMA, refer to Field Manual 3-38, Cyber Electromagnetic Activities.

b. **Marine Corps**

(1) Headquarters, United States Marine Corps Combat Development and Integration (HQMC CD&I), is the advocate for Marine Corps EMSO. HQMC CD&I is responsible for coordinating with the operating forces, supporting establishments, and mission partners in order to identify, prioritize, and integrate expeditionary cyberspace and EW capability solutions across the pillars of doctrine, organization, training, materiel, leadership and education, personnel, and facilities; battlespace functions; and joint requirements. Marine Corps EMSO requirements are generated by HQMC CD&I, HQ Aviation, and operating forces input.

(2) EMSO facilitate Marine air-ground task force (MAGTF) C2 while simultaneously denying unimpeded EMS access to adversaries. This facilitates MAGTF efforts to dictate operational tempo in support of a CDR's objectives. Based upon accurate, timely, and shared understanding of the EMOE, coordinated MAGTF EMSO can more effectively target adversaries while minimizing interference of friendly and neutral systems within a congested and contested EMS.

(3) The Marine Corps approach to EMSO reflects a five-element design. This provides the intellectual foundation for how the Marine Corps approaches EMSO in order to maintain EMS superiority in a congested, contested, and competitive EMOE. With this understanding, a more detailed concept of employment can be developed. Each element builds upon the next, and together they support how the MAGTF achieves and maintains EMS superiority:

(a) Network-enabled systems.

(b) Networks and connectivity.

(c) Common data sources and formats.

(d) Common Service framework.

(e) Common user environment.

(4) The cyberspace and electronic warfare coordination cell (CEWCC) coordinates the integrated planning, execution, and assessment of cyberspace and EMS actions across the MAGTF's OE in order to increase operational tempo and achieve military advantage. The CEWCC construct originates from the traditional electronic warfare coordination cell (EWCC), but with additional capability for planning, requesting, and/or coordinating organic and external support for CO. The CEWCC is the principal means for the CDR to plan, coordinate, synchronize, and deconflict operations in and through the EMS and their potential impacts on the EMOE. The CEWCC will use EMS coordination documents to define supporting and supported roles and determine specific control measures to synchronize operations occurring in and through the EMS.

(5) The Headquarters, United States Marine Corps Director, Command, Control, Communications, and Computer Systems (HQMC C4)/Department of the Navy (DON) Deputy Chief Information Officer (CIO) Marine Corps, provides Marine Corps EMS policy and oversees EMS use, requirements, and operations. HQMC C4 establishes Marine Corps

policy; provides oversight, guidance, and procedures relating to the proper and efficient management of the EMS; provides Marine Corps representation (at the policy level) to various national, DOD, joint, and DON organizations, working groups, and forums; and provides administrative, technical, and operational support to the operating forces and supporting establishment in support of Marine Corps EMS operational requirements. Marine Corps management and use of the EMS are governed IAW Marine Corps Order 2400.2, *Marine Corps Management and Use of the Electromagnetic Spectrum.*

For more information on Marine Corps EMS operations, refer to the Marine Corps Interim Publication (MCIP) 3-40.04, Electromagnetic Spectrum Operations.

(6) The Navy and Marine Corps spectrum offices (NMCSOs) are the Navy's principal regional offices providing administrative EMS management support and assistance for all unit, installation, and Navy customers requiring tactical, non-tactical, communications, and non-communications frequency assignment requests for the US and its territories. Outside the continental United States (OCONUS), EMS support must follow CCMD guidance.

(7) While the Marine Corps is evaluating multiple staff organizational options for EMSO, EW management activities are still doctrinally coordinated and deconflicted through an EWCC under the staff cognizance of the MAGTF operations staff. If a CEWCC is formed, it is the principal means for the CDR to plan, coordinate, synchronize, and deconflict operations in and through the EMS. Personnel may also be provided for liaison teams to HHQs' EW coordination organizations when required, such as the JFC's EW staff or the JEMSOC. The MAGTF's primary mechanism for spectrum management (SM) is the Service-level restricted frequency list, which identifies friendly and enemy frequencies that cannot be jammed for various reasons.

c. **Navy**

(1) Electromagnetic maneuver warfare (EMW) is the Navy's warfighting approach and foundational concept that supports JEMSO. The EMW approach considers the activities required to describe the highly variable physical parameters that create the EMOE temporally and spatially while creating battlespace awareness to tactically exploit the EMS and the EMOE. Those activities of sensing, assessing, and monitoring the EMOE and all EMS-related activities provide the military a strategic advantage and enable freedom of action across all Navy mission areas. The primary means to gain EMS access and control are EMOE sensing and exploitation, which allows EMS agility. EW includes EA, ES, EP, DE, and EM-enabled cyberspace attacks.

(2) The Navy EMSO element works in conjunction with subordinate cells to convey across the force and up the chain of command the joint force maritime component commander's (JFMCC) plan for achieving EMS superiority within the maritime domain. At a minimum, the JFMCC or maritime EMSCA as delegated, utilizes the Navy EMSO element to effectively contribute to, and participate in, the EMSCO cycle to reflect its support to JEMSO and specific maritime needs for operating in and through the EMS.

(3) The areas of EW, EMS management and operations, METOC, and intelligence are interdependent disciplines for afloat forces and will inform and affect JEMSO. The JFC will coordinate and employ EW, EMSO, METOC, intelligence and cryptology subject matter expert (SME) personnel provided by the Services, to address challenges across the range of military operations.

(4) At the Navy operational level of war, the Navy component commander (NCC) and numbered fleet commander (NFC) aided by their maritime operations center (MOC), are responsible for coordination with other component CDRs and CCDRs, setting conditions for subordinates and integration of EMW into planning. EMW will place added responsibilities on the NCC/NFC and the MOC. Receipt of the CDR's guidance will be critical to units, which may be unable to request guidance or clarification due to imposed EMCON limitations or the tactical situation. The MOC will also have responsibility for evaluating and dissemination of non-organic intelligence information to subordinates to aid them in maneuvering to avoid threats during EMCON. Logistics requirements and other support, such as METOC data, may also need to be pushed, rather than requested, to ensure forces can sustain operations in EMCON restricted conditions.

(5) MOCs, in support of the NCC/NFC, will interpret strategic and operational guidance (on JEMSO) for planning, coordination, and synchronization of EMW-related actions with subordinate forces. The MOC performs EMW-related battle management/C2 functions to allow the NCC or NFC to dynamically plan, direct, monitor, and assess operations within the EMOE.

(6) EMW battle management/C2 consists of the abilities to:

(a) Maintain reliable connectivity (airspace C2) and interoperability among warfighting HQ and supporting/supported forces.

(b) Perform effective C2 in a degraded/denied communications environment.

(c) Create netted EMSO related common operational pictures (COP) to provide situational awareness of all spectrum dependent systems (including friendly, enemy, and neutral forces) as the EMOE affects detection/counter-detection ranges.

(d) Integrate cross-capability/platform operations, to include lower echelons.

(e) Employ mission command to enable subordinate CDRs to act independently in consonance with the higher CDR's intent, and effect the necessary cross-capability/platform integration.

(7) When operating under a JFC, the MOC EMSO cell provides maritime component EMSO requirements to the JEMSOC and Joint Spectrum Management Office/NMCSOs, and coordinates all maritime EMSO changes to include modifications of the JRFL and to assist with JSIR online reports and mitigation. When a strike group (SG) or unit is operating independently or in theater during peacetime operations, the MOC uses procedural control or delegates all operational control (OPCON) and de-confliction to SG or unit CDRs.

(8) The EMSO cell for operating naval units is outlined in tactical memorandum 3-51.1-15, *Electromagnetic Spectrum Operations Afloat.* The EMSO cell improves warfighting readiness through a cadre of EMS SMEs from technical and tactical ratings to create, analyze and implement the EMS plan for all EMS-dependent systems to support the naval force objectives in the EMOE. The EMSO cell will assist in the tactical employment of afloat spectrum dependent systems through own force monitoring, EMCON verification, EMI mitigation techniques, HN restrictions, JRFL compliance, JSIR online reporting, and METOC support requests. The Navy-Marine Corps Spectrum Center and NMCSOs are the Navy's principal regional offices to provide administrative EMS management support and assistance for all unit, installation, and Navy customers requiring tactical and non-tactical frequency assignment requests within respective regions/areas of operations (AOs). OCONUS, EMS support must follow CCMD guidance.

For more information concerning Navy support, see JP 6-01, Joint Electromagnetic Spectrum Management Operations, *JP 3-32,* Command and Control for Joint Maritime Operations, *Navy Tactics, Techniques, and Procedures (NTTP) 3-31.1,* Maritime Operations Center, *and NTTP 3-13.2,* Information Operations Warfare Commanders Manual.

d. **Air Force.** The CDR, Air Force forces provides EW and EMS management support to the JFC through the air component communications directorate (A-6) and EWCC. The EWCC, as a part of the Air Force air operations center, coordinates and integrates EW and SM across the range of airpower operations for planning, execution, and assessment.

For a detailed description of how the Air Force component presents EW capabilities to a JFC, see Air Force Doctrine Annex 3-51.

e. **United States Coast Guard (USCG).** USCG JEMSO operational activities, such as EM maneuver warfare, currently only include monitoring, assessing, and providing intelligence products. USCG may conduct JEMSO under Title 10, United States Code (USC), and Title 14, USC, authorities. USCG planning and execution of JEMSO requires coordination among several USCG organizations:

(1) The USCG Communications Policy Division, Office of the Commandant (CG-652), located in Washington, DC, is the USCG service-level office responsible for spectrum policy and equipment certification related matters. CG-652 falls under the Deputy Commandant for Mission Support and USCG CIO/CG-6.

(2) The Command, Control, Communications, Computers, and Information Technology Service Center Field Services Division (C4IT-FSD)/spectrum management branch (SMB) manages RF spectrum and represents the USCG in the coordination of SM issues with civil, military, and national regulatory organizations. C4IT-FSD/SMB directs USCG-wide SM activities, develops and implements SM doctrine, allocates frequency resources and assignments to support USCG missions, and serves as the principal advisor to the USCG CIO/CG-6 and CG-652 for RF SM and frequency spectrum regulatory matters.

(3) USCG District Commands have principal spectrum managers located throughout the US. The principal spectrum managers serve as the principal field office

representative providing SM support for their assigned district AOR, including all USCG units, installations, and special case USCG customers.

For more information on USCG support to JEMSO, see Commandant of the Coast Guard Instruction M2400.1, Spectrum Management Policy and Procedures.

f. **National Guard Bureau (NGB)**

(1) The NGB provides mission-ready military forces (Army National Guard [ARNG] and Air National Guard [ANG]) to assist local, state, and national authorities during normal day-to-day operations, emergencies, incidents of national significance and homeland defense (HD)/defense support of civil authorities (DSCA) operations. The variety of missions makes the efficient use of joint electromagnetic spectrum management operations (JEMSMO) extremely important, and the additional requirement for communications interoperability with local first responders, state and federal civilian agencies, and Title 10, USC, makes JEMSMO considerations a priority. The National Guard (NG) normally serves under the control of the state governor when in state active duty or Title 32, USC. When federalized in Title 10, USC, status, they serve under their assigned CCMD, usually United States Northern Command (USNORTHCOM) or United States Pacific Command.

(2) The NGB J6-C4/SMB is the designated office within the NGB responsible for supporting SM within the several states. The NGB J6 (as an agent of Chief, NGB), acts as the channel of communications between spectrum managers at the National Guard joint forces headquarters-state (NG JFHQ-State) and USNORTHCOM and all other federal agencies on spectrum usage during HD/DSCA operations. The NGB J6-C4/SMB will request the state J6 to provide copies of the State Emergency Support Function 2, Tactical Interoperability Plans, State Communications Interoperability Plans and other applicable documentation. NG J6-C4/SMB maintains state and territories' RF authorization and facilitates interstate and regional SM efforts while conducting domestic operations. NGB J6 publishes an NG Interoperability Field Guide for use with land mobile radios, NG joint incident site communications capability assemblages and other NG specific communications equipment.

(3) The NGB J6/SMB will also maintain the National Guard spectrum flyaway team (SFAT). When requested, the NGB J6/SMB SFAT will perform the functions of a JSME within the supported J-6 element. They will establish and implement policies and procedures governing military use of the RF spectrum within the limits imposed by higher authority.

For a detailed description of how the NGB J6-C4/SMB provides support to the JFC or to a NG JFHQ-State, see JP 6-01, Joint Electromagnetic Spectrum Management Operations, *and the US Supplement to Allied communications publication (ACP) 190(D),* Guide to Electromagnetic Spectrum Management in Military Operations.

(4) NG JFHQ-State spectrum managers should ensure use of their assigned spectrum resources are, IAW current procedures to ensure unity of effort with respect to state active duty, Title 32, USC, or Title 10, USC, forces conducting domestic operations. JFC

and staff, when not endemic to any one state, need to be aware that conducting operations in a state requires coordination with the NG JFHQ-State spectrum manager and state emergency operations center to allow unity of effort and an interference-free EMS environment.

5. Multinational Force Organization

a. **Multinational Force Commander (MNFC).** The MNFC provides guidance for planning and conducting JEMSO to the MNF through the J-3's combined EWCC. It should be recognized that the EWCC assumes responsibilities designated in paragraph 3b, "JEMSOC Responsibilities and Functions," for the JEMSOC. Note: North Atlantic Treaty Organization (NATO)/multinational terminology still references the EWCC. Therefore, EWCC, not JEMSOC, will be used when discussing NATO/multinational operations.

b. **Multinational Staff.** The MNFC should assign responsibilities for management of JEMSO resources in multinational operations among the staff for the following:

(1) **Operations Officer.** The multinational staff's operations directorate has primary responsibility for planning and integrating JEMSO with other mission areas.

(2) **Staff JEMSO.** The JEMSO staff's primary responsibility should be to ensure the MNFC is provided the same JEMSO support that a US JFC would expect. In addition to the JEMSOC duties previously described, the EWO should be responsible for the following:

(a) Ensuring all component CDRs of the MNF provide qualified EWOs as members of the MNFC JEMSO staff. The chain of command should be established by the director for operations. The rationale for augmentee status is that partner nation officers normally are full members of the multinational JEMSO planning cell and responsible to the chain of command. They should not be subjected to the possibility of split loyalties to a lower command within the force, as could be the case if they adopt the traditional liaison role.

(b) Determining the need for placing US JEMSO LNOs with multinational commands to ensure that the MNFC's JEMSO plans and procedures are correctly interpreted.

(c) Integrating partner nation EWO augmentees at the initial planning stage, delegating them duties and responsibilities similar to those given to equivalent US officers.

(d) Coordinating the necessary JEMSO communications connectivity for assigned forces. Particular emphasis should be given to equipment, encryption devices and keying material, and procedural compatibility when integrating MNFs.

(e) Ensuring constant liaison with the multinational staff's intelligence directorate and cryptologic support group in order to provide the most adaptive and effective intelligence support to JEMSO efforts. Ensuring planned EW targeting efforts have minimal impact on friendly collection efforts.

(f) Integrating partner nation communications system directorate processes into JEMSO planning and oversight. Integrating JEMSO C2 requirements into the JRFL. Coordinating with the multinational staff's communications system directorate to ensure tracking and remediation of JSIR events.

(g) Providing, at the earliest possible stage, MNFs with current US JEMSO doctrine and planning guidelines.

(h) Ensuring timely EW reprogramming coordination and support.

(3) **Partner Nation EWOs.** Partner nation CDRs should assign qualified EWOs to the MNF JEMSO planning cell. These officers should:

(a) Have an in-depth knowledge of their forces' operational SIGINT and JEMSO requirements, organization, capabilities, national support facilities, and C2 structure.

(b) Possess national clearances equivalent with the level of classified US military information that they are eligible to receive IAW US national disclosure policy. These requirements may mean the individuals concerned will be a senior O-3 or O-4 pay grade level or equivalent. As a result, they may be augmentees drawn from national sources other than the unit(s) involved in the MNF.

Intentionally Blank

CHAPTER III
PLANNING JOINT ELECTROMAGNETIC SPECTRUM OPERATIONS

1. Introduction

JFCs centralize JEMSO planning under the designated EMSCA and decentralize execution to ensure JEMSO unity of effort while maintaining tactical flexibility. Viewed holistically, JEMSO across all joint functions and domains are often complex and interwoven. This requires detailed integration and synchronization to avoid friendly fire and achieve EMS superiority. The complex EMOE joint forces may experience makes this integration more difficult. JEMSO planning provides the basis for the prioritization, integration, and synchronization of joint force EMS activities between the staff functions (primarily J-2, J-3, and J-6), components, and multinational partners. As all joint functions are heavily dependent on the EMS, JEMSO must be a key planning consideration across all phases of military operations. The JEMSOC is the lead staff element for JEMSO planning.

2. Joint Electromagnetic Spectrum Operations Planning Process

The CDR's guidance and estimate form the basis for determining components' objectives. During mission analysis, JEMSO planners develop a staff estimate which forms the basis for an EMS superiority strategy. The JEMSO staff estimate is used during COA development and analysis to determine EMS supportability. When a COA is chosen, it becomes the basis to develop the JEMSO annex which outlines JEMSO missions, priorities, policies, processes, and procedures across all phases of the operation. The joint force components will develop component EMSO plans and submit them to the JEMSOC for integration into the JEMSO appendix. During planning and execution, the JEMSOC consolidates component EMSO plans and attendant requirements, prioritizes, integrates, and synchronizes them, and produces an EMSCP. An updated EMSCP begins the JEMSO execution cycle resulting in an EMSCO directing joint force EMS use.

For information on joint planning, refer to JP 5-0, Joint Planning, *and CJCSM 3130.03,* Adaptive Planning and Execution (APEX) Planning Formats and Guidance. *For more information on EW planning, see JP 3-13.1,* Electronic Warfare.

a. **JEMSO Staff Estimate.** A primary product of mission analysis, planners use staff estimates to prepare evaluation request messages to solicit COA input from subordinate units and subsequently develop preliminary COAs. The EMSCA uses the JFC's mission, CDR's estimate and objectives, CDR's intent, CONOPS, and the components' inputs to develop COAs. The JEMSO staff estimate informs the CDR, staff, and subordinate commands how JEMSO supports mission accomplishment and COA development and selection. During COA development and selection, JEMSO planners fully develop their estimate, providing an EMS analysis of the COAs, as well as recommendations on which COAs are JEMSO supportable. Planners should identify critical shortfalls or obstacles that impact mission accomplishment. The JEMSO staff estimate is continually updated based on changes in the situation.

Appendix A, "Joint Electromagnetic Spectrum Operations Staff Estimate," details the content of a JEMSO staff estimate.

For information on staff estimates, refer to JP 5-0, Joint Planning.

(1) **EMS Superiority Strategy.** An EMS superiority strategy outlines how the JFC should achieve EMS superiority. This strategy ensures joint forces achieve the advantage in the EMS that permits the conduct of operations at a given time and place without prohibitive interference, while affecting an adversary's ability to do the same. The strategy is comprised of the mission analysis and mission statement portions of the JEMSO staff estimate and is usually located in the EMSO section of the OPLAN/CONPLAN/OPORD. It outlines the key missions and tasks the joint force components will carry out to achieve EMS superiority and establishes the basic relationships between the exploit, attack, protect, and manage activities the joint force will accomplish. The strategy identifies key EMS users, both functionally, such as space operations and CO, as well as organizationally, such as multinational partners. It provides the framework for detailed JEMSO planning. Key elements of the EMS superiority strategy include:

(a) JEMSO missions that joint forces are expected to perform (e.g., mitigating an adversary's ability to contest friendly force operations through the EMS, degrading/denying the adversary from maneuvering in the EMS to support their operations, optimizing friendly force EMS use, coordinating through the JFMO the necessary joint force EMS-use authorities with HN and relevant adjacent nations according to treaty/international agreements).

(b) Assumptions (e.g., HN EMS-use authorizations).

(c) Key considerations based on the expected EMOE.

(d) Anticipated scale of operations and the number and type of friendly forces (to include multinational partners).

(e) Establishment of JEMSO organizations.

(f) Relationships between EMS organizations both internal and external to the joint force.

See Appendix A, "Joint Electromagnetic Spectrum Operations Staff Estimate," for additional details on EMS superiority strategy and JEMSO estimate.

(2) **Define and Characterize the EMOE**

(a) The situation analysis portion of the JEMSO staff estimate is where the EMOE is initially defined and characterized, forming the foundation for the JEMSO aspects of COA development, analysis, and selection. JEMSO planners should provide a mechanism to periodically characterize the EMOE to ensure relevant EMS-systems and activities impacting joint force operations are captured and planned.

(b) Characterizing the EMOE is an iterative process that employs many of the tasks and methodologies associated with JIPOE. An EMOE tends to be dynamic, requiring the associated databases and analyses be updated periodically, often on a very short timeline. The physics of the EMS dictate that the military usefulness and properties of a given set of frequencies may vary periodically based on environmental factors outside of JFC control. JEMSO planners must not only allow for changes in both neutral and adversary operations in the EMS, but need to consider potential naturally occurring EMOE changes as well.

(c) EMOE information should be current, accurate, and accessible to authorized users. JEMSO planners should designate primary EMOE data sources to facilitate this. This source designation should be accompanied by information on the organization(s) responsible for maintaining the data sources, the associated processes and timelines for source population, requirements for access (user clearances and timelines), and the processes for dealing with data source conflicts.

(d) **METOC.** JEMSO planners should include the effects of atmospherics and space weather on both the EMOE and friendly/adversary EMS-dependent systems. The various types of atmospheric conditions and phenomena can positively or negatively affect these systems. For example, atmospheric temperature inversions can increase the propagation of radio transmissions; high humidity and rainy climates are detrimental to IR systems; and ionospheric scintillation can adversely affect GPS. Some atmospheric effects are well known and are categorized by season and location. Planners should consult with the CCMD METOC officer to determine the type of support available for their operation.

(3) **Determine Friendly EMS-Use Requirements**

(a) A joint force employs EMS-dependent systems across almost all functions and activities. Components identify the EMS-dependent systems they will employ in the JOA, describing their capabilities and associated EMS-use requirements, and registering them with the JEMSOC. The JEMSOC establishes the process to solicit, compile, and process joint EMS-use requirements. The resultant data is used to inform the EMS superiority strategy, characterize the EMOE, determine COA EMSO supportability, and build the EMSCP/EMSCO which authorizes component EM transmissions.

1. JEMSO planners at all echelons and components should account for any special classification requirements and communicate them to the JFC's JEMSO staff to ensure proper clearances and "need to know" are established.

2. Proliferating network-enabled joint warfighting capabilities have increased the number of EMS-dependent links between previously autonomous capabilities. JEMSO planners should review EMS-use requirements submissions to ensure that cross-capability and cross-functional EMS links have been properly captured.

(b) The EMSCA issues guidance to the joint force staff elements, components, and supporting agencies on how to request JEMSO support for EMS-dependent systems that operate under their control within the joint force's JOA. The guidance includes requirements for all EMS-dependent systems, including those that are receive-only. The message requires

units to submit their EMS-use requirements to the JEMSOC. The EMSCA guidance typically includes the following:

1. Joint force JEMSO policy and guidance.

2. Security classification guidance.

3. Procedures for submitting EMS-use requests to support EMS-dependent equipment or request non-organic JEMSO support, including lead times and request format.

4. EMBM guidance and processes.

5. Master net list (MNL) requirements collection process, including the need for identifying nets requiring call signs, call words, and possible frequency sharing.

6. EMS coordination measure (e.g., JRFL) submission procedures, including lead times and restrictions.

7. JSIR reporting requirements and routing procedures.

b. **JEMSO Appendix**

(1) Once a COA is chosen, the JEMSOC develops the JEMSO appendix within the operations annex for the JFC's approval. The JEMSO appendix establishes procedures for EMBM system use in the JOA and includes EMS coordination measures, specifying procedures and ROE for joint force EMS use. In order to provide effective operational procedures, the JEMSO appendix must be integrated across all portions of the JFC's OPLAN and orders. The JEMSO appendix considers procedures and interfaces with the international or national frequency control authorities/systems necessary to effectively support JEMSO, augmenting forces, and JFC objectives. Consequently, the JEMSO appendix should be preplanned to the highest degree possible and maintained in a basic, understandable format.

(a) The JEMSO appendix should be coordinated with HN representatives, if appropriate and feasible.

(b) Planning factors to be addressed when developing the JEMSO appendix include familiarity with the basic OPLAN or OPORD; knowledge of both HN and multinational considerations; consideration of lessons learned; an understanding of the operational and mission variables; a familiarity with the capabilities and procedures of EMS control and military and civil Federal Communications Commission-equivalent agencies; and the general locations of friendly, neutral, and enemy forces.

(c) The JEMSO appendix supports transitions across the range of military operations. Such transitions may occur during a period of increasing and/or decreasing tensions or suddenly without warning. The JEMSO appendix should support all phases of an operation with flexibility to respond to current requirements.

(2) **Policy and ROE.** JEMSO activities frequently involve a unique set of complex issues. There are DOD directives and instructions, laws, rules, the law of war, and ROE that may affect them. Laws, rules, policies, and guidelines become especially critical during peacetime operations when international and domestic laws, treaty provisions, and agreements (e.g., status of forces agreements) may affect JEMSO planning and execution. JFCs should seek legal review during all phases of JEMSO planning and execution, to include development of theater ROE. While ROE should be considered during the planning process, it should not inhibit developing a plan that employs available capabilities to their maximum potential. If, during the planning process, a ROE-induced restriction is identified, planners should work with staff legal advisors to clarify the ROE or develop supplemental ROE applicable to JEMSO. EMS policy and ROE requirements are promulgated though the EMSCP/EMSCO as they become effective.

(3) **Prioritization.** JFC EMS-use prioritization guidance is a key planning factor used by the JEMSOC to rank EMS-use requests in congested EMOEs and by the components to rank assigned tasks. The JEMSOC regularly reviews the JFC's priorities, solicits component inputs, and recommends EMS-use prioritization changes to the JFC.

(4) **EMS-Use Requests.** EMS-use requests represent joint force requirements for conducting operations in the EMS in support of their assigned missions and tasks. To be properly prioritized and integrated, they include the following information:

(a) The activity to be conducted in the EMS (sense, communicate, attack).

(b) The purpose of the activity.

(c) The relative priority of the activity.

(d) The platform/system conducting the activity.

(e) Missions supported by the activity.

(f) Required EMS-use parameters (e.g., time, location, frequencies, power, waveform).

(5) **EMS Coordination Measures.** EMS coordination measures are rules, mechanisms, and directions governed by joint doctrine and defined in the JEMSO appendix. These measures direct maneuver within the EMS in specified dimensions (e.g., space, time, frequency, power, waveform). The JEMSO appendix specifies EMS coordination measures (e.g., JRFL) to be used in the JOA and how these measures will be distributed and implemented. During execution, the EMSCP should provide guidance on what EMS coordination measures will be activated in the EMSCO. EMSO elements establish EMS coordination measures to accomplish one or more functions during specific time windows and geographical areas:

(a) Establish reserved EMS bands for specific EMS activities.

(b) Restrict the actions of some EMS users.

(c) Create EMS bands in which units can use EMS-dependent systems with minimal risk of EMI.

(d) Require EMS users to accomplish specific actions.

(e) **JRFL.** The JRFL is an EMS coordination measure that operational, intelligence, and support elements use to identify the level of protection desired for various networks and frequencies. The JRFL is a time, frequency, and geographically oriented listing of functions, nets, and frequencies requiring protection from friendly EM transmissions and is limited to the minimum number of frequencies necessary for friendly forces to accomplish joint force objectives. Although the JRFL is the primary coordination method, it may be necessary to coordinate the protection of intelligence collection frequencies via the immediate joint EMS-use request process to meet the time sensitive needs of collection activities. The JRFL is developed prior to initiating joint force operations and is continually modified during operations.

Refer to Appendix C, "Electromagnetic Spectrum Coordination Measures," for more information.

(6) **EMBM-Related Capabilities.** The systems and tools that facilitate EMBM and provide EMSO-related planning capabilities. EMBM guidance establishes which capabilities and related databases will be used and how they should exchange data using approved DOD architectures for vertical and horizontal interoperability. This interoperability facilitates timely and routine JEMSO data exchanges. This exchange may be conducted in either non- real time or near real time (NRT) via common, secure, jam-resistant radios and data links. The ability to exchange NRT data (such as targeting information) to enhance situational awareness and combat coordination between various force elements is a critical combat requirement. EMBM guidance should include:

(a) Type/version of EMSO planning tools used.

(b) Secure connectivity to components.

(c) Availability of C2 networks.

(d) Compatible data exchange format and processes.

(e) EMS coordination processes (e.g., frequency assignment, EM targeting, EMI resolution).

(f) Interfaces to national and intelligence databases.

(g) Interfaces to battlefield sensors.

(7) **EM Signature Control.** JEMSO planners determine adversary EMS capabilities and potential impacts on JEMSO to establish the necessary level of EMCON. Signature control includes:

(a) Assessing adversary ES and SIGINT capabilities against friendly forces.

(b) Planning and implementing appropriate EMCON measures by task and phase.

(c) Providing EMCON guidance and direction to components.

(d) Nominating adversary ES and SIGINT systems for targeting.

(8) **EW.** The JEMSO appendix EW section outlines the EW requirements for achieving EMS superiority. Specific planning actions include:

(a) Reviewing EMS superiority strategy.

(b) Identifying the purpose and intent of performing EW, the immediate desired effects, and enabling conditions for authorizing EW.

(c) Determining the status of EW capability of available forces relative to adversary capability and determining if sufficient assets are available to perform the identified EW tasks. Draft requests for support if in-place assets are insufficient.

(d) Considering friendly EMS use with respect to the anticipated operations, tactical threat expected, and EMI possibilities. Once identified, these requirements should be entered into the JRFL under appropriate categories (e.g., TABOO).

(e) Identifying measures to deny operations security (OPSEC) indicators to adversary passive EM sensors.

(f) Establishing and updating appropriate EMS coordination measures (e.g., JRFL TABOO).

(g) Determining the processes necessary to eliminate or mitigate EMI from EW activity with other JEMSO.

(h) Identifying the EMS-related CCIRs. These CCIRs should be included in the intelligence annex (normally annex B) of the OPLAN/OPORD to facilitate timely and comprehensive ES.

(i) Coordinating and establishing procedures to ensure fulfillment of EW planning tasks.

(j) Reviewing ROE and applicable legal factors to determine the authorities needed or the restrictions, if any, that apply to EW operations.

(k) Identifying EM target element categories in order to guide collections priorities and support EM target element development.

(l) Analyzing the vulnerabilities of friendly force EMS-dependent systems, determining the ability of the adversary to exploit those vulnerabilities, and evaluating the resulting mission impact.

(m) Analyzing the vulnerabilities of adversary EMS-dependent systems and networks, determining the ability of friendly forces to exploit those vulnerabilities, and evaluating the resulting mission impact.

(9) **NAVWAR.** Due to the dual civil/military nature of GPS/global navigation satellite system (GNSS) and other PNT services, potential impacts from NAVWAR efforts on nonmilitary users and the civil/commercial critical infrastructure must be thoroughly analyzed during COA development and may need to be coordinated with HN EMS authorities. NAVWAR considers the impact of adversary GPS jammers on friendly force systems, provides guidance on the type of GPS receivers needed to support mission execution, aids in determining the quantity and types of GPS-aided munitions required to execute a COA, and recommends GPS jammers as targets.

(10) **Interoperability.** Interoperability is essential in order to use JEMSO effectively as an element of joint military power. JEMSO planners must know and integrate the EMS-dependent capabilities in theater and how they will interact during execution to minimize EMS conflicts and enhance EW effectiveness.

c. All JEMSO are subject to the EMSCP and the EMSCO. The EMSCP and EMSCO provide direction to prioritize, integrate, coordinate, direct, and deconflict all joint force EMS-use within the JOA. (Note: This does not imply any level of command authority over EMS assets or their self-defense [defensive EA] capabilities.)

(1) **EMSCP.** The JEMSO appendix (approved by the JFC as part of the operations annex) provides overarching guidance for the control of the EMS. The JEMSOC issues an EMSCP at the beginning of the JEMSO execution cycle containing updated JEMSO guidance for that cycle.

(2) **EMSCO.** The EMSCO is an order that provides the details of the approved EMS-use requests, EMS control procedures, and EMS coordination measures for a given time period. Joint forces unable to comply with EMS coordination measures, specified transmission authorization, or ROE, are not authorized to transmit EM energy in the JOA. The EMSCO defines and establishes the portions of the EMS for military operations as approved by the JFC. It notifies all agencies of the effective time of activation and the composite structure of the EMS to be used. The EMSCO may include coordination measures such as JRFL. Timely EMSCO change alerts and promulgation of EMSCO changes to all EMS users, to include MNFs, is essential to avoid friendly EMI and unintended engagements against civil and neutral receivers, and to increase operational effectiveness. Figure III-1 shows the relationships between the JEMSO appendix, EMSCP, and EMSCO within the joint planning and execution cycle.

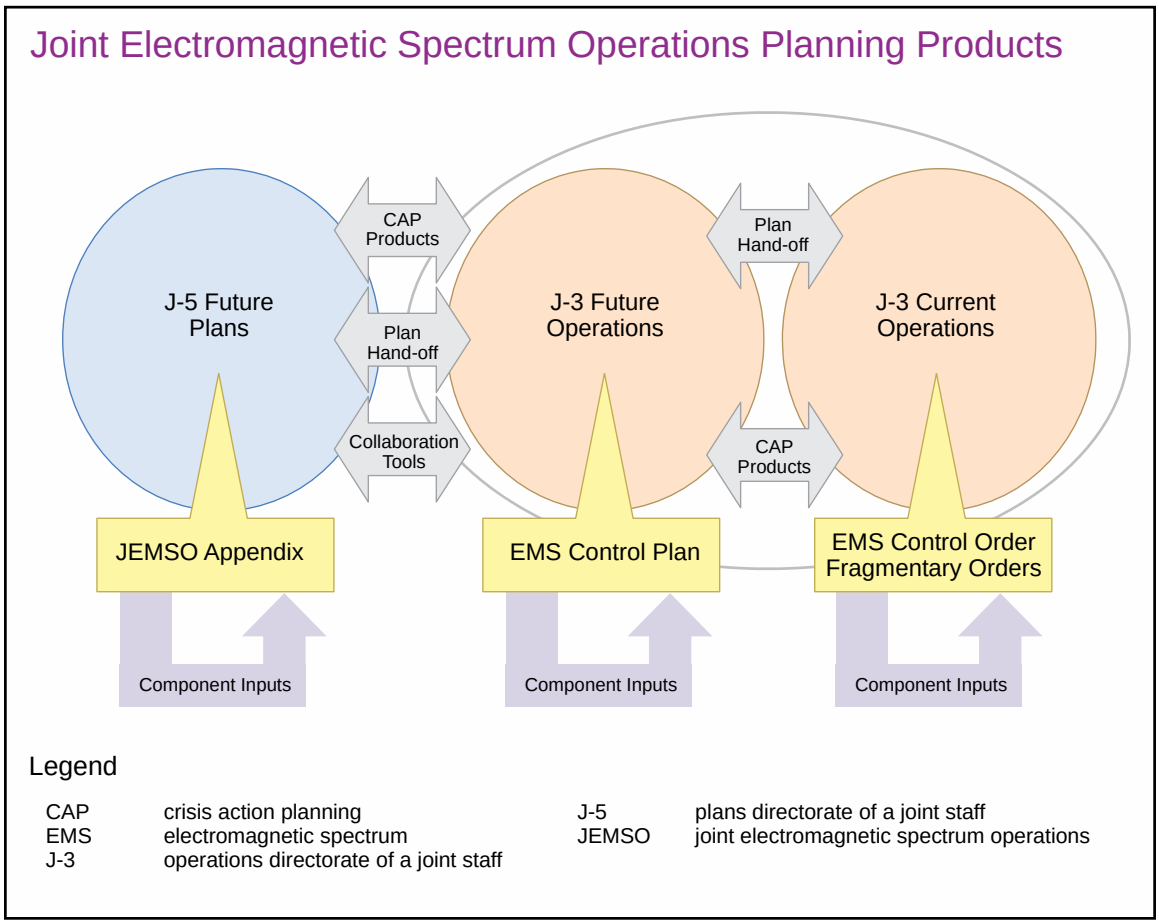

Figure III-1. Joint Electromagnetic Spectrum Operations Planning Products

(a) **Specified Transmission Authorization.** Certain regions of the EMS may require finer control of joint force EMS transmissions than EMS coordination measures provide for a variety of reasons (e.g., excessive congestion, potential collateral effects). The EMSCO will identify/publish specified transmission authorizations.

(b) **EMSCO Development.**

1. Normally, the EMSCO is published and distributed daily and contains coordination measures, procedural control instructions, and the portions of the EMS required to implement the EMSCP. The EMSCO activates and deactivates control measures.

2. Procedures to develop and update the EMSCO are included in the EMSCP. Normally, component CDRs consolidate, prioritize, deconflict, and forward their EMS-use requests to the EMSCA by a specified time for further consolidation with other inputs. Guidance should be given, depending on the level and the number of forces in the OA, on what other information should be included, (e.g., EMS coordination measures and other coordination measures).

3. The EMSCA is responsible for EMS control for the entire OA, but may delegate specific authority for EMS control to the component CDRs through EMSCP

guidelines. The JFC may also elect to task the component CDRs to generate EMSCO annexes for their assigned sectors. Regardless, the JEMSOC is tasked with providing continuity along sector boundaries and ensuring integration of each sector authority's EMSCO within the EMSCP guidelines.

(c) **JCEOI.** The JCEOI is the portion of the EMSCO which provides the JFC the voice and data network EMS-use authorizations necessary to support operations. It contains the technical characteristics of communications networks. The JCEOI consists of the following subsections: directory of radio nets or units and their associated frequencies, call signs, call words, and network identifications listed by time period, supplemental procedures for electronic, visual, and verbal interactions, such as sign/countersigns, smoke/pyrotechnics and suffix/expanders. It is usually further subdivided into different sections, or layers (e.g., joint layer, components, corps, fleet, wing). Additionally, the JCEOI provides procedures for conducting electronic, visual and verbal communications methods (e.g., sign or countersign, smoke or pyrotechnics, suffix and expanders) to supplement or enhance radio communications.

For information on JCEOI, refer to CJCSI 3320.03, Joint Communications Electronic Operating Instructions. *For more information on planning guidance for JEMSO, EMS Management, EW, EMS Control Plan, and the EMS Control Order as part of an OPLAN, see Appendix B, "JEMSO."*

3. Joint Electromagnetic Spectrum Operations Coordination

a. Intelligence, Surveillance, and Reconnaissance (ISR)

(1) IC operated sensors can provide NRT EMOE information for augmenting the ES activities organic to JEMSO. A major part of intelligence efforts prior to and during an operation are collection efforts targeted against adversary activity within the EMS. Processing that data through SIGINT channels and combining it with other sources of intelligence data yields adversary and neutral EOB information. JEMSO planners use this information to conduct EA targeting, enhance EP, conduct JSIR, address gaps in ES sensing, plan communications and data networks, support component EMS-dependent system reprogramming, etc.

(2) The J-2 must ensure that SIGINT collection priorities are integrated with ES activities into a complete JEMSO support plan. This plan maximizes use of intelligence and ES collection assets to support all aspects of the JFC's objectives.

For information on ISR, refer to JP 2-01, Joint and National Intelligence Support to Military Operations.

(3) The EMSCO process and the associated EMBM guidance should delineate the process threads and authorities to enable intelligence coordination at the lowest possible level. Coordination timelines are primarily based on how dynamic the EMOE is, and can vary from minutes to months depending on priority, echelon, phase of operation, etc.

(4) Joint forces transmitting EM energy must maintain awareness of and follow applicable EMSCO restrictions. Conversely, intelligence personnel should keep their JRFL inputs as current as possible to support coordination and eliminate or mitigate EMI. The primary conduit for this coordination is through the JEMSOC via associated EMBM processes that may require coordination with the national IC.

(5) The JEMSOC will analyze IC collection plans for potential blue force EMI and recommend alternatives to the IC and components to minimize mission impacts.

b. **CO**

(1) Modern military operations are inherently reliant on networked capabilities enabled by EMS access. CO are enabled by JEMSO for the transport of information through the EMS within the JOA, but can be conducted from remote locations well outside the JOA.

(2) The increasing prevalence of wireless networks in the OE creates opportunities when JEMSO and CO capabilities are used synergistically. When wired access to a particular network is limited, EMS access may be required for successful CO. For example, an EA transmitter may be used to deliver executable code via an EMS aperture. The EMS can also be used as a vector for conveying an attack directly against cyberspace infrastructures. For instance, EW fires (e.g., high energy laser, HPM, EMP weapons) can be employed to damage or destroy cyberspace infrastructure to support CO within the AO. EW operations (EA, ES, and EP) can assist in setting the conditions in cyberspace to ensure availability of the area requiring access, provide the ability to engage adversaries decisively, and conduct CO to enable the creation of the desired effects.

(3) The effectiveness of the Department of Defense information network (DODIN) is measured in terms of security, availability, and reliability. DODIN EMS-use requirements are addressed in the same manner as any other joint EMS use. DODIN tools used to assign frequencies for the network should also determine the EMS-use requirements (e.g., frequencies, bandwidth) for the network and provide this information to the EMS manager in the approved DOD format. JEMSO planners review the requirements and integrate them into the EMSCP/EMSCO. The JEMSOC will then provide this approved allotment of frequencies to DODIN in the same DOD-approved format. JEMSO planners review DODIN plans to ensure they are synchronized with EP activities.

For information on CO, refer to JP 3-12, Cyberspace Operations.

c. **PNT Operations**

(1) Military and civil users are dependent on assured PNT, which is essential to effective joint operations and defense/civil critical infrastructure. GPS is the primary source of space-based PNT for US and multinational warfighters. Adversaries recognize the US dependence on GPS and are developing and fielding increasingly capable jammers to deny GPS and other GNSS services to friendly forces.

(2) JEMSO supports NAVWAR operations by establishing EMS superiority at a specific time, duration, and place, ensuring freedom of access for mission critical PNT

operations. The majority of PNT operations rely on the space control and user segments of GPS, along with the EMS that links them.

d. **IO**

(1) IO is the integrated employment, during military operations, of information-related capabilities (IRCs) in concert with other lines of operation to influence, disrupt, corrupt, or usurp the decision-making of enemies and adversaries while protecting our own. JEMSO enables IO and IRCs, such as MISO, by coordinating and integrating IO EMS-use requirements to eliminate or mitigate EMI caused by friendly or adversary forces. JEMSO also provides IO with the means of transit through the EMS using EW and other EMS emitters.

(2) One of the primary functions of the IO cell is to coordinate IRC employment to support IO in the JFC's CONOPS. Nearly all IRCs depend on, use, or exploit the EMS for at least some of their functions. JEMSO prioritization, integration, and synchronization are continuous processes and a constant consideration in IO planning efforts.

(3) EA can create decisive, enhanced effects in the information environment and provide the JFC with an operational advantage by gaining and maintaining information superiority. Information superiority is the operational advantage derived from the ability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same.

(4) When EA is employed as nonlethal fires, it often can be employed with little or no associated physical destruction. EA fires in support of IO must be integrated at the JFC level, through the JTCB or like body, to predict collateral damage and/or effects and incorporate risk mitigation techniques.

For more information on IO, refer to JP 3-13, Information Operations.

e. **MISO.** JEMSO supports MISO by providing a means to deliver MISO-developed messages to target audiences via the EMS, using EW platforms or other joint EMS emitters. JEMSO planners, especially when planning EA operations, must be aware of the potential to interfere with MISO efforts to convey information to adversaries or foreign target audiences. MISO platforms and units depend on information gathered through JEMSO coordinated ES and SIGINT sensors to warn them of potential threats and provide feedback about reaction to MISO broadcasts and other activities. MISO uses EP and JSIR processes to eliminate or mitigate adversary EA activities or inadvertent EMI from disrupting their efforts. MISO and JEMSO coordination, especially with regards to EA, depends on timely updates to the EMSCO.

For more information on MISO, refer to JP 3-13.2, Military Information Support Operations.

f. **OPSEC.** JEMSO supports OPSEC by degrading adversary ISR operations against friendly units and activities. ES can support the OPSEC effort by providing information about adversary capabilities and intent to collect intelligence on friendly forces through the

EMS. ES can also be used to evaluate the effectiveness of friendly force EMCON measures and recommend modifications or improvements. An effective and disciplined EMCON plan and other appropriate EP measures are important aspects of good OPSEC. OPSEC supports EMSO by concealing units and systems to deny information on the extent of EMSO capabilities. During operations, OPSEC planners and JEMSO staff personnel should frequently review the JFC's critical information requirements in light of the dynamics of the operation. Adjustments should be recommended to ES collection efforts, EMCON posture, and other EP measures as necessary to maintain effective OPSEC.

For more information on OPSEC, refer to JP 3-13.3, Operations Security.

g. **MILDEC**

(1) JEMSO supports MILDEC by using EA as deception measures degrading adversary capabilities to see, report, and process competing observables; providing an adversary with information received by EM means that is prone to misinterpretation; and using EP and EMCON to control EM activity observable by an adversary. MILDEC frequently relies on the EMS to convey the deception to adversary intelligence or tactical sensors. JEMSO planners should ensure that EMS frequencies necessary to support deception plans are accounted for in EMS management databases and in the EMSCO, without disclosing that specific frequencies, are related to deception.

(2) Designated JEMSO planners must work through the J-3 staff to coordinate and integrate JEMSO support to MILDEC operations. Forces assigned to the deception effort are often electronically "enhanced" to project a larger or different force structure to adversary sensors. Friendly EA assets may be an integral part of the deception effort by selectively jamming, interfering, or masking the EM profile of the main operational effort. Friendly assets can also be used to stimulate air defense systems (communications and radar) through either EM or physical means. Stimulation of an air defense system enables the ability to target or map the EOB and causes the adversary to commit assets (air or ground).

(3) Disciplined EMCON and other appropriate EP efforts, by both deception assets and those of the main effort, are essential to preventing the adversary from distinguishing deception activities from the main effort.

(4) ES assets can provide immediate warning to deception forces about adversary forces reacting to their presence or actions. ES assets are also an important means to determine that the adversary is capable of receiving the EM aspects of a deception. Since deception forces are often positioned "off axis" from the main effort, ES platforms positioned with the deception effort may assist in location of adversary forces by assisting with triangulation in direction finding (DF) activities. Designated JEMSO staff personnel should have the security clearances and access necessary to work with MILDEC planners during planning and execution of an operation that involves deception. During the execution of an operation, JEMSO staff personnel should monitor EW support to the deception effort and coordinate any changes or conflicts in a timely manner.

For more information on MILDEC, refer to JP 3-13.4, Military Deception.

h. **Cybersecurity.** The DOD cybersecurity program is concerned with preventative, protective, and restorative measures for information systems and the information contained therein. Many of these measures involve the use of the EMS. EP equipment, attributes, and processes assist in assuring the availability and integrity of modulated data traversing the EMOE. EA TTP assist in compromising those same qualities which adversary cybersecurity seeks to protect. EMS management procedures, particularly EMI resolution, assist cybersecurity in overcoming the problem of EM friendly fire.

i. **Chemical, Biological, Radiological, and Nuclear (CBRN) Environments.** In a CBRN threat environment, JEMSO planners should consider the potential effects of a CBRN attack on EMS-dependent systems. Chemical contaminants and most decontamination solutions can be corrosive and may damage sensitive equipment. A high altitude EMP from a nuclear detonation can damage or destroy electronic devices that are not appropriately hardened. Additionally, systems' operations may be impeded if operators are required to wear CBRN-protective ensembles. Redundancy, dispersal, protection, hardening, and decontamination of mission-critical EMSO equipment may help ensure mission continuation following a CBRN attack.

For additional guidance on CBRN environments, see JP 3-11, Operations in Chemical, Biological, Radiological, and Nuclear Environments.

j. **Targeting and Fire Support**

(1) JEMSO exploitation activities, including ES and SIGINT, are foundational to joint force targeting and fire support. ES and SIGINT data is used to dynamically map the EMOE for targeting and threat avoidance planning. ES assets provide timely warning of adversary reaction to friendly strike and other physical destruction actions. ES and SIGINT also perform an important combat assessment role by providing feedback on the results of friendly attack actions. ES can also be used to evaluate the effectiveness of friendly force EMCON measures and recommend modifications or improvements.

(2) EA degrades or destroys susceptible adversary assets and performs vital screening functions (including the use of standoff weapons) for friendly strike actions. EA also plays an important role in countering enemy attacks using EMS-dependent sensors and precision strike weapons. EA can provide effects with instantaneous time of flight, low collateral damage, and low cost per shot. JEMSO personnel participate in the JTCB and related processes to integrate EA and other fires-related joint force EMS use requirements with other JEMSO actions.

(3) EP protects friendly targeting sensors, navigation, and communications from enemy activity. Non-EW forms of fire support JEMSO by destroying enemy EM transmitters and receivers including targeting, communications, and EA systems. Disciplined EMCON and other EP measures protect friendly maneuver/strike elements from adversary ISR. EP measures also protect friendly forces handling or operating around live ordnance during combat operations by preventing inadvertent detonations due to hazards of EM radiation to ordnance.

(4) EMS management and associated EMBM processes integrate joint force EMS-use to minimize and mitigate EMI, ensuring friendly EMS-dependent sensors, data links, and weapons seekers are able to operate in a congested and contested EMOE.

For more information, refer to JP 3-09, Joint Fire Support, *and JP 3-60,* Joint Targeting.

k. **Physical Security.** JEMSO supports physical security by using EP to safeguard communications used in protecting facilities. Additionally, EP features may guard personnel, facilities, and equipment from the broader effects (both intended and unintended) of EM energy. Physical security supports JEMSO by safeguarding equipment used in EW. EMSO capabilities can be used to preempt and disrupt threats that may be using part of the EMS to attack joint ground forces. EA can protect personnel, facilities, and equipment from attack by EMS triggered or controlled weapons.

l. **Civil-Military Operations (CMO).** In operations such as foreign humanitarian assistance (FHA), EW assets may be used to map the EMS and broadcast civil defense information similar to the way they have been used successfully to broadcast MISO messages. In all operations, CMO frequencies should be included in the EMSCO to ensure proper coordination and integration with EW assets' activities. As requirements for EW assets expand into peacetime contingency roles, it becomes more imperative that planners consider diplomatic clearance requirements of HNs as early as possible.

For more information on CMO, refer to JP 3-57, Civil-Military Operations.

4. National and International Coordination

a. **HNC**

(1) HNC is the activity to obtain authorization to operate EMS-dependent systems within a sovereign nation. HNC of EMS access cannot be overlooked or ignored when planning for operations in the EMOE. HNC agreements are normally established by geographic combatant commanders (GCCs). The JFMO normally has standing EMS coordination channels with the nations in the GCC's AOR. As interactions with a given nation may change over time, there may be an absence of formal coordination channels when needed. The CCMD JFMO must ensure subordinate elements do not conduct HNC without the approval of the JFMO. HNC is normally based on the fostering of mutual trust and rapport between the JFMO and the HN. Outside attempts at coordination may disrupt or damage this relationship, making support more difficult to obtain.

(2) Effective HNC requires a technical understanding of how a nation manages its sovereign EMS as well as a cultural understanding of the HN (i.e., how they conduct business) in order to procure the necessary EMS-use authorizations required to conduct joint operations. An HN may seek to protect its commercial interests by restricting joint force EMS use, thus limiting a JFC's ability to maneuver. HNC includes:

(a) Reviewing HN allocation/channel plan and usage/broadcast schedules for joint use suitability.

(b) Determining if joint force emitters comply with the HN allocation tables (e.g., emission bandwidth, type of service).

(c) Determining if HN EMS-use allocations are sufficient to support the JFC's EMS-use requirements.

1. Cooperatively devise coordination plan with appropriate HN EMS organizations/representatives to resolve HN and joint EMS-use conflicts.

2. Prepare command brief of HN agreement status and the mitigation strategy or COAs for concerns or shortfalls.

(3) The unauthorized use of the EMS in HNs may be considered a violation of international treaty/law or local laws/regulations. JFCs, subordinate CDRs, or operators may be held criminally or financially liable for HN violations and may have equipment confiscated.

b. **Multinational Operations**

(1) The JEMSOC must be prepared to integrate joint EMS-use requirements into a multinational EMS-use plan to support the mission. The development of specific procedures to support this requirement is made more difficult because of concise security guidance, differences in the level of training, different automation tools, and some language and terminology barriers.

(2) An EMS superiority strategy with an associated CONOPS must be developed in order to execute EMBM in a multinational environment. The CONOPS should address the organizational structure and processes used in a multinational environment, security requirements/concerns, EMS data exchange requirements, and EMBM tools.

(3) An EMSO structure should be established for each operation. The structure should identify the location and responsibilities of EMS users. Multinational operations will generally be conducted one of two ways: either all forces operate in the same area, or the OE will be subdivided and national forces will be given responsibility for particular geographic areas. The first is generally the most complicated because the number and types of equipment will vary greatly between the MNFs. Even when the OE is divided, it will be necessary to plan and coordinate among adjacent EMS users.

(4) The joint force foreign disclosure officer (FDO) provides foreign disclosure guidelines at the beginning of planning to facilitate the flow of information. EMOE definition and characterization should include all partner nation concerns and capabilities. Due to security considerations related to the use or employment of some equipment for military intelligence or other sensitive functions, some information may not be releasable to all countries involved in an operation. The JEMSOC should establish a robust EMI/EP process to mitigate instances where this equipment is employed. EMS releasability/classification information must be distributed and available at all levels. This should apply to all multinational EMS information, to include the JEMSO appendix, EMSCP, and EMSCO, etc.

(5) The information exchange format should be agreed to as early as possible in the planning process. DOD forces should advocate the use of DOD data exchange standards to minimize the time and effort necessary to build their EMS databases. As much as possible, forces should agree upon the EMBM tools used to facilitate operational issues such as interference resolution and reporting, constructing restricted frequency lists for JEMSO, and constructing and producing operating instructions.

(6) Multinational EMS users may not be trained to the same standards as joint EMS managers. They have different automation capabilities, responsibilities, and national requirements. Joint EMS managers can be expected to lead the overall database management effort and provide training to their multinational counterparts when DOD automation tools are used. CDRs should resource the multinational EMS office with experienced EMS users commensurate with the size and scope of the operation.

c. **Multinational EWCC**

(1) **NATO Forces.** Although NATO EW policy contained in Military Committee (MC) 64/10, *NATO Electronic Warfare Policy,* is consistent with much of US JEMSO policy, the perspective and procedures of an MNF EWCC will be new to most.

(a) MC 515, *Concept for the NATO SIGINT and EW Operations Centre (SEWOC),* provides the operational requirements and the operational procedures for an interoperable signals intelligence/electronic warfare operations centre (SEWOC) to support the full range of possible NATO and NATO-led operations in a multinational and joint environment. It also provides a standard of operations between agencies, Services, organizations, and nodes. In addition, it outlines the basic principles, relationships, establishments, and specific details required to manage SIGINT and EW in support of NATO operations and to exercise the capability in peacetime.

(b) MC 486, *Concept for NATO Joint Electronic Warfare Core Staff (JEWCS),* describes the functions of the JEWCS. The primary functions of the JEWCS is to provide a core staff to augment EWCCs, serve as the primary EWCC element for the NATO response force, and provide an operational planning capability for NATO operations and exercises. EWCCs and the primary EWCC element for the NATO response force are to be augmented by those nations contributing to the operation with assets using EW. The JEWCS provides EW training for NATO forces and Alliance members and provides EW support for, and analysis of, NATO and Alliance member EW systems and capabilities. At best, participants may have worked joint issues and served in adjacent forces who have exchanged EW LNOs. However, precedent exists; maritime forces have, for many years, worked multinational issues with little difficulty.

(c) Allied Tactical Publication (ATP)-08(B), *Doctrine for Amphibious Operations,* now contains a supplement on EW. This includes procedures necessary to exchange SIGINT information.

(d) Allied Joint Publication (AJP)-01(C), *Allied Joint Doctrine,* includes a chapter on EW and the EWCC. NATO members invariably base their national EW doctrine

on that agreed within NATO MC 64/10. However, there is a need to ensure the most recent, releasable, US EW publications are provided to supporting MNFs. NATO has also established a NATO emitter database to exchange information about member countries' and nonmember countries' EM emissions and facilitate the coordination of JEMSO.

(2) **FOUR EYES Forces.** Great Britain, Canada, and Australia have a traditional relationship with US forces and exchange much information at the national level. One example of the close ties is the Quadripartite Working Group on EW, the American, British, Canadian, Australian, and New Zealand (ABCA) EW forum. Although Australia is not a party to NATO agreements, it is aware of the current status of NATO's EW policy contained in MC 64/10. Quadripartite Standardization Agreement (QSTAG) 593, *Doctrine on Mutual Support between EW Units,* reflects current NATO policy and meets Australia's needs. This document contains standard operating procedures for an EWCC. Air and Space Interoperability Council (ASIC) Working Parties (WPs) 45 (Air Operations) and 70 (Mission Avionics) both deal with EW issues. WP 45 looks at the operational employment of the MNF's EW assets, while WP 70 investigates the possibility of standardizing EW systems.

(3) **Other MNFs.** The MNFC should include EWOs from supporting MNFs within the EWCC. Should this not be practical for security reasons or availability, the MNFC should, based on the mission, be prepared to provide EW support and the appropriate LNOs to the multinational units.

d. **Exchange of SIGINT information** in support of EW operations should be conducted IAW standard NATO, ABCA, and ASIC procedures, as appropriate. The information data elements are also contained in appropriate Allied publications—notably, NATO's supplement to ATP-8(A), *EW in Amphibious Operations;* ATP-44(C), *Electronic Warfare (EW) in Air Operations;* ATP-51(A), *Electronic Warfare in the Land Battle;* MC 101/12, *NATO Signals Intelligence Policy and Directive;* and ABCA's QSTAG 593, *Doctrine on Mutual Support Between EW Units.* Care should be taken not to violate SIGINT security rules when exercising EW mutual support procedures.

e. **Exchange of EOB.** In peacetime, this type of exchange is normally conducted under bilateral agreement. NATO has procedures in place within the major NATO CDRs' precautionary system that can be put into effect during times of tension. They include the requirement to exchange information on WARMs. The procedures also determine at what stage MNFs change to the use of WARM. However, in low-level conflict, they are unlikely to be activated. Therefore, the EWCC chief, through the EW intelligence support organization and the theater joint analysis center or theater joint intelligence operations center (JIOC), should ensure maintenance of an up-to-date EOB. Multinational staff officers should be included and should ensure their national commands provide appropriate updates to theater joint analysis in discussions on EOB. These staff officers should ensure their national commands also provide appropriate updates to theater joint automated communication-electronics operating instructions system and JIOCs. MC 521, *Concept for Resources and Methods to Support an Operational NATO EWCC/SEWOC,* describes a NATO EOB and who is responsible for its development and upkeep.

f. **US EW Planning Aids.** Significant improvements have been made within the US in the automation of EW planning aids. These improvements allow US EW planners to extract information from theater and national databases and depict it in graphic format for planning and briefing purposes. Supporting MNFs are unlikely to have an equal level of automation. Working with multinational officers, the EWCC chief should determine what EW information would assist the MNF at the planning and unit level and ensure that they receive it. To do this, EWCC personnel should understand security issues that preclude the release of some data and its source but do not necessarily preclude the release of EW mission planning tools.

g. **Releasability.** A clear, easily understood policy on the disclosure of EW information requested by multinational partners should be developed by the CDR's FDO as early as possible.

h. **Reprogramming.** Reprogramming of EW equipment is a national responsibility. However, the EWCC chief should be aware of reprogramming efforts being conducted within the MNF. The EWCC chief should keep the MNFC aware of limitations that could result in EM friendly fire and, when necessary, seek the MNFC's assistance in attaining a solution. To do this, national and multinational commands should provide the EWCC chief with information on the following on request:

(1) Capabilities and limitations of MNF EW equipment.

(2) EW reprogramming support available within MNF units.

(3) Country-specific letters of agreement on reprogramming support for MNF units employing US EW equipment, to include any agreement on flagging support.

(4) Country-specific letters of agreement on exchange of EW reprogramming information with those nations not employing US EW equipment.

(5) Reports from friendly units experiencing reprogramming difficulties, to include information on efforts being made to rectify the problem.

(6) Immediate reports on incidents that could have resulted in EM friendly fire.

(7) Operational change requests sent to US reprogramming organizations that identify deficiencies in the partner nation's EW equipment and their request for reprogramming support. In turn, the EWCC chief should ensure that multinational units in the MNF receive the most recent data held within the theater tactical EOB database and, as appropriate, the associated parametric information. This should allow multinational units within the MNF to address the operational change requests, judge the reliability of their current reprogramming data, and, if necessary, identify problems to the MNF EWCC and national support agencies. Without this level of EW mutual support, EMI on friendly systems may occur.

i. **FHA.** FHA consists of DOD activities normally in support of the United States Agency for International Development or Department of State, conducted OCONUS and its

territories to relieve or reduce human suffering, disease, hunger, or privation. Military forces may be deployed to provide aid to the civil administration in a mix of civil and military humanitarian relief agencies. The civil administration (if one exists) should provide an EMS management framework for the deployed military force. The JEMSOC, through coordination with the CCMD JFMO, would focus on HNC and ensuring that disruption to civil systems would be minimized through coordination. Where administration does not exist, this responsibility may be delegated to a lead military force as directed by the CCDR. The support would be much more like a forced entry operation, and the JEMSOC would need to develop and implement the EMSCP/EMSCO to support operations.

5. Interagency Coordination for Homeland Defense and Defense Support of Civil Authorities

a. HD and DSCA missions are likely to affect operations being conducted by other EMS users. HD and DSCA missions require an unprecedented level of interoperability and cooperation between federal, state, and local governments; civilian first responders; and the public.

b. JFMO NORTH is the designated office within the USNORTHCOM AOR responsible for planning and execution of EMS management for HD and DSCA assigned forces. It provides support to NG forces in Title 10, USC, status and forces planning or executing operations in support of HD and DSCA missions. When contingency operations, missions, and training for joint and multinational exercises are in areas where GCCs' AORs intersect or are not clearly defined, JFMO NORTH will coordinate EMS-use requirements with the respective CCMD JFMO.

c. During normal operations, NG forces in state active duty or Title 32, USC, status will submit their peacetime requirements through existing EMS support channels (e.g., ARNG will submit through NG JFHQ-State to Army Frequency Management Office—United States and Possessions, and ANG units will submit through the A-6 EMS Management Office to Air Force Spectrum Management Office). All JFMO NORTH component, supporting, and subordinate commands will submit frequency requests through JFMO NORTH. USNORTHCOM Title 10, USC, forces may be ordered into the impacted area by the President, normally at the request of the governor. USNORTHCOM EMS manager will join the SFAT to assist in coordinating/integrating EMS issues at the lowest level possible. On request, EMS managers will support the joint force formed of Title 10, USC, forces which are supporting the contingency. Frequency requests follow the process used by Title 10, USC, forces. NG JFHQ-State continues to request frequencies through the NGB J-6/SMB. Coordination with Title 10, USC, assets occurs through the SFAT. Both USNORTHCOM and NGB J-6 C4/SMB will request EMS resources through the appropriate Service EMS management office.

d. For contingencies and exercises, the North American Aerospace Defense Command/USNORTHCOM CDR may use the JEMSOC to support a Title 10, USC, JFC during exercises and contingencies IAW CJCSI 3320.01, *Joint Electromagnetic Spectrum Operations.*

e. Contingency OPLANs have been developed to provide a preplanned rapid response to virtually any event having an impact upon HD or DSCA. These OPLANs vary in type of response to cover events ranging from natural to man-made and peaceful to hostile, and may require support from any or all HD or DSCA responders in support of other national federal or state agencies. The majority of contingency OPLANs identify the command structures and relationships involved in executing various options or phases contained therein. It is imperative that the basic EMS-use requirements for implementation of an OPLAN are identified in advance and incorporated in that particular plan or appended thereto.

Intentionally Blank

CHAPTER IV
CONDUCTING JOINT ELECTROMAGNETIC SPECTRUM OPERATIONS

1. Introduction

JEMSO are conducted according to the same plan, prepare, execute, and assess cycle as other aspects of joint operations and are all subject to the EMSCP and the EMSCO. The EMSCP and EMSCO provide direction to prioritize, integrate, coordinate, direct, and deconflict all joint force EMS use within the JOA. (Note: This does not imply any level of command authority over EMS assets.) While JEMSO are centrally planned to ensure unity of effort, they are decentrally executed to permit maximum tactical flexibility in a highly dynamic EMOE. All joint force EMS transmissions operate under procedural control. The EMSCA does not positively identify, track, and direct joint force EMS transmissions (i.e., positive EMS control). The EMSCP provides component EMSO planners with the EMS-use prioritization scheme.

2. Execution

a. **Concept of Control.** The supported JFC designates an EMSCA to authorize joint force EMS use. EMSCA is normally delegated to the JEMSOC director. The EMSCA approves the EMSCO which the JEMSOC will publish and provide timely updates.

b. **Battle Rhythm.** The JEMSOC establishes the battle rhythm for JEMSO planning and operations IAW the JEMSO appendix. This battle rhythm is based on the phase of operation, pace of operations, nature of the EMOE (i.e., how dynamic it is), and battle rhythms of related operations (e.g., orders cycle, air operations cycle, intelligence cycle). It includes the required participation in cross functional staff organizations associated with JEMSO planning and execution. The JEMSOC will participate in key joint force battle rhythm processes throughout the entire JEMSO cycle, to ensure effective and efficient production, dissemination and execution of each assigned EMSCO (see Figure IV-1).

c. **Issue EMSCP.** The JEMSOC begins the JEMSO operations cycle by issuing an updated EMSCP to the components. The EMSCP includes:

(1) CDR's JEMSO-related guidance.

(a) Updated EMS superiority objectives.

(b) EMOE boundary changes.

(c) ROE changes.

(2) JIPOE information (e.g., red/gray EOB updates, EMS-related METOC data).

(3) EMS-use prioritization changes.

(4) EACA/Federal Aviation Administration (FAA) delegation.

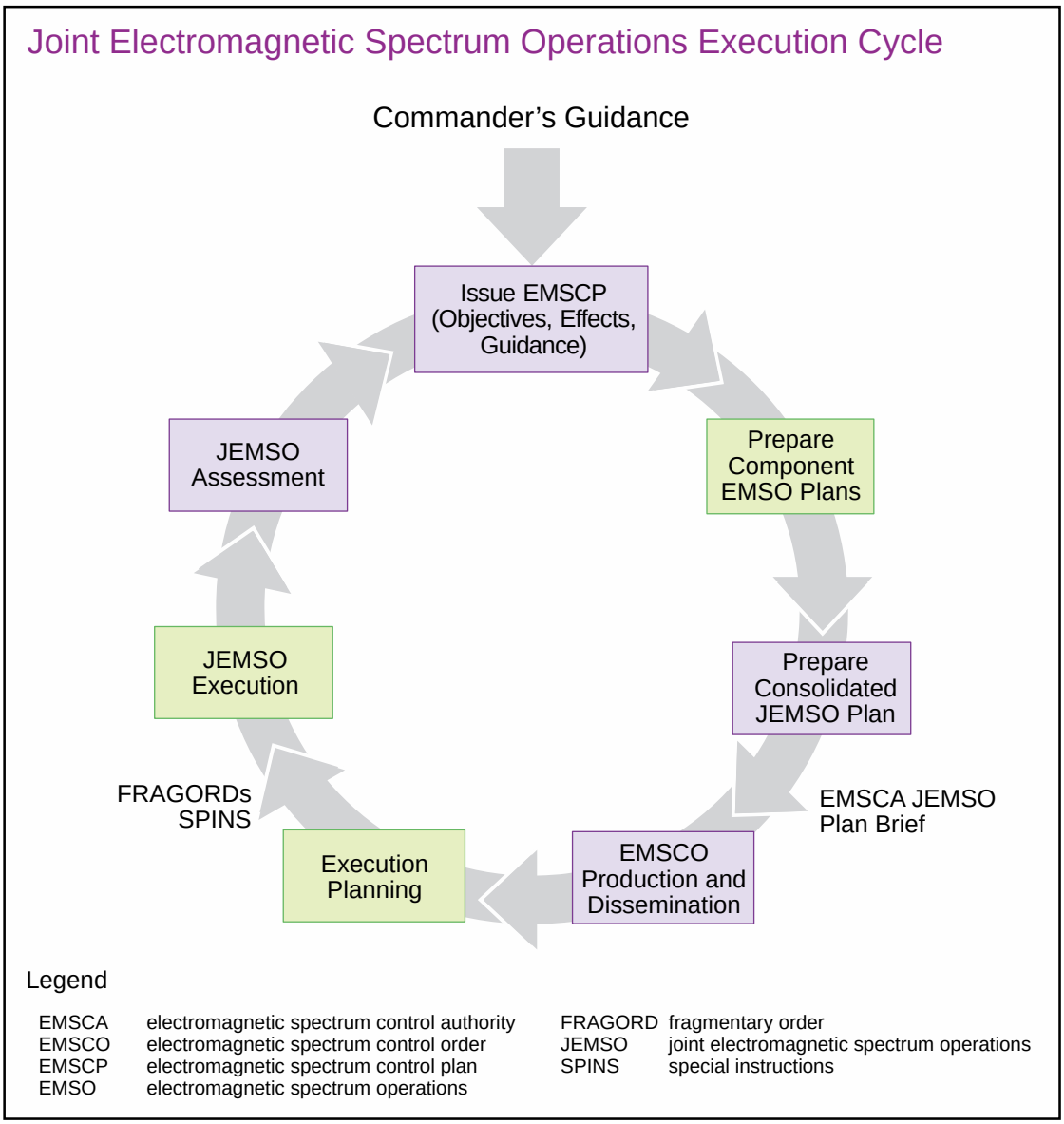

Figure IV-1. Joint Electromagnetic Spectrum Operations Execution Cycle

(5) EMS coordination measure activation/deactivation.

(6) Blue EOB changes.

(7) Projected EMS-use allotment changes.

(8) EMS-use tasking changes.

(a) Branch/sequel execution.

(b) New operations.

(c) EMS-use associated with JTCB-approved EMS-related target elements.

d. **Update Component EMSO Plans.** Components update their respective EMSO plans based on the EMSCP. Components conduct sufficiently detailed EMSO planning to identify changes in their EMS-requirements along with any EMSO shortfalls and generate prioritized EMS-use requests which are passed to the JEMSOC.

(1) **EMS-Use Request.** Components submit EMS-use requests to the JEMSOC to obtain authorization to transmit EM energy or reserve EMS frequencies/bands for sensing. The EMSCO lists all authorized joint EMS use including EMS-authorization delegation. EMS-use requests are not necessary for units operating equipment IAW established EMS coordination measures.

(2) **Non-Organic EMS Support.** Components needing to conduct EMSO but lacking required organic capabilities or EMS-use allocations may submit EMS-use requests to the JEMSOC for prioritization and approval. The EMSCO lists prioritized approved EMS-use requests along with the tasked components. The EMSCO lists the detailed EMSO activity associated with a given EMS-use request.

e. **Prepare JEMSO Plan.** The JEMSOC consolidates, prioritizes, integrates, and synchronizes the component EMSO plans and attendant EMS-use requests to produce an integrated JEMSO plan. It conducts EM policy and engineering analyses on the JEMSO plan to ensure compliance and feasibility. The JEMSOC director briefs the EMSCA on the JEMSO plan and its impact on joint force operations.

f. **Generate and Distribute EMSCO.** When the EMSCA approves the JEMSO plan, the JEMSOC generates and distributes the EMSCO. The EMSCO contains the following information:

(1) EMSCO period objectives.

(2) EMOE boundary changes.

(3) ROE.

(4) EMS-use prioritization.

(5) EACA/FAA delegation.

(6) EMS band allotments (including EM parametric restrictions).

(7) Specified transmission authorizations.

(a) JCEOI.

(b) Master rapper tables.

(c) Other as required.

(8) Active EMS coordination measures.

(a) JRFL.

(b) Other as required.

(9) JEMSO support tasking.

(10) EMBM reporting procedures.

(11) EW reprogramming considerations.

g. **Conduct Detailed EMSO Execution Planning.** Components conduct detailed EMSO planning as directed by the EMSCO. If delegated authority for specific portions of the EMOE, components will conduct the necessary EMSO prioritization, integration, and synchronization and publish orders/fragmentary orders (FRAGORDs) as required. Component EMSO orders/FRAGORDs will be forwarded to the JEMSOC who will distribute them across the joint force for situational awareness.

h. **Monitor and Direct JEMSO.** During the period an EMSCO is active, the JEMSOC will monitor execution and direct changes in JEMSO prioritization and tasking based on J-3 direction and component inputs using EMBM processes. The JEMSOC distributes these changes via FRAGORD across the joint force for situational awareness. Key processes include the immediate support process and the JSIR process.

(1) **Immediate JEMSO Requests.** Component EMS-use requests that arise after the JEMSO planning cycle cutoff time will be submitted directly to the JEMSOC. The JEMSOC will conduct an abbreviated staff coordination and analysis cycle to determine request priority and feasibility. The JEMSOC will immediately distribute approved requests across the joint force via FRAGORD through EMBM processes for situational awareness, notifying impacted units directly.

(2) **JSIR.** The JEMSOC assists components with EMI incidents that cannot be resolved or mitigated at a lower level. If the JEMSOC cannot resolve or mitigate the EMI, it will determine if joint EMS-use or tasking need to be reprioritized and if so, staff resultant immediate EMS-use and/or EMS-support requests as required.

3. Assessment

a. At the end of an EMSCO cycle, the JEMSOC collates component feedback and assesses JEMSO using the measures of effectiveness/measures of performance established during planning in the JEMSO appendix and observed during the EMSCO period.

b. **JEMSO Assessment Data Uses**

(1) **JEMSO Effectiveness/Shortfalls.** The JEMSOC uses the assessment information to update the EMSCA on JEMSO effectiveness, process efficiency, capability shortfalls, and recommended EMSCP changes.

(2) **Lessons Learned.** The JEMSOC develops lessons learned for dissemination to the components as well as the relevant joint and Service organizations. Lessons learned can be used for current operations, but also form the basis for future crisis action planning. JEMSO observations are reported into the JLLIS. This website can be found at https://www.jllis.mil or http://www.jllis.smil.mil.

For further information on lessons learned, see CJCSI 3150.25, Joint Lessons Learned Program.

(3) **Intelligence Updates.** Assessment data is a key element for updating intelligence support to JEMSO. Assessment data ensures timely JEMSO activity feedback is distributed across the joint force. It is also used to update automated correlation and analysis algorithms increasing accuracy, reducing ambiguity, and enhancing situational awareness, effectiveness, and efficiency.

(4) **EW Reprogramming.** EW reprogramming maintains and/or enhances the effectiveness of EW and target sensing system (TSS) equipment in a rapidly evolving, congested, and contested EMOE. EMOE changes may be the result of deliberate actions on the part of friendly, adversary, or third parties, or may be brought about by EMI or other inadvertent phenomena. EW reprogramming includes changes to self-defense systems, offensive weapons systems, ES, and intelligence collection systems. The reprogramming of EW and TSS equipment is the responsibility of each Service or organization through its respective EW reprogramming support programs. Service reprogramming efforts must include coordination from the joint CDR's JEMSO staff to ensure those reprogramming requirements are identified, processed, deconflicted, and implemented in a timely manner by all affected friendly forces.

(5) **Software Reprogrammable EMS-Dependent System Waveforms.** Provide software control of a variety of modulation techniques, wide-band or narrow-band modulation, communications security functions, and waveform requirements of current and evolving standards over a broad frequency range. The purpose of SDR policy updates is to maintain or enhance the effectiveness of automated communications equipment in a rapidly evolving, congested, and contested EMOE. EMOE changes may be the result of deliberate actions on the part of friendly, adversary, or third parties, or may be brought about by EMI or other inadvertent phenomena.

Intentionally Blank

APPENDIX A
JOINT ELECTROMAGNETIC SPECTRUM OPERATIONS STAFF ESTIMATE EXAMPLE

1. Mission

a. **Mission Analysis**

(1) Analyze the JFC's mission statement and guidance for the JEMSO related context.

(2) Determine specified, implied, and essential JEMSO tasks and their priorities.

(3) Determine JEMSO objectives and consider desired and undesired effects.

b. **Mission Statement**

(1) Express JEMSO in terms of who, what, when, where, and why (purpose).

(2) Frame as a clear, concise statement of the essential JEMSO tasks and purpose.

2. Situation and Courses of Action

a. **Situation Analysis.** JEMSO-tailored JIPOE products can facilitate the JEMSO staff estimate by providing a system of systems perspective within a geostrategic context of the OE, to include adversary, neutral, and friendly situation overviews.

(1) **EMOE Characterization.** Summarize significant characteristics of the EMOE and the effects on military operations.

(a) **Physical Domain.** How will the terrain, weather, civil infrastructure, and populace affect the employment of joint EMS-dependent systems? EMI caused by or encountered by friendly forces will impact mission critical capabilities and should be considered.

(b) **Information Environment.** How will EMS in the JOA and its quality, distribution, and flow affect the functions of military information systems?

(2) **Analysis of the Adversary.** Adversary dispositions, composition, strength, capabilities, vulnerabilities, and COAs that affect the EMOE.

(a) Dependencies on the EMS and potential vulnerabilities.

(b) Use of the EMS to support operations.

(c) Ability to exploit friendly force EMS dependencies.

(d) Ability to impact friendly force operations by employing EMS capabilities.

(3) **Friendly Situation.** Friendly dispositions, composition, strength, capabilities, vulnerabilities, and COAs that affect the EMOE.

(a) Status of joint, interagency, and multinational assets available to produce effects in the EMS.

(b) Dependencies on the EMS and potential vulnerabilities.

(c) Use of the EMS to support operations.

(d) Ability to exploit/attack adversary EMS-dependencies.

(4) **HNs/Neutral Nations/Nonaligned Actors**

(a) EMS military, commercial, and civil EMS use.

(b) Host/neutral nation EMOE restrictions and limitations.

(5) **Operational Limitations.** Factors impacting the employment of joint EMS-dependent systems (e.g., international treaty, HN limitations, ROE) or the targeting of adversary EMS-dependent systems (e.g., safety of life networks, navigation systems).

(6) **Assumptions.** Assumptions are intrinsically important factors upon which the conduct of the operation is based and must be noted as such.

(7) **Deductions.** Deductions from the above analysis should yield estimates of relative combat power, including enemy capabilities that can affect mission accomplishment.

b. **COA Development and Analysis.** The JEMSO portions of COAs are based on the above analysis and a creative determination of how the JEMSO aspects of the mission will be accomplished. Each COA must be adequate, feasible, and acceptable from a JEMSO standpoint. Each COA typically will constitute an alternative theater strategic or operational concept and should outline the following JEMSO considerations:

(1) Major JEMSO strategic and operational tasks to be accomplished in the order in which they are to be accomplished.

(2) Major forces or capabilities required (to include joint, interagency, and multinational).

(3) Comparison of required to available EMS maneuver space.

(4) Determine which COA elements, if any are JEMSO infeasible. If any are, determine if this makes the entire COA JEMSO infeasible.

(5) EMS superiority strategy.

3. Analysis of Adversary Capabilities and Intentions

a. Determine the probable effect of possible adversary EMSO capabilities and intentions on the success of each friendly COA.

b. Conduct this analysis in an orderly manner by time phasing, geographic location, and functional event. Consider:

(1) The potential actions of subordinates two echelons down.

(2) Conflict termination issues; think through own action, opponent reaction, and counteraction.

(3) The potential impact on friendly desired effects and the likelihood that the adversary's actions will cause specific undesired effects.

c. Conclude with revalidation of friendly COAs. Determine additional requirements, make required modifications, and list advantages and disadvantages of each adversary capability.

4. Comparison of Own Courses of Action

a. Evaluate the advantages and disadvantages of each COA from a JEMSO perspective.

b. Compare with respect to evaluation criteria.

c. If appropriate, merge elements of different COAs into one.

5. Recommendation

Provide an assessment of which COAs are JEMSO supportable, an analysis of the risk for each, and a concise statement of the recommended COA with its JEMSO requirements.

Intentionally Blank

APPENDIX B
JOINT ELECTROMAGNETIC SPECTRUM OPERATIONS APPENDIX FORMAT

This appendix provides a nominal format for a JEMSO Appendix to be considered during the next update to *CJCSM 3130.03,* Adaptive Planning and Execution (APEX) Planning Formats and Guidance.

Tab A—JEMSO Framework

Enclosure A—JEMSO policy and guidance.

Enclosure B—JEMSO security classification guidance.

Enclosure C—Procedures for requesting frequencies to support EMS-dependent equipment, including lead times and request format.

Enclosure D—EMBM Process.

Enclosure E—EMBM automation system configuration.

Enclosure F—JSIR reporting requirements and routing procedures.

Tab B—EMS Management

Enclosure A—EMS coordination measure (e.g., JRFL) submission procedures, including lead times and restrictions.

Enclosure B—EMI Reporting.

Enclosure C—MNL requirements collection process, including the need for identifying nets requiring call signs, call words, and possible frequency sharing.

Tab C—EW

Tab D—EMS Control Plan

Enclosure A—CDR's JEMSO-related guidance.

Updated EMS superiority objectives.

EMOE boundary changes.

ROE changes.

Enclosure B—JIPOE information (e.g., red/gray EOB updates, EMS-related METOC data).

Enclosure C—EMS-use prioritization changes.

Enclosure D—EMSCA delegation.

Enclosure E—EMS coordination measure activation/deactivation.

Enclosure F—Blue EOB changes.

Enclosure G—Projected EMS-use allotment changes.

Enclosure H—EMS-use tasking changes.

Enclosure I—Branch/sequel execution.

Enclosure J—New operations.

Tab E—EMS Control Order

Enclosure A—EMSCO period objectives.

Enclosure B—EMOE boundary changes.

Enclosure C—ROE.

Enclosure D—EMS-use prioritization.

Enclosure E—EMSCA delegation.

Enclosure F—EMS band allotments (including EM parametric restrictions).

Enclosure G—Specified transmission authorizations.

JCEOI

Master rapper tables

Other as required

Enclosure H—Active EMS coordination measures

JRFL

Other as required

Enclosure I—JEMSO support tasking.

Enclosure J—EMBM reporting procedures.

Intentionally Blank

APPENDIX C
ELECTROMAGNETIC SPECTRUM COORDINATION MEASURES

1. General

EMS coordination measures are rules, mechanisms, and directions governed by joint doctrine and defined in the EMS control plan and are activated via the EMSCO. These measures control how to use the EMS in specified dimensions (spatial, time, frequency, power, waveform). EMSO elements establish EMS coordination measures to accomplish one or more functions:

a. Establish reserved EMS bands for specific EMS users.

b. Restrict the actions of some EMS users.

c. List EMS bands in which units can use EMS-dependent systems with minimal risk of friendly EMI.

d. Control actions of specific EMS users.

e. Require EMS users to accomplish specific actions.

2. Joint Restricted Frequency List

a. The JRFL EMS coordination measure is a time- and geographic-oriented listing of TABOO, PROTECTED, and GUARDED functions, nets, and frequencies. The JRFL should be limited to the minimum number of frequencies necessary for friendly forces to accomplish objectives. The JEMSOC compiles the JRFL based on the coordinated inputs from the operations, intelligence, and communications staffs within the command and affected subordinate commands. An example of these inputs is comparing potential EA load sets for self-protection systems such as counter radio-controlled IED EW and aircraft EA in order to build coordinated communications/self-protection EA load sets. The JEMSOC establishes the process for frequency assignments of unit nets designated for inclusion as PROTECTED or TABOO submission for final approval. The restrictions imposed by the JRFL may only be removed, by direction of the EMSCA, if the EMSCA or delegated representative determines the benefit of EA on a restricted frequency surpasses the immediate criticality of exploited or required information to friendly forces. Operations and intelligence functions should be consulted before this decision. However, the self-protection of friendly forces has priority over all controls. GUARDED, PROTECTED, and TABOO frequencies are defined as follows:

(1) **GUARDED.** GUARDED frequencies are adversary frequencies that are currently being exploited for combat information and intelligence. A GUARDED frequency is time-oriented in that list changes as the adversary assumes different combat postures. These frequencies may be jammed after the CDR has weighed the potential operational gain against the loss of the technical information.

(2) **PROTECTED.** PROTECTED frequencies are friendly frequencies used for a particular operation, identified and protected to prevent them from being inadvertently jammed by friendly forces while active JEMSO are directed against hostile forces. These frequencies are of such critical importance that jamming should be restricted unless absolutely necessary or until coordination with the using unit is made. They are generally time-oriented, may change with the tactical situation, and should be updated periodically.

DEFINITION

TABOO frequencies. Any friendly frequency of such importance that it should not be deliberately jammed or interfered with by friendly forces including international distress, safety, and controller frequencies. (Modified from JP 1-02)

(3) **TABOO.** TABOO frequencies are friendly frequencies of such importance that they should not be deliberately jammed or interfered with by friendly forces. Normally these include international distress, safety, and controller frequencies. They are generally long-standing frequencies. However, they may be time-oriented in that, as the combat or exercise situation changes, the restrictions may be removed. Specifically, during crisis or hostilities, short duration EA may be authorized on TABOO frequencies for self-protection to provide coverage from unknown threats or threats operating outside their known frequency ranges, or for other reasons.

b. **JRFL Updates.** The JRFL is reviewed by all joint force staff sections and subordinate commands. The J-2 might need additions, deletions, or qualified frequencies based on possible SIGINT and ES targets. The JEMSOC monitors the JRFL with respect to changes in operations, timing, dates, and TABOO frequencies. Classified annex(es) may be required. The JEMSOC ensures TABOO and PROTECTED frequencies are congruent with assigned frequencies. The JEMSOC also amends the JRFL based on J-2 and J-6 input. Supporting EA units should check the JRFL because this is the source of “no jam” frequencies. A review of the JRFL is required to identify potential conflicts between frequencies afforded protection by the JRFL and those designated for EA activities. If conflicts are identified, they should be brought to the attention of the JEMSOC for final resolution. The resolution will take the form of either “override” of the JRFL protection or alter/cancel the EA activity. The decision ultimately rests with the JFC, or designated representative, and is based on the value of the EW mission versus the gains from JRFL protection.

APPENDIX D
JOINT ELECTROMAGNETIC SPECTRUM OPERATIONS MODELING

1. General

Modeling and simulation tools are essential for the evaluation of JEMSO capabilities and vulnerabilities. These tools must cover the full JEMSO analytical spectrum from the basic engineering/physics level through the aggregate effects at tactical, operational, and strategic applications levels. Simulations are critical because of the high cost associated with system development, field testing, and training exercises. Additionally, it is often impossible to replicate the scenarios required to test or exercise the multitude of variables, conditions, and interactions that occur at various levels of combat operations.

2. Application

a. **Operational Test Support.** Laboratory and range agencies use simulations to assist in test planning, scenario development, test equipment configuration, and data reduction and verification, as well as for extrapolating or expanding the use of test results.

b. **Analysis Support.** Combat developers and other analysis activities use simulations to conduct cost and operational effectiveness studies, assist in defining requirements, perform force mix and trade-off analyses, and develop TTP.

c. **Operational Support.** Operational commands use simulations to provide training from the individual to theater staff levels, serve as tactical decision aids, develop and evaluate OPLANs, and conduct detailed mission planning.

d. **Weapon System Development.** Materiel developers use simulations to support engineering development and design, capability/vulnerability and survivability analyses, and value-added assessments.

e. **Intelligence Support.** Intelligence agencies use simulations to evaluate raw intelligence, reverse engineer developing threats, develop threat projections, analyze threat design options, and evaluate threat tactics and employment options.

3. Modeling Agencies

There are numerous government agencies and contractors involved in JEMSO modeling. The Joint Staff (JS) Director for Force Structure, Resource, and Assessment periodically publishes the *Catalog of Wargaming and Military Simulation Models.* This is the most comprehensive catalog of models available and identifies most agencies involved in JEMSO modeling. Listed below are some of the joint and Service organizations involved with JEMSO modeling and simulation.

a. **Joint.** Defense Modeling and Simulation Office, Joint Electronic Warfare Center (JEWC), Joint Warfighting Analysis Center, Joint Training and Simulation Center, Joint Spectrum Center, Warrior Preparation Center, and Joint Warfighting Center.

b. **Army.** Aviation and Missile Command, National Ground Intelligence Center (NGIC), Air Defense Center and School, Intelligence Center of Excellence, US Army Training and Doctrine Command Analysis Center, 1st Information Operations Command (Land), Electronic Proving Ground, Communications Electronics Command, Army Material Systems Analysis Agency, Test and Evaluation Command, Cyber Center of Excellence and US Signal Center and School, and National Simulation Center.

c. **Navy.** Navy Information Operation Commands, Naval Command and Control and Ocean Surveillance Center, Naval Air Warfare Center, Naval Research Laboratory, Navy Modeling and Simulation Office, Naval Aviation Warfighting Development Center, Naval Oceanographic Office, Center for Naval Analyses, Naval Network Warfare Command, Space and Naval Warfare Systems Command, Fleet Weather Center Norfolk, and Naval Surface Warfare Center.

d. **Air Force.** Air Force Agency for Modeling and Simulation, Air Force Research Laboratory, National Air and Space Intelligence Center (NASIC), 53rd Electronic Warfare Group, Air Force Operational Test and Evaluation Center, Air Force A-9, Aeronautical Systems Center, Survivability and Vulnerability Information Analysis Center, Air Armaments Center, Air and Space C2 Agency, Aeronautical Systems Center Simulation and Analysis Facility, and Air Force Wargaming Centers.

e. **Marine Corps.** Marine Corps Warfighting Lab, Marine Corps Combat Development Command's Modeling and Simulation Office, Training and Education Command's Training and Education Capability Division, Training Simulation Branch, and the Air-Ground Task Force Staff Training Program's Modeling and Simulation Branch.

4. Fidelity Requirements

Fidelity is the degree of accuracy and detail to which the environment, physical entities, and their interactions are represented. Fidelity requirements vary widely depending on the particular purpose and application. Considerations in determining the proper fidelity should be based on scope (e.g., individual versus corps staff, engineering versus operational), consequences of inaccurate results (e.g., strike planning and execution), time available (minutes/hours to weeks/months), computer resources available (e.g., processing speed, networking requirements, data feeds and memory/storage), accuracy and availability of data (e.g., level of detail, confidence level, and form/format), and allowable tolerance of results. Regardless of the fidelity required, a consistent methodology is required to define and guide the process. This typically entails problem definition (scope and objective), research (data gathering), analytical methodology development (how the data is used or applied), and the results/reporting format (satisfy objective/answer question). High-fidelity tools often are needed to generate data that can be used to aggregate realistic effects at higher order simulation levels (e.g., mission/campaign level wargaming). In all cases, analytical comments and methodologies should be available to interpret model output and results in

modeling manuals all other documentation to document data sources, analytical assumptions, parametric discrepancies, and atmospheric effects, thereby clarifying assumptions, limitations, and aggregation techniques. In general, the setup time, input data requirements, model processing time, computer resources, and user knowledge/expertise increase proportionally with the model scope, fidelity, and flexibility of the modeling and simulation tools.

5. Model Design

a. **User Interface, Preprocessors, and Postprocessors.** These requirements will drive the development of the model and will vary widely depending on the particular application. For example, an engineering level model will require complex mathematical parameter input in order to produce an in-depth, system-on-system (one-on-one) level modeling product. At the tactical level, an analyst would have limited time and computing resources and would have limited resources in the development of a tactical decision aid. Other than purpose, setup, and analysis, time requirements and user expertise are key considerations in designing preprocessors and postprocessors and the user interface. In general, maximum use should be made of standard graphic user interfaces.

b. **JEMSO Functions.** Depending on the level of complexity, any one JEMSO function, or various combinations of functions, may need to be replicated in the model. JEMSO model functions and capabilities must address areas such as RF and EO-IR wavelength propagation, radar line of sight, terrain masking, self-protect jamming, standoff jamming (communications and noncommunications), ES systems, expendables (chaff and flares), decoys (active and passive), suppression of enemy air defenses targeting, acquisition and tracking sensors (radar, EO-IR), clutter (land/sea/atmospheric), satellite coverage (polar/geosynchronous), link analysis, missile guidance and flyout, evasive maneuvers, communications processes, EP, communications targeting, and doctrinal issues.

c. **Software Architecture.** The design of a JEMSO model or system of models should be modular and object oriented. Existing standards and commonly used commercial software packages should be used where appropriate. Standards include those from the Institute of Electrical and Electronics Engineers (IEEE), American National Standards Institute, Federal Information Processing Standards, Military Standard 2167A, Open Software Foundation, and NSA/CSS. Military Standard 2167A standards should be tailored to meet the user requirements for documentation. Standards are particularly important with regard to interfaces. The primary objective of standardization is to make the simulation as machine independent as possible. To this end, the operating system environment should conform to IEEE Portable Operating System Interface for Computer Environments standards. Additionally, communications protocols and interfaces should conform to the Government Open Systems Interconnection Profile, which is the DOD implementation of international Open Systems Interconnect standards.

6. Verification and Validation

a. **Verification.** Model verification is related to the logic and mathematical accuracy of the propagation algorithms within a model. Verification is accomplished through such

processes as design reviews, structured walk-throughs, and numerous test runs of the propagation algorithms within a model. Test runs are conducted to debug the algorithms as well as determine the sensitivity of the propagation output to the full range and accuracy of input parameters. Included in verification is a review of input data for consistency, accuracy, and source. Ultimately, verification determines if the model functions as designed and advertised. Verification is rather straightforward but time-consuming.

b. **Validation.** Model validation relates to the correlation of the model with reality. In general, as the scope of a simulation increases, validation becomes more difficult. At the engineering level for a limited scope problem, it is often possible to design a laboratory experiment or field test to replicate reality. At the force level, it is not possible to replicate all the variables in the OE and their interaction. It may be possible to validate individual functional modules by comparison with test data, or previously validated engineering-level or high- to medium-resolution models. A model cannot predict 100 percent accuracy in given scenarios, and the number of assumptions and limitations increase as the model scope increases. At the force level, models tend to be stochastically driven but can provide relative answers, insights, and trends so alternatives may be rank ordered. Model users must thoroughly understand the capabilities, limitations, and assumptions built into the tool and integrate results with off-line or manual methods, during post-processing, to compensate for these shortfalls. Although the above methods may be used for the validation of individual modules in a force level model, three techniques are used for validating the bottom-line output of force-on-force simulations: benchmarking with an accepted simulation, comparing with historical data, and using sound military judgment. As rapidly moving technological advances are incorporated in modern force structures, availability of useful historical data becomes less prevalent for predicting outcomes in future mid- to high-intensity conflicts. The use of forecasts and assumptions becomes necessary, but such efforts tend to be less reliable the further into the future one tries to project. Benchmarking against widely accepted simulations provides a straightforward and less biased method of validation. However, problems are caused by differences in input data structures, assumptions, and output formats between the models. To the extent possible, careful review, analysis, and data manipulation must be applied to minimize the potential of creating apparent discrepancies that can result from attempts to “compare apples to oranges.”

7. Databases

Numerous databases are available to support JEMSO modeling. Data include doctrinal, order of battle, parametric, signature, antenna pattern, communications networks, and topographic. One of the most comprehensive database catalogs available is the directory of DOD-sponsored research and development databases produced by the Defense Technical Information Center. Some sources of data for EW modeling include the following:

a. **Doctrinal or Scenario Order of Battle and Communications Networks. Defense Intelligence Agency (DIA),** NSA, Joint Training and Simulation Center, Combined Arms Center, NGIC, NASIC, 688th Cyberspace Wing, Naval Air Warfare Center Weapons Division, National Maritime Intelligence Center (NMIC), Marine Corps Intelligence Activity, and Air Force Air Warfare Center.

b. **Parametric, Signature, and Antenna Pattern.** NSA, DIA, NGIC, NMIC, Missile and Space Intelligence Center, Office of Naval Intelligence, nuclear weapons reconnaissance list, Navy Information Operations Command, NASIC, Joint Spectrum Center, Air Force Research Lab, Army Research Lab, Navy Research Lab, and 688th Cyberspace Wing.

c. **Topographic.** National Geospatial-Intelligence Agency (NGA), Central Intelligence Agency, US Geological Survey, Army Geospatial Center, and Waterways Experiment Station.

Intentionally Blank

APPENDIX E
ORGANIZATIONS SUPPORTING JOINT ELECTROMAGNETIC SPECTRUM OPERATIONS

There are a variety of agencies and organizations capable of providing direct and indirect support to the JEMSOC for JEMSO coordination, synchronization, and deconfliction. During joint operations, JFCs may require assistance from DOD, national, multinational, international, public, and private organizations. Annexes A through F provide information on the missions and responsibilities of some of these key agencies for JEMSO:

Annex A Electromagnetic-Space Analysis Center

B Global Positioning System Operations Center

C United States Strategic Command (USSTRATCOM) JEWC

D Joint Navigation Warfare Center (JNWC)

E Defense Information Systems Agency (DISA)–Joint Force Headquarters-Department of Defense Information Network (JFHQ-DODIN) Joint Spectrum Center

F NSA/CSS

Intentionally Blank

ANNEX A TO APPENDIX E
ELECTROMAGNETIC-SPACE ANALYSIS CENTER

1. General

a. As a DOD focal point, the electromagnetic-space (E-Space) program is chartered by the Under Secretary of Defense for Intelligence to provide CCMDs and their component commands with intelligence support for EW operations.

b. The NSA is designated as the Executive Agent for the program. Organizationally, the E-Space Program Office is part of the Customer Relationships Directorate within the NSA SIGINT Directorate.

c. Self-service data source portals are established on the SECRET internet protocol router network (SIPRNET) and Joint Worldwide Intelligence Communications System (JWICS) to provide access to intelligence data from across DOD and the IC. This capability, combined with the all-source analytic center, provides direct support to EW consumers across the DOD intelligence, operations, planning, and communications communities. Direct support is also afforded to the IC.

2. Mission

a. Deliver full EMS views of an adversary's EM space to enable CCDRs to develop operational COAs.

b. Serve operational users' needs by providing tailored support and technical analytic expertise to operational planners, tactical warfighters, EW system developers, and the modeling and simulation communities.

c. Ensure access to all-source, targetable, and operationally actionable intelligence information relating to EM capabilities and potential means of access to those targets using collaborative tools, databases, and analysis.

d. Provide holdings of information that will assist in preparation of the OE and electronic mapping of targets.

3. Electromagnetic-Space Support to Electronic Warfare

a. There are two entities within E-Space. The first is the acquisition of secure Web portals for both SIPRNET and JWICS. The second is the daily operations of an all-source intelligence analysis center with resident expertise capable of providing tailored support to US military forces conducting EW missions.

b. The E-Space secure Web portals provide users with a single point of access to a variety of data sources. They also provide an analytic environment to retrieve, assess, and display or format data for use in external analytic tools. These portals are designed to provide those involved in EW operations with "self-service" rapid access to critical, decision quality intelligence.

c. The Electromagnetic-Space Analysis Center (ESAC) provides tailored all-source analysis to EW customers based on specific requests for intelligence. This joint center gathers intelligence from across DOD and the IC to produce tailored intelligence summaries for its customers. ESAC analysts leverage access to other experts, data sources, and analytic tools to provide warfighters with decision quality intelligence.

4. Mailing Address

E-Space
9800 Savage Road, Suite 6295
Fort George G. Meade, MD 20755-6295

5. Telephone Numbers

Defense Switched Network (DSN): 689-9910 (Portal) DSN: 689-5811/9991 (ESAC)
COMMERCIAL: 443-479-5811 (ESAC)

6. E-Mail

SIPRNET: ESpace_Helpdesk@nsa.smil.mil (Portal) JWICS: ESpace_Helpdesk@nsa.ic.gov (Portal) SIPRNET: ESpaceAC@nsa.smil.mil (ESAC) JWICS: ESpaceAC@nsa.ic.gov

7. URLs

SIPRNET: www.nsa.smil.mil/producer/other/espace/index.shtml
JWICS: www.nsa.ic.gov/producer/other/espace/index.shtml

ANNEX B TO APPENDIX E
GLOBAL POSITIONING SYSTEM OPERATIONS CENTER

1. General

The Global Positioning System Operations Center (GPSOC) provides a single center of excellence for user support and GPS constellation operations. The GPSOC, located at Schriever Air Force Base (AFB), Colorado, provides DOD and multinational GPS users worldwide with anomaly reports and other information 24 hours a day, 7 days a week. USSTRATCOM's Joint Functional Component Command for Space (JFCC-Space) has OPCON of the GPSOC that is exercised through the Joint Space Operations Center.

2. Mission

a. The mission of the GPSOC is to operate, maintain, and employ GPS to produce a desired effect in support of military, civil, and multinational operations. Key aspects of this mission are:

(1) Optimized constellation operations fully synchronized and supportive of CCDRs' needs and operational priorities.

(2) Robust, real-time performance monitoring and reporting to ensure a COP and full situational awareness across all echelons of command. This is done through operational coordination with other PNT services.

(3) Full integration, coordination, and deconfliction of GPS NAVWAR operations with routine military and civil GPS operations for maximized impact and minimal collateral effects.

(4) Direct and immediate access to time-critical GPS products and services designed to leverage the effectiveness of operations reliant on GPS services.

(5) Rapid identification, isolation, and resolution of user reported outages or interference.

b. The GPSOC brings together the expertise, data fusion, and visualization capabilities, security controls, and performance information required to operate, maintain, and employ GPS to produce the desired effects to support military operations.

3. Global Positioning System Operations Center Support to Electronic Warfare

a. The GPSOC maintains databases and provides data about friendly force GPS system technical characteristics for use in planning EP measures. These databases provide EW planners with information covering GPS receivers and augmentations operated by DOD, other government agencies, and private businesses or organizations. Information from these databases is available on a quick reaction basis in a variety of formats and media to support EW planners and EMS managers.

b. The GPSOC assists GPS users across DOD with predicted GPS performance impacts to operations; post performance analysis of GPS constellation accuracy; DOD user reports of interference or jamming; user problems or questions regarding GPS; tactical support for planning; and assessing military missions involving GPS use. For EW planners, the GPSOC can assist with COA development for the EP of GPS frequencies and access to GPS information for authorized users. Additionally, the GPSOC can assist with ES through its monitoring of the GPS jammer location system hosted by NGA and the integration of the Global Positioning System Interference and Navigation Tool (GIANT) to predict GPS jamming effects on GPS receivers. With additional information, GIANT can be used to model and predict the effects of blue force jamming on friendly systems and the use of blue force EA to prevent enemy use of GPS frequencies.

c. The GPSOC assists in the resolution of operational interference and jamming incidents through the use of the GPS jammer location system and the request for information or request for anomaly analysis process. The GPSOC also maintains a historical database of interference and jamming incident reports and solutions to assist in trend analysis and correction of recurring problems. CCMDs, subordinate unified commands, JTFs, and their components can request assistance in resolving suspected GPS interference, jamming, and anomalous behavior.

4. Mailing Address

2nd Space Operations Squadron
300 O'Malley Avenue, Suite 41
Schriever AFB, CO 80912

5. Telephone Numbers

DSN: 560-2541/5081 (UNCLASSIFIED)
COMMERCIAL: 719-567-2541/5081

6. E-Mail

Nonsecure Internet Protocol Router Network (NIPRNET):
gps_support@ schriever.af.mil
SIPRNET: gpsv3@afspc.af.smil.mil

ANNEX C TO APPENDIX E
UNITED STATES STRATEGIC COMMAND JOINT ELECTRONIC WARFARE CENTER

1. General

The JEWC is USSTRATCOM's EW organization providing direct support to its Unified Command Plan EW responsibilities.

2. Mission

The mission of the JEWC is to enable warfighter control of the EMS through joint training, planning, operations support, and assessment.

3. Joint Information Operations Warfare Center/Electronic Warfare Directorate Support to Electronic Warfare

a. Serves as the central DOD repository for joint EW-related subject matter expertise supporting the Secretary of Defense (SecDef), JS, CCDRs, JFCs, and partner nations.

b. Advocates joint EW doctrinal, organizational, training, materiel, leadership and education, and personnel advancements in pursuit of EMS control.

c. Serves as Office of the Deputy Under Secretary of Defense's single point of contact for EW vulnerabilities inherent in joint capability technology demonstration systems and technologies.

d. Provides advanced EW analysis support to JFC operations, tests, and exercises. In addition to short-suspense, crisis-action EW analysis and mission development, this support includes providing RF propagation and three-dimensional terrain modeling and simulation for airborne, ground-based, and shipboard EMS-dependent systems.

e. Maintains an EW rapid deployment team capable of supporting JFCs with a surge capability.

f. Maintains, as the DOD lead for joint EW training oversight, the Joint EW Theater Operations Course. As a certified and required course for joint EWOs, it transforms Service EW experts into theater EW staff officers capable of shaping the EMOE for JFCs.

g. Monitors and evaluates the impact of current US and adversary EW technologies, systems, and TTP employed within the EMS. It also maintains an EM opposing force (OPFOR). The JEWC EM OPFOR (red cell) replicates a coherent, realistic EMOE capable of mirroring adversary and civilian infrastructure in order to train and enhance DOD/United States Government (USG) EM capabilities, processes, and TTP proficiency. The red cell is vital in providing blue forces the keys to developing a joint culture of robust, survivable EM processes via a contested/congested EMOE. For EM OPFOR applications, they provide a scalable real-world target set (primarily commercial off-the-shelf equipment such as wireless networks/computers, cellular infrastructure, SATCOM, and push-to-talk) for operators to

train against. Other capabilities include, but are not limited to, radio DF and communications intercept, RF vulnerability assessments, STO validation, and EW effects validation. The red cell also supports TTP development for ground, sea, and air EW asset integration across the OE.

h. Collaborates with laboratories, joint and Service analysis centers, weapons schools, battle labs, centers of excellence, US and multinational operational EW communities, and academia to explore innovative EW employment options and concepts for capabilities against existing and emerging EM targets throughout the OE.

i. Provides oversight and advocacy for evolving EW capabilities and joint force requirements by identifying emerging capability gaps and technology trends employed within the EMS in order to advocate short-term mitigation possibilities and long-term solutions to the Services, CCMDs, and other agencies able to fund, or otherwise address, these shortfalls.

j. Assists CDRs, as the executive agent for exercising joint coordination of EW reprogramming, with identification, confirmation, and dissemination of electronic threat changes; coordinates compatibility; and facilitates the joint EW reprogramming data exchange among the IC, Services, and CCMDs per CJCSI 3210.04, *Joint Electronic Warfare Reprogramming Policy*.

k. Manages, as the JS's Executive Agent and technical advisor, US participation in the NATO Emitter Database and performs management and coordination functions of the US EM Systems Database IAW CJCSM 3320.04, *Electronic Warfare in Support of Joint Electromagnetic Spectrum Operations.*

4. Mailing Address

JEWC
2 Hall Boulevard, Suite 217
San Antonio, TX 78243-7074

5. Telephone Numbers

DSN: 969-5967 (UNCLASSIFIED)
COMMERCIAL: 210-977-5967
DSN: 969-2507 (Duty Officer)
COMMERCIAL: 210-977-2507 (Duty Officer)
FAX: DSN 969-4233 (UNCLASSIFIED)

6. E-Mail

NIPRNET: ew_ewos@jiowc.osis.gov
SIPRNET: ew_ewos@jiowc.smil.mil
JWICS: ew_ewos@jiowc.ic.gov

ANNEX D TO APPENDIX E
JOINT NAVIGATION WARFARE CENTER

1. General

The JNWC is assigned to USSTRATCOM's JFCC-Space.

2. Mission

The JNWC's primary mission is to provide operational-level joint warfighter support and serve as the center of excellence for all NAVWAR-related issues. In addition, the JNWC integrates and coordinates PNT capabilities across DOD; provides a core interagency framework to coordinate, conduct, and report on NAVWAR testing and integration and identify mitigation TTP for PNT-based vulnerabilities (to include all terrestrial and space-based user equipment and platforms and their augmentation); and advises decision makers on significant NAVWAR issues.

3. Joint Navigation Warfare Center Support to Electronic Warfare

a. Develops and maintains current information on NAVWAR matters of interest to the warfighter and JFCs. These include assessments of adversary capabilities, assessments of multinational capabilities and limitations, and EW topics of special interest. The JNWC actively disseminates NAVWAR information to warfighters and JFCs, as well as joint and Service training organizations.

b. Analyzes and tests ES system capabilities, EA system TTP and EP vulnerabilities in relation to NAVWAR and submits recommendations to the JS, warfighter, trainers, and weapon system developers.

c. Provides a capability for independent field testing of EW against rapidly emerging NAVWAR threats.

d. Integrates NAVWAR PNT capabilities across ISR, IO, and space operations.

4. Joint Navigation Warfare Center Navigation Warfare Support Cell

The Joint Navigation Warfare Center Navigation Warfare Support Cell (JNSC) provides a 24/7/365 operational reachback capability to the warfighter to address NAVWAR concerns during planning and current operations. The JNSC functions as the JNWC's operating staff and implements decisions, on behalf of the JNWC director, and provides assistance to HHQ and CCMDs as authorized in applicable orders. The JNSC develops operational-level support recommendations for CDR, JFCC-Space; coordinates appropriate command responses to requests for information; responds to HHQ tasking; assists with EMI event information collection and analysis; and assists operational planners in developing integrated NAVWAR plans. The JNWC reachback capabilities include GPS jamming modeling and simulation, access to the NAVWAR capabilities and vulnerabilities database repository, current country-specific NAVWAR threat briefs, and consultation with operational planners.

5. Joint Navigation Warfare Center Theater Navigation Warfare Coordination Cell

The JNWC Theater Navigation Warfare Coordination Cell (TNWCC) provides a planning support element source from USSTRATCOM staff forces or subordinate organizations to provide the GCC/JFC expertise in planning and conducting NAVWAR operations across space, EW, cyberspace, and ISR operations. JNWC TNWCCs are aligned to USSTRATCOM regional/adversary teams, and maintain a continual relationship with the AORs they support, and are thoroughly familiar with their numbered plans. On order from CDR USSTRATCOM, the TNWCC shall deploy as a part of the liaison/augmentation team (L/AT); or as a standalone element of the GCC/JFC staff. When deployed as part of the L/AT, CDR USSTRATCOM retains (OPCON) of all L/AT elements. When deployed as a standalone element, CDR JFCC-Space retains OPCON of the TNWCC.

6. Mailing Address

JNWC/J-3
2050A 2nd Street SE
Kirtland AFB, NM 87117-5669

7. Telephone Numbers

STE DSN: 312-246-6792
COMMERCIAL: 505-206-7594 (JNWC Duty Officer, available 24/7)
COMMERCIAL: 505-846-6846 (JNWC office, available during normal working hours)
DSN: 246-6846 (JNWC office, available during normal working hours)

8. E-Mail

NIPRNET: JNWC@kirtland.af.mil
SIPRNET: jnwcadmin@afmc.af.smil.mil
JWICS: ~wccas_jnwccdodiis.ic.gov

ANNEX E TO APPENDIX E
DEFENSE INFORMATION SYSTEMS AGENCY

DISA provides cybersecurity support for the DOD in coordination with the Chairman of the Joint Chiefs of Staff (CJCS), the NSA, and the DIA. DISA provides engineering, architecture, and provisioning support for the DODIN and acquires all commercial SATCOM resources. At the direction of the CDR, USSTRATCOM, DISA supports USSTRATCOM as the consolidated SATCOM system expert for commercial SATCOM and DOD Gateways. DISA conducts DODIN operations, Defense Collaboration Services and plans, mitigates, and executes service restoration at the global and enterprise level. DISA provides, operates, and assures C2, information sharing capabilities, and a globally accessible enterprise information infrastructure in direct support to the joint force, national level leaders, and other partner nations. It also provides standards, interoperability testing, spectrum support and deconfliction, and integrated architecture development for the DOD net-centric enterprise information environment.

1. General

The JFHQ-DODIN is one of United States Cyber Command's (USCYBERCOM's) operational commands that provides unity of command and effort to secure, operate, and defend the DODIN by providing situational monitoring and enabling planning, and decision making.

2. Mission

The CDR, JFHQ-DODIN has OPCON over each DODIN command for global DODIN/defensive CO-internal defense measures activities supporting USCYBERCOM's global DODIN mission.

3. Joint Force Headquarters-Department of Defense Information Network Support to Joint Electromagnetic Spectrum Operations

a. JFHQ-DODIN ensures lateral coordination, information sharing, and synchronization.

b. It assists JEMSO planners with the unity of effort for the operation and the defense of the DOD information environment.

4. Joint Spectrum Center Support to Joint Electromagnetic Spectrum Operations Mailing Address

DISA
P.O. Box 549
Fort Meade, MD 20755-0549

6. Telephone Numbers

COMMERCIAL: 301-225-8100

7. Website

NIPRNET: https://disa.deps.mil/ext/cop/cpp/support/mpi.aspx

ANNEX F TO APPENDIX E
NATIONAL SECURITY AGENCY AND CENTRAL SECURITY SERVICE

1. General

The NSA/CSS is a unified organization structured to protect the security of US signals and information systems and provide intelligence information derived from the exploitation of the signals and information systems of US adversaries. The NSA/CSS has a unique position among the defense agencies because of its government-wide responsibilities providing products and services to the DOD IC, government agencies, industry partners, and select allies and coalition partners. NSA/CSS is also designated as a combat support agency performing specific combat support activities for DOD.

2. Mission

The NSA/CSS is the USG lead for cryptology, and its mission encompasses both SIGINT and cyberspace security activities. The NSA/CSS provides SIGINT and cyberspace security guidance and assistance to DOD organizations engaged in collection, processing, analysis, production, and dissemination of SIGINT data and information for foreign intelligence purposes. They support national and departmental missions and provide SIGINT support for the conduct of military operations as assigned by SecDef.

3. National Security Agency/Central Security Service Support to Joint Electromagnetic Spectrum Operations

a. Maintains multiple databases that provide technical data for use in planning EMSO. Databases maintained by the NSA/CSS provide JEMSO planners with information covering communications, radar, navigation aids, broadcast, identification, and systems operated by DOD, other USG departments and agencies, and private businesses or organizations. Information from these databases is available through searchable Web portals or on a quick reaction basis in a variety of formats and media to support JEMSO planners.

b. Assists JEMSOC and the JFC's staff with EMSO-related activities to coordinate, deconflict, and manage the use of the EMS as well as provide support to cyberspace security.

4. Mailing Address

National Security Agency
Attn: NIAP-CCEVS
9800 Savage Road, Suite 6757
Fort Meade, MD 20755-6757

5. E-Mail

scheme-comments@niap-ccevs.org

Intentionally Blank

APPENDIX F
REFERENCES

The development of this JDN is based upon the following primary references.

1. Department of Defense Publications

a. Department of Defense Directive (DODD) 3222.04, *Electronic Warfare (EW) Policy.*

b. DODD 3700.01, *DOD Command and Control (C2) Enabling Capabilities.*

c. DODD 4650.05, *Positioning, Navigation, and Timing (PNT).*

d. DODD 5100.1, *Functions of the Department of Defense and Its Major Components.*

e. DODD 5100.35, *Military Command, Control, Communications, and Computers Executive Board (MC4EB).*

f. Department of Defense Instruction (DODI) 3222.03, *DOD Electromagnetic Environmental Effects (E3) Program.*

g. DODI 4630.09, *Wireless Communications Waveform Development and Management.*

h. DODI 4650.01, *Policy and Procedures for Management and Use of the Electromagnetic Spectrum.*

i. DODI 4650.08, *Positioning, Navigation, and Timing (PNT) and Navigation Warfare (NAVWAR).*

j. DODI 8320.05, *Electromagnetic Spectrum Data Sharing.*

2. Chairman of the Joint Chiefs of Staff Publications

a. CJCSI 3121.01B, *Standing Rules of Engagement/Standing Rules for the Use of Force for US Forces.*

b. CJCSI 3210.04A, *Joint Electronic Warfare Reprogramming Policy.*

c. CJCSI 3320.01D, *Joint Electromagnetic Spectrum Operations (JEMSO).*

d. CJCSI 3320.02F, *Joint Spectrum Interference Resolution.*

e. CJCSI 3320.03C, *Joint Communications Electronics Operating Instructions.*

f. CJCSI 3500.02B, *Universal Joint Task List Program.*

g. CJCSI 3810.01D, *Meteorological and Oceanographic Operations.*

h. CJCSI 5116.05, *Military Command, Control, Communications and Computers Executive Board.*

i. CJCSI 6130.01E, *2013 CJCS Master Positioning, Navigation, and Timing Plan (MPNTP).*

j. CJCSI 6740.01C, *Military Telecommunications Agreements and Arrangements Between the United States and Regional Defense Organizations or Friendly Foreign Nations.*

k. CJCSM 3130.03, *Adaptive Planning and Execution (APEX) Planning Formats and Guidance.*

l. CJCSM 3212.02D, *Performing Electronic Attack in the United States and Canada for Tests, Training, and Exercises.*

m. CJCSM 3320.01C, *Joint Electromagnetic Spectrum Management Operations in the Electromagnetic Operational Environment.*

n. CJCSM 3320.02D, *Joint Spectrum Interference Resolution (JSIR) Procedures.*

o. CJCSM 3320.04, *Electronic Warfare in Support of Joint Electromagnetic Spectrum Operations.*

p. JP 2-0, *Joint Intelligence.*

q. JP 2-01, *Joint and National Intelligence Support to Military Operations.*

r. JP 2-01.3, *Joint Intelligence Preparation of the Operational Environment.*

s. JP 2-03, *Geospatial Intelligence Support to Joint Operations.*

t. JP 3-0, *Joint Operations.*

u. JP 3-09, *Joint Fire Support*.

v. JP 3-12, *Cyberspace Operations*.

w. JP 3-13, *Information Operations.*

x. JP 3-13.1, *Electronic Warfare*.

y. JP 3-13.2, *Military Information Support Operations.*

z. JP 3-13.3, *Operations Security.*

aa. JP 3-13.4, *Military Deception.*

bb. JP 3-14, *Space Operations.*

cc. JP 3-59, *Meteorological and Oceanographic Operations.*

dd. JP 3-60, *Joint Targeting.*

ee. JP 5-0, *Joint Planning.*

ff. JP 6-0, *Joint Communications System.*

gg. JP 6-01, *Joint Electromagnetic Spectrum Management Operations.*

3. Service Publications

a. Air Force Doctrine Annex 3-13, *Information Operations.*

b. Air Force Doctrine Annex 3-51, *Electronic Warfare Operations*.

c. Air Force Instruction 10-703, *Electronic Warfare Integrated Reprogramming.*

d. Army Regulation 5-12, *Army Use of the Electromagnetic Spectrum*.

e. Army Regulation 525-22, *US Army Electronic Warfare.*

f. Army Regulation 525-15, *Software Reprogramming For Cyber Electromagnetic Activities.*

g. Army Doctrine Publication (ADP) and ADRP 2-0, *Intelligence*.

h. ADP and ADRP 3-0, *Unified Land Operations*.

i. Field Manual 2-0, *Intelligence Operations.*

j. Field Manual 3-38, *Cyber Electromagnetic Activities.*

k. Army Techniques Publication 3-36, *Electronic Warfare Techniques.*

l. Army Techniques Publication 6.02.70, *Techniques For Spectrum Management Operations.*

m. Army Techniques Publication 2-22.6, *Signals Intelligence Techniques.*

n. NTTP 3-13.2, *Navy Information Operation Warfare Commander's Manual.*

o. NTTP 3-51.1, *Navy Electronic Warfare.*

4. Multi-Service Publications

a. Army Techniques Publication 3-13.10; Marine Corps Reference Publication (MCRP) 3-40.5A; NTTP 3-51.2; Air Force Tactics, Techniques, and Procedures (AFTTP) 3-2.7; *Multi-Service Tactics, Techniques, and Procedures for the Reprogramming of Electronic Warfare Systems.*

b. Army Techniques Publication 3-09.32, MCRP 3-16.6A, NTTP 3-56.3, AFTTP 3-2.23, *Multi-Service Tactics, Techniques, and Procedures for the Joint Application of Firepower.*

5. Multinational Publications

a. MC 64/10 NATO, *Electronic Warfare Policy.*

b. MC 101/10 NATO, *SIGINT Policy and Directive.*

c. MC 486 NATO, *Concept for NATO Joint Electronic Warfare Core Staff (JEWCS).*

d. MC 515, *Concept for the NATO SIGINT and Electronic Warfare Operations Centre (SEWOC).*

e. MC 521, *Concept for Resources and Methods to Support an Operational NATO EW Coordination Cell/SIGINT & EW Operations Centre (EWCC/SEWOC).*

f. Air Standard 45/14, *Electronic Warfare.*

g. Air Standard 45/3B, *Joint Air Operations Doctrine.*

h. AJP-01(C), *Allied Joint Doctrine.*

i. AJP-2, *Allied Joint Intelligence, Counter Intelligence and Security Doctrine.*

j. AJP-3.6(A), *Allied Joint Electronic Warfare Doctrine.*

k. ATP-8(B), *Doctrine for Amphibious Operations.*

l. ATP-44(C), *Electronic Warfare (EW) in Air Operations.*

m. ATP-51(A), *Electronic Warfare in the Land Battle.*

n. QSTAG 593, *Doctrine on Mutual Support Between EW Units.*

o. QSTAG 1022, *Electronic Warfare in the Land Battles.*

6. Other Publications

a. US DOD, *Department of Defense Electromagnetic Spectrum Strategy*.

b. US DOD, *Capstone Concept for Joint Operations (CCJO): Joint Force 2020.*

c. US DOD, *Joint Operational Access Concept (JOAC).*

d. CJCS, *Joint Concept for Electromagnetic Spectrum Operations (JCEMSO).*

e. CJCS, *National Military Strategic Plan for Electronic Warfare.*

f. USSTRATCOM, *Operational Concept for Electromagnetic Battle Management.*

Intentionally Blank

GLOSSARY

PART I—ABBREVIATIONS AND ACRONYMS

A-6	communications directorate (Air Force)
ABCA	American, British, Canadian, Australian, and New Zealand
ADP	Army doctrine publication
ADRP	Army doctrine reference publication
AFB	Air Force base
AFTTP	Air Force tactics, techniques, and procedures
AJP	allied joint publication
ANG	Air National Guard
AO	area of operations
AOR	area of responsibility
ARNG	Army National Guard
ASIC	Air and Space Interoperability Council
ATP	allied tactical publication
C2	command and control
C4IT-FSD	Command, Control, Communications, Computers, and Information Technology Service Center Field Services Division (USCG)
CBRN	chemical, biological, radiological, and nuclear
CCDR	combatant commander
CCMD	combatant command
CCIR	commander's critical information requirement
CDR	commander
CEMA	cyber electromagnetic activities
CEWCC	cyberspace and electronic warfare coordination cell
CIO	chief information officer
CJCS	Chairman of the Joint Chiefs of Staff
CJCSI	Chairman of the Joint Chiefs of Staff instruction
CJCSM	Chairman of the Joint Chiefs of Staff manual
CMO	civil-military operations
CO	cyberspace operations
COA	course of action
CONOPS	concept of operations
CONPLAN	concept plan
CONUS	continental United States
COP	common operational picture
CSS	Central Security Service
DE	directed energy
DF	direction finding
DIA	Defense Intelligence Agency
DISA	Defense Information Systems Agency
DOD	Department of Defense

DODD	Department of Defense directive
DODI	Department of Defense instruction
DODIN	Department of Defense information network
DON	Department of the Navy
DSCA	defense support of civil authorities
DSN	Defense Switched Network
E3	electromagnetic environmental effects
EA	electronic attack
EACA	electronic attack control authority
EM	electromagnetic
EMBM	electromagnetic battle management
EMCON	emission control
EME	electromagnetic environment
EMI	electromagnetic interference
EMOE	electromagnetic operational environment
EMSCA	electromagnetic spectrum control authority
EMSCO	electromagnetic spectrum control order
EMSCP	electromagnetic spectrum control plan
EMP	electromagnetic pulse
EMS	electromagnetic spectrum
EMSC	electromagnetic spectrum control
EMSO	electromagnetic spectrum operations
EMW	electromagnetic maneuver warfare
EOB	electromagnetic order of battle
EO-IR	electro-optical-infrared
EP	electronic protection
ES	electronic warfare support
ESAC	Electromagnetic-Space Analysis Center (NSA)
E-Space	electromagnetic-space program
EW	electronic warfare
EWC	electronic warfare cell
EWCC	electronic warfare coordination cell
EWO	electronic warfare officer
FAA	Federal Aviation Administration
FDO	foreign disclosure officer
FHA	foreign humanitarian assistance
FM	frequency management
FRAGORD	fragmentary order
G-2	intelligence staff officer (Army)
G-6	signal staff officer (Army)
GCC	geographic combatant commander
GIANT	Global Positioning System Interference and Navigation Tool

GNSS	global navigation satellite system
GPS	Global Positioning System
GPSOC	Global Positioning System Operations Center
HD	homeland defense
HERF	hazards of electromagnetic radiation to fuels
HERO	hazards of electromagnetic radiation to ordnance
HERP	hazards of electromagnetic radiation to personnel
HHQ	higher headquarters
HN	host nation
HNC	host nation coordination
HPM	high-power microwave
HQ	headquarters
HQMC C4	Headquarters, United States Marine Corps Director, Command, Control, Communications, and Computer Systems
HQMC CD&I	Headquarters, United States Marine Corps Combat Development and Integration
IAW	in accordance with
IC	intelligence community
IED	improvised explosive device
IEEE	Institute of Electrical and Electronics Engineers
IO	information operations
IR	infrared
IRC	information-related capability
ISR	intelligence, surveillance, and reconnaissance
J-2	intelligence directorate of a joint staff
J-3	operations directorate of a joint staff
J-5	plans directorate of a joint staff
J-6	communications system directorate of a joint staff
J-8	force structure, resource, and assessment directorate of a joint staff
JCEMSO	Joint Concept for Electromagnetic Spectrum Operations
JCEOI	joint communication-electronics operating instructions
JCEWS	joint force commander's electronic warfare staff
JDN	joint doctrine note
JEMSMO	joint electromagnetic spectrum management operations
JEMSO	joint electromagnetic spectrum operations
JEMSOC	joint electromagnetic spectrum operations cell
JEWC	Joint Electronic Warfare Center
JEWCS	Joint Electronic Warfare Core Staff (NATO)
JFC	joint force commander
JFCC-Space	Joint Functional Component Command for Space (USSTRATCOM)

JFHQ-DODIN	Joint Force Headquarters-Department of Defense Information Network
JFMCC	joint force maritime component commander
JFMO	joint frequency management office
JIOC	joint intelligence operations center
JIPOE	joint intelligence preparation of the operational environment
JLLIS	Joint Lessons Learned Information System
JNSC	Joint Navigation Warfare Center Navigation Warfare Support Cell
JNWC	Joint Navigation Warfare Center
JOA	joint operations area
JP	joint publication
JRFL	joint restricted frequency list
JS	Joint Staff
JSIR	joint spectrum interference resolution
JSME	joint spectrum management element
JTCB	joint targeting coordination board
JTF	joint task force
JWICS	Joint Worldwide Intelligence Communications System
L/AT	liaison/augmentation team
LNO	liaison officer
MAGTF	Marine air-ground task force
MC	Military Committee (NATO)
MCRP	Marine Corps reference publication
METOC	meteorological and oceanographic
MILDEC	military deception
MISO	military information support operations
MNF	multinational force
MNFC	multinational force commander
MNL	master net list
MOC	maritime operations center
NASIC	National Air and Space Intelligence Center
NATO	North Atlantic Treaty Organization
NAVWAR	navigation warfare
NCC	Navy component commander
NFC	numbered fleet commander (Navy)
NG	National Guard
NGA	National Geospatial-Intelligence Agency
NGB	National Guard Bureau
NGIC	National Ground Intelligence Center
NG JFHQ-State	National Guard joint force headquarters-state
NIPRNET	Nonsecure Internet Protocol Router Network

NMCSO	Navy and Marine Corps spectrum office
NMIC	National Maritime Intelligence Center
NRT	near real time
NSA	National Security Agency
NTTP	Navy tactics, techniques, and procedures
OA	operational area
OCONUS	outside the continental United States
OE	operational environment
OPCON	operational control
OPFOR	opposing force
OPLAN	operation plan
OPORD	operation order
OPSEC	operations security
PNT	positioning, navigation, and timing
QSTAG	quadripartite standardization agreement
RF	radio frequency
ROE	rules of engagement
SATCOM	satellite communications
SDR	software defined radio
SecDef	Secretary of Defense
SEWOC	signals intelligence/electronic warfare operations centre (NATO)
SFAT	spectrum flyaway team
SG	strike group
SIGINT	signals intelligence
SIPRNET	SECRET Internet Protocol Router Network
SM	spectrum management
SMB	spectrum management branch
SME	subject matter expert
SMO	spectrum management operations
STO	special technical operations
TNWCC	Theater Navigation Warfare Coordination Cell (USSTRATCOM)
TSS	target sensing system
TTP	tactics, techniques, and procedures
US	United States
USC	United States Code
USCG	United States Coast Guard
USG	United States Government

USCYBERCOM	United States Cyber Command
USNORTHCOM	United States Northern Command
USSTRATCOM	United States Strategic Command
WARM	wartime reserve mode
WP	Working Party (NATO)

electromagnetic battle management. The dynamic monitoring, assessing, planning, and directing of joint electromagnetic spectrum operations in support of the commander's scheme of maneuver. Also called **EMBM.** (*DOD Dictionary of Military and Associated Terms.* Source: JP 3-13.1)

electromagnetic environment. The resulting product of the power and time distribution, in various frequency ranges, of the radiated or conducted electromagnetic emission levels encountered by a military force, system, or platform when performing its assigned mission in its intended operational environment. Also called **EME.** (*DOD Dictionary of Military and Associated Terms.* Source: JP 3-13.1)

electromagnetic interference. Any electromagnetic disturbance, induced intentionally or unintentionally, that interrupts, obstructs, or otherwise degrades or limits the effective performance of electronics and electrical equipment. Also called **EMI.** (*DOD Dictionary of Military and Associated Terms.* Source: JP 3-13.1)

electromagnetic operational environment. The background electromagnetic environment and the friendly, neutral, and adversarial electromagnetic order of battle within the electromagnetic area of influence associated with a given operational area. Also called **EMOE.** (*DOD Dictionary of Military and Associated Terms.* Source: JP 6-01)

electromagnetic spectrum management. Planning, coordinating, and managing use of the electromagnetic spectrum through operational, engineering, and administrative procedures. (*DOD Dictionary of Military and Associated Terms.* Source: JP 6-01)

emission control. The selective and controlled use of electromagnetic, acoustic, or other emitters to optimize command and control capabilities while minimizing, for operations security: a. detection by enemy sensors; b. mutual interference among friendly systems; and/or c. enemy interference with the ability to execute a military deception plan. Also called **EMCON.** (*DOD Dictionary of Military and Associated Terms.* Source: JP 3-13.1)

PART II—TERMS AND DEFINITIONS

electromagnetic battle management. The dynamic monitoring, assessing, planning, and directing of joint electromagnetic spectrum operations in support of the commander's scheme of maneuver. Also called **EMBM.** (JP 1-02. Source: JP 3-13.1)

electromagnetic environment. The resulting product of the power and time distribution, in various frequency ranges, of the radiated or conducted electromagnetic emission levels encountered by a military force, system, or platform when performing its assigned mission in its intended operational environment. Also called **EME.** (JP 1-02. Source: JP 3-13.1)

electromagnetic interference. Any electromagnetic disturbance, induced intentionally or unintentionally, that interrupts, obstructs, or otherwise degrades or limits the effective performance of electronics and electrical equipment. Also called **EMI.** (JP 1-02. Source: JP 3-13.1)

electromagnetic operational environment. The background electromagnetic environment and the friendly, neutral, and adversarial electromagnetic order of battle within the electromagnetic area of influence associated with a given operational area. Also called **EMOE.** (JP 1-02. Source: JP 6-01)

electromagnetic spectrum management. Planning, coordinating, and managing use of the electromagnetic spectrum through operational, engineering, and administrative procedures. (JP 1-02. Source: JP 6-01)

emission control. The selective and controlled use of electromagnetic, acoustic, or other emitters to optimize command and control capabilities while minimizing, for operations security: a. detection by enemy sensors; b. mutual interference among friendly systems; and/or c. enemy interference with the ability to execute a military deception plan. Also called **EMCON.** (JP 1-02. Source: JP 3-13.1)

Intentionally Blank


JOINT
CHIEFS OF STAFF