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ELECTROMAGNETIC WARFARE (EW)

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This Department of the Air Force Instruction (DAFI) implements Department of the Air Force Policy Directive (DAFPD) 10-7, *Information Operations* and provides guidance for electromagnetic warfare (EW) capability development and sustainment. This publication applies to the United States Space Force, Regular Air Force, the Air Force Reserve, and the Air National Guard. Ensure all records created as a result of processes prescribed in this publication are maintained in accordance with Air Force Instruction (AFI) 33-322, *Records Management and Information Governance Program*, and disposed of in accordance with the Air Force Records Disposition Schedule located in the Air Force Records Information Management System. Refer recommended changes and questions about this publication to the Office of Primary Responsibility (OPR) using the AF Form 847, *Recommendation for Change of Publication*; route AF Forms 847 from the field through the appropriate functional chain of command then send to Electromagnetic Spectrum Superiority Directorate (AF/A5L), email to the AF/A5L Workflow AF.A5L.Workflow@us.af.mil. This publication may be supplemented at any level; supplements are not required to be routed to the OPR of this publication for coordination prior to certification and approval. Compliance with the **attachment 2** is mandatory. The authorities to waive wing/unit level requirements in this publication are identified with a Tier (“T-0, T-1, T-2, T-3”) number following the compliance statement. See DAFI 33-360, *Publications and Forms Management*, for a description of the authorities associated with the Tier numbers. Submit requests for waivers through the chain of command to the appropriate Tier waiver approval authority, or alternately, to the requestor’s commander for non-tiered compliance items.

SUMMARY OF CHANGES

This document has been substantially revised and needs to be completely reviewed. Major changes include (1) replacing many acronyms with correct terms to improve readability, (2) revising the acronym listing, and (3) updating terminology so that it aligns with current Department of Defense (DoD) terminology.

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Chapter 1

DOCTRINE AND GUIDANCE

1.1. Background. Electromagnetic warfare (EW) is military action involving the use of electromagnetic and directed energy to control the electromagnetic spectrum or to attack the enemy. The DAF presents EW forces and capabilities to enable joint force commanders' and combatant commanders' ability to achieve electromagnetic spectrum (EMS) superiority, temporally and/or geographically. Disciplined analysis and experience led to the establishment of a DAF EMS Superiority Directorate, led by a general officer and owner of EMS superiority capabilities. This action ensures continuity of thought and discipline beginning with long-term strategy and conceptual experimentation, through capability development, and ultimately to force delivery, presentation, and sustainment. This chapter articulates key EW principles compelling proper organization, material, logistics, personnel, facilities, and policy assumptions under which EW stands.

1.2. General Guidance. Doctrine provides fundamental principles by which military forces guide their action in support of national objectives. This instruction reflects updated information based on Air Force Doctrine Annex 3-51, *Electromagnetic Warfare and Electromagnetic Spectrum Operations*; and joint doctrine found in Joint Publication (JP) 3-85, *Joint Electromagnetic Spectrum Operations*. In order to achieve EMS superiority, EW forces are integrated fully into campaigns achieving strategic ends for our Nation. Joint forces use EW to exploit, employ, and empower basic physical principles to achieve effects within three distinct frequency regions—radio frequency (RF) (to include microwaves), electro-optical (EO) and infrared (IR), and ionizing radiation.

1.2.1. Radio Frequency (RF) region exploitation is predicated on the propagation of electromagnetic waves through applicable physical domains. Military equipment and utilization can be broken into communication, sensing, and energy effects. Characteristics of this region are well known and studied exhaustively, resulting in implicit cross-functional decisions in platform, electromagnetic counter-measures, and tactical designs. Technology in signal processing, aperture development, and creative thinking upset much conventional thinking through presentation of complex EMS environments.

1.2.2. The electro-optic (EO) and infrared (IR) region includes infrared (IR) and visible light. The physical principles driving exploitation, employment and energy effects mix traditional electromagnetic wave propagation with particle physics. EO region utilization has proven useful in communications, sensing, and direct energy effects. Characteristics of this region are well known and understood, but do present challenges in processing, controlling, and exploitation.

1.2.3. Ionizing radiation includes ultraviolet rays, X-rays, and gamma rays, of which the military applications are found predominately in sensing, but could include direct energy effects.

1.3. Major Components of EW. The major components of EW include electromagnetic attack (EA), electromagnetic protection (EP), and EW support (ES).

1.3.1. Electromagnetic Attack is the use of electromagnetic energy, directed energy, or anti-radiation weapons to attack personnel, facilities, or equipment. The primary effects achieved by EA are deception, disruption, denial, degradation, and destruction. The terrestrial weather environment can adversely affect the ability to create precise EA effects. Creating precise EA effects also require use of a battle management function. This includes spectrum management to ensure electromagnetic spectrum deconfliction in multiple dimensions (e.g., time, altitude, and distance).

1.3.1.1. Electromagnetic Attack includes any actions taken to prevent, reduce or manipulate an enemy's effective use of the electromagnetic spectrum. EA techniques include jamming, electromagnetic deception or direct attack of an enemy's electronic capabilities. EA employs weapons that use either electromagnetic energy or directed energy as their primary disruptive or destructive mechanism. Examples of EA weapons include lasers, high power microwave weapons, and particle beams.

1.3.1.2. Examples of EA systems include jammers onboard the EC-130H, COMPASS CALL; EA-18G; anti-radiation missiles; chaff; flares; self-protection jamming systems; Large Aircraft Infrared Countermeasures systems; active towed decoys; and counter radio-controlled improvised explosive devices.

1.3.2. Electromagnetic Protection involves techniques designed to protect personnel, facilities, and equipment from the effects of friendly or enemy employment of EA or other electromagnetic spectrum capabilities (such as an electromagnetic pulse) that have the potential to deny, degrade, disrupt, deceive, or destroy friendly combat capability. The space environment can be a source of unintentional radiated electromagnetic energy with the potential to degrade, neutralize, or destroy friendly combat capability. Geomagnetic disturbances due to solar activity can produce similar effects to an electromagnetic pulse. Examples of EP include RF agility, pulse repetition frequency agility, or laser eye protection.

1.3.3. Electromagnetic Warfare Support involves actions tasked by, or under direct control of, an operational commander to search for, intercept, identify, and locate sources of intentional and unintentional radiated electromagnetic energy for the purpose of immediate threat recognition, targeting, planning, and conducting future operations. Examples of ES systems include radar and laser warning receivers, the High-Speed Anti-Radiation Missile targeting system, sensors forward capabilities, Rapid Attack Identification Detection and Reporting System, Global Positioning System jammer geo-location systems or the Battlefield Laser Detection System.

1.4. EW Effects. Air Force Doctrine Annex 3-51 describes the proper employment of EW capabilities as producing the effects of detection, denial, deception, disruption, degradation, exploitation, destruction, and protection. Offensive effects are delivered using electromagnetic energy or directed energy. Protection from enemy effects are achieved through agile frequency manipulation, hardened communications equipment, frequency deconfliction, etc. Air Force Doctrine Annex 3-01, *Counterair Operations* describes offensive counterair and defensive counterair. EW supports both counterair operations by delivering effects against: (1) enemy air defense systems (including integrated air defense systems (IADS)); (2) military command and

control nodes; and (3) non-IADS systems. EW assets are vital to any effective operation to suppress enemy command and control, IADS, and other significant military capabilities that use the electromagnetic spectrum. Friendly EW capabilities are critical and, if left unhindered, enemy EW operations could have devastating effects on friendly command and control systems. Early and persistent efforts should be aimed at defeating enemy EW capabilities.

1.5. EW's Evolving Role. EW is evolving due to technological advances and an increasing reliance on the use of the electromagnetic spectrum within military and civilian sectors. EW supports joint warfighting operations within and across the range of military operations and across all warfighting domains to include air, space, and cyberspace. While EW retains its traditional role in counterair, it intersects with other military capabilities such as spectrum management, space control, cyberspace operations, navigation warfare, and information warfare. Correspondingly, DAF EW capability developers and warfighters are required to engage spectrum management, space control, cyberspace operations, navigation warfare, and information warfare professionals. They must engage these professionals to address existing and emerging military capabilities that use both military and commercial electronic and electromagnetic technologies. Emerging non-IADS targets include non-military leadership networks, commercial or media networks, communications networks, positioning, navigation, timing networks, and others as directed by a combatant commander. EW targeting is required to comply with applicable domestic and international law, rules of engagement and the law of war.

1.5.1. Joint Publication 3-85, *Joint Electromagnetic Spectrum Operations* describes military actions undertaken by two or more Services operating in concert to exploit, attack, protect, and manage the electromagnetic operational environment. Joint electromagnetic spectrum operations prioritize, integrate, synchronize, and deconflict all joint force actions in the electromagnetic operational environment, enhancing unity of effort.

1.5.2. EW capabilities can markedly enhance information warfare, the employment of military capabilities in and through the information environment to affect deliberately adversary human and system behavior. Denying, degrading, disrupting, deceiving, or destroying the sensing or communication signals associated with an adversary's command and control has been proven repeatedly as a key component to a winning campaign strategy. In the same manner, traditional physical attacks (e.g., bombs) against key adversary information nodes can support information warfare. EW can employ attacks against key adversary nodes through multiple domains, with either temporal or permanent effects, expanding a joint force commander's options in achieving objectives.

Chapter 2

ORGANIZATIONS, ROLES AND RESPONSIBILITIES

2.1. Deputy Chief of Staff, Strategy, Integration and Requirements (AF/A5/7).

2.1.1. Develops DAF EW and EMS Superiority policy, strategy, doctrine, capability, and prioritizes operational capabilities. AF/A5/7 owns all DAF EW and EMS Superiority doctrine, organization, training, materiel, leadership and education, personnel, facilities, and policy (DOTMLPF-P) actions.

2.1.2. Employs a Spectrum Integration Group (SIG) to address interdepartmental and cross major command (MAJCOM) or field command (FLDCOM) EW issues. The SIG is chartered to identify and prioritize EW issues to ensure the DAF is organized, trained, and equipped to conduct combat operations. The SIG may report its findings or recommendations to the Capability Development Working Group, which, in turn, may request a lead MAJCOM or FLDCOM to develop the appropriate Joint Capabilities Integration and Development System documentation as described in AFI 10-601, *Operational Capability Requirements Development* (refer to para 5.3).

2.1.3. Ensures EW and EMS Superiority capabilities are properly planned for and integrated across the DAF capability development construct.

2.2. Director, Electromagnetic Spectrum Superiority (AF/A5L).

2.2.1. Owns all DAF EW and EMS Superiority requirements, capability development, and sustainment through DOTMLPF-P. Facilitates staffing and coordination of EW requirements documentation to ensure validated EW requirements compete within the Capability Development Council and Joint Capabilities Integration and Development System process.

2.2.2. Communicates DAF EW operational vision; disseminates operational guidance concerning EW capabilities, gaps or shortfalls across the various missions, organizations, and functions of the DAF. A5L documents, articulates, and advocates current and future EW requirements within the DAF corporate process.

2.2.3. Acts as SIG chairperson and responsible for charter maintenance, membership, agenda content, minute distribution, and follow-on actions.

2.2.4. In coordination with DAF EMS stakeholders, communicates DAF's EW policy, doctrine, and future force structure to external organizations. Additionally, the Director establishes and advocates DAF EW positions on issues and ensures these positions are articulated correctly within appropriate Joint Chiefs of Staff (JCS) or Office of the Secretary of Defense (OSD) organizations (e.g., DoD EW Executive Committee).

2.2.5. Supports the Director, Training and Readiness (AF/A3T) to develop current policy and guidance for operational deployments, rated career field management, training and range instrumentation, or other supporting elements to satisfy DAF and joint operational requirements.

2.2.6. In coordination with the Chief Information Officer (SAF/CIO), advocates for joint capability technology demonstrations, applied technology demonstrations, or other technology demonstrations that address EW capability.

2.2.7. Provides guidance to acquisition, research and development, intelligence, testing and operations, and sustainment communities to ensure they have adequate Headquarters Air Force (HAF) guidance concerning the future direction of the DAF's EW capabilities and requirements.

2.2.8. Acts as DAF focal point to leverage and integrate EW technologies, evaluates innovative EW concepts, plans, and operational demonstrations of these concepts, and recommends policy, programming, budgeting, organizational training (including tactics, techniques and procedures), and equipping actions.

2.2.9. Provides subject matter expertise to other United States (US) Government agencies (e.g., Department of Homeland Security, Department of Justice) concerning DAF EW programs. Support is subject to AFI 10-801, *Defense Support of Civil Authorities*.

2.2.10. Supports the Director, Strategy, Posture and Assessments (AF/A5S), as needed, to review all EW-related deployment planning policy, unit type code development, and associated operational plans and concepts of operation.

2.2.11. Monitors future threat assessments and recommends corrective actions, as required. Implements anticipatory actions in capability-based planning efforts.

2.2.12. In coordination with the Deputy Chief of Staff, Intelligence, Surveillance, Reconnaissance and Cyber Effects Operations (AF/A2/6), tracks preparation of those portions of the National Intelligence Program, General Defense Intelligence Program and Military Intelligence Program for which there is AF EW equity.

2.2.13. In coordination with AF/A2/6, ensures intelligence support for EW programs.

2.2.14. In coordination with the Assistant Secretary of the Air Force for Acquisition, Technology and Logistics (SAF/AQ) and the Director, Air Force Programs (AF/A8P), ensures EW resources associated with EA or ES systems are planned, programmed, and budgeted. Ensures programs map to current requirements and address anticipated needs of the warfighter.

2.2.15. Coordinates with the Deputy Chief of Staff for Operations (AF/A3) to develop or obtain the operational perspective on all Foreign Military Sales requests concerning US EW systems or associated equipment. In addition, monitors and makes recommendations on directed energy technology transfer requests.

2.2.16. Coordinates with the AF/A3 to develop or obtain the operational perspective concerning the request and prioritization of EW-related acquisitions made under the AF Foreign Materiel Program.

2.2.17. Provides the perspective for the assessment of coalition EW interoperability issues. Recommends courses of action to accommodate effective and timely participation in coalition operations.

2.2.18. In coordination with the Director, Legislative Liaison, Weapons Division (SAF/LLW), SAF/AQ, or AF/A8P, responds to Congressional, OSD and JCS inquiries on EW programmatic, capability or operational issues on behalf of AF/A3 and AF/A5/7.

2.2.19. Conducts Electromagnetic Warfare Integrated Reprogramming process roles and responsibilities in accordance with AFI 10-703, *Electronic Warfare (EW) Integrated Reprogramming*.

2.2.20. Supports the AF Spectrum Management Office with regard to its spectrum management responsibilities in accordance with AFI 17-220, *Spectrum Management*.

2.2.21. In coordination with Chief, Execution and Oversight Division (SAF/AQXE), supports preparation of the Congressional Budget Justification Books by drafting procurement documents and research and development documents.

2.2.22. Acts as United States Air Force (USAF) Career Force Manager for all EW professionals in coordination with Deputy Chief of Staff Manpower, Personnel and Services (AF/A1), AF/A3T, and Headquarters Air Force Personnel Center functional managers.

2.3. Director of Operational Capability Requirements (AF/A5R).

2.3.1. Facilitates EW requirements documentation staffing and coordination. Ensures validated EW requirements compete within the Capability Development Council and Joint Capabilities Integration Development System processes.

2.3.2. Works with SAF/AQ, the Administrative Assistant to the Secretary of the Air Force (SAF/AA), and the Deputy Chief of Staff, Plans and Programs (AF/A8) directorates to resolve requirements and/or programmatic issues associated with EW programs (includes Special Access Programs which are programs covered by security protocols that provide safeguards and access restrictions exceeding those for regular classified information. Special Access Programs are established and maintained when absolutely necessary to protect the most sensitive capabilities, information, technologies and operations or when required by statute).

2.3.3. Assumes operational sponsorship for validated force application and force protection concepts and associated requirements using Air Force EW systems.

2.3.4. Provides operational perspective on Foreign Military Sales issues involving US EW systems or support elements (includes software products).

2.4. Deputy Chief of Staff for Logistics, Engineering, and Force Protection (AF/A4).

2.4.1. Reviews weapon system support equipment requirements to ensure that acquisition and sustainment programs consider common support equipment. Ensures justification of peculiar support equipment, including automatic test systems and automatic test equipment.

2.4.2. Designates an office or individual to review EW capabilities-based requirements documentation.

2.4.3. Acts as lead agent for funding and fielding for replacement of existing unsustainable common aircraft support equipment.

2.4.4. Monitors the “state of health” and common sustainment issues with EW systems and associated equipment.

2.4.5. Supports the SIG as defined within the integrated product team’s charter.

2.5. Director of Air Force Test and Evaluation (AF/TE).

2.5.1. Oversees the AF test and evaluation (T&E) infrastructure and ensures adequate T&E resources and facilities are available to support EW systems development and acquisition activities.

2.5.2. Designates an office or individual to monitor and support EW-related programs by:

2.5.2.1. Reviewing requirements documents.

2.5.2.2. Assessing key performance parameters and key system attributes for testability and measurability.

2.5.2.3. Assisting in the development of strategies for T&E.

2.5.2.4. Reviewing and coordinating test and evaluation master plans.

2.5.3. Coordinates with AF/A5/7 to ensure EW requirements and equities are included in and supported by AF Foreign Materiel Program activities.

2.6. Deputy Chief of Staff, Manpower, Personnel, and Services (AF/A1). Through the AF Personnel Center and in coordination with A3T and career field managers, tracks EW expertise and is responsible for EW officer AF specialty codes and E-prefix maintenance.

2.7. Assistant Secretary of the Air Force for Acquisition, Technology, and Logistics (SAF/AQ).

2.7.1. Provides direction and oversight of acquisitions involving EW-related operational programs in accordance with AFI 63-101/20-101, *Integrated Life Cycle Management*.

2.7.2. Supports SIG as defined within its charter.

2.7.3. Assists Air Staff, the Office of the Chief of Space Operations (informally referred to as Space Staff), MAJCOMs and FLDCOMs in documenting, articulating, and advocating for space-related EW requirements to the Joint Staff, OSD, other Services, or Congress.

2.7.4. Assists AF/A5L with responses to Congressional, OSD and JCS inquiries on EW issues.

2.8. Deputy Under Secretary of the Air Force, International Affairs (SAF/IA).

2.8.1. Oversees the Foreign Military Sales and international armaments cooperation agreements with foreign governments.

2.8.2. Coordinates with AF/A5/7 and the Space Staff's equivalent for the DAF's operational perspective regarding Foreign Military Sales issues involving US EW systems and associated hardware and software.

2.8.3. Directs the development of the Foreign Military Sales EW integrated reprogramming database for system mission data file reprogramming. Ensures a degree of coalition interoperability until theater forces can provide EW system mission data file updates.

2.8.4. Supports SIG as defined within its charter, ensuring partner nation equities are represented.

2.9. Deputy Chief, Information Officer (SAF/DCIO), (SAF/CN).

2.9.1. Supports AF/A2/6 in performing related responsibilities and oversight of spectrum management.

2.9.2. Supports the SIG charter as defined within SAF/CN Mission Directive.

2.10. MAJCOMs and FLDCOMs (as applicable).

2.10.1. Identify EW skills and billets required for specific needs.

2.10.2. Assign qualified EW personnel to specified command billets.

- 2.10.3. Conduct a periodic review of EW authorizations.
- 2.10.4. Resolve training shortfalls where possible and submit annual reports on the status of resolution to the AF/A3 and the Space Staff equivalent.
- 2.10.5. Develop formal EW training to cover individual, unit and senior officer training and continued career learning courses tailored to the command's specific mission(s).
- 2.10.6. Perform EW training assessments during large force exercises.
- 2.10.7. Develop EW training assessments for evaluations and inspections.
- 2.10.8. Support EW integrated reprogramming process in accordance with AFI 10-703.
- 2.10.9. Ensure assigned MAJCOM, FLDCOM, numbered air force, and warfighting headquarters have appropriate and sufficient EW expertise prepared to support or act as liaisons to applicable EMS Operations Centers.
- 2.10.10. Coordinate and comment on relevant EW doctrine, policy, capability development, requirements, operational sustainment, or programmatic issues with A5L and other appropriate HAF agencies (e.g., AF/A2/6, AF/A3, AF/A4, AF/A8P, DAF/JA, SAF/AQ, SF/S2/3/4/6/10, and SF/S5.8).
- 2.10.11. Acquire, maintain and sufficiently fund T&E facilities such as integrated system test facilities, like those at Arnold, Edwards, and Eglin Air Force Bases and mission simulation laboratories at Arnold, Edwards, Eglin, Holloman, and Kirtland Air Force Bases which provide key T&E capabilities to ensure EW programs meet validated operational requirements.
- 2.10.12. Ensure DAF EW test activities will utilize DoD test facilities for applicable tests to the maximum extent possible in accordance with AFI 99-103, *Capabilities-Based Test and Evaluation*.

2.11. Lead Commands. Lead Commands for specific weapon systems as specified in DAFPD 10-9, *Lead Command Designation and Responsibilities for Weapon Systems*:

- 2.11.1. Coordinate with A5L when initiating or developing EW-related force development concepts.
- 2.11.2. Document requirements, identify resources, and prioritize EW upgrades or new systems to better control, exploit or enhance electromagnetic spectrum capabilities.
- 2.11.3. Execute mission data upgrades on a timeline appropriate to the urgency of the change and provide upgrades to gained reserve component units before any real-world deployments.
- 2.11.4. Conduct force development evaluations in order to determine EW system gaps or shortfalls in operations and training.
- 2.11.5. Document and staff EW effectiveness shortfalls identified in contingency operations.
- 2.11.6. Provide readiness standards and effectiveness data for EW systems.
- 2.11.7. Plan, program, and support EW-specific ground test sets, test procedures and technician training.
- 2.11.8. Plan, program and support appropriate equipment for conducting EW sustainment along with gained reserve component units.

- 2.11.9. Identify opportunities for the development of common and interoperable support equipment.
- 2.11.10. Plan, program, and support EW system upgrades and their operational sustainment.
- 2.11.11. Ensure derived system requirements for new EW capabilities are accompanied with command-sponsored analysis. This analysis must be supported with combat simulations with sufficient rigor to provide decision-makers with operationally relevant data upon which to base their decisions.
- 2.11.12. Identify and prioritize EW capability plans, shortfalls or gaps.
- 2.11.13. Lead high performance team actions associated with requirements development.
- 2.11.14. As required, provide qualified subject matter experts to participate in DAF studies related to EW or to attaining or maintaining electromagnetic spectrum superiority.
- 2.11.15. Support the EW integrated reprogramming process in accordance with AFI 10-703.
- 2.11.16. Meet combatant commander needs by developing employment and overall allocation authority for cross-MAJCOM EW systems (e.g., ALQ-131, AAQ-24 Large Aircraft Infrared Countermeasures pods, ALE- 47, ALR-56M, MALD-J).
- 2.11.17. Coordinate with the AF's EW assessment program known as COMBAT SHIELD to establish criteria for EW assessments on all applicable airframes.

2.12. Using Commands. Using Commands as specified in DAFFD 10-9:

- 2.12.1. Ensure assigned MAJCOM, FLDCOM, numbered air force, or warfighting headquarters have a sufficient number of EW-experienced personnel prepared to support or act as liaisons to the EW cell.
- 2.12.2. As available, participate in high performance team actions associated with EW requirements development.
- 2.12.3. Support modeling and simulation analyses as required for the lead command's EW requirements.
- 2.12.4. Support the EW integrated reprogramming process in accordance with AFI 10-703.
- 2.12.5. Operate EW equipment within the US, US territories, and Canada for testing, training, or exercises, in accordance with applicable domestic and international law, rules of engagement, and the Chairman of the Joint Chiefs of Staff Manual (CJCSM) 3212.02E, *Performing Electronic Attack in the US and Canada for Tests, Training, and Exercises* (This restricted document may be accessed through the website at www.jcs.mil.)

2.13. Implementing Commands. Implementing Commands as specified in AFI 63-101/20-101:

- 2.13.1. Field operationally effective and suitable EW programs to control, exploit, and enhance AF electromagnetic spectrum capabilities.
- 2.13.2. Provide core and support high performance team members, as appropriate, for EW requirements development.
- 2.13.3. Assist the lead MAJCOM or FLDCOM in developing and preparing analysis of alternatives studies.

2.13.4. Employ modeling, simulation, and analysis tools and processes to determine EW requirements in the capabilities-based planning process. Analyses will be supported by combat simulations realistic enough to provide the decision-maker with quality, operationally relevant measures of effectiveness and cost information.

2.13.5. Assist the lead command concerning EW acquisition and sustainment phases.

2.13.6. To the maximum extent possible, ensure commonality for similar EW systems, support equipment, and training and range equipment.

2.13.7. Air Force Global Strike Command will provide sufficient resources to conduct COMBAT SHIELD EW assessments for Air Force Global Strike Command aircraft.

2.13.8. United States Space Force (USSF) organizations charged with performing acquisition related activities for space systems will coordinate through the Chief of Space Operations with A5L on EW-specific space control policy and guidance, requirements and programmatic issues.

2.14. Air Combat Command (ACC).

2.14.1. Assume operational lead for the combat air forces on innovative EW concepts or sustainment (current and future) actions. ACC will ensure EW gaps or shortfalls with common force application or force protection functions are properly coordinated across the MAJCOMs and FLDCOMs. Coordination is necessary to ensure accurate and complete characterization of terrestrial and space environment effects.

2.14.2. As appropriate, coordinate and comment on relevant EW doctrine, policy, capability development, requirements derivation, operational sustainment, or programmatic issues with A5L and other appropriate HAF agencies (e.g., AF/A2/6, A3, A4, A8P, DAF/JA, and SAF/AQ).

2.14.3. Allocate emitters for the electronic warfare ranges.

2.14.4. Be operational proponent for AF's EW assessment program known as COMBAT SHIELD and coordinate with other MAJCOMs on the establishment of similar activities.

2.14.5. Be designated lead for AF EW Cell integration and associated training.

2.14.6. Build operational-level EW training objectives for Flag and AF Weapons School exercises, including advanced and campaign-level training.

2.14.7. Develop requirements for and fund scalable, modular, and interoperable EW systems and equipment.

2.14.8. Maintain and continually assess the currency of the Centralized Aircraft Survivability Assessment System as an EW operations key support tool.

2.14.9. Host annual combat air forces and senior leader conferences as well as supporting the SIG as defined within its charter.

2.14.10. Provide sufficient resources to conduct AF EW COMBAT SHIELD assessment program and other ACC assessment programs. Coordinate with USSF on COMBAT MACE Space EW assessments.

2.14.11. ACC organizations charged with performing acquisition related activities for cyber systems will coordinate with AF/A3 through the Chief, Cyber Warfare Division (AF/A3CX/A6CX) on EW-specific cyber policy, guidance and AF/A5/7 through the Chief, Cyberspace Requirements Division (AF/A5RK) on requirements and programmatic issues.

2.14.12. Coordinate with the Deputy Chief of Staff for Intelligence (AF/A2/6), A5L, and MAJCOMs concerning National Intelligence Program programming resources.

2.14.13. Support EW integrated reprogramming process in accordance with AFI 10-703.

2.14.14. Validate training devices' threat databases to ensure proper function and fidelity of the simulators' EW functions.

2.14.15. In coordination with AF/A2/6, collect and maintain data on all laser incidents involving USAF aircraft.

2.15. Air Education and Training Command (AETC).

2.15.1. Provide undergraduate courses for awarding EW officer DAF specialty codes.

2.15.2. Responsible for developing, conducting and evaluating initial EW skills training, advanced technical training, and graduate academic and flight education programs, except for the responsibilities set out in [para 2.17.3](#).

2.15.3. Coordinate with combat air forces, mobility air forces and Space Operations Command (SpOC), as appropriate, regarding development of advanced EW academic programs and senior leadership EW courseware.

2.15.4. Coordinate on DAF EW requirement documentation or other Service requirements that may have direct training implications.

2.15.5. Coordinate with combat air forces regarding common EW equipment and support annual assessment requirements.

2.15.6. Provide high performance team membership for undergraduate EW training issues that arise during the requirements process.

2.15.7. Support the SIG as defined within its charter.

2.16. Air Force Materiel Command (AFMC). AFMC performs the following activities for EW systems (except for space-related systems):

2.16.1. Assist EW requirements owners, providing integrated modeling, simulation and analysis assessment of AF warfighter operational needs and AF capability documents to ensure the identified capability requirements are technologically sound, testable, sustainable, affordable, and address system of systems considerations.

2.16.2. Oversee execution of operational flight program software upgrades to fielded AF EW systems (e.g., ALQ-131, ALR-56M).

2.16.3. Accomplish hardware upgrades to fielded AF EW systems in response to identified requirements that cannot be satisfied through software upgrades. **Note:** Any hardware changes that impact RF characteristics must meet supportability and compliance requirements found in AFI 17-220.

- 2.16.4. Develop, procure, and sustain EW systems, support equipment, and training and range equipment in support of using command-funded programs.
- 2.16.5. Identify EW-related sustainability shortfalls to the appropriate MAJCOM.
- 2.16.6. Serve as the OPR for EW developmental test and evaluation training to maintain an adequate supply of properly trained EW developmental testers.
- 2.16.7. Maintain dedicated research and development facilities to facilitate the rapid development of quick reaction capabilities that go beyond traditional EW functions.
- 2.16.8. Establish direct liaison and coordination relationship with force provider units supporting rapid software updates predicated by increased complexity of the EMS operating environment.
- 2.16.9. Ensure Reliability, Availability, and Maintainability for Pods and Integrated Systems (RAMPOD) data is available for analysis of support and sustainment shortfalls. RAMPOD is a reliability, availability, and maintainability logistics engineering support system for EA pods and integrated systems.
- 2.16.10. Ensure requests for legal review of directed energy weapons are forwarded through the AFMC staff judge advocate to the Air Force Operations and International Law Directorate (AF/JAO) on a timely basis in accordance with AFI 51-401, *The Law of War*. (T-0).
- 2.16.11. Provide combined AF and Foreign Military Sales EW support in accordance with AFI 10-703.
- 2.16.12. Support the SIG as defined within its charter.
- 2.16.13. Assign EW mission data software programmers into all EW acquisition programs prior to establishment of Milestone A, as defined in the *Manual for the Operation of the Joint Capabilities Integration and Development System*. Within the Joint Capabilities Integration and Development System, a milestone marks the start or finish of a capability development phase and has defined entrance or exit criteria. Milestone A is a review that occurs at the end of the Materiel Solutions Analysis Phase in the Defense Acquisition Process and is led by a milestone decision authority. Its purpose is to make a recommendation or seek approval to enter the next phase of development, referred to as the Technology Maturation & Risk Reduction Phase.
- 2.16.14. Air Force Life Cycle Management Center (AFLCMC) and Air Force Sustainment Center having EW self-protection (defensive EA) systems within their portfolio will coordinate with the respective MAJCOM requirements communities on state of health reports identifying key system shortfalls, gaps or future trends. These reports will be sent to AF/A2/6, the Director, Current Operations (AF/A3O), the Director, Logistics (AF/A4L), and AF/A5L for follow-on Air Staff actions.
- 2.16.15. AFLCMC Architecture and Integration Directorate (AFLCMC/XA) is responsible for charter maintenance, membership, agenda content, minute distribution and follow-on actions.

2.17. Air Force Special Operations Command.

2.17.1. Assume operational lead for the AF special operations forces on innovative EW concepts or sustainment (current and future) actions in accordance with DAFFD 10-9. Ensure that identified EW gaps or shortfalls with common force application or force protection functions are properly coordinated across the MAJCOMs.

2.17.2. Establish a capability to conduct EW assessment program testing in accordance with AFI 10-703.

2.17.3. Be the focal point for developing and conducting graduate AF special operations forces EW academic education programs.

2.17.4. Coordinate with combat and mobility air forces concerning common EW systems and training range emitter requirements.

2.17.5. Support SIG as defined within the integrated product team's charter.

2.18. Air Mobility Command (AMC). Coordinate with combat air forces agencies concerning common EW systems and training range emitter requirements. AMC supports SIG as defined within the integrated product team's charter.

2.19. Air Force Operational Test and Evaluation Center. Manage and conduct DAF EW-related operational test and evaluation in accordance with AFI 99-103. Report results of major operational test and evaluation events to AF/A5/7.

2.20. National Air and Space Intelligence Center (NASIC). In coordination with ACC and AF/A2/6, collect and maintain data on all laser incidents involving AF aircraft.

2.21. Space Operations Command (SpOC). Note that some of these responsibilities may transfer to the Space and Missile Systems/Space Systems Command or Space Training and Readiness Command, once established as Field Commands.

2.21.1. Assume operational lead for innovative space EW concepts or sustainment (current and future) actions. SpOC will ensure space EW gaps are properly coordinated across the MAJCOMs and FLDCOMs. Coordination is necessary to ensure accurate and complete characterization of terrestrial and space environment effects.

2.21.2. As appropriate, coordinate and comment on relevant space EW doctrine, policy, capability development, requirements derivation, operational sustainment, or programmatic issues with AF/A5L and other appropriate HAF organizations (e.g., AF/A2/6, AF/A3, AF/A4, AF/A8P, DAF/JA, SAF/AQ, SF/S2/3/4/6/10, and SF/S5/8).

2.21.3. Responsible for the space EW assessment program known as COMBAT MACE. Coordinate with ACC on COMBAT MACE space EW assessments.

2.21.4. Designated as the space lead for DAF EW Cell integration and associated training.

2.21.5. Build operational-level space EW training objectives for Flag and AF Weapons School exercises, including advanced and campaign-level training.

2.21.6. Develop requirements for and fund scalable, modular, and interoperable space EW systems and equipment.

2.21.7. Support the SIG as defined within its charter.

2.21.8. Develop, procure and sustain space EW systems, support equipment and training and range equipment.

2.21.9. Validate space training devices threat databases to ensure proper function and fidelity of the simulators' EW functions. Guidance on validation is provided in 5600-series Department of Defense (DoD) and FLDCOM guidance.

Chapter 3

TRAINING, EDUCATION AND EXERCISES

3.1. Introduction to EW Training. This chapter provides a broad overview of basic to advanced levels of EW training accomplished in the classroom, in-flight as a single aircraft and during large force exercises. Proficiency in DAF EW operations begins with having quality training programs. Training programs are required to have attainable objectives that are specific, relevant and necessary. They address full-spectrum operations and use the full range of training devices, local training operations, and exercises to hone individual skill sets.

3.2. Levels of EW Training. Basic, senior, continuation, and advanced levels of EW training need to correspond to requirements at the tactical, operational and strategic levels of warfare. This training is required to integrate both space EW and cyber capabilities as they relate to EW.

3.2.1. Basic Level Training: AETC has oversight for conducting basic EW training. The primary method for qualification is the completion of the appropriate formal training course listed in the Education and Training course announcement.

3.2.2. Senior Level Training: AETC will continue to provide an upper-level program that focuses on the integration of full-spectrum information operations and cyber capabilities, as they pertain to EW, into the campaign plan.

3.2.3. Continuation Training: MAJCOMs and FLDCOMs will define both individual and crew EW training requirements across all skill levels.

3.2.3.1. Rated (EW officer AF specialty code) continuation training will be required for the personnel assigned to wing or below levels. **(T-3)**. Training is outlined in each aircraft platform's respective 11-series AF instructions.

3.2.3.2. Individuals holding an "E" prefix and used to fill an EW-related request for forces from the acquisition, engineering, test and evaluation, communications or intelligence communities are required to be mission-ready in accordance with HAF, MAJCOM or numbered air force guidance prior to deployment.

3.2.4. EMS data collected from operational reconnaissance missions should be fed into virtual and simulated environments employed for training. This requires close collaboration between the intelligence community, operational air forces, and simulation environment developers.

3.2.5. Advanced Level Training: The combat air forces, in coordination with AETC, have oversight for advanced EW training above the unit level. Advanced EW training provides an in-depth knowledge of national assets, EA targeting and joint/combined operations necessary. This training equips the commander to employ integrated EW capabilities in an effort to meet operational objectives. **Note:** Hands-on, in-depth graduate-level engineering courses are available to EW acquisition and engineering professionals through the EW T&E University, operated and maintained by the 771st Test Squadron, 412th Electronic Warfare Group, Edwards Air Force Base (AFB), California. EW testing requires an extensive understanding of threat systems, threat modes, range assets, and various EW systems undergoing developmental or operational testing. Engineers need to understand the importance of emerging threats,

proliferation, threat laydowns and threat functionality to better develop effective test methodology. EW T&E University provides classified course offerings that are not available to the general public. The courses are intended to provide an array of EW knowledge to beginner engineers as well as build, develop and maintain EW engineering expertise for those more experienced professionals.

3.3. Coalition Operations. Coalition operations create unique challenges on the battlefield. Therefore, the entire DAF EW community should support the development of courses enabling training and operations with partner nations. This includes maintaining awareness of foreign system capabilities to determine their interoperability within a coalition environment.

3.4. EW Exercises. The culmination of EW effectiveness and integration is best evaluated during exercises. EW exercises should address force application and force protection tactics, techniques and procedures. These exercises should measure how well specific EW capabilities support air expeditionary force requirements.

3.4.1. Exercises can take on many levels of sophistication ranging from unit-level exercises to Air Expeditionary Force preparation. Whenever possible, the 57th Operations Group and similar opposing force organizations should be incorporated to emulate adversary EW from ground, air, space, or cyberspace. The mission of the 57th Operations Group, located at Nellis Air Force Base, Nevada, is to educate, exercise and advocate integration of airpower into the joint fight and to support the preparation of combat air forces maintainers and aircrews while it trains AF leaders and enhances their combat preparation. Exercise scenario developers must use EW targets and effects in the battlespace since non-kinetic attacks are challenging to integrate into scripts. **(T-3).**

3.4.2. Large force exercises will incorporate both offensive and defensive EA activities. **(T-3).** SERENE BYTE reprogramming activities, as described in AFI 10-703, should be considered for inclusion during all large force exercises. Where possible, activities should include other Services and allied partners to fully exploit joint and/or combined operational training opportunities.

3.5. Training Requirements. Organizations employing EW resources should regularly analyze their EW training and their associated enablers to modify or establish new training requirements as needed. MAJCOMs and FLDCOMs are required to assess the quality of EW training and identify any gaps or shortfalls.

Chapter 4

MATERIEL DEVELOPMENT, SUSTAINMENT AND READINESS

4.1. Development. In accordance with 10 U.S.C. § 9013 and DoDD 5100.01, *Functions of the Department of Defense and Its Major Components*, the Secretary of the Air Force is responsible for, and has the authority necessary to conduct all affairs of the Department of the Air Force including organizing, supplying, equipping (including research and development), maintaining, construction, outfitting, and repairs of military equipment, and training. The Joint Capabilities Integration and Development System is used to determine the requirement for and support of the acquisition of an EW materiel solution to a validated capability gap. The Joint Capabilities Integration and Development System is a key component of the capabilities-based planning process and operates with the planning, programming, budgeting, and execution process. The guidance contained in this document does not take precedence over that found in AFI 10-601 when validating EW requirements. In addition, information from this document is required to be used in concert with the guidance found in AFI 63-101/20-101.

4.1.1. MAJCOMs and FLDCOMs will develop requirements and will acquire, field, operate, and sustain EW capabilities and EW-related systems to achieve certain effects. Those effects are aimed to control the electromagnetic environment in support of the Air Force and Space Functions in Enclosure 6 of DoDD 5100.01.

4.1.2. Developers, operators, planners and subject matter experts involved in developing new EW systems are required to understand the electromagnetic environment. That understanding is critical to ensure fielded systems can achieve desired effects and prevent undesired effects. These fielded capabilities are required to be deconflicted with other capabilities being employed in or across the entire battlespace to prevent fratricide within the electromagnetic spectrum.

4.1.2.1. EA systems require spectrum supportability documentation processed through the Joint Staff, Military Command, Control, Communications, and Computers Executive Board Equipment Support Working Group and included into the DoD Joint Spectrum Data Repository.

4.1.2.2. EA system developers are required to submit spectrum supportability risk assessment in accordance with Department of Defense Instruction (DoDI) 4650.01, *Policy and Procedures for Management and Use of the Electromagnetic Spectrum*.

4.1.3. Test and evaluation relies on support from the acquisition and exploitation activities of the AF Foreign Materiel Program to provide data on the technical and operational vulnerabilities of foreign systems.

4.1.3.1. Valid EW-related testing necessitates an environment that is practical and faithfully represents operations. Therefore, AF Foreign Materiel Program provides representative systems to the maximum extent possible. AFMC test and evaluation organizations provide threat-representative EW systems when Foreign Materiel Program assets are not available.

4.1.3.2. Test and evaluation development includes a systematic understanding of the concept of threat employment, capability and proliferation. This understanding is critical to prioritize acquisition of adversary systems or upgrades to older systems. DAF officials will incorporate conclusions from the Foreign Materiel Program or foreign materiel exploitation to hone documents related to targets and threat analysis. **(T-3)**. Efforts to prioritize resources should consider exploiting traditional IADS emitters and when appropriate, non-IADS emitters.

4.1.3.3. EW capability developers should make every effort to integrate developmental, operational, and tactics development test events. Although these three distinct test disciplines pursue different objectives, integrated testing allows programs to efficiently collect and analyze data in common, while saving on costly and limited test range resources.

4.2. Sustainment. This section provides guidance to organizations charged with EW sustainment efforts related to EW integrated reprogramming and test and evaluation.

4.2.1. EW integrated reprogramming is a systematic process designed to increase aircrew survivability and mission success. This process is designed to operate in an environment in which friendly, neutral and hostile systems all use the electromagnetic spectrum. EW integrated reprogramming provides all operators with a timely and accurate means to detect, identify and respond to electromagnetic emissions. EW integrated reprogramming functions are governed by AFI 10-703, *Electronic Warfare (EW) Integrated Reprogramming*.

4.2.2. DAF will move from existing EW integrated reprogramming paradigms to new reprogramming paradigms that will effectively support operations in complex EMS environments, employ software-defined/software-intensive systems and operate with open systems principles.

4.2.3. Guidance on testing of EW-related mission data software changes, minor system software changes and minor hardware changes is outlined in AFI 99-103 and AFI 17-220. CJCSM 3212.02E establishes requirements for performing EA in the US and Canada for testing, training, or exercises. Users shall collect spectrum-related data and administer it according to the requirements of DoDI 8320.05, *Electromagnetic Spectrum Data Sharing*. **(T-0)**.

4.3. Readiness.

4.3.1. MAJCOMs and FLDCOMs establish readiness standards for EW systems based on their operational requirements to ensure sufficient numbers of fully mission-capable systems are available to meet operational commitments. Lead MAJCOMs and FLDCOMs conduct readiness assessments of EW systems associated with their weapons platforms on at least an annual basis.

4.3.1.1. COMBAT SHIELD is the lead USAF air EW assessment program and is responsible for advising, as requested, all MAJCOM-specific EW assessment programs. The COMBAT SHIELD program will be prepared to support all MAJCOMs by offering airframe-specific EW readiness assessments. **(T-3)**.

4.3.1.2. Fighter, bomber, and rescue aircraft unit commanders will conduct EW system readiness assessments using the COMBAT SHIELD program. **(T-3)**. Other aircraft types should model their readiness assessments after the COMBAT SHIELD example whenever possible.

4.3.1.3. COMBAT MACE is the lead space EW assessment program and is responsible for advising, as requested, all FLDCOM-specific space EW assessment programs. The COMBAT MACE program will be prepared to support all FLDCOMs by offering space EW platform readiness assessments. **(T-3)**.

4.3.1.4. AMC will conduct EW assessments in accordance with technical orders. AMC will seek COMBAT SHIELD assistance, as required.

4.3.2. MAJCOMs/FLDCOMs assess EW support equipment and training devices (e.g., systems used for electromagnetic signal recognition, electromagnetic attack or ES training). MAJCOMs/FLDCOMs should take advantage of all opportunities to exercise their respective systems and support equipment to determine operational status.

4.3.3. AFI 10-201, *Force Readiness Reporting* requires wing-level or delta-level and below unit commanders will report readiness of EW systems in the Defense Readiness Reporting System.

Chapter 5

LEADERSHIP

5.1. DAF EMS Superiority Strategy. The Chief of Staff of the Air Force provides the strategic vision for EMS superiority. DAF recognizes EW is a maneuver force able to project power through air, space, and cyber domains providing varied options from temporal effects through physical destruction. Deputy Chief of Staff for Strategy, Integration, and Requirements (AF/A5/7) established the EMS Superiority Directorate (AF/A5L) based upon multiple studies and analysis conducted, completed, and approved over the last decade.

5.2. Air Force EW Roadmap Reporting. AF/A5L will own and submit an annual “report card” to AF/A5/7 assessing progress against each EW roadmap milestone. AF/A5L is responsible for updating this document and coordinating those changes with enterprise stakeholders.

5.3. Spectrum Integration Group (SIG). This is the DAF corporate body for facilitating effective integrated management of DAF EW across DOTMLPF-P.

5.3.1. The SIG is chaired by AF/A5L and is responsible for the most effective and efficient utilization of materiel capabilities, including requirements refinement and endorsement, technology and system development, procurement and fielding, sustainment and upgrading, and eventual retirement. It sets the objectives and provides recommendations to the Secretary of the Air Force, Chief of Staff of the Air Force, and Chief of Space Operations. The SIG shall meet annually in order to support the planning, programming, budgeting, and execution process.

5.3.2. Membership in this organization is comprised of general officer/senior executive service stakeholders from the HAF, Air Reserve Component, MAJCOMs, FLDCOMs, and other vested organizations [e.g., National Security Agency, sister Services, the Joint Staff Cyberspace and Electronic Warfare Operations Division (J-39)]. Leadership from the AF reprogramming centers (in accordance with AFI 10-703) are key members of this group.

5.4. EW Test and Evaluation (T&E) Consortium. The AF EW T&E Consortium works test and evaluation efforts through the SIG and AF/TE. Chaired by AF/TE, the AF EW T&E Consortium membership consists of senior representatives at the O-6 level or civilian equivalents (or their designated representative) from the MAJCOMs/FLDCOMs and test organizations with an interest in the test and evaluation of EW systems. The EW T&E Consortium is the AF agent for coordinating EW T&E activities including 1) recommending lead test organizations, 2) prioritizing test facility use and modernization, 3) standardizing test practices, and 4) reducing duplication and increasing efficiencies and effectiveness.

Chapter 6

PERSONNEL

6.1. Force Development. This chapter provides guidance concerning specialized manning, readiness, proficiency, and expertise to increase the DAF's ability to maximize each component of EW operations.

6.1.1. DAF EW personnel are required to be ready to operate at the strategic, operational, and tactical levels of warfare. Maintaining a professional fighting force requires personnel with in-depth knowledge of their EW specialty and an awareness of other information-related capabilities. Career progression should facilitate development of this expertise and familiarization of these disciplines within individual career paths. This knowledge and experience is tracked so personnel are readily identifiable for additional training opportunities or assignments.

6.1.2. The primary method for identifying and tracking rated EW expertise (AF-wide) is the AF specialty code. Individuals not in possession of an EW officer AF specialty code but having critical EW expertise are distinguished via an "E" prefix to their primary AF specialty code. To ensure adequate expertise is available the following tasks are accomplished:

6.1.2.1. MAJCOM Operations (MAJCOM/A3) or USSF FLDCOM Operations (FLDCOM/S3) divisions will identify which non-EW officer AF or Space Force specialty code officer positions require specialized EW knowledge and experience to their MAJCOM Manpower (MAJCOM/A1) or Space Force equivalent counterparts. These positions include but are not limited to pilots, navigators, and operators (cyberwarfare and space control expertise), along with EW-related platform maintenance, intelligence, engineering, and acquisitions personnel.

6.1.2.2. AF/A5L has oversight for "E-prefix" management including recruiting, training, assignments, and career development studies or reports. AF members may contact the local manpower office to obtain details on the current unit manning document with "E" prefixes attached to MAJCOM authorized AF specialty codes.

6.1.3. MAJCOMs/FLDCOMs will manage their respective EW force structure to ensure their organizations have available resources for all documented unit manning document positions.

6.1.4. MAJCOMs/FLDCOMs utilizing special experience identifiers to fill information operations or information-related capability career force billets will also ensure their EW experts are easily identifiable. They will also ensure these experts are distinct from those with proficiency in offensive cyber operations, space operations or military information support operations. These distinctions are required to meet DAF operational tasks. Policy on DAF operational tasks is provided in DAFPD 10-4, *Operations Planning: Air & Space Expeditionary Force (AEF)*.

6.2. EW Manpower Requirements. MAJCOMs will assess their EW manpower requirements (e.g., operations, maintenance, logistics, intelligence, mission data engineers, and associated support staffs) and forward this information to AF/A3T for follow-on action. In turn, HAF directorates will do the following:

6.2.1. A5L, in coordination with AF/A3T, will assess authorized billets against MAJCOM requirements and fill positions requiring EW expertise.

6.2.2. The Director, Manpower, Organization, and Resources (AF/A1M) will determine the number of authorizations earned, correct grades and skill levels based on man-hour and workload factors.

Chapter 7

FACILITIES

7.1. Types of Facilities. EW operators, maintainers, engineers, and analysts require different types of facilities to provide operational EW capability to the warfighter. Facilities including laboratories for development and sustainment, installed systems test facilities, test and training ranges, and associated instrumentation are needed to test, train, and prepare for combat operations.

7.1.1. EW laboratories, ranges, and associated instrumentation support the EW development, demonstration, T&E, and sustainment efforts needed to successfully operate in a congested and contested electromagnetic environment. These EW facilities are required to maintain the ability to generate up-to-date red, gray, blue, or white signals in order to accurately simulate the congested and contested electromagnetic environment of anti-access and/or area denial environments. They include:

7.1.1.1. Anechoic RF Test Facilities: The Air Force Test Center operates anechoic RF facilities with a broad range of capabilities. It supports the research, developmental and operational test communities, industry, and US-allied foreign militaries (i.e., partner nations) in the execution of EW and other RF test requirements. Anechoic facilities are used to absorb RF energy to reduce the electromagnetic reflections. This, in turn, simulates open-air environments within acceptable limitations based on frequency, the size of the facility, and the system undergoing testing. The quiet RF environment allows for military standard electromagnetic interference and compatibility testing on various EW systems and other avionics. Additionally, anechoic facilities allow testing in a highly secure and controlled environment.

7.1.1.2. The Benefield Anechoic Facility at Edwards AFB supports installed systems testing for avionics test programs requiring a large, shielded chamber with RF absorption capability that simulates the open-air environment. The Benefield Anechoic Facility provides the capability to:

7.1.1.2.1. Investigate and evaluate anomalies associated with EW systems, avionics, tactical missiles and their host platforms.

7.1.1.2.2. Accommodate tactical-sized (single or multiple) or large vehicles that can be operated in a controlled electromagnetic environment with emitters on and sensors stimulated while RF signals are recorded and analyzed.

7.1.1.2.3. Generate RF signals with a wide variety of characteristics, simulating red/gray/blue/white surface-based, sea-based, and airborne systems.

7.1.1.2.4. Produce combination of signals and control functions emulating a wide variety of test conditions.

7.1.1.2.5. Generate conditions that are not available on outdoor ranges from the aspect of signal density, pulse density, and number of simultaneous types.

7.1.1.2.6. Have the capabilities for real-time and post-test RF signal parameter measurement, instrument display recording, data analysis and test coordination, as well as providing the data for signal verification.

7.1.2. Working together, the Joint Preflight Integration of Munitions and Electronic Systems facility and the Benefield Anechoic facility provide complementary anechoic chamber capabilities. This combination of facilities effectively tests and fields RF-centric systems and other avionics that must operate in a dense or high power electromagnetic environment. The Air Force Test Center will work with program offices to determine which combination of anechoic chamber test capabilities can best support test requirements based on technical requirements, location, and schedule availability. **(T-3)**.

7.1.3. The Electronic Warfare Aviation Integration Support Facility at Robins AFB, Georgia and mission data development labs at Eglin AFB, Florida and Robins AFB are equipped and maintained to support the reprogramming process in accordance with AFI 10-703.

7.1.4. The Digital Integrated Air Defense System Mission Simulation Laboratory provides a verified and validated mission-level simulation of integrated air defense systems. It provides the ability to model and test the effects of a variety of EW systems on the IADS, from end to end, within an operationally representative scenario in size and density that is not available elsewhere. This simulation's strength lies in its ability to accurately model air picture development. That more accurate model makes it a relevant tool for providing to testers and trainers the answers for more effective systems and tactics.

7.1.5. The Multi-Spectral Test and Training Environment provides a multi-use threat EW capability supporting open-air and component-in-the-loop testing and training. The Multi-Spectral Test and Training Environment consists of a suite of fully instrumented threat air defense systems. There are 13 primary threats that support multiple programs. A few additional systems are dedicated for and funded by specific customers. The primary purpose of the Multi-Spectral Test and Training Environment systems is to support open-air testing. The systems are also available to provide EW training for aircrews. The Multi-Spectral Test and Training Environment also provides the capability to support open-air component-in-the-loop testing using a tower complex, the Electronic Systems Test Facility. This enables developing and testing EW algorithms and techniques.

7.1.6. Hardware-in-the-loop simulation facilities include the Guided Weapons Evaluation Facility at Eglin AFB. The Guided Weapons Evaluation Facility supports testing of domestic munitions systems and, in its EW role, provides infrared countermeasure hardware-in-the-loop testing to evaluate the effectiveness of countermeasure systems to defeat electro-optical and infrared threat missiles. In order to provide effectiveness evaluations, the Guided Weapons Evaluation Facility maintains and operates validated hardware-in-the-loop simulations employing actual threats against simulated targets emitting in the optical band of the threat missile. These simulations allow thousands of simulated engagements under varying aircraft operating conditions to determine if flares, directed energy, or laser countermeasures are effective in defeating threat missile guidance systems.

7.2. Test and Training Ranges. The DAF test and training range infrastructure:

7.2.1. Provides open-air operation in support of air-to-air and air-to-ground weapons developmental and operational test and evaluation for DoD, non-DoD and commercial customers.

7.2.2. Includes mission scheduling, test and training resources, test operations, and test analysis. All of these functions serve to support test programs for weapons systems; command, control, communications and computers; and intelligence, surveillance and reconnaissance.

7.2.3. Supports MAJCOM/FLDCOM EW investment and modernization efforts.

7.3. MAJCOM/FLDCOM Facilities Responsibilities. MAJCOMs/FLDCOMs will:

7.3.1. Acquire, maintain, and sufficiently fund T&E facilities such as integrated system test facilities, like those at Arnold, Edwards and Eglin Air Force Bases and mission simulation laboratories at Arnold, Edwards, Eglin, Holloman, and Kirtland Air Force Bases which provide key T&E capabilities to ensure EW programs meet validated operational requirements. Conducting EW testing in these facilities enables the identification of issues prior to open-air testing, and reduces the expensive and time-consuming “fly-fix-fly” process. These facilities support:

7.3.1.1. EW range test and training operations.

7.3.1.2. Anechoic RF test facilities for antenna tests, installed systems tests, and RF interoperability or compatibility tests.

7.3.1.3. Building and maintaining live-virtual-constructive EW operations.

7.3.1.4. Operation of hardware-in-the-loop capabilities to support evaluation of aircraft self-protection systems against ground and airborne threat missile systems, intelligence, surveillance and reconnaissance systems, and radar systems. An example of this capability exists at Edwards AFB in the Integrated Facility for Avionics Systems Test.

7.3.1.5. Operation of hardware-in-the-loop capabilities to support evaluation of guidance, navigation and geo-location systems in threat-representative navigation warfare environments such as the 746th Test Squadron’s Navigation Test and Evaluation Laboratory.

7.3.2. Ensure DAF EW test activities will utilize DoD test facilities for applicable tests to the maximum extent possible in accordance with AFI 99-103.

S. CLINTON HINOTE, Lt Gen, USAF
DCS, Strategy, Integration, and Requirements

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

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Prescribed Forms

None

Adopted Forms

AF Form 847, *Recommendation for Change of Publication*

Abbreviations and Acronyms

ACC—Air Combat Command

AETC—Air Education and Training Command

AF—Air Force

AFB—Air Force Base

AFI—Air Force Instruction

AFLCMC—Air Force Life Cycle Management Center

AFMC—Air Force Materiel Command

AFOTEC—Air Force Operational Test and Evaluation Center

AFSOC—Air Force Special Operations Command

AMC—Air Mobility Command

CJCSM—Chairman of the Joint Chiefs of Staff Manual

DAF—Department of the Air Force

DAFI—Department of the Air Force Instruction

DAFPD—Department of the Air Force Policy Directive

DoD—Department of Defense

DoDI—Department of Defense Instruction

DOTMLPF-P—Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, Facilities, Policy

EA—Electromagnetic Attack

EMS—Electromagnetic Spectrum

EO—Electro-Optical

EP—Electromagnetic Protection

ES—Electromagnetic Warfare Support

EW—Electromagnetic Warfare

FLDCOM—Field Command

HAF—Headquarters Air Force

IADS—Integrated Air Defense System

IR—Infrared

JCS—Joint Chiefs of Staff

JEMSO—Joint Electromagnetic Spectrum Operations

MAJCOM—Major Command

OPR—Office of Primary Responsibility

OSD—Office of the Secretary of Defense

RAMPOD—Reliability, Availability, and Maintainability for Pods and Integrated Systems

RF—Radio Frequency

SIG—Spectrum Integration Group

SpOC—Space Operations Command

T&E—Test and Evaluation

US—United States

USAF—United States Air Force

USSF—United States Space Force

Terms

Note—The purpose of this glossary is to help the reader understand the terms used in this publication. It is not intended to encompass all pertinent terms. The *Department of Defense Dictionary of Military and Associated Terms* https://jdeis.js.mil/jdeis/new_pubs/dictionary.pdf, and the *Air Force Glossary* <https://www.doctrine.af.mil/External-Links/Air-Force-Glossary/> contain standardized terms and definitions for DoD and DAF use respectively.

BLUE—Term used to describe the platforms, systems or the electromagnetic characteristics of systems associated with US military users.

Capabilities-Based Planning—A planning methodology that identifies and provides capabilities that the joint warfighter and supporting defense entities need to address a range of challenges. Capabilities-based planning is planning under uncertainty to provide capabilities suitable for a wide range of challenges and circumstances, all designed to achieve certain battlespace effects. The AF uses a capabilities-based planning process based on analysis to identify required capabilities and capability objectives. Joint Capabilities Integration and Development System analysis and A5X capabilities-based planning are primary contributors to the AF planning process, but top-down direction, urgent warfighter needs, technological opportunities, and experiments and demonstrations provide other means for identifying the need for a new capability.

Capability—The ability to complete a task or execute a course of action under specified conditions and level of performance.

Capability Gap—The inability to meet or exceed a capability requirement, resulting in an associated operational risk until closed or mitigated.

COMBAT MACE—The USSF EW assessment program responsible for assessing the system readiness of space systems and to provide local commanders with on-site analysis, feedback and recommendations on how to improve operations and maintenance processes related to EW system readiness. Not applicable to USAF.

COMBAT SHIELD—The AF EW assessment program responsible for assessing the defensive system readiness of combat air forces (CAF) aircraft by deploying assessment teams with specialized equipment to provide senior leadership an independent assessment of the overall health of CAF systems and to provide local commanders with on-site analysis, feedback and recommendations on how to improve operations and maintenance processes related to EW system readiness. Not applicable to USSF.

COMPASS CALL—The primary offensive EA capability for the AF. It is currently fielded on the EC-130H and will transition to the EC-37B.

Cyberspace—A global domain within the information environment consisting of the interdependent network of information technology infrastructures and resident data, including the internet, telecommunications networks, computer systems, and embedded processors and controllers.

Cyberspace Operations—The employment of cyberspace capabilities where the primary purpose is to achieve objectives in or through cyberspace.

Electromagnetic pulse—A strong burst of electromagnetic radiation caused by a nuclear explosion, energy weapon, or by natural phenomenon, that may couple with electrical or electronic systems to produce damaging current and voltage surges.

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.

Electromagnetic Spectrum Management—The operational, engineering, and administrative procedures to plan and coordinate operations within the electromagnetic operational environment. Its objective is to enable electronic systems to perform their functions in the intended environment without causing or suffering unacceptable interference.

Electromagnetic Warfare (EW)—Military action involving the use of electromagnetic and directed energy to control the electromagnetic spectrum or to attack the enemy. The three major subdivisions within EW are: electromagnetic attack (EA), electromagnetic protection (EP), and EW support (ES).

Electromagnetic Warfare (EW) Cell—Fully trained core of EW experts to coordinate and execute operational EW activities to meet joint force commander objectives.

Electromagnetic Warfare Integrated Reprogramming—The process that fully integrates operations, intelligence, communications, logistics, and other support functions to provide changes to reprogrammable EW equipment hardware and software, tactics, and equipment settings.

Emitters—Devices that transmit electromagnetic energy.

Function—The broad, general, and enduring role for which an organization is designed, equipped, and trained. The DAF functions are those core duties and responsibilities the AF and Space Force perform supported across doctrine, organization, training, materiel, leadership and education, personnel, facilities, and policy.

Geomagnetic Disturbance—A storm in the Earth’s magnetosphere that occurs when there is a very efficient exchange of energy from the solar wind into the space environment surrounding Earth. These storms result from variations in the solar wind that produces major changes in the currents, plasmas, and fields in Earth’s magnetosphere.

GRAY—Term used to describe the platforms, systems or the electromagnetic characteristics of systems associated with non-US, non-hostile military users. Examples:

Countries or coalitions traditionally identified as US allies (UK, CAN, AUS, NATO, etc.). Countries or coalitions identified as neutral or unknown in their alliance with US. US systems sold to other countries through foreign military sales or similar processes. Different organizations may be assigned different parts of GRAY to comply with existing laws and DoD, joint or service policies.

Joint Capabilities Integration and Development System—Supports the Chairman of the Joint Chiefs of Staff and the Joint Requirements Oversight Council in identifying, assessing, and prioritizing joint military capability needs as required by law. Additionally, Joint Capabilities Integration and Development System is a key element in the Chairman's effort to realize the initiatives directed in the Transformation Planning Guidance.

Materiel Solution—A new item (including ships, tanks, self-propelled weapons, aircraft, etc., and related spares, repair parts, and support equipment, but excluding real property, installations, and utilities) developed or purchased to satisfy one or more capability requirements (or needs) and reduce or eliminate one or more capability gaps.

Operational Test and Evaluation—The field test, under realistic conditions, of any item (or key component) of weapons, equipment, or munitions for the purpose of determining the effectiveness and suitability of the weapons, equipment, or munitions for use in combat by typical military users; and the evaluation of the results of such tests. In addition, operational test and evaluation provides information on organization, personnel requirements, doctrine, and tactics. Within the AF, the Air Force Operational Test and Evaluation Center (AFOTEC), and MAJCOMs conduct operational test and evaluation.

RED—Term used to describe the platforms, systems or the electromagnetic characteristics of systems associated with hostile (non-US) users.

Reliability, Availability, Maintainability for Pods (RAMPOD)—Reliability, Availability, Maintainability for Pods (RAMPOD) is a multi-service program which captures maintenance, status, and inventory of EW, precision attack and targeting, test, training, and radar pods. RAMPOD was developed in 1982 as a result of the SEEK ICE initiative, which was a pod procurement program. That program identified the need to have a maintenance data collection system that would capture all aspects of pod scheduled and unscheduled events and provide users with usable performance metrics. The AF EW programs currently supported include the ALQ-131/184/188 EA Pods, ALE-40/45/47 chaff/flare systems.

SERENE BYTE—Term used to describe the exercising of AF EW system changes.

User—An operational command or agency that receives or will receive benefit from an acquired system. Combatant commands and their component commands are users. There may be more than one user for a system. Because the military Services are required to organize, equip, and train forces for the combatant commands, they also are seen as users for systems. The heads of other DoD components are validation and approval authorities and are not viewed as users.

WHITE—Term used to describe the platforms, systems or the electromagnetic characteristics of systems associated with non-military, non-hostile users

Attachment 2

AF EW SUPPORT TO JOINT TASK FORCES

A2.1. Guidelines. This attachment provides Service guidelines to commanders concerning DAF EW during contingency operations. As always, JCS guidance takes precedence over the information provided in this attachment.

A2.2. EW Cell Roles and Responsibilities. The DAF needs a fully trained core of EW Cell experts to coordinate and execute operational EW activities to meet joint force commander objectives. The DAF EW Cell will:

A2.2.1. Act as the joint force commander's mechanism for coordinating and executing EW operations within a theatre of operations including those involving a combined or joint task force. (T-3). Responsibilities include EW planning, coordination/monitoring, source of advice, line-of-fire deconfliction, as well as the traditional EA activities normally reserved for offensive air operations and defensive activities associated with the force protection mission.

A2.2.2. Work closely with the joint force commander's EW staff or component equivalents (as designated by the lead Service) to provide subject matter experts on DAF EW capabilities. (T-3).

A2.2.3. Coordinate as appropriate with the combined air operations center plans and operations divisions, information operations, space, intelligence, battlefield coordination detachment, J-6, or other cells as required by its assigned joint force commander function(s). (T-3).

A2.2.4. Act as the DAF's primary agency for the deconfliction of intentional electromagnetic emissions across Services and other coalition partners participating in the joint operational construct. (T-3).

A2.2.5. Provide constant liaison with the ground maneuver, intelligence, and communications staffs/elements in order to synchronize combat operations. (T-3).

A2.2.6. Locate in a secure area for the handling and storage of sensitive intelligence material, within close proximity to component information operations staff, operations, space, intelligence and communications interface shelter staff cells. (T-3).

A2.2.7. Integrate with numbered air force headquarters/component staff during peacetime to enable operational plan development, exercise planning and conducting effective EW training. (T-3).

A2.2.8. Provide DAF subject matter experts to support the expertise areas contained in [Figure A2.1](#). (T-3).

Figure A2.1. EW Cell Subject Matter Expertise.

Strategy Plans Team/ Strategy Guidance Team
Target Effects Team/Master Air Attack Plan Team
EW special instructions - rules of engagement
Joint Restricted Frequency List jamming control authority
EW battle management activities as directed by the joint force commander
EW integrated reprogramming in respective areas of responsibility

A2.3. DAF EW Cell manning.

A2.3.1. The chief of the EW Cell will be a senior DAF EW officer and designated by the appropriate component commander. **(T-3)**. This designated individual will be the combined air operations center EW focal point to ensure proper coordination within the Information Operations Cell and other specialty teams. **(T-3)**. As a minimum, the chief will be cleared and briefed into special technical operations; and strong consideration should be given to providing the chief with a COAL WARFIGHTER, a special access program, in-brief. **(T-3)**. All other EW Cell personnel will be cleared to Top Secret/Special Compartmented Information. **(T-3)**.

A2.3.2. Manning levels must be commensurate with the scale of EW operations being conducted. **(T-3)**. In order to function correctly, liaison links must be established with supporting commands as well as EW specialists from correlating capabilities and other employed EW elements. **(T-3)**.