DEPARTMENT OF THE AIR FORCE
OFFICE OF THE CHIEF OF SAFETY
WASHINGTON, DC 20330

DAFI91-208_DAFGM2024-01

6 February 2024

MEMORANDUM FOR DISTRIBUTION_C
MAJCOMs/FLDCOMs/FOAs/DRUs

FROM: AF/SE
1400 Air Force Pentagon
Washington, DC 20330-1400

SUBJECT: Air Force Guidance Memorandum to AFI 91-208, *Hazards of Electromagnetic Radiation To Ordnance (HERO) Certification and Management*

By Order of the Secretary of the Air Force, this Department of the Air Force Guidance Memorandum immediately redesignates this publication to Department of the Air Force Instruction 91-208, *Hazards of Electromagnetic Radiation To Ordnance (HERO) Certification and Management*, and implements changes to it as noted in the attachment. Compliance with this memorandum is mandatory. This memorandum applies to the US Air Force, Air National Guard, AF Reserve, and US Space Force. To the extent its directions are inconsistent with other Department of the Air Force publications, the information herein prevails, in accordance with Department of the Air Force Instruction 90-160, *Publications and Forms Management*, and Department of the Air Force Manual 90-161, *Publishing Processes and Procedures*.

This Memorandum becomes void after one year has elapsed from the date of this Memorandum, or upon publication of an Interim Change or rewrite of the DAFI 91-208, whichever is earlier.

SEAN M. CHOQUETTE
Major General, USAF
Chief of Safety

Attachment:
Guidance Changes

DAFI91-208_DAFGM2024-01, 6 February 2024

Attachment
Guidance Changes

The below changes to DAFI 91-208, dated 6 February 2024, are effective immediately.

*Introduction. **(Changed to read)**: This instruction applies to Foreign Military Sales and explosive operations of any kind in US Air Force (USAF), Air National Guard (ANG), AF Reserve, and US Space Force (USSF) owned or leased facilities, United States-titled ammunition in contractor or host-nation facilities, civilian and military members of the USAF, ANG, AF Reserve, and USSF.

*Summary of Changes. **(Changed to read)**: The publication has been revised to include modern mobile emitters (MMEs) or their batteries will not be charged unattended in areas where ordnance is undergoing maintenance, both assembly and disassembly, or stored due to the possibility of batteries exploding. **(T-1)**

*5.5.6 **(Changed to read)**: MMEs or their batteries will not be charged unattended in areas where ordnance is undergoing maintenance, both assembly and disassembly, or stored due to the possibility of batteries exploding. **(T-1)**

BY ORDER OF THE
SECRETARY OF THE AIR FORCE

AIR FORCE INSTRUCTION 91-208

24 OCTOBER 2019

Safety

HAZARDS OF ELECTROMAGNETIC RADIATION TO ORDNANCE (HERO) CERTIFICATION AND MANAGEMENT

COMPLIANCE WITH THIS PUBLICATION IS MANDATORY

ACCESSIBILITY: Publications and forms are available on the e-Publishing website at **www.e-Publishing.af.mil** for downloading and ordering.

RELEASABILITY: There are no releasability restrictions to this publication.

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(Colonel William C. Culver)

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Pages: 31

This Air Force (AF) Instruction (AFI) implements and extends the policy of the Department of Defense (DoD) Directive (DoDD) 5000.01, *The Defense Acquisition System*, DoDD 6055.09E, *Explosives Safety Management (ESM)*, DoD Instruction (DoDI) 5000.02, *Operations of the Defense Acquisition System*, DoDI 3222.03, *DoD Electromagnetic Environmental Effects (E3) Program*, Defense Explosives Safety Regulation (DESR) 6055.09, Edition 1, AF Policy Directive (AFPD) 91-2, *Safety Programs*, and AF Manual (AFMAN) 91-201, *Explosives Safety Standards*. This publication establishes AF policy for Hazards of Electromagnetic Radiation to Ordnance (HERO) certification and management for ordnance in the AF inventory. This instruction applies to Foreign Military Sales and explosive operations of any kind in AF, Air National Guard, and AF Reserve owned or leased facilities, United States-titled ammunition in contractor or host-nation facilities, civilian and military members of the Regular Air Force, The Air Force Reserve, and the Air National Guard. Refer recommended changes and questions about this publication to the Office of Primary Responsibility (OPR) using AF Form 847, *Recommendation for Change of Publication*; route AF Form 847 from the field through the appropriate functional chain of command. Send Major Command supplements for coordination before publication to AF Safety Center (AFSEC), AF Weapons Safety (AFSEC/SEW) at **HQAFSCSEW@us.af.mil**. The authorities to waive wing or 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 AFI 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. Ensure all records created as a result of processes prescribed in this publication are maintained in accordance

with AFMAN 33-363, *Management of Records*, and disposed of in accordance with the Disposition Schedule located in the Air Force Records Information Management System. The use of the name or mark of any specific manufacturer, commercial product, commodity, or service in the publication does not imply endorsement by the AF.

SUMMARY OF CHANGES

This instruction has been substantially revised and should be completely reviewed. Major changes include updated guidance for and use of modern mobile emitters (MME). This document has also been updated to reflect current references and modified to conform with recent changes to publication guidelines.

Chapter 1

GENERAL GUIDELINES AND BACKGROUND

1.1. Purpose.

1.1.1. This AFI implements the HERO certification and management requirements of the weapon system safety and explosive safety programs. With the exception of the Eastern (45th Space Wing) and Western (30th Space Wing) Test Ranges, this instruction establishes and implements explosives safety and reliability standards, criteria, instructions, regulations, and electromagnetic emission control procedures for electromagnetic radiation (EMR) emitters throughout the AF in accordance with the organization and general responsibilities assigned by this instruction.

1.2. Background.

1.2.1. An electrically initiated device (EID) is a single unit, device, or subassembly that uses electrical energy to produce an explosive, pyrotechnic, thermal, or mechanical output. Examples include electro-explosive devices such as hot bridgewire, exploding bridgewire, semiconductor bridge, carbon bridge, and conductive composition, as well as laser initiators, burn wires, fusible links, and exploding foil initiators, such as slapper detonators and low energy exploding foil initiators.

1.2.2. MIL-HDBK-240A, *HERO Test Guide*, defines HERO as the situation in which exposure to an external electromagnetic environment (EME) results in specific safety or reliability margins of EIDs to electrically powered ordnance firing circuits to be exceeded, or EIDs to be inadvertently actuated. External EMEs may originate from intentional transmitting sources (e.g., radios, radars, and electronic countermeasures) or unintentional sources (e.g., arcing and high current switching transients). Consequences include both safety (premature firing) and reliability (EID dudding or altered functional characteristics) effects.

1.2.3. EMR hazards stem from the functional characteristics of electrically initiated ordnance. EMR hazards are the result of absorption of electromagnetic energy by the firing circuit of the EIDs. Consequently, the induced energy causes heating of the EID's bridgewire and primary explosive with which it is normally coated. The ordnance EIDs may accidentally initiate or have their performance degraded by exposure to EME. In general, ordnance is most susceptible to EME during both assembly and disassembly, handling, and loading or unloading. HERO guidance provided in this instruction addresses protection of ordnance from the EME during all stockpile-to-safe separation sequence (S4), nuclear weapon stockpile-to-target sequence (STS) phases, and ordnance demilitarization operations.

1.2.4. Significant differences in the physical configuration of the ordnance item can be expected as the item transitions from one phase to another. Different physical configurations can provide different levels of protection. Furthermore, it is likely that the EME associated with each phase will be quite different. The potential for a HERO problem is highly dependent on both of these phase-dependent conditions. From a HERO protection standpoint, it is especially important to address all unique ordnance configurations.

1.2.5. Technological advances have resulted in the proliferation of communication and radar equipment, many of which radiate high levels of electromagnetic energy. These advances, coupled with the increased trend to use more sensitive, low-powered electronic circuits in the

design of ordnance systems, perpetuate a long-standing hazard. The hazard that results from adverse interactions between the EME and the electrical initiators or initiating system contained within ordnance systems are referred to as HERO. The need for HERO control arises from a fundamental incompatibility between the EIDs or EID firing circuits contained within the ordnance and the external radiated EME that the ordnance encounters during its progression through the S4 or STS phases.

1.2.6. EIDs perform a variety of functions, such as initiating rocket motors, arming and detonating warheads, and ejecting chaff and flares. The need for HERO control arises so that these functions do not occur unintentionally or prematurely because of exposure to electromagnetic energy. There are two potential forms of such unintentional, EME-induced EID response. First, the activation of the initiating device itself by electromagnetic energy coupled directly into the device or upset of an energized firing circuit, resulting in a firing signal erroneously sent to the EID. Second, the degradation or dudding of the initiating device by electromagnetic energy coupled directly into the device. In the first case, accidental EID activation can have negative consequences on safety (premature initiation of explosive trains) or on reliability (once initiated, EIDs can no longer perform their intended function, thus rendering the system incapable of performing its mission). In the second case, the presence of electromagnetic energy in an EID can alter its ignition properties without actually firing the device, so the device will not function when legitimate firing stimuli are applied; most likely, this will adversely affect system reliability. The combination of severe EME levels and sensitive, insufficiently protected components and circuits can have disastrous consequences. This problem has persisted because of the introduction of more powerful transmitters, which have raised the operational EME levels, and the continued use of sensitive electrically initiated systems.

1.3. Scope.

1.3.1. HERO includes, but is not limited to, vulnerable assets and sources. Vulnerable assets include nuclear weapons and conventional ordnance, such as gun systems and their munitions, missiles, bombs, countermeasures, aerial target drones, depth charges, mines, torpedoes, and other material embodying EIDs (e.g., cable cutters, chaff, and munition dispensers, self-destruct devices, aircraft engine fire extinguishing systems, and aircraft ejection seats). Sources include aircraft and store EMR emitters, radars, antennas, radio frequency identification systems, wireless laptops and tablets, and handheld communication devices.

1.3.2. HERO also includes all equipment, subsystems, and materials containing EIDs, which affect safety and mission reliability. Safety and mission-critical EIDs are typically used to initiate explosives, chemicals, pyrotechnics, and similar stores on airborne, sea, space, and ground systems. For platforms, **Chapter 6** applies.

1.4. Applicability.

1.4.1. Applies to research and development, testing, operations, and equipment utilized during all of the S4 phases, as defined in MIL-HDBK-240A (transportation and storage, assembly and disassembly, staged, handling and loading, platform-loaded, and immediate post-launch), and all STS phases.

1.4.2. All ordnance containing EIDs, used in or on AF installations, ground vehicles, and aircraft, foreign ordnance, and ordnance test variants containing EIDs and include temporary

instrumentation, such as measurement hardware, telemetry, flight safety systems, and flight terminations systems. If the ordnance is percussion initiated or non-explosive, EMR controls within this AFI do not apply.

1.5. HERO Classifications.

1.5.1. MIL-STD-464C, *E3 Requirements for Systems*, and MIL-HDBK-240A establish the three classifications pertinent to HERO for ordnance containing EIDs.

1.5.2. HERO SAFE ordnance is any item that is sufficiently shielded or otherwise so protected that all EIDs contained by the item are immune to adverse effects (safety or reliability) when the item is employed in the EME delineated in MIL-STD-464C.

1.5.3. HERO SUSCEPTIBLE ordnance is any item containing EIDs proven by test or analysis to be adversely affected by electromagnetic energy to the point that safety or reliability of the system is in jeopardy when the system is employed in the EME delineated in MIL-STD-464C.

1.5.4. HERO UNSAFE ordnance is any item containing EIDs that have not been classified HERO SAFE or HERO SUSCEPTIBLE as a result of a HERO test or analysis. Additionally, any item containing EIDs, including those previously classified as HERO SAFE or HERO SUSCEPTIBLE, that has its internal wiring exposed; when tests are being conducted on that item that results in additional electrical connections to the item; when EIDs having exposed wire leads are present and handled or loaded in any but the tested conditions; when the item is being assembled or disassembled; or when such ordnance items are damaged causing exposure of internal wiring or components or destroying engineered HERO protective devices.

Chapter 2

HERO POLICY AND REQUIREMENTS

2.1. DoD Policy.

2.1.1. Per DoDI 3222.03, military platforms, systems, subsystems, and equipment will be mutually compatible in their operational EME. Military systems will meet their operational performance requirements without experiencing unacceptable performance degradation from E3 or causing unacceptable performance degradation from E3.

2.1.1.1. E3 is the impact of the EME upon the operational capability of military forces, equipment, systems, and platforms. It encompasses all electromagnetic disciplines, including electromagnetic compatibility; electromagnetic interference; electromagnetic vulnerability; electromagnetic pulse; electronic protection; electrostatic discharge; and hazards of electromagnetic radiation to personnel, ordnance, and volatile materials such as fuel; and includes the electromagnetic effects generate by all EME contributors including radio frequency systems; ultra-wide band devices; high-powered microwaves systems; and precipitation static.

2.1.1.2. Requirements to control E3 will be developed during the risk reduction phase of the acquisition life-cycle of military platforms, systems, and equipment; and fully defined and evaluated before production and deployment. HERO will be mitigated before the administration of military exercise, operations, and activities.

2.1.2. Per DESR 6055.09, military munitions containing EIDs will be designed or protected such that EMR does not cause an inadvertent initiation, degradation, or disablement. Both direct EMR induced actuation of the EID or electrical coupling to and triggering of the associated firing circuit can occur, especially in a tactical radiated EME.

2.1.2.1. During acquisition, HERO evaluation and certification of munitions will be accomplished, for developmental testing, routine employment mission profiles, and for any anticipated joint or combined operational employment to include all phases of the life-cycle EME.

2.1.2.1.1. HERO certification will be accomplished when legacy military munitions are redesigned or before military munitions are employed in an EME for which they were not previously HERO certified.

2.1.2.1.2. Minimally, HERO certification will involve evaluation without adverse effects on military munitions in an EME relevant to all life-cycle configurations. This life-cycle is referred to as the S4 or STS.

2.1.2.1.3. All data from HERO evaluations will be compiled in a centralized data repository to support the Joint Spectrum Center Ordnance E3 Risk Assessment Database for subsequent use in information applications supporting DoD Components.

2.1.2.2. The DoD Components will take measures (identifying susceptibilities, quantifying EMEs, evaluating risks associated with operating procedures, and establishing tailored emission control instructions) to ensure that HERO effects on military munitions are resolved during the planning of joint or combined operations and training exercises.

2.1.2.3. Areas where the levels of electromagnetic fields constitute a radiation hazard (RADHAZ) to military munitions, or to flammable materials located in areas where military munitions exist, will be clearly marked with warning signs or labels for mobile emitters.

2.1.2.3.1. Warning signs will be posted at any location where radar equipment or other possible sources of EMR might create the potential for premature initiation of military munitions. Warning signs should alert operators of mobile or portable EMR emitter systems to a potential hazard and restrictions when using these emitters (radios, cellular telephones) past the designated point.

2.1.2.3.2. Warning labels may be affixed to all operated portable or mobile emitter systems to alert the user of the potential hazard if the EMR emitter is operated closer than the prescribed safe separation distance (SSD) for the military munitions-related operation of concern where appropriate.

2.2. MIL-STD Requirements.

2.2.1. MIL-STD-464C general requirements indicate that each system will be electromagnetically compatible among all subsystems and equipment within the system and with environments caused by EMR emitters and other electromagnetic sources external to the system to ensure safe and proper operation and performance.

2.3. AF Requirements.

2.3.1. The primary objective is to have all AF ordnance certified HERO SAFE. Uncertified ordnance will be treated as HERO UNSAFE, until suitable modifications are fabricated, evaluated, and retrofitted.

Chapter 3

ROLES AND RESPONSIBILITIES

3.1. AFSEC. AFSEC will:

3.1.1. Establish criteria and guidance to ensure legacy, future, and modified ordnance are safe from EMR hazards.

3.1.2. Establish and maintain procedures for ordnance HERO certifications and assessments, and disseminate these procedures to the AF, such as the AF Sustainment Center and AF Life Cycle Management Center organization commanders, program executive offices, and program managers, for all ordnance under their responsibility.

3.1.3. Certify and assess ordnance in accordance with this instruction within thirty days after receipt of the request.

3.1.4. Maintain a permanent file of AF ordnance certifications in a database, located on the website at **https://cs2.eis.af.mil/sites/11007/hero/default.aspx**. AFSEC/SEW-analyzed MMEs, ordnance exempt from certification, platform EME characterizations (to include a list of all platforms describing the EME with respect to approved certified ordnance location), and the AFSEC SSD Calculator are also located on the website.

3.1.5. Provide guidance for preparing the HERO survey package to determine safe processes for use on AF installations during all S4 and STS phases.

3.1.6. Represent the AF in HERO matters on committees, boards, panels, and programs with other services and foreign nations; Joint Ordnance Commanders Group E3 Ordnance Safety Subgroup; and the Joint Spectrum Center Ordnance E3 Risk Assessment Database configuration control board.

3.1.7. Provide the Joint Spectrum Center HERO certifications for incorporation into the Joint Spectrum Center Ordnance E3 Risk Assessment Database, which provides a list of approved equipment, a joint ordnance repository, and the capability to calculate the associated SSDs. The database will be available to the United States military and government, including their supporting contractors.

3.2. AF Nuclear Weapons Center. AF Nuclear Weapons Center will:

3.2.1. Minimize EMR emissions that could cause a nuclear hazard or weapon ignition in accordance with AFMAN 91-118, *Safety Design and Evaluation Criteria for Nuclear Weapon Systems*.

3.2.2. Specify the EME delineated in MIL-STD-464C in the military characteristics or STS and ensure the designs are to be HERO SAFE during all STS phases.

3.2.3. Request HERO test or analysis when changes are proposed involving the EIDs, directly affecting the EID's susceptibility to EMR, or adding EMR emitters to systems.

3.2.4. Require systems entering the Phase 6.X, or DoD 5000-series acquisition process (life extension program or major modification) undergo HERO certification.

3.2.5. Have variants, which include instrumentation such as measurement hardware, telemetry, flight safety systems, and flight termination system, and contain EIDs or EMR emitters, HERO tested or analyzed. **(T-1)**.

3.3. Major Commands. Major Commands will:

3.3.1. Respond to installation safety offices' HERO safety inquiries and distribute updated HERO information on their installation when it becomes available. **(T-1)**.

3.3.2. Provide the requisite parametric data as specified in this instruction for EMR emitters under their design oversight to the installation safety office to determine SSDs for ordnance. **(T-1)**.

3.3.3. Ensure installations either have a permanent Installation Spectrum Manager, or are afforded the services of one, to facilitate completion of the annual HERO survey package.

3.4. AF Materiel Command and System Lead Commands.

3.4.1. AF Materiel Command and System Lead Commands should ensure engineering support and test facilities are available to verify compliance with the EME delineated in MIL-STD-464C, and testing is conducted in accordance with MIL-HDBK-240A.

3.5. AF Life Cycle Management Center.

3.5.1. AF Life Cycle Management Center will:

3.5.2. Define the HERO EME and establish design and verification requirements (preparing activity for MIL-STD-464C).

3.5.3. Review and provide technical coordination for HERO UNSAFE and SUSCEPTIBLE certifications.

3.5.4. Provide technical advisors on HERO certifications and overall E3 matters to AFSEC/SEW and AF Materiel Command.

3.6. AF Program Executive Offices.

3.6.1. Program executive offices will implement HERO requirements for programs and include the criteria for HERO safety in applicable program documents (e.g., system engineering plans, test and evaluation master plans, and system and equipment specifications) in accordance with MIL-HDBK-237D, *E3 and Spectrum Supportability Guidance for Acquisition Process*.

3.7. Installation Safety Office. Installation safety office will:

3.7.1. Ensure HERO safety procedures are implemented for ordnance on their installation. **(T-1)**.

3.7.2. Request a RADHAZ survey, with the assistance of the installation spectrum manager to determine if required, when all sources of EMR cannot be taken into account, the attenuation of the surrounding environment is unknown, or the minimum SSD cannot be met. **(T-3)**. Funding of the RADHAZ survey is the responsibility of the unit.

3.7.3. Prepare and maintain the installation HERO survey package (see **paragraph 5.12**) and annually review the information against munition procedures performed on the installation in accordance with AFI 91-202, *The United States AF Mishap Prevention Program*, and this instruction. **(T-3)**. Provide the HERO survey package to installation level users, Explosive

Ordnance Disposal, munition supervisors and control, fire department, and any other organization deemed necessary. **(T-3)**.

3.7.4. Review and approve for HERO safety all installation level changes involving the installing, relocating, and upgrading of EMR emitters. **(T-3)**. Add relocated or upgraded EMR emitters to an existing HERO survey package when EMR emitter characteristics (EMR emitter transmitter power, frequency or frequency range, and antenna gain) change which result in a change to the SSDs. Assess whether the SSDs encompass the ordnance location outlined in the existing HERO survey package. Assess the SSDs and identify EMR emitter locations, compare these distances with the distances from known ordnance locations, and incorporate EMR control restrictions (radio silence) into the HERO survey package for the appropriate location. EMR emitters providing fire alarm systems, giant voice systems, and remote pump control or metering do not require individual identification but need to be evaluated for HERO.

3.7.5. Identify upon receipt of new ordnance its location and HERO certification to determine if the existing HERO survey package needs modification. **(T-3)**. Match the ordnance location to the location description, specific conditions, and procedures provided in the existing HERO survey package. Similarly, when ordnance items are relocated, evaluate the new ordnance location, and add the results to the HERO survey package. Consult with the munitions accountable systems officer to determine the type and locations of ordnance items.

3.7.6. Ensure nuclear weapons, in maintenance configurations, and components (limited life components containing EIDs) are treated as HERO UNSAFE, unless specifically HERO SAFE certified, and maintenance operations are conducted only when the EME is restricted under HERO UNSAFE levels. **(T-0)**. This includes the removal of shielding from EID sensitive external connectors. Removal or installation of dust caps and electrical connectors or cables for inspection, Permissive Action Link, weapons load, or weapons shipping operations are not considered maintenance as applied in this instruction.

3.7.6.1. Maintain the appropriate SSD for HERO UNSAFE nuclear weapons and components and verify that the EME is below HERO UNSAFE levels utilizing the RADHAZ survey. **(T-0)**.

3.7.6.1.1. If a RADHAZ survey or installation HERO survey package is not up to date or does not take into account all EMR emitters present, determine the appropriate SSD using AFSEC SSD Calculator. **(T-3)**.

3.7.6.1.2. If the EMR emitter is an MME, refer to guidance provided in **paragraph 5.5**.

3.7.6.2. HERO UNSAFE nuclear weapons and components are only authorized in approved mobile maintenance platforms, e.g., the Secure Transportable Maintenance System (**paragraph 5.10**) and facilities maintaining an EME at or below HERO UNSAFE levels. **(T-0)**. Methods to verify if a facility can maintain an EME at or below HERO UNSAFE levels consist of having a RADHAZ survey performed or using the AFSEC SSD Calculator to ensure the HERO UNSAFE SSD are adhered to.

3.8. Installation Spectrum Manager. Installation spectrum manager will:

3.8.1. Provide the installation safety office with EMR source list and characteristics, as listed in **paragraph 5.12.2**. **(T-1)**. If the installation does not have an installation spectrum manager, contact the local communications squadron or the host-nation equivalent.

3.8.2. Coordinate between the using unit and weapons safety office prior to relocating EMR emitters or changing characteristics, as listed in **paragraph 5.12.2**. **(T-1)**.

3.8.3. Inform the installation safety office ninety days prior to adding or decreasing the amount of EMR emitters. **(T-1)**.

3.8.4. Assist installation safety office in determining whether or not all sources of EMR have been taken into account or the attenuation of the surrounding environment is known or unknown. **(T-1)**.

3.8.5. Advise installation safety office on the necessity of having a RADHAZ survey conducted. **(T-1)**.

3.8.6. Clarify which EMR emitters are active or inactive in their identification and characterization of EMR emitters. **(T-1)**.

3.9. Civil Engineering Squadron. Civil engineering squadron will:

3.9.1. Report any using unit project plans or efforts to install new or relocate EMR emitters or to change its characteristics (EMR emitter transmitter power, frequency or frequency range, and antenna gain) to the installation spectrum manager and weapons safety office. **(T-1)**.

3.9.2. Place warning signs along transportation routes approaching military munitions operations at designated locations. **(T-0)**. Contact the installation safety office for identification of transportation routes requiring signage.

3.9.3. Ensure HERO warning symbols are posted at any location where radar equipment or other possible sources of EMR are located, that might create the potential for premature initiation or dudding of military munitions. **(T-0)**.

3.10. Munitions Squadrons and Organizations Utilizing Ordnance.

3.10.1. Munitions squadrons and organizations utilizing ordnance will:

3.10.2. Provide the installation safety office with current local explosives operating instructions, locations where operations are planned, and a list of ordnance. **(T-1)**.

3.10.3. Apply control measures to mitigate identified HERO effects to operations. **(T-1)**.

3.11. Munitions Accountable Systems Officer. Munitions Accountable Systems Officer will:

3.11.1. Consult with the installation safety office to determine the type and location of ordnance items and ensure Operational Security and security certification requirements are enforced. **(T-1)**.

3.11.2. Identify ordnance locations to the installation safety office for inclusion on the Explosive Location Map, as well as the ordnance transportation routes. **(T-1)**. This information is useful when performing RADHAZ surveys.

3.12. Program Manager. Program manager of existing, new, or modified ordnance will:

3.12.1. Provide information to the HERO evaluation organization concerning the design, development, and evaluation schedules for items under their cognizance; designate all subsystems containing EIDs be evaluated individually; and provide a list of all affected complete round codes, if applicable, anticipated deployable platforms (e.g., aircraft and ground vehicles), with applicable launcher or bomb rack, item nomenclature, DoD Identification Codes, National Stock Numbers, part numbers, cognizant branch, field station, and contractor concerned with development phase. **(T-1)**.

3.12.2. Provide cost and scheduling estimates, for consultation, analyses, and testing services. **(T-1)**.

3.12.3. Ensure adequate funding is provided to the HERO evaluation organization, which will provide test plans, test reports (including data), and a plan of action and milestones. **(T-1)**.

3.12.4. Review and approve the test plan prior to the start of the HERO test submitted by the HERO evaluation organization for accuracy of handling and loading procedures and hardware nomenclature, and provide comments prior to the performance of the HERO tests. **(T-1)**.

3.12.5. Attempt to resolve the issue involving HERO test or analysis indicating a classification other than HERO SAFE. **(T-1)**.

3.12.6. Submit for certification complete rounds and any system containing EIDs at the appropriate assembly level. **(T-1)**.

3.12.7. May request component certification to support operations in the field.

3.12.8. Request HERO certification or assessments from AFSEC/SEW and provide the HERO test or analysis report as rationale, complete round code (if applicable), DoD Identification Codes, National Stock Numbers, and part numbers. **(T-1)**. This ensures production design is the same as the tested configuration with respect to HERO.

3.12.9. Provide a risk assessment for HERO UNSAFE and HERO SUSCEPTIBLE ordnance certifications in accordance with AFI 91-202 and MIL-STD-882E, *DoD Standard Practice for System Safety*, for determining the relative level of risk associated consequence and probability. **(T-0)**. Base the risk assessment upon currently available E3 test data or analysis and assess against the completeness, or lack thereof, versus EME delineated in **Table 5.1** for HERO UNSAFE and **Table 5.2** for HERO SUSCEPTIBLE. **(T-1)**.

Chapter 4

ORDNANCE HERO CERTIFICATION AND ASSESSMENT

4.1. HERO Certification.

4.1.1. The HERO evaluation organization may be either an AFSEC approved contractor or a DoD facility: Naval Surface Warfare Center, Dahlgren Division Laboratory, E3 Assessment and Evaluation Branch (B52), HERO program manager; United States Army White Sands Test Center, E3 Test Facility, Electromagnetic Effects Division; or the United States Army Redstone Test Center, System Engineering Directorate, commercial.

4.1.2. HERO evaluation organization will schedule the HERO test based on the availability of facilities and assets, instrument the EIDs, install them in the ordnance test article, conduct the test, and submit the HERO test or analysis report to the program manager with a HERO classification recommendation. **(T-1)**.

4.1.3. Ordnance may be certified as HERO UNSAFE if testing or analysis is lacking or HERO SUSCEPTIBLE if test results indicate failure to meet EME delineated in MIL-STD-464C in all S4 or STS phases and appropriate margins.

4.1.4. Testing or analysis will address the ordnance item in all S4 or STS phases and appropriate margins. **(T-1)**. Operational history alone does not provide justification for HERO certification no matter how much time has passed without incident.

4.1.5. Ordnance components containing EIDs do not require HERO certification but are HERO UNSAFE. A complete round code is any combination of DoD Identification Codes to form a higher assembly. If applicable, identify a complete round by using the complete round code in the complete round dictionary maintained by the Global Ammunition Control Point at Hill AF Base, Utah.

4.2. HERO Assessment.

4.2.1. A HERO assessment is necessary to support test and evaluation (supports aircraft and store compatibility) any time prior to low rate initial production or production approval. The program executive office or program manager will request a HERO assessment from AFSEC/SEW and provide supporting test data or analysis in accordance with MIL-HDBK-240A.

4.2.2. Test assets containing telemetry will require an intersystem HERO test or analysis. Because telemetry is an emitter, program manager will provide the telemetry characteristics (see **paragraph 5.12.2**) to determine the appropriate SSDs. **(T-1)**.

4.2.3. Test data or analysis used to support the HERO assessment may be used to support HERO certification if modifications performed after the assessment do not directly affect the EIDs or their EMR susceptibility.

4.2.4. At a minimum, conventional ordnance program executive offices and program managers or AF Nuclear Weapons Center will provide test data or analysis regarding all EIDs having a safety consequence. **(T-1)**. If risk is accepted for those EIDs having a reliability consequence (dudding or inadvertently firing) the item is assessed for safety only. **(T-1)**. Test

articles used in the development or flight testing of nuclear weapons (Joint Test Assemblies) will require HERO assessment. **(T-1)**.

4.3. HERO Certification and Assessment Requests.

4.3.1. HERO certification or assessment (memorandum for certifications or email format for assessments) requests will consist of recommended HERO classification, test report or analysis, and a technical point of contact familiar with the technical data or analysis. **(T-1)**.

4.4. Ordnance Modifications Requiring HERO Evaluation.

4.4.1. EID changes that require HERO evaluation consist of changing firing stimuli response characteristic, changing the type of transducer that converts electrical input to energetic output, changing the EID's fit or form, changing EMR suppression components, and relocating EIDs to within ¼ λ, approximately 0.667 inches, of wiring that enters or exits ordnance envelope.

4.4.2. Firing circuit changes that required HERO evaluation consist of changing all non-direct current firing circuits (always requires testing), relocating circuits within ¼ λ, approximately 0.667 inches, of wiring that carries signals or enters or exits ordnance envelope, changing EMR suppression components, and changing firing circuits.

4.4.3. S4 and STS phase changes that require HERO evaluation consist of changing EMR levels in authorized assembly and disassembly spaces for operations that expose EIDs to internal wiring or ordnance subassemblies that contain EIDs, and changing shipping and storage containers where the container is intended to provide EMR protection.

Chapter 5

MAINTAINING SAFE HERO OPERATIONS

5.1. Overview.

5.1.1. Unless otherwise stated, ordnance consists of conventional ordnance, nuclear weapons, and components containing EIDs. The primary method to protect ordnance from EMR hazards is to ensure ordnance is never located where the EMR electric field or power density is sufficiently high to couple enough electrical energy into the device to initiate the EIDs or degrade performance. In addition, shielding, filtering, bonding, grounding, or a combination thereof may be used if an approved analysis or test supports such EMR protection.

5.1.2. A nuclear weapon is certified HERO SAFE in an ultimate user configuration, as an all-up round. Nuclear weapon systems (intercontinental ballistic missiles and cruise missiles) components containing EIDs (e.g., reentry vehicles, fuzes, and cruise missile warheads) certifications will be based on their particular configurations during STS phases; e.g., the B61 weapon family are classified HERO SAFE in all up round configuration, even when the J-1 dust cover cap, also known as the "EMR" cap, strike enable plug, and shipping plug are removed during Permissive Action Link, weapons load, or shipping operations.

5.2. Ordnance Operation HERO Requirements.

Personnel handling ordnance will:

5.2.1. Plan ordnance operations so that the ordnance has minimal exposure to EME. **(T-3)**. Use the HERO survey package for guidance.

5.2.2. Not alter ordnance or handle umbilical cables and cable connectors, or expose internal wiring and firing circuits by assembling or disassembling the ordnance unless authorized or approved by technical order or higher authority. **(T-1)**.

5.2.3. Treat ordnance containing disassembled EIDs or when exposed EIDs, firing circuits, or wiring are present as HERO UNSAFE. **(T-1)**.

5.2.4. Transport HERO UNSAFE and SUSCEPTIBLE ordnance in sealed, all-metal or EMR impervious containers, which is a HERO SAFE configuration. **(T-1)**. When transporting ordnance in a vehicle, the minimum SSD requirements will be adhered to. **(T-1)**. Transportation of HERO UNSAFE nuclear weapons or components without EMR protection will not be authorized. **(T-1)**.

5.3. Maximum Allowable Environment (MAE) Requirements.

5.3.1. MAE is the highest radiated electric field strength (E_{MAE}) in Volts/meter-root mean square (V/m-rms) over a specific frequency (f) range in Megahertz (MHz) which ordnance can be exposed to without exceeding EID HERO margins.

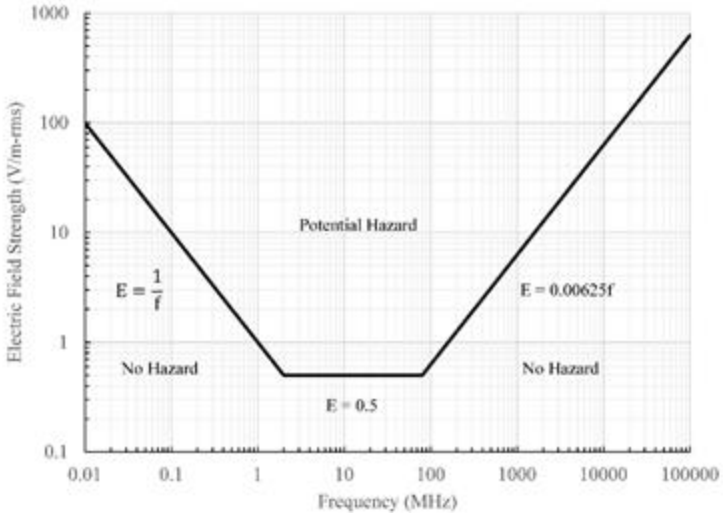
5.3.2. HERO SAFE ordnance will not be exposed to E_{MAE} exceeding the levels delineated in MIL-STD-464C. **(T-0)**.

5.3.3. HERO UNSAFE ordnance will not be exposed to E_{MAE} exceeding the levels delineated in **Table 5.1** and illustrated in **Figure 5.1**. **(T-0)**.

Table 5.1. HERO UNSAFE Conventional Ordnance E_{MAE}.

Frequency Range (MHz)	E_{MAE} (V/m-rms)
$0.01 \le f < 2$	$\frac{1}{f}$
$2 \le f < 80$	0.5
$80 \le f \le 100{,}000$	0.00625f

Figure 5.1. HERO UNSAFE Conventional Ordnance E_{MAE} Curve.

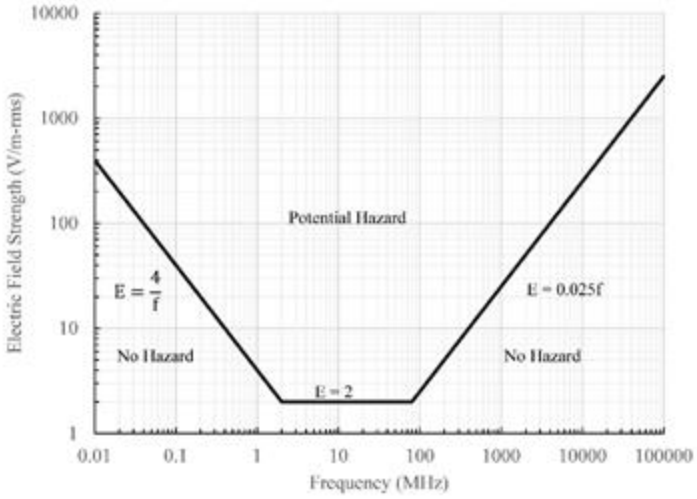


5.3.4. HERO SUSCEPTIBLE ordnance will not be exposed to E_{MAE} exceeding the levels delineated in **Table 5.2** and illustrated in **Figure 5.2**. **(T-0)**. HERO SUSCEPTIBLE ordnance may have a MAE that is less restrictive than the MAE presented (worst-case), otherwise it is used when no other information is available.

Table 5.2. HERO SUSCEPTIBLE Conventional Ordnance E_{MAE}.

Frequency Range (MHz)	E_{MAE} (V/m-rms)
$0.01 \le f < 2$	$\frac{4}{f}$
$2 \le f < 80$	2
$80 \le f \le 100{,}000$	0.025f

Figure 5.2. HERO SUSCEPTIBLE Conventional Ordnance E_{MAE} Curve.

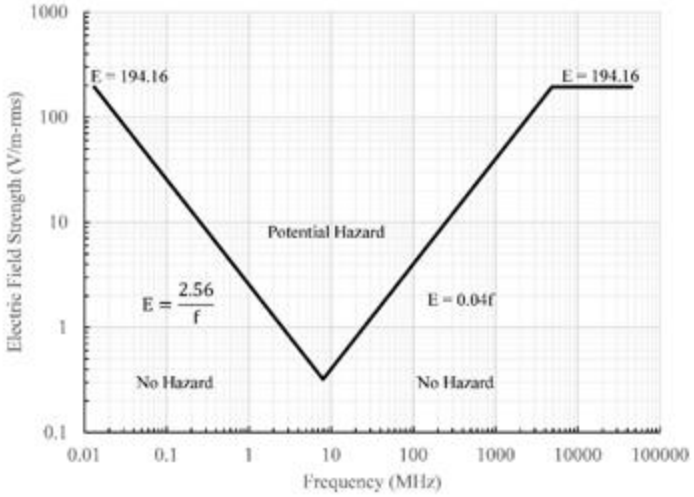


5.3.5. Unless otherwise specified in the HERO certification, HERO UNSAFE nuclear weapons will not be exposed to E_{MAE} exceeding the levels delineated in **Table 5.3** and illustrated in **Figure 5.3**. **(T-1)**.

Table 5.3. HERO UNSAFE Nuclear Weapon E_{MAE}.

Frequency Range (MHz)	E_{MAE} (V/m-rms)
$f < 0.0132$	194.16
$0.0132 \leq f < 8$	$\frac{2.56}{f}$
$8 \leq f \leq 4{,}850$	$0.04f$
$4{,}850 \leq f < 45{,}000$	194.16

Figure 5.3. HERO UNSAFE Nuclear Weapon E_{MAE} Curve.



5.4. SSD Requirements.

5.4.1. EMR emitters must be maintained at a minimum 10 feet SSD from HERO SAFE ordnance. Alternative SSDs may be authorized in accordance with the AFSEC/SEW approval for use memorandum, ordnance-specific technical orders, or when determined by the installation safety office through the AFSEC SSD Calculator. **(T-1)**.

5.4.2. EMR emitters must maintain the appropriate SSD for HERO UNSAFE and SUSCEPTIBLE ordnance. **(T-1)**. If relying on a RADHAZ survey, the E_{MAE} will not exceed the levels delineated in **paragraph 5.3**. Otherwise, use the AFSEC SSD Calculator which uses the equations specified in **Table 5.4** and **Table 5.5**, where the effective isotropic radiated power (EIRP) is in Watts. **(T-1)**. The AFSEC SSD Calculator is limited to frequencies specified and, for frequencies not included, request assistance from AFSEC/SEW.

Table 5.4. AFSEC SSD Calculator Equations (feet).

Conventional Ordnance			Nuclear Weapons	
Frequency Range (MHz)	HERO UNSAFE	HERO SUSCEPTIBLE	Frequency Range (MHz)	HERO UNSAFE
$0.01 \le f < 2$	$18f\sqrt{EIRP}$	$4.5f\sqrt{EIRP}$	$0.0132 < f$	$0.0925\sqrt{EIRP}$
$2 \le f < 80$	$36\sqrt{EIRP}$	$9\sqrt{EIRP}$	$0.0132 \le f < 8$	$7.01f\sqrt{EIRP}$
$80 \le f \le 100{,}000$	$\frac{2{,}873\sqrt{EIRP}}{f}$	$\frac{718\sqrt{EIRP}}{f}$	$8 \le f < 4{,}850$	$\frac{448.625\sqrt{EIRP}}{f}$
			$4{,}850 \le f < 45{,}000$	$0.0925\sqrt{EIRP}$

5.4.3. There are exceptions whereby EMR emitters are expected to be, or are required to be, closer than 10 feet to HERO certified ordnance. Their proximity to ordnance and low-powered EMR emitters requires a different technique for mitigating HERO. The AFSEC SSD Calculator will determine SSDs less than 10 feet if the EMR emitter's characteristics meet the criteria set forth in **Table 5.5**.

Table 5.5. Minimum SSD Exceptions for HERO Certified Ordnance.

Minimum SSD (feet)	HERO Certification		
	SAFE	SUSCEPTIBLE	UNSAFE
5	$0.5 < EIRP \le 5$ All f	$EIRP \le 0.5$ $f \ge 100$ MHz	$0.025 < EIRP \le 0.1$ 200 MHz $\le f <$ 1 GHz
1	$0.1 < EIRP \le 0.5$ All f	$0.025 < EIRP \le 0.1$ $f \ge 200$ MHz	$0.025 < EIRP \le 0.1$ $f \ge 1$ GHz
0*	$EIRP \le 0.1$ All f	$EIRP \le 0.025$ All f	$EIRP \le 0.025$ $f \ge 100$ MHz

***WARNING: Do not touch antenna to ordnance.**

5.4.4. For multiple EMR emitters collocated, determine the SSD for each individual EMR emitter and if any one affects munitions operations, request a RADHAZ survey. **(T-1)**.

5.5. MME Requirements.

5.5.1. Personnel operating MMEs around ordnance or nuclear weapons containing EIDs shall comply with the following guidance. **(T-1)**:

5.5.2. MMEs are devices which can be brought closer to ordnance due to their small size and increased mobility. MME examples include cellular phones, active pagers, tablet computers, land mobile radios, smart watches, cellular and Wi-Fi antennas installed in devices or vehicles.

5.5.3. MMEs constitute a RADHAZ only when transmitting EMR. MME transmissions occur either when the operator actively interfaces with the device, e.g., land mobile radio keying or voice-activation, or when the MME has the capability of automatically transmitting regardless of active operator interface. Examples of automatic transmission include, but are not limited to, encrypted land mobile radios connecting to relay towers, e.g., trunking systems, cellular phones connecting to network towers, or tablet computers connecting to Wi-Fi hotspots.

5.5.4. MMEs do not automatically transmit when that capability is switched off, provided active user interface does not result in transmissions, e.g., airplane mode, switching land mobile radios to unencrypted mode. Disable automatic transmissions prior to using these MMEs at less than the SSD for ordnance containing EIDs. **(T-1)**. Implement procedures to prevent active operator actions that result in transmissions when MMEs are at less than SSD. **(T-1)**.

5.5.5. For MMEs not currently listed on the HERO website, the SSDs are determined using the AFSEC SSD Calculator. If insufficient information is available to utilize the AFSEC SSD Calculator, request assistance from AFSEC/SEW and provide the Federal Communications Commission Identification, or actual test data or analysis. AFSEC/SEW determines the appropriate SSDs and responds with a memorandum within thirty days after receipt of the request.

5.5.6. MMEs or their batteries will not be charged in areas where ordnance is undergoing maintenance, both assembly and disassembly, or stored due to the possibility of batteries exploding. **(T-1).**

5.5.7. Multiple MMEs (two or more).

5.5.7.1. Multiple MMEs will be authorized around ordnance, regardless of classification, if the appropriate SSD is maintained for each MME outdoors.

5.5.7.2. Multiple MMEs which have SSDs 10 feet or less will be authorized around HERO UNSAFE or HERO SUSCEPTIBLE ordnance indoors but must maintain a minimum SSD of 10 feet. **(T-1)**. Multiple MMEs which have SSDs greater than 10 feet will not be authorized indoors around HERO UNSAFE and SUSCEPTIBLE ordnance unless authorized by AFSEC/SEW; the aggregated effects on the ambient or volumetric electromagnetic fields in enclosed spaces may increase as a result of complex cavity effects. **(T-1)**.

5.5.7.3. If a RADHAZ survey, completed by organizations in **paragraph 5.9.4**, includes the use of multiple MMEs indoors without exceeding E_{MAE} levels for the ordnance, multiple MMEs will be permissible. **(T-1)**. Submit the completed RADHAZ survey to AFSEC/SEW for review and approval for use of multiple MMEs.

5.5.7.4. Multiple MMEs will be authorized around HERO SAFE ordnance indoors but must maintain a minimum SSD of 10 feet. **(T-1)**.

5.5.8. All remote entry devices, including car entry keys, must maintain a SSD of 10 feet. **(T-1)**.

5.6. Other Requirements.

5.6.1. Restrict the following items from coming into physical contact with ordnance regardless of HERO classification: desktop computers, laptops, tablets, associated hardware (e.g., printers and mice).

5.6.2. Items not configured with EMR emitters.

5.6.2.1. Must be certified to meet Title 47, Code of Federal Regulations, Part 15, *Radio Frequency Devices*, current edition, Class A and B limits, and labeled accordingly. **(T-1)**. Such devices are not MMEs and are not to be factored in multiple MME restrictions.

5.6.2.2. Must maintain a SSD of 10 feet if not in compliance with regulations or properly labeled. **(T-1)**.

5.7. Ordnance Exposed to EMR.

5.7.1. Ordnance will be unserviceable after exposure to E_{MAE} exceeding levels defined for their specific HERO classification due to the potential for both direct EMR induced EID actuation and inadvertent electrically power firing circuit activation or dudding. **(T-1)**.

5.7.2. For conventional ordnance, unserviceable conditions must be reported through appropriate service channels. **(T-1)**.

5.7.3. For nuclear weapons, SSD violations, or exposure to E_{MAE} exceeding levels defined for their specific HERO classification must be reported via Dull Sword in accordance with AFMAN 91-221, *Weapon Safety Investigations and Reports*. **(T-1)**. Weapons may remain operational pending Dull Sword resolution. If AFSEC/SEW determines a SSD violation has occurred and E_{MAE} exceeded, submit an Unsatisfactory Report in accordance with Technical Order 11N-5-1, *Unsatisfactory Reports*. The weapon may continue to remain operational pending official resolution of Unsatisfactory Report from the Department of Energy for the incident.

5.7.4. During emergency situations, as defined in DoD Manual 3150.02, *DoD Nuclear Weapon System Safety Program Manual*, HERO SSD restrictions should be strictly adhered to. However, when violations of the SSDs are not the primary cause of lost or degraded weapon reliability, deviations to SSDs under emergency situations are authorized. **(T-1)**. Reporting of exposure to EMR will be accomplished as required in accordance with AFMAN 91-221.

5.8. HERO Margin Requirements.

5.8.1. HERO margin is the difference between the maximum no-fire stimulus and the permissible EID response level.

5.8.2. Conventional ordnance will have a margin of 16.5 decibels for EIDs having a safety consequence and 6 decibels for EIDs having a reliability consequence in accordance with MIL-STD-464C.

5.8.3. For EIDs having safety consequences, nuclear weapons and components will have a margin of 16.5 decibels and intercontinental ballistic missile components will have a margin of 20 decibels. **(T-1)**. Nuclear weapon EIDs having reliability consequences are taken into account in the system reliability determination.

5.9. RADHAZ Survey.

5.9.1. The RADHAZ survey consists of performing EME measurements and documenting the results. Conclusions and recommendations regarding the use of an EMR emitter during ordnance operations are included and presented with supporting documentation. Provides measurement of EMR fields, as well as a more detailed look at the operational environment. In some instances, data gathered by the RADHAZ survey alleviates some restrictions imposed by this instruction.

5.9.2. The resulting report may have the following:

5.9.2.1. Installation layout of the area showing transportation routes of EIDs and ordnance subsystems, ordnance locations, EID maintenance, storage, and both assembly and disassembly areas.

5.9.2.2. Locations of all EMR emitters and their characteristics as listed in the HERO survey package.

5.9.3. RADHAZ survey results are sent to the originating installation or command with information copies sent to all agencies involved in the decision process.

5.9.4. If necessary to be accomplished, the RADHAZ survey will be performed by either the 85th Engineering Installation Squadron or the Naval Surface Warfare Center, Dahlgren Division, E3 Assessment and Evaluation Branch (B52). The 85th Engineering Installation Squadron, Keesler AF Base, Mississippi, is the AF provider of electromagnetic compatibility, electromagnetic interference, EMR and electromagnetic pulse field measurements, and analytical capabilities. For technical information, contact the 85th Engineering Installation Squadron/SCY at **85EIS.SCYM.1@us.af.mil**.

5.10. Secure Transportable Maintenance System.

5.10.1. The Secure Transportable Maintenance System does not provide sufficient protection against EMR. The AFSEC SSD Calculator determines appropriate SSD. **(T-1)**. MMEs are not authorized inside the Secure Transportable Maintenance System where HERO UNSAFE nuclear weapons or components are maintained or stored if not in a HERO protective container, unless authorized by AFSEC/SEW. **(T-1)**.

5.10.2. MMEs are authorized inside the protective aircraft shelter containing a Secure Transportable Maintenance System, provided SSDs from associated emitters to the Secure Transportable Maintenance System are met for operations involved. **(T-1)**.

5.10.3. An MME having an SSD of 10 feet or less, or multiple MMEs, all of which have SSDs 10 feet or less, are authorized without restriction when the vault is completely lowered.

5.11. X-Rays.

5.11.1. Damage to explosives, resulting from exposure to X-ray radiation is related to total dose exposure time (dose rate in some instances), and the physical properties of the material.

5.11.2. With the addition of a safety margin, the X-ray dose will not exceed 1,400 rads/minute and the total dose will not exceed 100,000 rads. **(T-1)**. Under these conditions, no HERO problems are expected and explosives should remain safe and reliable. Total dose exceeding 100,000 rads likely changes decomposition rates and increases the time to explosion.

5.12. HERO Survey Package. The HERO survey package will consist of:

5.12.1. Locations that are limited by HERO represented in the S4 or STS phases for specific ordnance items. **(T-3)**. Ordnance may include components, subsystems, all-up rounds, or HERO untested ordnance.

5.12.2. List of EMR emitters and SSDs, which is generated using the AFSEC SSD Calculator. **(T-3)**. For each emitter, document the military nomenclature or, if appropriate, the manufacturer and model, location, signal type (continuous or pulse-modulated), frequency type (single or band), EMR emitter transmitter power (average power for continuous and peak power for pulse-modulated), and antenna gain, in addition to pulse width and pulse repetition frequency for pulse-modulated.

5.12.3. List identifying the ordnance at the installation and their HERO certification. **(T-3)**. In some instances an EID item Technical Order may provide HERO classification. Should there be a conflict, this publication takes precedence in determining the HERO classification of the item.

5.12.4. The Explosive Location Map showing potential EMR zones that could affect munitions operations involving HERO SUSCEPTIBLE or HERO UNSAFE ordnance. **(T-3)**. Plot only those zones that impact munition operations to include primary and alternate explosive routes. Include all relevant operations of the S4 or STS phases.

5.12.5. An assessment, in writing, for existing and new EMR emitter hazards to operations. **(T-3)**. If required, the assessment is included as part of the site plan submittal. Once EMR emitters, ordnance, and their respective locations have been identified, use the installation Explosive Location Map to determine the distances between the EMR emitters and various ordnance locations. Identify the EMR emitter requiring HERO EMR control for each ordnance location, if required. If mitigation is necessary, provide a description of the hazard controls. Different locations may have identical HERO EMR control imposed in more than one location in order to limit the number of HERO controls imposed.

5.12.6. The RADHAZ survey results, if applicable. **(T-3)**. If a RADHAZ survey has been performed, determine if the measured EME levels are acceptable at the locations in question.

Chapter 6

PLATFORM EME CHARACTERIZATION

6.1. Overview.

6.1.1. The characterization process for the host platform's EME is a key step in weapon system integration process and supports compliance to the HERO certification requirements. This process applies to both ground-base and airborne platforms. Airworthiness requirements are defined by AFI 62-601, *United States AF Airworthiness,* and specifically for HERO by MIL-HDBK-516C, *Airworthiness Certification Criteria*.

6.1.2. This integration process is an assessment looking at the balance of locating the ordnance at a sufficient distance apart from on-board EMR emitters in order to adhere to the SSD criteria of the given ordnance. To properly manage that balance, knowledge is required of the ordnance capability to withstand EME (HERO classification and the host platform EMR emitters' capabilities).

6.1.3. If the characterization of the EME at the store locations indicate that the EME does not exceed HERO SAFE levels if the emitters are operational, ordnance that has not been secured to the platform, e.g., missiles on trailer, bomb lift truck, or being otherwise carried or staged immediately adjacent to the platform, SSDs do not apply. If the EME exceeds HERO SAFE levels the emitters must be turned off during such operations.

6.2. Process.

6.2.1. Ordnance will be integrated onto the host platform as not to exceed the safe exposure levels of the EME delineated by the ordnance classification. **(T-1)**.

6.2.2. The program manager will consider airborne platform EME characterization as an element of SEEK EAGLE certification in accordance with AFI 63-104, *The SEEK EAGLE Program,* and of the airworthiness certification in accordance with AFI 62-601. **(T-1)**.

6.2.3. The program manager will characterize their platform's (e.g., aircraft and ground vehicles) EME by test or analysis, provide the information to AFSEC/SEW, and update the characterization when modifications to the system affect the platform EME throughout the system life-cycle. **(T-1)**. The EME characterization verifies that intra-system EME does not pose a hazard to platform carried ordnance. Resulting platform EME characterization includes all documentation achieved through testing or analysis.

6.2.4. Program manager will include the EME in enclosed cavities such as weapons bays, by system level test or analysis, which directly impacts ordnance and retain the information to ensure ordnance remains safe from EMR hazards. **(T-1)**.

6.2.5. The data may be acquired by accessing existing historical data, component or system testing, or analysis. The EME characterization will consist of:

6.2.5.1. A full list of ordnance locations. **(T-1)**. For airborne platforms, include a full list of ordnance locations, such as stations: fuselage station, butt line and water line. Include EMR emitter antenna transmit patterns, side lobes, and gain; EMR emitter transmitter power characteristics (peak power, average power, and duty cycle); and frequency or frequency range of operation and associated bandwidth; all of which are typically

determined by the EMR emitter's certification datasheet (DD Form 1494, *Application for Equipment Frequency Allocation*).

6.2.5.2. The determined EME/SSD at each location as it is related to each of the HERO classifications. **(T-1)**. In cases where the EME/SSD are not met, a corrective action to remedy the conflict will be accomplished or limitations must be placed on the host platform to reduce or eliminate risk. **(T-1)**. If a corrective action cannot be accomplished and the situation impacts ordnance reliability, ordnance premature firing, or airworthiness, the limitation placed upon the host platform or the ordnance to reduce or eliminate risk will be coordinated and accepted by the appropriate risk acceptance authority. **(T-1)**.

6.2.5.3. A cover memorandum with a cumulative HERO summation for the platform based on testing or engineering analysis. **(T-1)**. This summation is the most restrictive HERO classification of all involved ordnance. A risk acceptance package will be provided for each ordnance location where the E_{MAE} exceeds the levels delineated in MIL-STD-464C. **(T-1)**. Also, document if the platform can accommodate HERO UNSAFE and SUSCEPTIBLE ordnance and what mitigation steps are required to reduce the EME. **(T-1)**.

6.2.6. Typically, the platform EME characterization is performed using computer-based calculations and equations. The EME and resulting SSDs have a very strong dependency upon platform geometry, the complexity of the EMR emitter radiation patterns and side lobes, reflections, multiple antenna locations, cavities, enclosed weapon bays, and equipment with classified performance parameters add to the overall complexity of the analysis. In some cases it is prudent and sufficient to make simplified assumption to keep calculations in a first order line of sight SSD determination. When these calculations yield noncompliant EME, SSD, or overall severe limitations, a more detailed analysis or in some cases testing may be required.

6.2.7. EME characterization process is performed by an experienced E3 engineer who has detailed knowledge of the host platform's electromagnetic performance characteristics. **(T-1)**. This responsibility typically falls upon the platform program manager's technical staff such as the chief engineer or the platform contractor responsible for E3 integration. Additional technical support for consultation or performing these assessments can be provided by the AF E3 subject matter experts; their contact information can be found on the website at **https://cs2.eis.af.mil/sites/21373/E3/default.aspx**.

JOHN T. RAUCH
Major General, USAF
Chief of Safety

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

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AFI 62-601, *United States USAF Airworthiness*, 11 June 2010

MIL-HDBK-516C, *Airworthiness Certification Criteria*, 12 December 2014

AFI 63-104, *The SEEK EAGLE Program*, 21 January 2005

Adopted Forms

AF Form 847, *Recommendation for Change of Publication*

DD Form 1494, *Application for Equipment Frequency Allocation*

Abbreviations and Acronyms

AF—Air Force

AFI—Air Force Instruction

AFMAN—Air Force Manual

AFPD—Air Force Policy Directive

AFSEC—Air Force Safety Center

AFSEC/SEW—Air Force Safety Center/ Air Force Weapons Safety

DESR—Defense Explosives Safety Regulation

DoD—Department of Defense

DoDD—Department of Defense Directive

DoDI—Department of Defense Instruction

DoDM—Department of Defense Manual

E3—Electromagnetic Environmental Effects

EID—Electrically Initiated Device

EIRP—Effective Isotropic Radiated Power

$\mathbf{E}_{\mathbf{MAE}}$—Electric Field Strength Maximum Allowable Environment

EME—Electromagnetic Environment

EMR—Electromagnetic Radiation

f—Frequency

HERO—Hazards of Electromagnetic Radiation to Ordnance

m—Meter

MAE—Maximum Allowable Environment

MHz—Megahertz

MME—Modern Mobile Emitter

OPR—Office of Primary Responsibility

RADHAZ—Radiation Hazard

rms—Root Mean Square

S4—Stockpile-to-Safe Separation Sequence

SSD—Safe Separation Distance

STS—Stockpile-to-Target Sequence

V—Volts

Terms

Antenna—Part of the receiving or emitting system designated to radiate or receive electromagnetic energy.

Antenna Gain—Performance figure combining the antenna's directivity and electrical efficiency. In an emitting antenna, describes how well the antenna converts input power into electromagnetic fields headed in a specific direction. In a receiving antenna, describes how well the antenna converts electromagnetic fields arriving from a specific direction into electrical power.

Bridgewire—Metal wire heated by the passage of electrical current, which initiates the deflagration or detonation charge surrounding the wire.

Continuous Signal—Uninterrupted electromagnetic energy produced by an EMR emitter. Amplitude, frequency, and phase modulations are considered continuous because the electromagnetic energy is continuously present. The power may vary with time due to modulation, but the electromagnetic energy is always present.

Dudding—The inability of the EID to function as intended because their physical and electrical properties have been altered due to application or repeated application of energy below that required to initiate the device.

Duty Cycle—Ratio of time-on and time-off over an interval of a pulse-modulated EMR emitter.

Effective Isotropic Radiated Power—Amount of power a theoretical isotropic antenna would emit to produce a peak power density observed in the direction of maximum antenna gain.

Electric Field Strength—Electric field is a region associated with the distribution of electric charge or a varying magnetic field in which forces due to that charge or field act upon other electric charges. The electric field strength is a quantitative expression of the intensity of an electric field at a particular location in V/m.

Electromagnetic Environment—The resulting product of the power and time distribution, in various frequency ranges, of the radiated or conducted electromagnetic emission levels that may be encountered by a military force, system, or platform when performing its assigned mission in its intended operational environment (in the case of ordnance, during its S4 or STS phases). It is dynamically comprised of electromagnetic energy from a multitude of natural sources (e.g., lightning, precipitation static, electrostatic discharge, and galactic and stellar noise) and man-made sources (electrical and electronic systems). When defined, the EME will be for a particular time and place. Specific equipment characteristics, such as operating frequency and EMR emitter transmitter power levels, operational factors, such as distance between items and force structure and frequency coordination, all contribute to the EME.

Frequency (f)—Measure of how many times the peak of an electromagnetic wave passes a particular point each second in cycles per second, hertz.

Mission-Critical—Unless otherwise defined in the procurement specifications, a term applied to a condition, event, operation, process, or item which if performed improperly may prohibit execution of the mission, significantly reduce the operational capability, or significantly increase system vulnerability.

Power Density—Power flow rate of an electromagnetic wave at a specific point in a medium.

Pulse-Modulated Signal—Electromagnetic energy transmitted by pulse-modulated radars consisting of a series of equally spaced pulses separated by very short but relatively long periods during which no electromagnetic energy is transmitted.

Radiation Hazard (RADHAZ)—Radio frequency electromagnetic fields of sufficient intensity to cause spark ignition of volatile combustibles, actuate electro-explosive devices, or otherwise negatively impact weapons components and subcomponents.

RADHAZ Survey—Survey of a specific operational environment, or defined set of environments, wherein the information contained in HERO survey packages and the installation safety office's annual review is not sufficient to know all potential exposures of weapons and related components to RADHAZ.

Rad—A unit of absorbed dose of ionizing radiation equal to an energy of 100 ergs per gram of irradiated material.

Stockpile—to-Safe Separation Sequence—Progressive stages (phases) that begin at the time the ordnance is manufactured and continue until it is expended or reaches a safe distance from the launch vehicle, platform, or system. This progression may consist of up to six of the following distinct stages in which varying degree of susceptibility can result from unique physical configurations or operational EMEs:

Transportation and Storage is the phase in which the ordnance is packaged, containerized, or otherwise prepared for shipping or stored in an authorized storage facility. This includes transporting of the ordnance.

Assembly and Disassembly is the phase involving all operations required for ordnance build-up or breakdown and typically involves personnel.

Staged is the phase where the ordnance has been prepared for loading and is pre-positioned in a designated staging area.

Handling and Loading is the phase where physical contact is made between the ordnance item and personnel, metal objects or structures during the process of preparing, checkout, performing built-in tests, programming or reprogramming, installing, or attaching the ordnance item to its end-use platform or system; e.g., aircraft, launcher, launch vehicle, or personnel. These procedures may involve making or breaking electrical connections, opening or closing access panels, removing or installing safety pins, shorting plugs, clips, and dust covers. This configuration also includes all operations required for unloading; that is, removing, disengaging, or repackaging the ordnance item.

Platform-Loaded is the phase where the ordnance item has been installed on or attached to the host platform or system (e.g., aircraft, ground vehicle, and personnel) and all loading procedures have been completed.

Immediate Post-Launch is the phase where the ordnance item has been launched from its platform or system, but up to its safe separation distance with regard to the actuation of its explosives, pyrotechnics, or propellants.

Stockpile-to-Target Sequence—Order of events involved in removing a nuclear weapon from storage and assembling, testing, transporting, and delivering it on the target. The document that defines the logistic and employment concepts and related physical environments involved in the delivery of a nuclear weapon from the stockpile to the target.

Trunking—A method for a system to provide network access to many clients by sharing a set of lines or frequencies instead of providing them individually. Examples include telephone systems and two-way radios.

Wi-Fi—A wireless networking technology that allows computers and other devices to communicate over a wireless signal. It described network components that are based on one of the 802.11 standards developed by the Institute of Electrical and Electronics Engineers and adopted by the Wi-Fi Alliance.