BY ORDER OF THE SECRETARY OF THE AIR FORCE

DEPARTMENT OF THE AIR FORCE INSTRUCTION 91-401

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Safety

DIRECTED ENERGY SYSTEM SAFETY

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This Instruction implements requirements from Department of Defense Instruction (DoD) Instruction 3200.19, *Non-Lethal Weapons (NLW) Human Effects Characterization*, DoD Instruction 6055.15, *DoD Laser Protection Program,* DoD Instruction 6055.11, *Protecting Personnel from Electromagnetic Fields,* Air Force Policy Directive (AFPD) 91-4, *Directed Energy System Safety,* specific requirements from the Food and Drug Administration (FDA) Standard, Title 21, Code of Federal Regulations (CFR), Part 1040.10, *Laser Products*, and Part 1040.11, *Specific Purpose Laser Products*. It provides the requirements for directed energy system safety certification and guidance for establishing a directed energy safety program. This Instruction explains the safety verification and certification process for new or modified directed energy systems. This publication is applicable to the entire Department of the Air Force (DAF), including all uniformed members of the Regular Air Force (RegAF), United States Space Force (USSF), Air Force Reserve (AFR) and Air National Guard (ANG), except where noted otherwise, all DAF civilian employees, and those with a contractual obligation to abide by the terms of DAF issuances. This Instruction also applies to Air Force and Space Force research and development organizations prior to capability fielding or operational testing by non-developmental personnel, including Air Force Research Laboratory (AFRL), commercial product, commercially available off-the-shelf item, government-off-the-shelf, non-developmental item, or capabilities identified as solutions for rapid fielding and/or rapid development programs given to an organizational unit for evaluation as of the date of publication. This publication may be supplemented at any level, but all supplements must be routed to the office of primary responsibility listed above for coordination prior to certification and approval. Refer recommended changes and questions about this publication to the OPR using DAF Form 847, *Recommendation for Change of Publication*; route DAF Forms 847

from the field through the appropriate functional chain of command. The authorities to waive wing, unit or delta level requirements in this publication are identified with a Tier ("T-0, T-1, T-2, T-3") number following the compliance statement. See Department of the Air Force Manual (DAFMAN) 90-161, *Publishing Processes and Procedures*, 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 Chief, Weapons Safety Division (AFSEC/SEW) for non-tiered compliance items. Ensure all records generated as a result of processes prescribed in this publication adhere to Air Force Instruction (AFI) 33-322, *Records Management and Information Governance Program*, and are disposed in accordance with the Air Force Records Disposition Schedule, which is located in the Air Force Records Information Management System.

SUMMARY OF CHANGES

This document has been substantially revised and must be completely reviewed. Major changes include changing this publication to a Department of the Air Force Instruction (DAFI) and including USSF applicability, revising certification processes for commercially available off-the-shelf items, the directed energy systems safety certification process, and the incorporation of the military specific Laser System Safety Review Board certification from AFI 48-139, *Laser and Optical Radiation Protection Program*, into the Directed Energy System Safety Program.

Chapter 1

INTRODUCTION

1.1. Purpose.

1.1.1. This Instruction establishes the safety review and certification process for military specific directed energy systems. This instruction incorporates guidance and criteria for the safe use of lasers and laser systems as defined in the American National Standards Institute (ANSI) Z136.1, *Safe Use of Lasers*, and ANSI Z136.6, *Safe Use of Lasers Outdoors*.

1.1.2. ANSI Z136.1 classifies lasers according to the type of hazards they present and according to the extent of safety controls required. Classes range from the least hazardous, Class 1, through the most hazardous, Class 4. For Class 1 and Class 2 lasers, the letter M after the number refers to viewing the laser with optical aids so that the laser is magnified. Class 3 is divided into subcategories of Class 3R and Class 3B. The older ANSI designation for Class 3 was Class 3A and Class 3B. ANSI changed Class 3A to Class 3R with the R designating reduced risk. For reference, **Table 1.1** below provides a general, but not all encompassing, description of the classes. All mandatory requirements are in this DAFI. For a non-mandatory guide describing best force health protection management practices and information when working with lasers and laser systems use refer to AFRL-SW-WP-SR-2013-0011, *Technical Guide to Lasers and Optical Radiation*.

Table 1.1. Laser Class Description.

Class	Description
1	Not recognized as hazardous
1M	Could be hazardous if viewed with optical aids (telescopes, binoculars or loupes)
2	Could be hazardous if viewed for > 0.25 seconds, on-axis
2M	Increased hazard if viewed with optical aids
3R	Potential direct and diffuse hazard if eye focused
3B	Direct eye exposure hazard
4	Hazardous for direct or scattered exposure
Note: Class 2 and 2M only apply to lasers that emit radiation in the visible spectrum.	

1.2. Overview.

1.2.1. This Instruction applies to military specific directed energy systems.

1.2.1.1. Directed energy refers to a beam or field of highly concentrated energy such as those found in lasers, microwaves, particle beams and sound beams. A directed energy system encompasses any technological capabilities designed and/or modified for directed energy applications.

1.2.1.2. Directed energy weapons are those that use directed energy (i.e., no projectile) to incapacitate, damage, or destroy enemy equipment, facilities, and/or personnel. The phrase “directed energy weapon” will only be used in this Instruction to specify a directed energy weapon specific requirement. Refer to supporting information provided in **Attachment 1**, for clarification of definitions. Guidance regarding joint weapon systems may be found in paragraphs **2.6.2**, **5.3.5**, and **6.8**.

1.2.1.3. Directed energy devices are systems using directed energy for purposes other than as a weapon. Non-weapon systems include guidance radar, laser range finders, target designators, directed energy system trainers or simulators, some aircraft self-defense laser systems, etc. Refer to supporting information provided in **Attachment 1**, for clarification of definitions.

1.2.1.4. Military specific directed energy, non-weapon and weapon systems are defined as those systems used for combat, combat training, or are classified in the interests of national security.

1.2.1.5. Military specific lasers and laser systems are a subset of directed energy systems, also defined as "used for combat, combat training, or classified in the interest of national security", that require DAF Laser System Safety Working Group (DAF LSSWG) review prior to acquisition and/or use. Examples include, but are not limited to: laser illuminators, designators, range finders, tactical pointers, tactical lasers, lasers employed to augment explosive ordnance disposal, and laser weapons.

1.2.1.6. The DoD, or its components, are authorized to exempt military specific lasers from portions or the entirety of Title 21, Code of Federal Regulations (CFR), Parts 1010 and/or 1040 IAW Food and Drug Administration (FDA) Exemption No. 76EL-01. Hereafter, FDA Exemption No. 76EL-01 will be referred to as simply "FDA Exemption". This exemption can only be used to meet mission requirements and requires additional oversight and measures for laser safety in accordance with DoDI 6055.15, AFI 48-139 and this instruction. **(T-0)** FDA Laser Notice 52 clarifies and updates the conditions of FDA exemption no. 76EL-01DOD granted in 1976 to the U.S. Department of Defense (DoD) for laser products procured for combat or combat training or that are classified for reasons of national security. It is available at **https://www.fda.gov/media/71322/download** and identifies the current resources in the military for the administration of this exemption.

1.2.1.7. FDA Variance, described in 21 CFR 1010.4 is when the FDA grants a variance from one or more provisions of any performance standard of the radiological health subchapter; specifically, when the scope of the requested variance is so limited in its applicability as not to justify an amendment to the standard. Traditionally, variances are provided to law enforcement agencies (or other non-DoD users), have had different designs from military specific products and were distinguished by labeling requirements and part numbers.

1.2.1.7.1. In the case of laser products approved by the FDA's Variance process, any such variance includes conditions of applicability, alternate controls, and/or limits of distribution. DoDI 6055.15 provides additional clarification on regulatory limits regarding military use of lasers operating with an FDA variance.

1.2.1.7.2. Further, DoDI 6055.15 identifies the service-specific organizations implementing laser system approval policy. The Air Force Safety Center (AFSEC), as the service-specific Laser Safety Review Authority (LSRA) can require 'additional' controls, restrictions, limitations, and safety mitigations, but cannot authorize procurement or use of alternate controls from the requirements issued by the FDA in the variance. If the FDA allows sale to DoD in a variance, the procuring activity must obtain a Laser Hazard Evaluation from AFRL 711th Human Performance Wing (HPW) Bioeffects Division (711 HPW/RHD), as the Laser Safety Review Coordinator (LSRC)

to independently determine or verify laser hazard parameters before testing, fielding, training, operations, or other use by the DAF.

1.2.2. This DAFI applies to both Program of Record and non-Program of Record acquisition activities, regardless of purchase price or method of payment used. It includes when the system will be used by non-developmental personnel not supervised by government developmental personnel, non-developmental personnel supervised by any developmental personnel when exposure to system hazards during live fire tests is possible (see **paragraph 7.4**), when the decision to field the capability is made, or if exposure to incidental personnel is possible.

1.2.2.1. This instruction applies to any directed energy system referred by the Chairman of the Joint Chiefs of Staff Directed Energy Weapon Initial Operational Employment Review and Approval Process or a quorum recommendation request by the Directed Energy Weapons Safety Board. The "Directed Energy Weapons Safety Board" is referred to as the "Board" for the remainder of this Instruction.

1.2.2.2. This Instruction does not apply to systems determined by the AF/SE to be within the scope of other instructions.

1.2.3. Directed energy weapons and non-weapon systems may create unique hazards and effects requiring additional evaluation by technical experts or the Board. Although acoustic energy is excluded from the Joint definition of directed energy, it has some effects and hazards similar to directed energy systems. Acoustic systems will follow the same safety policy as directed energy weapons.

1.2.3.1. The hazards of directed energy and acoustic systems can span from levels that are considered safe for human exposure, levels that can induce pain but cause no permanent or physiological damage, to levels that could be fatal to humans and/or destroy materiel.

1.2.4. Test, training, or operational use of higher risk military specific directed energy systems by non-developmental personnel not supervised by government developmental personnel requires Board review and prior safety approval. **(T-1)** Refer to AFMAN 13-212, Volume 1, *Range Planning and Operations* and MIL-HDBK-828C, *Range Laser Safety* for laser use on United States Air Force (USAF) ranges.

1.2.5. Prior to entry of a new directed energy and/or acoustic system into the USAF and/or USSF inventory, regardless of source, a Headquarters Air Force (HAF) safety certification for operational use is required. Certification of high-risk systems are based on Board recommendations. Certification requirements are detailed in Chapters **6** and **7**.

1.2.6. Directed energy systems reviewed by the Board, typically higher risk systems, will only be released for operational use and training once adequate technical data (maintenance, storage, training, operating procedures, etc.) are available to the user in accordance with **Chapter 7**.

Chapter 2

ROLES AND RESPONSIBILITIES.

2.1. The Assistant Secretary of the Air Force (Acquisition, Technology & Logistics) (SAF/AQ) and Assistant Secretary of the Air Force for Space Acquisition and Integration (SAF/SQ). Ensures Program Managers and acquiring activities address directed energy systems' health and safety issues early and throughout the acquisition and sustainment life cycle.

2.2. Department of the Air Force Chief of Safety (AF/SE).

2.2.1. Oversees the DAF Directed Energy System Safety Program.

2.2.2. Exercises safety certification authority for directed energy systems covered by this DAFI.

2.2.3. Approves directed energy DAFI supplements.

2.2.4. Serves as the office of primary responsibility for safety standards for all military specific directed energy systems.

2.2.5. Designates the Chairperson of the DEWSB with the grade of Colonel (or civilian equivalent) or above.

2.2.6. Issues DoD exemption notification to manufacturers through the Program Manager or acquiring activity of military specific lasers that cannot meet the Federal laser safety requirements in 21 Code of Federal Regulations (CFR), Part 1040.10, *Laser Products*, and 21 CFR 1040.11, *Specific Purpose Laser Products*, current editions. **(T-0)** May delegate this exemption authority to AFSEC/SEW. For the purpose of this instruction, a "FDA-compliant" laser system includes systems that meet requirements detailed in 21 CFR Part 1040.10 and 21 CFR Part 1040.11, or equivalent clauses of International Electrotechnical Commission (IEC) standard 60825-1 allowed by FDA Laser Notice 50 or 56.

2.3. Air Force Safety Center Weapons Safety Division (AFSEC/SEW).

2.3.1. Develops DAF directed energy safety criteria and directive guidance.

2.3.2. Manages DAF directed energy certification processes.

2.3.2.1. Normally, chairs the Board unless otherwise designated in accordance with **paragraph 2.2.5**. If not designated as the Chairperson, AFSEC/SEW will provide the Board with a representative to function as an advisor or consultant to the Board at every meeting.

2.3.2.2. Maintains official records for directed energy certification documentation and risk assessments in accordance with the Records Disposition Schedule. **(T-0)**

2.3.2.3. Designates a member to the DoD Laser Systems Safety Working Group, Transmitted Electromagnetic Frequency Radiation Protection Working Group, and the Human Effect Review Board.

2.3.2.4. Reviews MAJCOM and FLDCOM directed energy DAFI supplements and coordinates staffing of documents through AF/SE.

2.3.2.5. Ensures important directed energy safety issues are addressed at the AF Environment, Safety, and Occupational Health Council. **(T-1)**

2.3.2.6. Advises the Program Manager or acquiring activity on safety issues regarding directed energy systems. **(T-1)**

2.3.2.7. Supports the Milestone Decision Authority on directed energy safety during Milestone Reviews and other processes as required. **(T-1)**

2.3.2.8. Develops system safety standards for programs associated with potentially hazardous exposures related to directed energy systems. **(T-1)** Coordinates with other stakeholders as appropriate (e.g., AF Installations, Environment and Energy, Surgeon General, Human Performance Wing, etc.).

2.3.2.9. Issues DoD Exemption Notifications through Program Managers or acquiring activities to manufacturers for military specific laser systems unable to be FDA-compliant as defined in **paragraph 2.2.6** and in accordance with FDA Exemption No. 76EL-01DOD, *Department of Defense Exemption from the FDA Performance Standard for Laser Products*, 1976.

2.4. Air Force Surgeon General (AF/SG).

2.4.1. Provides Board members as outlined in **Chapter 5** of this Instruction.

2.4.2. Supports AF/SE by providing medical expertise and health risk evaluation.

2.4.3. Ensures installation Bioenvironmental Engineering conducts health risk assessments of work areas where directed energy systems are used or maintained in accordance with DAFI 48-145, *Occupational and Environmental Health Program* and AFI 48-139, *Laser and Optical Radiation Protection Program*.

2.5. Chief, Operational Training Infrastructure Division (AF/A3TI). Ensures range directive guidance for directed energy and military specific laser safety requirements is consistent with this Instruction.

2.6. MAJCOMs, FLDCOMs, Numbered Air Forces, Centers, Field Operating Agencies, and Direct Reporting Units.

2.6.1. Provide Board members as outlined in **Chapter 5** of this Instruction.

2.6.2. Ensure directed energy weapons are certified by AF/SE and approved in accordance with the Chairman of the Joint Chiefs of Staff Manual 3230.01A, *Joint Chiefs of Staff Directed Energy Weapon Initial Operational Employment Review and Approval Process*, and as required by this Instruction. **(T-0)** See delineation of responsibilities for weapon and non-weapon directed energy systems in DAFI 91-202, *The US Air Force Mishap Prevention Program*.

2.6.3. Ensure directed energy mishaps are reported in accordance with DAFI 91-204, *Safety Investigations and Reports*. Further reporting is required in accordance with AFI 48-139, *Laser and Optical Radiation Protection Program*, and AFI 48-109, *Electromagnetic Field Radiation (EMFR) Occupational and Environmental Health Program* through the supervisor and Bioenvironmental Engineer to the injury hot line to help ensure prompt medical guidance to minimize the impact of injuries and ensure capture of directed energy associated injury and near-miss events. The hotline phone number is listed below, in **paragraph 2.7.2.5**.

2.6.4. Ensure FLDCOM, MAJCOM, delta, wing and unit level directed energy safety programs are established and maintained as appropriate in accordance with DAFI 91-202*;* AFI 48-139; AFI 48-109*;* AFI 48-127, *Occupational Noise and Hearing Conservation Program*; and DAFI 48-145. **(T-1)** Ensures that deltas, wings, and units work closely with installation Bioenvironmental Engineering to assess additional training requirements if the directed energy system presents health hazards to users such as laser energy, acoustical energy, or electromagnetic frequency radiation.

2.7. Air Force Materiel Command (AFMC) and Space System Command (SSC), in addition to the roles and responsibilities in **paragraph 2.6**:

2.7.1. Coordinates, through the AFMC and/or SSC board representative, the needed safety, scientific, technical, and engineering expertise to support Board studies and analyses.

2.7.1.1. Maintains technical expertise to evaluate control system integration onto airborne platforms and as stand-alone systems with remotely located controls safety in DAF operations. The 96 Test Wing Systems Safety Office (96 TW/SES) is the default subject matter experts for control integration for complex systems.

2.7.1.2. An engineer (AFSC 62E or DoD civilian equivalent) with at least Practitioner Level in Engineering & Technical (ENG) or Test & Evaluation (T&E) may review test plans, with respect to control effectiveness, systems integration and test hazard assessment review (THAR), with 711 HPW/RHD provided nominal hazard distance(s), safety parameters (LEP, OD), and laser class determination(s). Test plans determined to mitigate risk to low or eliminate risk, based on test bed design, test team training and range procedures, do not require THAR approval at the Directed Energy Weapons Safety Board (DEWSB). Currently, this only regards laser testing because hazard boundaries can be well defined and regulated. In contrast, other forms of DE often must consider broader operational concerns due to antenna side/back lobe hazard zones, ionizing radiation transport or tolerance for probabilistic risk.

2.7.1.3. The Directed Energy Directorate (AFRL/RD) maintains expertise in directed energy system engineering. An AFRL/RD Director may be the approval authority for any system reviewed by their respective directorate, including developmental and operational testing on approved ranges when following their directorate safety board's processes.

2.7.2. Conducts, through AFRL and consistent with DAF science and technology investment priorities, the research on hazards associated with directed energy systems, to include hazards to people and materiel. Communicates new discoveries in directed energy principles and effects in a timely manner to related capability development programs.

2.7.2.1. Maintains technical expertise to evaluate directed energy health effects and safety in DAF operations, through the AFRL 711th Human Performance Wing Bioeffects Division (711 HPW/RHD), the 711 HPW United States Air Force School of Aerospace Medicine (USAFSAM) Occupational/Environmental Health Division (USAFSAM/OE) / Defense Centers for Public Health – Dayton (DCPH-D), and AFRL Safety (Detachment 3/SE). Further, the Directed Energy Directorate (AFRL/RD) maintains expertise in directed energy system engineering.

2.7.2.2. Maintains, through the Bioeffects Division (711 HPW/RHD), the capability to conduct independent hazard evaluations of laser systems for testing or fielding on DAF's

test and training ranges. In addition, 711 HPW/RHD maintains a repository of laser hazard evaluations for all laser systems evaluated for range testing or fielding. Finally, the 711 HPW/RHD provides evaluation information to the USAFSAM/OE (DCPH-D) for health risk assessment, accident or incident investigations, and distribution to Bioenvironmental Engineering personnel and/or laser safety officers.

2.7.2.3. Maintains expertise on directed energy personnel protective technologies for DAF use and is responsible for conducting medical/health effects consulting and education/training in coordination with USAFSAM/OE (DCPH-D).

2.7.2.4. AFRL 711th Human Performance Wing (711 HPW) provides expert medical advice in the event of a potential overexposure to DoD personnel from lasers.

2.7.2.5. Laser and Electromagnetic Field incidents must be reported to the 711 HPW Environmental, Safety, and Occupational Health (ESOH) service center. Unclassified laser incidents should be reported online at **https://hpws.afrl.af.mil/dhp/OE/ESOHSC/laserinjury/**. Unclassified Electromagnetic Field incidents should be reported online at **https://hpws.afrl.af.mil/dhp/OE/ESOHSC/emfinjury/**. For classified incidents of Directed Energy, contact the ESOH service center for instructions at Defense Switched Network (DSN) 798-3764, commercial 937-938-3764, toll-free 1-888-232-ESOH (3764), or via email **esoh.service.center@us.af.mil**.

2.8. Program Managers and Acquiring Activities.

2.8.1. Comply with the directed energy certification process outlined in this instruction.

2.8.2. When suitable for the mission, procure laser systems meeting the Federal Laser Product Performance Standards (FLPPS). These systems meet the Code of Federal Regulation (CFR) for civilian use; specifically, 21 CFR §§ 1040.10 and 1040.11, and the provisions of 21 CFR Part 1002 (except § 1002.20). The FDA regulates that portion of the CFR and identified equivalent clauses from international specifications by way of FDA Laser Notices 50 and 56. If sufficient capability is not available to the Installation Laser Safety Officer (ILSO) at the installation to confirm compliance with 21 CFR, the product will be evaluated by 711 HPW/RHD against 21 CFR.

2.8.3. When the design requirements for the civilian versions are not suitable for 'combat, combat training, or must be classified in the interest of national security', military specific laser systems can be procured by the FDA's DoD Exemption 76EL-01DOD. Program managers and acquiring activities have the following additional obligations when exercising this option:

2.8.3.1. Provide inventory control and tracking to ensure exempted military specific systems are not transferred outside the DoD. This can be met by assigning an equipment custodian or supply chain manager to ensure products are demilitarized and maintaining a permanent record of the status of exempted laser products, including their ultimate disposition. The products will not be disposed of through excess or surplus property channels without advance authorization by the FDA. **(T-0)**

2.8.3.1.1. Normally, these items need to have a model number that is exclusively for DoD use, per FDA Laser Notice 9. In rare cases, if FDA allows DoD to participate in a variance allowed for law enforcement, the procuring agency should seriously

consider procuring under a unique, military-specific model number to facilitate inventory control.

2.8.3.1.2. DoD exempted laser products will be clearly identified through labeling.

2.8.3.2. Ensure military specific laser systems comply with Military Standard (MIL-STD) 1425A, *Safety Design Requirements for Military Lasers and Associated Support Equipment* or secures safety certification for non-compliant systems in accordance with this Instruction.

2.8.3.3. Incorporate safety criteria into training and instructions. The exemption was provided based on the laser user safety and control procedures utilized by the DoD, currently ANSI Z136.1, *American National Standard for Safe Use of Lasers* and additional control procedures utilized by the DoD:

2.8.3.3.1. Develop operator training in the safe use of tactical equipment, including emergency safety procedures if overexposure is suspected.

2.8.3.3.2. Perform an in-depth hazard analysis of such equipment during various stages of its life cycle.

2.8.3.3.3. Perform a hazard analysis of training and testing sites.

2.8.3.3.4. Routine surveys of such equipment located at military installations.

2.8.3.4. Develops a System Certification Requirements Plan for any non-compliance with FLPPS or MIL-STD-1425A. **(T-1)** Specifically, when deviating from the standards, the justification and alternate means of achieving the related hazard mitigation needs to be articulated to AFSEC/SEW or the Board and indicated in the exemption notification.

2.8.3.4.1. Identify a need for AFMC, SSC, or another organization possessing sufficient safety engineering expertise to conduct system safety analysis in accordance with **Chapter 7** and to fully characterize human effects if data is lacking or unknown. The Board determines the suitability of an organization's safety engineering expertise. The 711 HPW/RHD's Laser Hazard Evaluation and 96 Test Wing's assessment of system integration are used to support the acquiring activity's MIL-STD-882E, *Systems Safety*, Hazard Analysis.

2.8.3.4.2. Request a DoD Exemption Notification issued by AFSEC/SEW if a laser system cannot meet the requirements of Sections 10 and 11 of 21 CFR Part 1040, or FDA-accepted clauses of international specification EIC 60825-1. This notification should be requested as soon as the need is identified and may occur concurrently with Requirement Plans development or safety evaluations. Subsequent modifications to a military exempt laser product require a new DoD Exemption Notification.

2.8.4. Must budget and plan for LHEs performed by the LSRC.

2.9. Commanders or Directors. For units that operate directed energy systems, execute a directed energy safety program in accordance with DAFI 91-202 and AFI 48-139. Each system design may have unique/novel standard operating procedures, hazard mitigations and system safety rules levied by the certification process. The local shop may have additional controls that they have directed. Close coordination with the Unit Safety Representative (USR) will be

necessary for spot inspections and efforts supporting the unit's annual safety report mentioned in DAFI 91-202.

2.10. Range Safety Officers. Ensure safe operations of directed energy systems on their range in accordance with AFMAN 13-212, Volume 1, *Range Planning and Operations,* and guided by Military Handbook 828C.

Chapter 3

DIRECTED ENERGY WEAPONS SAFETY BOARD ADMINISTRATIVE PROCEDURES

3.1. Administrative Procedures. Hazard evaluations and analysis of weapons and high-risk systems must be reviewed by DAF stakeholders, such as the DAF Laser System Safety Working Group (DAF LSSWG) for laser systems, prior to submission to the Directed Energy Weapons Safety Board (DEWSB). See **Chapter 4** for more details on the DAF LSSWG. Information briefs to the DEWSB are preferred earlier, but certification plans are more likely to change if DAF stakeholder review has not concluded based on clearly defined hazards and mitigation recommendations. The LSSWG and DEWSB processes are intended for configurations being developed for fielding; therefore, developmental and Low or Medium risk testing are managed by other mandatory instructions and manuals when conducted on a Laser Safety Range Review Assessor-approved range compliant with AFMAN 13-212v1 and Range LSO's approval or indoor labs complying with AFRL's safety review board's process.

3.1.1. Meeting Frequency. Normally, meetings of the DEWSB Board are held semi-annually. Meetings of the Board will be scheduled only by the Chairperson or designated representative, generally not to exceed once each quarter. The Chairperson will decide on a case-by-case basis if the amount of Board business warrants scheduling additional meetings. Regular meetings are conducted in person. The Chairperson may approve the use of synchronous telephone or web cast. Funding for Board member travel is at the expense of the member's unit.

3.1.2. In addition to these regular DEWSB meetings, special meetings may be held at the discretion of the Chairperson when required to support time-critical directed energy weapon or higher risk non-weapon system development program activities. These special meetings may be conducted in person, by telephone, by web cast, asynchronously via electronic means, or via a blend of these methods. If a requesting agency will present a higher risk system for review, the Chairperson may require that a special meeting be held in person. The Executive Secretary informs the requesting agency that funding of the Board members' and Chairperson's travel expenses will be a condition for conducting the special meeting. The Executive Secretary polls members as to their availability before final special meeting dates are established.

3.1.3. The Board (members and advisory personnel) will meet in regular session when called by the Chairperson, or designated representative.

3.1.4. The Executive Secretary should poll Board members for availability at least 60 days prior to a scheduled meeting and provide finalized meeting notification at least 30 calendar days in advance of a regularly scheduled meeting date.

3.1.5. If a voting Board member is not represented and proxy has not been assigned or is present, the Chairperson determines if the meeting will proceed with available members.

3.1.6. If a member abstains from a vote on a matter, the Chairperson determines if the matter will go to ballot with participating members. The Chairperson will consider if a quorum still exists and if the quorum is sufficient to conduct Board business on this matter. The abstaining member may elect to submit a minority report if the matter goes to a vote.

3.2. Protocol.

3.2.1. Members will make a concerted effort to reach a consensus for each matter requiring a Board position.

3.2.2. When unanimous agreement is not possible, the majority position is established by open ballot of the members and proxies present and voting.

3.2.3. Members representing the minority position may, at their discretion, prepare a minority report for inclusion in the official meeting minutes.

3.3. Presentations.

3.3.1. Normally all items appearing in a Board meeting agenda will be supported by a structured presentation. The presentation is intended to answer questions arising during documentation review and to stimulate detailed discussions.

3.3.2. Agencies preparing Board presentations should ensure essential supporting personnel (e.g., DAF program management and acquiring activity authorities, contractor representatives, etc.) are present to participate as needed during the presentation and discussions. Non-government personnel presence should be restricted for certain presentations, e.g., a conflict of interest is possible or proprietary and/or privileged information may be discussed.

3.3.3. The Executive Secretary provides appropriate guidance to agencies charged with preparing and delivering Board presentations.

3.4. Board Requirements.

3.4.1. During a regular session, complete a comprehensive review of any safety evaluations, i.e., Safety Studies (see **paragraph 7.3**.), Supporting Analyses (see **paragraph 7.5**.), Test Hazards Assessment Reviews (see **paragraph 7.4**), or Risk Assessments (see **paragraph 7.6**) presented for developmental, prototype, and existing directed energy systems and associated support equipment.

3.4.2. Review related issues such as the potential requirement for shields and barricades during testing and the availability of required technical data.

3.4.3. Identify areas of design safety deficiency relative to items under review. Specify conditions for certification when such deficiencies are noted.

3.4.4. Develop or review design safety standards and recommend adoption for DAF use as appropriate.

3.4.5. Recommend policies, controls, and procedures to minimize hazards during directed energy weapon operations.

3.4.6. Charter special projects and ad hoc groups, as required.

3.5. Meeting Minutes, Studies, and Board Actions.

3.5.1. Minutes. For each meeting, document Board proceedings with a comprehensive set of minutes. Minutes will typically include voting and non-voting members present, proxy votes, systems and studies presented, and any other major business of the Board, e.g., guidance or design standard discussion. For each item under review, the minutes (and any safety

evaluations as necessary) will include applicable findings, recommendations, and additional actions required.

3.5.1.1. If a directed energy weapon is also a military specific laser, verification or absence of an AFSEC/SEW issued DoD Exemption Notification or FDA accession number must be noted in the minutes. In addition, the Chairperson designates a primary action agency for items under review. These action agencies will typically be an individual or organization with a vested interest in and authority for completing the action, e.g., a Program Manager could be tasked to ensure a manufacturer applies for a DoD Exemption based upon proposed design changes.

3.5.1.2. Meeting minutes document the Board recommendation(s) that a system is acceptable or not for further testing and use, from a design safety viewpoint. When the minutes are signed by each voting member and delegated proxy and approved by the Chairperson, they become the official Board position. If unanimity cannot be achieved, minority reports may be prepared at the discretion of dissenting members for inclusion in the official minutes.

3.5.1.3. A Board certification recommendation, as captured in meeting minutes, constitute interim fulfillment of certification of directed energy weapon requirements and grant interim safety certification for directed energy weapons or related items. Final certification is granted after appropriate staff agency concurrence and AF/SE approval per **paragraph 3.5.2**.

3.5.1.4. As appropriate, the Executive Secretary notifies program management and acquiring activity authorities, test organizations, and unit commanders to proceed with planned activities and operations based on Board's recommendations. If a staff agency or AF/SE disapproves a Board recommendation, the Executive Secretary will notify concerned agencies of the disapproval and coordinate on impacts to directed energy weapon employment.

3.5.1.5. Commanders may proceed with directed energy system operations based on the interim certification and recommendations in Board meeting minutes per **paragraph 3.5.1.3**. Joint Chiefs of Staff concurrence may be as required for joint directed energy weapon systems.

3.5.1.6. The Executive Secretary finalizes meeting minutes and updates any safety evaluations (amended to include Board findings and recommendations). Also, the Executive Secretary submits minutes and the safety evaluations to the Chairperson to initiate the AF/SE and DAF staff agency concurrence and approval process as appropriate. The Chairperson will determine which staff agencies listed in **paragraph 3.6** will need to review and concur on Board recommendations prior to AF/SE review and approval based upon various factors, i.e., the risks and hazards of the system, operational use and training, bed-down requirements, etc.

3.5.1.7. Signed Board minutes and Safety Studies, with relevant findings and recommendations, are forwarded to AFSEC/SEW, 9700 G Ave SE, Kirtland AFB NM 87117-5670. AFSEC/SEW acts as the coordinating agency to obtain AF/SE, HAF and Joint Chiefs of Staff concurrence as required. **(T-1)**

3.5.2. Studies. Once notified of AF/SE approval of a Safety Study, the Executive Secretary documents the report in its final version IAW **Attachment 2** and distributes it to Board members and associates, agencies responsible for implementing Board recommendations, and other interested organizations.

3.5.2.1. Approval of a recommendation to develop or modify a system signifies staff agency awareness that such action would be desirable from a safety viewpoint. It does not infer that such an action will be officially proposed, initiated, or funded by a staff agency as a direct result of the recommendation. This is the primary responsibility of the acquiring organization.

3.5.2.2. After a study has the required staff concurrence and is approved by AF/SE, the Board's recommendations (as documented in the meeting minutes) become requirements levied on the designated action agencies. **(T-1)** The action agencies initiate and monitor actions on these requirements and makes periodic status reports to the Executive Secretary of the Board until the final action item closure.

3.5.2.3. On behalf of AF/SE, the Board determines when a recommended action item has been successfully completed.

3.5.2.4. In addition to duties specified in **Chapter 5**, the Board may delegate to the Executive Secretary the authority to close administrative action items or to close action items upon the completion of an event (e.g., the publication of a technical order, etc.).

3.5.2.5. When all action items generated per **paragraph 3.5.2.2** have been closed, final certification of a directed energy system is granted. Final certification is documented in the minutes of the Board meeting effecting closure.

3.6. Partnering Staff Agencies.

3.6.1. The following staff agencies may receive copies of Board actions at the discretion of the Chairperson: Office of the Assistant Secretary of the AF (Acquisition, Technology & Logistics) (SAF/AQ), Office of the Assistant Secretary of the AF for Space Acquisition and Integration (SAF/SQ), Director of Global Power (SAF/AQPM); the Deputy Assistant Secretary of the AF for Environment, Safety, and Occupational Health (SAF/IEE); the AF Director of Logistics, Deputy Chief of Staff/Logistics, Installations and Mission Support (Integrated Life Cycle Management Policy Division) (AF/A4LM); the AF Director of Logistics, Deputy Chief of Staff/Logistics, Installations and Mission Support (Nuclear Weapons, Missile, and Munitions Division) (AF/A4LW); and Deputy Chief of Staff AF Futures, Center 2 - Capability Development (AF/A5D); Director DAF Test and Evaluation (AF/TE); Operations (USSF/COO), Plans and Requirements (USSF/CSRO), Current Operations (USSF/COO/O), Future Operations (USSF/COO/X), Space Integration (USSF/S3I), Special Programs (USSF/S3Z), Mission Sustainment (USSF/S4O) and Deterrence Operations (USSF/S10N).

3.6.2. These agencies must respond to the Chairperson within 30 calendar days indicating their concurrence or non-concurrence with Board findings and recommendations. **(T-1)** Non-concurrences require specific and detailed rationale to determine operational impacts to interim certification and to facilitate resolution for concurrence and potential impacts to interim certification. No response within the prescribed 30 calendar day period from a staff agency constitutes concurrence. The Chairperson works with the appropriate staff agencies to resolve non-concurrences. The Executive Secretary communicates operational impacts to Program Manager and acquiring activities.

Chapter 4

DEPARTMENT OF THE AIR FORCE LASER SYSTEM SAFETY WORKING GROUP (DAF LSSWG)

4.1. Establishment of Laser Safety Review Requirements. Under DoDI 6055.15, each DoD component must establish a service-specific laser safety review process to provide a system's safety review of all lasers used in combat, combat training, or classified in the interest of national security. This chapter outlines the process by which the DAF meets this requirement. If the system is also a weapon or is referred to the Board for further review, then **Chapter 5** also applies.

4.1.1. Acquisition/Fielding Requirements for Military Specific Lasers. Any laser or laser system which meets the description of a military specific laser, as defined in **paragraph 1.2.1.5** of this instruction, regardless of whether the laser is FDA-compliant, must have its hazards and any safety criteria identified, prior to acquisition or fielding.

4.1.1.1. The requesting organization must obtain a letter of approval from the DAF LSSWG through AFSEC/SEW. If a laser is considered a Directed Energy Weapon (DEW), or if the DAF LSSWG determines that DEWSB approval is required, then the requesting organization must also obtain a letter of approval from the DEWSB. For DEW, the intent is that LSSR-validated hazards and safety criteria be established prior to DEWSB action.

4.1.1.2. The manufacturer must obtain, through the requesting organization, a DoD exemption notification through AFSEC/SEW if the laser or laser system does not fully comply with the 21 CFR, Part 1040.10 and Part 1040.11, or equivalent clauses listed in FDA Laser Notices 50 and 56. This same process must be followed prior to selling, distributing, lending, or turning over the device to the DAF for RDT&E, IAW FDA Exemption. **(T-0)**

4.1.1.3. To qualify for exemption, the laser design must meet the requirements of MIL-STD-1425A or other service-specific requirements to mitigate risks of laser use for military-specific laser systems that cannot comply with all Federal Laser Product Performance Standards (FLPPS) due to operational mission requirements. Use of this exemption is limited to the exemption of the provisions in the FLPPS, excluding Section 1002.20 of Title 21, CFR. **(T-0)**

4.1.1.4. The requesting organization must apply Risk Management (RM) to develop Concept of Operation (CONOP)/Concept of Employment (CONEMP), Tactics, Techniques and Procedures (TTPs) or equivalent and other written instructions to prevent overexposures from lasers to DoD personnel and the public. Written procedures must clearly spell out controls, employment conditions, and procedures in the event of an accident or incident.

4.1.2. Acquisition Requirements for FDA-compliant lasers. Any Class 1M, 2M, 3R, 3B, 4 laser, or laser system (or equivalent) which meets the description of an FDA-compliant laser as defined in **paragraph 1.2.1.5** of this instruction is subject to the following criteria:

4.1.2.1. The Installation Commander must serve as the final approval authority for the acquisition of all FDA-compliant lasers (or equivalent), unless otherwise delegated. **(T-2)** For purposes of complying with DoDI 6055.15 Paragraph 3.2.b, the ILSO is the Laser Safety Review Authority (LSRA) for FLPPS-compliant, non-weapon lasers. The ILSO

may require 711 HPW/RHD-provided Laser Hazard Evaluation or 96 TW/SES Hazard Assessment to support their review.

4.1.2.2. The Installation Commander and ILSO must develop guidelines governing the acquisition, review, and use of FDA-compliant lasers on the installation. **(T-2)**

4.1.2.3. The unit will coordinate with the ILSO, prior to acquiring any FDA-compliant lasers (or equivalent), to ensure compliance with local guidelines and determine if the device is safe for use on the installation. **(T-2)**

4.1.2.4. The ILSO will make recommendations for approval/disapproval to the Installation Commander, or designee, regarding all FDA-compliant Lasers.

4.2. DAF LSSWG. The DAF LSSWG serves as the USAF entity to certify that military specific lasers procured by the USAF meet all federal, DoD, and USAF laser safety regulations and design requirements prior to acquisition and fielding.

4.2.1. The DAF LSSWG also serves as entrance criteria for test and fielding requests for laser weapon systems at the DEWSB. See **Chapter 5** of this instruction.

4.2.2. Chair. AFSEC/SEW will chair or appoint a chair and coordinate the review of a military specific laser with the DAF LSSWG members.

4.2.3. Executive Secretary. The Executive Secretary appointed to the Directed Energy Weapons Safety Board will act in the same capacity with roles and responsibilities for the DAF LSSWG.

4.2.4. DAF LSSWG Members. Representatives from Air Force Medical Readiness Agency, Radiation Health Operations (AFMRA/SG3PB), 711 HPW/RHD, Air Force Operational Test and Evaluation Center - Safety (AFOTEC/SE), USAFSAM/OE (DCPH-D), Flight Medicine Consulting Division (USAFSAM/FEC), AFRL Directed Energy Directorate, Laser Division (AFRL/RDL), and Headquarters (HQ) AFMC System Safety (AFMC/SES) serve as members to the DAF LSSWG. The lead MAJCOM/FIELDCOM of the laser system will also appoint a representative to the LSSWG for discussions on their respective system. Representatives from 648th Aeronautical Systems Squadron (648 AESS/CC) and AFRL Hardened Materials Branch (AFRL/RXPJ) also participate when the military specific laser requires upgrades to existing aircrew laser eye protection capabilities or otherwise requires integration with existing Life Support Equipment. **(T-2)**

4.2.5. For lasers intended for joint use, the DAF LSSWG must collaborate with the other services' laser safety review boards and authorities under the Joint Service Laser Safety Review Process to harmonize test requirements, increase efficiency, and ensure that laser safety reviews result in one set of joint service findings. The DAF LSSWG serves as the DAF point of official communication to the DoD LSSWG for all issues associated with DoD laser approvals and the FDA exemption process. The DEWSB must perform the weapon-specific roles for DEW intended for joint use as part of the Joint Service Weapon Safety Review Process.

4.3. DAF LSSWG Approval and DoD Exemption Process. To obtain a letter of approval and a DoD exemption notification (if applicable) from the DAF LSSWG for any military specific laser the following criteria must be met prior to acquisition, fielding, or the manufacturer’s sale of the device to the DAF.

4.3.1. The requesting organization must submit on behalf of the manufacturer, through their MAJCOM/FLDCOM (or equivalent), a request to AFSEC/SEW for a letter of approval and DoD exemption notification (if applicable). The most likely requesting organization will be the MAJCOM/FLDCOM Director of Operations (or equivalent).

4.3.1.1. The submitted request will include a request to conduct a legal review to ensure compliance with the law of war, domestic, and international law. AFPD 51-4, *Operations and International Law,* para. 2.2.10.

4.3.2. For military specific lasers in development, early interface with AFSEC/SEW is recommended to ensure appropriate safety input into system designs and operations to meet federal regulations and DoD requirements. AFSEC/SEW should be involved prior to a Milestone C or COTS purchase review of the system to ensure no safety issues prevent Low-Rate Initial Production (LRIP).

4.3.3. The requesting SPO, PEO or PM (Program Manager) organization must coordinate with an AFSEC/SEW designated organization, specifically 711 HPW/RHD, to have an independent laser system hazard evaluation conducted prior to submission to the DAF LSSWG. If the system is significantly complex, the requesting SPO, PEO or PM organization must also coordinate with an AFSEC/SEW designated system safety organization to have an independent system hazard evaluation conducted prior to submission to the DAF LSSWG. Provisional exemptions with expiration dates may be issued to facilitate these reviews.

4.3.4. For permanent exemptions, the requesting organization must provide the following to AFSEC/SEW a minimum of 30 days prior to submission to the DAF LSSWG:

4.3.4.1. The independent laser system hazard evaluation.

4.3.4.2. CONOPs, CONEMPs, or TTPs drafts, at a minimum.

4.3.4.3. System Technical Orders or manufacturer’s use & maintenance instructions.

4.3.4.4. Standard Operating Procedures (SOPs).

4.3.4.5. Description of system specific user training identifying primary and ancillary hazards associated with the military specific laser.

4.3.4.6. Justification for each design requirement for which a military specific laser cannot meet MIL-STD-1425A requirements.

4.3.4.7. Test results of development and/or operational testing (if applicable).

4.3.4.8. Additional health and safety data not included in the laser system hazard evaluation.

4.3.5. Once the DAF LSSWG review is complete, the DAF LSSWG Chair, or delegee, will provide an approval or disapproval letter to the requesting organization. The DAF LSSWG approval letter will state whether a DoD exemption notification was issued.

4.3.6. If a DoD exemption notification is issued for a military specific laser, a copy must be provided to the manufacturer, and it is recommended the requesting organization maintain a copy. The Executive Secretary will maintain records of all issued approvals for use and DoD exemption notifications.

Chapter 5

DIRECTED ENERGY WEAPONS SAFETY BOARD

5.1. Directed Energy Weapons Safety Board Mission.

5.1.1. The Board, in accordance with DAFI 91-202, functions as an overall design review authority and System Safety Group for directed energy weapons and higher risk non-weapons systems. It conducts assessments, approvals, and certifications throughout research, development, test and evaluation, production, deployment, and operational life cycle of a directed energy weapon and higher risk systems. **(T-1)**

5.1.2. The Board completes the following actions for directed energy weapons intended for operational use by DAF.

5.1.2.1. Reviews and establishes design safety and qualification test criteria, standards, and requirements for directed energy weapons and related items. **(T-1)**

5.1.2.2. Provides guidance to program management and acquiring activity authorities throughout the life cycle of directed energy weapons programs and ensures criteria for safety certification reviews receive adequate consideration during the design, development, test and evaluation, and operational deployment phases. **(T-1)**

5.1.2.3. Maintains safety oversight through the certification process described in this DAFI over all new or modified directed energy weapons used by the DAF regardless of source. **(T-1)**

5.1.2.4. Ensures safety certification or approval by another service or government does not replace the required Board review and certification recommendation. **(T-1)** However, certification and approval actions conducted jointly with another service's certification or approval authority may satisfy the Board review and certification recommendation process.

5.1.3. During a review of the safety evaluations for a weapon intended for operational use in the DAF, the Board:

5.1.3.1. Ensures directed energy weapons are evaluated against DAF safety criteria, standards, and requirements and that evaluations are based on analysis results and data obtained from engineering, development, and operational testing. **(T-1)**

5.1.3.2. Verifies (through results of evaluations) that the required level of design and performance safety is achieved during the entirety of a directed energy weapon’s life cycle. **(T-1)** An item’s life cycle includes all phases of development, test, production, and DAF operational use (including transportation, handling, maintenance, employment, and disposal) from program initiation through item removal from the DAF inventory.

5.1.3.3. Reviews the safety aspects of directed energy weapon operations, when requested by a Board member or HAF office, and recommends to the responsible organization actions to improve safety or occupational health provisions of the operation. **(T-1)**

5.1.3.4. The Board may refer a directed energy weapons to the Nonnuclear Munitions Safety Board or the Nuclear Weapon Systems Surety Group as appropriate.

5.1.4. For directed energy weapons not intended for operational use by the DAF, the Board:

5.1.4.1. Retains review and System Safety Group authority and responsibility for directed energy weapons developed, procured, or otherwise obtained by the DAF but not intended for DAF operational use. **(T-1)**

5.1.4.2. When requested, reviews directed energy weapons intended solely for foreign military sales.

5.2. General Directed Energy Safety Board Directive Guidance.

5.2.1. The Board provides the safety certification review and recommendation of military specific directed energy weapons for use by DAF personnel. **(T-1)** For weapons developed in an acquisition Program of Record, non-Program of Record, or purchased as standardized weapons, this takes the form of a safety certification. Safety certification or approval by another US military service or foreign government does not replace Board review requirements.

5.2.1.1. For foreign military weapons manufactured, procured, or intended for entry into the USAF and USSF inventory, the Board will conduct a certification review in accordance with **Chapter 7**. **(T-1)**

5.2.1.2. When requested by a Program Manager or acquiring activity, the Board reviews directed energy systems intended solely for sale to foreign militaries. **(T-1)** These systems will receive the same level of design safety as systems that are certified by the Board. The Board will not act as certification authority during requested reviews. The findings of requested reviews will be advisory in nature.

5.2.2. Board safety certification review and recommendation is required for each directed energy weapon prior to operational and training use by AF and/or SF personnel. **(T-1)** Milestone Decision Authorities must include directed energy safety certification in their production and fielding decisions. **(T-1)** Program Managers and acquiring activities will include the certification in their program's Environment, Safety, and Occupational Health documentation as appropriate. **(T-1)**

5.2.2.1. Because the standard acquisition program milestones and phases may not exist for non-Program of Record, these acquiring activities must prepare the required safety evaluations and plans specified in Chapters **6** and **7**, as appropriate. **(T-1)**

5.2.2.2. These safety documents must be requested or prepared by the Program Manager or acquiring activity prior to the decision to transition a system to a fielded capability or before the Program Manager or acquiring activity begins testing or operating the capability with non-developmental personnel not supervised by government developmental personnel. **(T-1)**

5.2.2.3. The Board reviews design safety evaluations for operational testing of uncertified directed energy weapons when testing live systems on DAF aircraft and ground platforms and/or involving DAF vehicles, personnel, and infrastructure as test subjects. **(T-1)** Lead Developmental Test Organizations will seek Board safety evaluation and certification as a part of their Safety Review Board process prior to conducting tests as outlined in this Instruction and DoDI 5000.89/DAFI 99-103, *Capabilities-Based Test and Evaluation*. **(T-1)**

5.3. Chairperson and Member Duties.

5.3.1. The Chairperson:

5.3.1.1. The Chairperson, or his/her designated representative, presides at Board meetings. **(T-1)** For a given matter before the Board, the Chairperson casts a vote only when a ballot of members present, including proxies, results in a tie.

5.3.1.2. Serves as technical lead for resolving any issues arising during staff agency coordination of the studies detailed in **paragraph 3.5**. **(T-1)**

5.3.1.3. Designates a non-voting Executive Secretary of the Board. **(T-1)**

5.3.1.4. Upon receipt of concurrences or successful resolution of non-concurrences, forwards signed approvals to the Executive Secretary **(T-1)** In addition, the Chairperson provides minutes to the AF/SE for review if the Chairperson determines there is no need for staff agency review. **(T-1)**

5.3.1.5. Acts as approval authority for requests to deviate from mandatory engineering and/or design requirements. **(T-1)**

5.3.1.6. Reports unfavorable mishap trends identified for directed energy systems previously certified by the Board that may require reevaluation by the Board.

5.3.1.7. On behalf of AF/SE, the Chairperson is the point of contact for acquiring special access program billets for ad hoc special access program quorum Board members. **(T-1)**

5.3.2. Board member Major Commands, Field Commands, and agencies must designate one primary and one alternate voting representative to serve at least three years (whenever possible) and be a Master Sergeant select or higher, field grade officer select or higher, or a DoD civilian grade equivalent. **(T-1)** The primary objective for MAJCOMs, FLDCOMs, and agencies is to select the best individuals (military or civilian) with the requisite training, operational experience, understanding of system safety, and technical credibility to efficiently conduct Board business. Board members must be knowledgeable of their command or agency's unique policies, procedures and operational limitations and constraints, and must possess the authority needed to represent their command. In addition, members will be prepared to write a minority report if the majority position is not consistent with their respective MAJCOM's, FLDCOM's, or agency's position.

5.3.2.1. A waiver request from the Major Command Safety Office (MAJCOM/SE) or Field Command Safety Office (FLDCOM/SE) must be submitted to the Chairperson if a primary or alternate voting representative cannot meet the specified grade requirements.

5.3.2.2. The waiver request must include the individual's name and rank, relevant training, operational experience, and technical credibility. In addition, include the primary reason why the waiver is being requested.

5.3.3. Unless a summary board is being used for a special access program, minimum membership attendance must be at least 7 of the 15 standing voting representatives to be considered a quorum sufficient for conducting Board business. **(T-1)** Members from commands and agencies affected by the directed energy system under review must be present to represent the effected user community of that directed energy system as a stakeholder. **(T-1)**

Under unusual situations, such as a short notice or conflicting requirements, voting members may delegate their votes to another member (proxy), provided the proxy member and the Board Chairperson agree to the delegation. The membership is composed of one voting representative from each of the following commands and agencies:

5.3.3.1. HQ Air Combat Command (ACC) **(T-1)**

5.3.3.2. HQ Air Force Materiel Command (AFMC) **(T-1)**

5.3.3.3. HQ Air Mobility Command (AMC) **(T-1)**

5.3.3.4. HQ Pacific Air Forces (PACAF) **(T-1)**

5.3.3.5. HQ United States Air Forces in Europe and Africa (USAFE-AFAFRICA) **(T-1)**

5.3.3.6. HQ Air Education and Training Command (AETC) **(T-1)**

5.3.3.7. HQ Air Force Global Strike Command (AFGSC) **(T-1)**

5.3.3.8. HQ Air Force Reserve Command (AFRC) **(T-1)**

5.3.3.9. HQ Air Force Special Operations Command (AFSOC) **(T-1)**

5.3.3.10. Air National Guard (ANG) **(T-1)**

5.3.3.11. Air Force Operational Test and Evaluation Center (AFOTEC) **(T-1)**

5.3.3.12. Air Force Surgeon General (AF/SG) **(T-1)**

5.3.3.13. HQ Space Operations Command (SpOC) **(T-1)**

5.3.3.14. HQ Space Systems Command (SSC) **(T-1)**

5.3.3.15. HQ Space Training and Readiness Command (STARCOM) **(T-1)**

5.3.4. Advisory Personnel. Advisory personnel (e.g., DAF LSSWG Members, FLDCOM Deltas, AFMC/96th Test Wing, Program Managers, Representatives of other services, Air Force Sustainment Center personnel, 96th Test Wing/AF SEEK EAGLE Office, Air Force Life Cycle Management Center Airworthiness, Air Force Life Cycle Management Center System Safety, Air Force Civil Engineer Center, Authorizing Official or security control assessor, partner DoD weapon system safety boards) and other program specific technical personnel may be invited by any Board member, Program Manager, or acquiring activity to attend Board meetings as needed. At times attendance by such advisors may be essential to the effective conduct of Board business. Advisors do not hold or exercise Board voting rights. If the membership holds that inadequate advisory expertise is present to allow proper evaluation of system, then, at the discretion of the Chairperson, review of the item may be postponed until a subsequent meeting.

5.3.4.1. The Chairperson approves the composition of special ad hoc groups to provide Board related review and advisory services to special access programs. **(T-1)**

5.3.4.2. Individual Board members may invite advisors and consultants and notify the Executive Secretary of those attendees well in advance of the meeting.

5.3.4.3. If the Chairperson, the Executive Secretary, or member anticipates that operational limitations may be imposed as a condition of certification of a directed energy system for operational use, the Executive Secretary advises the affected organization

requesting Board review, the Program Manager or acquiring activity, and the lead Command for the system. **(T-1)** In addition, the organization may request participation by one or more advisory representatives of the affected Air Force and/or Space Force organizations.

5.3.4.4. Representatives, advisors, and consultants from other Headquarters Air Force offices or government agencies, as necessary, may be invited to attend Board meetings when their directed energy systems (or systems requiring their expertise) are under review.

5.3.4.5. Other advisors whose attendance may be appropriate are representatives of the Air Force and Space Force acquisition activities, the lead developmental test and evaluation organization, and the user organization or unit.

5.3.4.6. Advisory organizations that provide required hazard evaluations must be present, unless approved by the Chairperson. The 96 TW provides hazard evaluation related to systems integration and the 711 HPW provides personnel hazard evaluation of direct and indirect hazards from directed energy. When an approved design standard, such as MIL-STD-1425A, exists, compliance can be verified by either of these organizations, or a Practitioner Level in Engineering & Technical (ENG) or Test & Evaluation (T&E) engineer (62E or civilian equivalent) from AFSEC.

5.3.5. The Board may conduct joint reviews with the directed energy safety certification bodies of other services for joint development programs in accordance with Department of Defense Manual 5000.69, *Joint Services Weapon Safety Review (JSWSR) Process*. Joint reviews are normally co-chaired and can include participation of members from multiple services. DoDI 5000.69, *Joint Services Weapon And Laser System Safety Review Processes*, requires "joint reviews include the Services' existing weapon, … and laser safety review boards working collaboratively to provide one set of joint weapon or laser safety findings and recommendations." **(T-1)** The Executive Secretary communicates operational impacts to the appropriate Program Managers or acquiring activities. **(T-1)** Joint meeting minutes may also serve as or be included in official Board minutes when reviewed and approved in accordance with **paragraph 3.5**.

5.4. Technical Safety Functions. The Board is charged with performing the following technical safety functions:

5.4.1. Tailoring design safety criteria and standards and establishing safety performance requirements for directed energy weapons, subsystems, components, and related items the Board reviews and evaluates. The Board may delegate tailoring authority to the Executive Secretary for lower risk systems.

5.4.2. Identifying and evaluating hazards in the design of directed energy weapons, subsystems, components or related items using the system safety engineering principles outlined in MIL-STD-882E, *System Safety*. In addition, the Board makes recommendations to Program Managers and acquiring activities to reduce the risk of hazards identified during Board proceedings to obtain a level acceptable to the DAF.

5.4.3. Identifying or approving procedures and warnings to help protect personnel, equipment, and property to Program Managers and acquiring activities when risks cannot be adequately controlled through design provisions.

5.4.4. Developing safety recommendations, which minimize risk during the life cycle of directed energy weapons, taking into consideration the mission requirements, employment concepts, and operating environments.

5.4.5. Minimizing retrofit actions required to improve design safety. The Board accomplishes this by identifying and including safety design criteria during the development phase of directed energy weapons, subsystems, components, or related items.

5.4.6. Using historical safety data and lessons learned from similar non-weapon directed energy and directed energy weapons programs to help evaluate new designs.

5.5. Executive Secretary Duties.

5.5.1. Consults with DAF acquiring activity organizations, program offices, managers, or other agencies as necessary to clarify requirements specified in this Instruction. **(T-1)**

5.5.2. Informs the Chairperson about Board activities and issues that might affect Board proceedings. **(T-1)**

5.5.3. Maintains a list of designated Board members and alternates. **(T-1)** The Executive Secretary also provides new member orientation as requested. **(T-1)**

5.5.4. Interacts with the Chairperson, members, DAF Program Managers and acquiring activities, system program offices, or other agencies as necessary to ensure the effectiveness of the Board safety/review process. **(T-1)**

5.5.5. Maintains up-to-date reference material on the scope, content, level of detail, and format requirements for the Safety Study and Supporting Analysis and will provide appropriate guidance to agencies charged with preparing a Safety Study or Supporting Analysis. **(T-1)**

5.5.6. Notifies the appropriate Program Managers or acquiring activity authorities of a change in certification status of a directed energy system when AF/SE disapproves or a staff agency non-concurs on a Board recommendation on certification. **(T-1)**

5.5.7. Takes the following actions to schedule meetings authorized by the Chairperson:

5.5.7.1. Those duties specified in **paragraph 3.1** for regular and special meetings.

5.5.7.2. Establishes meeting agendas. **(T-1)**

5.5.7.3. Establishes deadlines for submission of safety evaluations scheduled for review. Deadlines are normally 30-45 calendar days prior to the meeting date. **(T-1)** For ambitious meetings, the Executive Secretary should establish a suspense at least 60 calendar days from the meeting date to support the timeline in **paragraph 6.3.1**. **(T-1)**

5.5.7.4. Invites appropriate advisors and special representatives to attend meetings as directed by the Chairperson. **(T-1)**

5.5.7.5. Provides all administrative services needed to support a meeting such as read-ahead packages and conference room(s). **(T-1)**

5.5.8. Examines all documentation intended for Board review to ensure appropriateness and technical quality. **(T-1)**

5.5.9. Performs the following actions in preparation for scheduled meetings:

5.5.9.1. Circulates safety evaluations to Board membership sufficiently in advance of a meeting to allow 25 calendar days, at a minimum, for review and requests a waiver from the Chairperson when a less than 25 calendar day requirement is unavoidable due to compressed timelines due to operational mission needs of the weapon or weapon information and analysis data being unavailable. **(T-1)**

5.5.9.2. Ensures read-ahead information to support Test Hazards Assessment Reviews, System Safety Group activities, and other matters requiring Board action are received by the members at least 14 calendar days before the meeting. **(T-1)**

5.5.9.3. Ensures related studies, correspondence, and background material is available for the Board meeting and establishes post-meeting liaison with agencies having a direct interest in the results of Board proceedings. **(T-1)**

5.5.10. When authorized by the Board, monitors follow-on actions established as a condition of a Board live fire test approval and issues the final approval when actions are completed. **(T-1)**

5.5.11. Notifies program management and acquiring activity authorities, test organizations, and unit commanders when it is permissible to proceed with planned activities and operations based on Board recommendations. **(T-1)**

5.5.12. Notifies concerned agencies of the change in certification status if a staff agency non-concurs with a Board recommendation. **(T-1)**

5.5.13. Provides System Safety Group guidance to program management and acquiring activity authorities when inclusion of such guidance in the official Board meeting minutes is deemed inappropriate. **(T-1)**

5.5.14. Ensures Board proceedings are fully documented and incorporated into the meeting minutes. **(T-1)** Provides draft minutes for review to the Board and Chairperson within 14 calendar days of Board adjournment and circulates final meeting minutes for signature. **(T-1)**

5.5.15. Forwards final meeting minutes for signature and updated safety evaluations for approval to the Chairperson. **(T-1)**

5.5.16. Forwards DoD Exemption Notification to program management and acquiring activities, manufacturers, and joint partners as appropriate once approved by AFSEC/SEW.

5.5.17. Issues and distributes final Supporting Analysis after Board approval. Issues and distributes Safety Studies after AF/SE approval. **(T-1)**

5.5.18. Manages status reporting actions that implement approved Board recommendations. Specifically, the Executive Secretary:

5.5.18.1. Periodically requests action item status reports from designated action agencies. **(T-1)**

5.5.18.2. Reports action item status at each regularly scheduled Board meeting. **(T-1)**

5.5.19. Maintains awareness of military and civilian and national and international standardization activities involving design and performance safety, analysis, and directed energy system testing, and offers such standards for possible Board approval for DAF use, as appropriate.

5.5.20. Maintains all Board historical records in accordance with the Records Disposition Schedule, including meeting proceedings, indexes of Safety Studies and Supporting Analyses, and logs of administrative closures issued by the Executive Secretary. **(T-1)** The Executive Secretary will assure the Board members are provided current copies of these indexes and logs and the Board membership roster. **(T-1)**

5.5.21. Maintains the Board certification database, prepares the catalogue of Board actions and distributes annual catalogue updates to Board members. **(T-1)**

5.5.22. Serves as principal administrative assistant and key advisor to the Chairperson and Board members for conducting Board affairs. The Executive Secretary should possess appropriate training, operational experience, understanding of system safety, and technical credibility to efficiently support Board business.

5.5.23. Is knowledgeable in public sector, DAF, and DoD directed energy related directives, policies, and standards.

5.5.24. Approves program management, acquiring activity, or preparing organization when documentation is acceptable for Board review. Provides guidance on changes needed to produce acceptable quality and reviews resubmitted documentation for acceptability.

Chapter 6

CERTIFICATION, STUDIES, TEST, AND SAFETY STANDARD FUNCTION

6.1. Overview. Board design safety certification action is required for directed energy weapons prior to entry into the DAF operational inventory and is accomplished through review of safety evaluations and/or test results. Attachments **4** and **5** provide certification flowcharts to assist Program Manager and acquiring activities. In addition, the Board will not recommend final certification until requirements of **paragraph 1.2.6** are met.

6.2. Administrative Certification Eligibility. Reference **Attachment 4** for certification process flowcharts.

6.2.1. For many directed energy systems, there are already robust safety and health reviews and/or mature controls developed prior to fielding these systems. Hazards generated by directed energy systems to ordnance and fuel are not part of the initial assessment criteria since established safety thresholds are implementation and environment specific and cannot be appropriately addressed until more information is generated in the acquisition process. Hazards to ordnance and fuel will be characterized and minimized as part of the acquisition process and Program Managers and acquiring activities may contact the Board for guidance as appropriate. For such minimal risk systems, Program Managers and acquiring activities may administratively certify a directed energy system if it meets all applicable personnel exposure standards. No further action is required unless the Board, at its discretion, elects to review an administrative certified system. Applicable exposure standards are as follows:

6.2.1.1. Stand alone commercial available off-the-shelf item used for their designed purpose and in accordance with manufacturer instructions are administratively certified.

6.2.1.2. Personnel are not exposed to a hazardous material above an action or compliance level during proposed or typical operational use. Action and compliance levels are typically based upon the Occupational Safety and Health Administration's compliance requirements, but more restrictive levels may be recommended by the National Institute for Occupational Safety and Health. Program Managers and acquiring activities will use the most restrictive of these exposure levels.

6.2.1.3. Exposure to ionizing radiation is below the public dose limits of no more than 2 millirem in any one hour and no more than 100 millirem in a year in accordance with AFMAN 40-201, *Radioactive Materials (RAM) Management*, and AFMAN 48-148, *Ionizing Radiation Protection* requirements.

6.2.1.4. Exposure to acoustic hazards is under the 85 decibels A-weighted time weighted average or equivalent exposure times, below 140 dB peak sound pressure level, and any other criteria specified in AFI 48-127, *Occupational Noise and Hearing Conservation Program*, during proposed or typical operational use. **Exception**: A Program Manager or acquiring activity must request Board requirements for certification if an acoustic directed energy system is intended to or has a likelihood of producing non-auditory target effects or hazards.

6.2.1.5. Exposure to non-ionizing electromagnetic frequency (e.g., radio and microwave) energy is below the Upper Tier limits for occupationally exposed personnel or the Lower Tier for general public exposures during proposed or typical operational use in accordance

with AFI 48-109, *Electromagnetic Field Radiation Occupational and Environmental Health Program*. The directed energy system also meets the requirements of MIL-STD-464C, *Electromagnetic Environmental Effects, Requirements for Systems*, DoD Instruction 3222.03, and DAFMAN 91-203, *Air Force Occupational Safety, Fire and Health Standards*, regarding hazards of electromagnetic radiation to fuel and AFI 91-208, *Hazards of Electromagnetic Radiation to Ordnance (HERO) Certification and Management*.

6.2.2. Military specific Class 1, 1M, 2, 2M, or 3R laser systems compliant with 21 CFR Part 1040 are considered administratively certified. For laser Classes 1M, 2, 2M, and 3R Program Managers and acquiring activities must still submit the documentation specified in **Attachment 2** to AFSEC/SEW at least 45 calendar days prior to fielding. Failure to do so may result in decertification. While military specific Class 1, 21 CFR Part 1040 compliant systems do not require review, AFSEC/SEW reserves the right to conduct assessments as deemed appropriate.

6.3. Non-Administrative Certification for Lower-Risk Systems.

6.3.1. Military specific laser systems that reduce risk to Low and Medium by compliance with MIL-STD-1425A are not administratively certified but may be certified by AFSEC/SEW. Laser systems compliant with MIL-STD-1425A still require a Laser Hazard Evaluation (LHE) from the LSRC, Laser Hazard Assessment (LHA) by the LSRA and Review by the DAF LSSWG, but they are only brought to the DEWSB if requested by a member, requesting agency, Executive Secretary or Chairperson. Program Manager and acquiring activities must still submit the documentation specified in **Attachment 2** to AFSEC/SEW at least 45 calendar days prior to desired certification date.

6.3.2. Certification is based on a Supporting System Safety Analysis, alternately the "Supporting Analysis". The Supporting Analysis is a less comprehensive safety evaluation than the Safety Study and is typically prepared for support equipment and lower risk weapons of any complexity that have a minor impact on safety. The Supporting Analysis is not subject to HAF approval; therefore, the Supporting Analysis should not be used as the basis for action when a certification issue regarding higher level management attention is expected, regardless of the development status or intended use of the item under review. The Executive Secretary is available to provide guidance as to the appropriateness of the Supporting Analysis versus the Safety Study for any given item.

6.3.3. A directed energy weapon review and certification does not require a board when it has been previously reviewed, changes do not increase or introduce new hazards and mitigations remain valid. (e.g., addition of a lower risk or well understood sub-system to an existing system). For such actions, the Board delegates certification to the AFSEC/SEW, to include the discretion to tailor required documentation. Each item certified by the AFSEC/SEW will be approved by an Executive Secretary Letter. These letters will be maintained on file by the Executive Secretary. At each regularly scheduled meeting of the Board, the Executive Secretary will inform the Board of such certifications accomplished after the previous meeting.

6.3.4. If a directed energy system is a safety critical component with impacts to safety critical functions of a weapon that is not adequately managed by hardware or discrete interruption of power, then the method of mitigation will require testing of software to achieve the appropriate 'level of rigor' in accordance with Table V of MIL-STD-882E; and require review by the DEWSB.

6.4. Non-Administrative Certification for Serious-Risk Systems.

6.4.1. A Summary Board that includes the using command may be used for fielding approval recommendation. Resolution of the safety design review remains at the AFSEC/SEW level, like with Low and Medium risk.

6.4.2. Laser systems require a LHE from the LSRC, LHA by the LSRA and Review by the DAF LSSWG, but they are only brought to a full DEWSB if requested by a member, requesting agency, Executive Secretary or Chairperson. Program Manager and acquiring activities must still submit the documentation specified in **Attachment 2** to AFSEC/SEW at least 45 calendar days prior to desired certification date.

6.4.3. Certification is based on a Supporting System Safety Analysis, alternately the "Supporting Analysis". The Supporting Analysis summarizes findings, conclusions and recommendations from the LHE, LHA and DAF LSSWG Review. The Supporting Analysis is not subject to HAF approval; therefore, the Supporting Analysis should not be used as the basis for action when a certification issue regarding higher level management attention is expected, regardless of the development status or intended use of the item under review. The Executive Secretary is available to provide guidance as to the appropriateness of the Supporting Analysis versus the Safety Study for any given item.

6.5. Non-Administrative Certification for Weapons and High-Risk Systems. Board certification is used for laser weapons and systems with critical or catastrophic consequences that are not mitigated below high risk by compliance with design requirements of MIL-STD-1425A.

6.5.1. Certification is based on the directed energy weapon system's Technical Safety Study, alternately the "Safety Study", reviewed during a regular or special meeting. **(T-1)** Results from the Safety Study will be the basis for Board certification recommendations. Directed energy weapon certifications are requested from Program Managers and acquiring activities or through the lead user MAJCOM/SE and/or FLDCOM/SE to AFSEC/SEW.

6.5.2. The Safety Study is a comprehensive safety evaluation of a directed energy weapon used to document safety engineering evaluations and to submit safety findings for Board review. The Safety Study must contain sufficient information to fully support the certification recommendations formulated by the Board.

6.5.3. The Chairperson and Board members will be provided the draft edition of the Safety Study in sufficient time prior to the scheduled meeting to allow proper review within the members' MAJCOMs and/or FLDCOMs. In no case should the review time be less than 25 calendar days (for two or less straightforward studies). For ambitious meeting agendas (e.g., 4 or 5 studies for complex systems), some of the draft Safety Studies and Supporting Analyses may be distributed 45 or more calendar days in advance, to level the members' review workload. Read-ahead information will also be provided for other than certification meeting business requiring a Board decision. Such read-ahead information will be provided at least 14 calendar days prior to the meeting. If any Board member states insufficient time was provided for a proper MAJCOM and/or FLDCOM review, then the item in question will be removed from the meeting agenda.

6.5.4. If during their Safety Study or Supporting Analysis review, the Board members have questions or identify concerns, they will inform the Safety Study or Supporting Analysis preparing activity so that additional information may be made available at the Board meeting.

6.5.5. Following formal review of the draft safety study, Board design safety conclusions and certification recommendations are included in the Safety Study. AFSEC/SEW may then forward the Safety Study to HAF and SAF for concurrence for a higher risk system in accordance with **paragraph 3.5**.

6.6. Systems and Components to be Evaluated.

6.6.1. Aspects of directed energy weapons, such as integral and add-on components, software, commercial products, and commercial-off-the-shelf items will be evaluated as integral parts of the systems to which they belong. The following directed energy systems and components, except as noted, are within the purview of the Board:

6.6.1.1. Command, Control, Firing, Safing, Arming, and Target-Detecting Devices. All components used to command, control, safe, arm, and/or fire directed energy weapons. This category also includes components of directed energy weapons used to establish and control system states, such as detecting a target and issuing signals for initiation of directed energy.

6.6.1.2. Release, Control, Suspension, and Mounting Devices. Applicable to all suspension and mounting systems (e.g., racks and rails), or packaging devices used to contain or physically control directed energy weapons or used as the direct firing platform. **(T-1)**

6.6.1.3. Support and Test Equipment. Applicable to all handling, storage, test, maintenance, and transport equipment for use with or in support of directed energy weapons, including locally manufactured equipment, data scanners, radio frequency identification device systems, components, and software. **(T-1)** Test equipment, including commercially available equipment, used for testing safety critical functions (e.g., arming or firing circuits) of directed energy weapons, subsystems, components, and software must be evaluated.

6.6.1.4. By-product thermal energy management systems. **(T-1)**

6.6.1.5. Power generation management systems. **(T-1)**

6.6.1.6. Hazardous material use, consumption, and disposal management. **(T-0)** Refer to AFJMAN 23-209, *Storage and Handling of Hazardous Materials*.

6.6.1.7. Miscellaneous. Examples include but are not limited to decoy devices, explosives simulators, remotely piloted vehicles that are intended to carry or fire directed energy weapons, training and scoring items, and targets that contain hazardous components. **(T-1)**

6.7. Test Evaluation Functions.

6.7.1. The basis for live fire test approval is the Test Hazards Assessment Review, prepared in accordance with **paragraph 7.4**, and reviewed during a regular or special meeting. Live fire test approval is distinct from the Live First Test and Evaluation process typically used in Programs of Record.

6.7.2. Under extraordinary circumstances the Board members may be requested to approve Test Hazards Assessment Reviews individually in lieu of a regular meeting. This procedure may be initiated only with the agreement of the Chairperson and a quorum of members. In this situation, test approval must be unanimous.

6.7.3. The Board members and Chairperson will be provided read-ahead information at least 14 calendar days prior to conducting a Test Hazards Assessment Review. **(T-1)** Such information may be a simple point paper for lower risk and non-complex items, or it may be a comprehensive technical data package for directed energy weapons that are potentially more hazardous and complex.

6.7.4. If a Test Hazards Assessment Review approval is issued conditional upon completion of follow-on actions, the Executive Secretary will monitor these actions until their completion. If Test Hazards Assessment Review is not approved, the Executive Secretary will inform the requesting agency of the reasons for non-approval. **(T-1)** Approval is based upon a majority vote of present and voting Board members, to include proxy votes.

6.8. Safety Standards and Functions.

6.8.1. The Board is the DAF focal point for the development and/or adoption of design and performance safety standards for directed energy weapons, but also tactical systems that present battlefield hazards requiring mitigations beyond the control of the individual user. When hazards are appropriately managed by the user and the weapon's design complies with MIL-STD-1425A, the focal point is the DAF LSSWG.

6.8.2. **Attachment 3** lists standards currently approved by the Board and considered applicable to the design, development, test, and evaluation of directed energy systems intended for use by DAF personnel. Deviations from these standards due to weapon functional requirements must be noted in the Safety Study, Supporting Analysis, Test Hazards Assessment Review, or Risk Analysis.

6.8.3. In its capacity as the DAF directed energy System Safety Group, the Board provides directed energy system safety guidance to program management and acquiring activity authorities responsible for acquisition of directed energy weapons. This guidance can be on design safety, analysis, and testing matters that could have a bearing on future certification. Guidance formulated by the Board will be documented in the meeting proceedings. If a Program Manager or acquiring activity authority believes this approach might impact acquisition strategy, the Board may direct the Executive Secretary to provide clarification to the Program Manager or acquiring activity authority regarding the Board's guidance. All official correspondence associated with Board guidance or Executive Secretary letters will be maintained by the Executive Secretary.

6.9. Non-AF Use of Directed Energy Systems in the Joint Safety Review Process.

6.9.1. The Executive Secretary for the Board is the DAF representative to joint safety review processes conducted in accordance with DoD Manual 5000.69. The Executive Secretary provides DAF and USSF coordination for joint directed energy systems that are presented for use by services or organizations other than the AF. **(T-1)**

6.9.1.1. If joint directed energy systems or weapons are to be used by DAF personnel, the respective agencies must follow the requirements outlined in this Instruction to support a review in conjunction with safety reviews conducted by other services. **(T-1)**

6.9.1.2. When the Board Executive Secretary receives a request for joint service review of directed energy systems or weapons that will not be used by DAF personnel, the Executive Secretary may deny the request as a Board review is not required.

6.9.2. The Chairperson may approve an ad hoc group, with select Board members, to expedite a joint safety review.

6.9.3. The Chairperson may assign members to a DAF review group as needed to review joint directed energy systems for DAF or non-DAF use.

6.10. Temporary Approval for Emergency Operational Capability (EOC).

6.10.1. If an EOC is requested by combatant commands, the requesting organization must submit a temporary approval package to AFSEC/SEW for expedited review by the DAF stakeholders, such as the DAF LSSWG, and DEWSB. The DEWSB will consider the urgency of the request and the completeness of technical review and documentation in its consideration of whether and for how long to grant temporary approval. **(T-1)**

6.10.2. The temporary approval package submitted to AFSEC/SEW must include as many of the following documents as practical: **(T-1)**

6.10.2.1. An AFSEC/SEW approved Preliminary Hazard Analysis with evaluation of regulatory compliance, such as the AFRL 711th Human Performance Wing Optical Radiation Bioeffects Division's (711 HPW/RHD)'s MIL-STD-1425A Checklist for lasers.

6.10.2.2. CONOPs, CONEMPs, or TTPs for the intended use of the system.

6.10.2.3. SOPs.

6.10.2.4. Description of system specific user training identifying primary and ancillary hazards.

6.10.2.5. A Letter of Intended Evaluation by an AFSEC/SEW approved organization, to document the requesting organization has scheduled an independent system hazard evaluation to ensure efforts are made to meet DAF stakeholder guidance in conjunction with fielding the system under a waiver.

6.10.2.6. A letter from the requesting organization outlining the operational necessity, the scope of intended use, and period of time required for the temporary approval.

6.10.2.7. For military specific lasers, a copy of manufacturer's DoD exemption notification, issued by the DAF LSSWG, granting the manufacturer the legal right to sell the military specific laser to the DAF. If the device is FDA-compliant, the requesting organization must provide the FDA accession number as proof that compliance has been registered with the FDA or inspected by an LSRA or LSRC-approved person for compliance with FDA Laser Notice 50 or 56.

6.10.3. Use section 7.6, *Preparing a Risk Assessment*, below, to ensure all required documentation is included.

6.10.4. If approved, AFSEC/SEW will provide a temporary approval, with a termination date, to the requesting organization. After that date, if permanent approval or extended temporary approval has not been granted, DAF personnel must cease use of the system.

Chapter 7

SAFETY STUDIES AND REVIEWS

7.1. Overview. The primary tool used by the Board to evaluate directed energy systems and related equipment items is the safety evaluation and review program set forth in MIL-STD-882E. Application of MIL-STD-882E techniques provides assurance that directed energy weapons and associated support and test equipment items, other directed energy weapon related items, and all operating procedures and technical data meet the highest safety standards. The safety evaluation process considers design, logistics, and operational requirements throughout a directed energy weapon's life cycle. Refer to **Attachment 5** for guidance regarding required safety evaluations.

7.2. Directed Energy System Safety Study and Review Process.

7.2.1. The Program Manager or acquiring activity responsible for procuring or modifying directed energy weapons (Program Executive Officers, Designated Acquisition Commanders, System Program Directors, Product Group Managers, Joint Program Offices, etc.), including all directed energy weapons and related items specified in **paragraph 6.6**, is also responsible for ensuring the requirements of this chapter are satisfied. These responsibilities include:

7.2.1.1. Ensuring a directed energy weapon item requiring Board study and review is identified to the Executive Secretary and designated system safety engineers early in the design or acquisition process. This allows review and certification actions to begin early enough to minimize any effect of the Board review on schedule and procurement costs.

7.2.1.2. Ensuring compliance with all required design safety standards.

7.2.1.3. Ensuring appropriate safety evaluations (Safety Study, Supporting Analysis or Test Hazards Assessment Review) are prepared at the earliest date possible in the development cycle as outlined below. In addition, early correspondence with and reviews by the Board are encouraged to minimize potential impacts of safety related design changes.

7.2.2. Designated system safety engineers will work with the responsible agency to ensure:

7.2.2.1. A copy of the study or review documentation is submitted to the Executive Secretary at least 45 calendar days prior to the Board meeting. Final design drawings, electronics diagrams, copies of failure analyses, etc. will be provided by the responsible agency no later than 90 calendar days prior to the Board meeting.

7.2.2.2. Review documents and a study or review presentation are provided at the scheduled Board meeting. The purpose of the presentation is to address design safety issues of the items under review and to respond to any concerns or questions the Board members may have. In addition, guidance on presentation scope, level of detail, and format should be requested from the Executive Secretary.

7.2.3. Requests for release of information contained in a staff approved Safety Study Supporting Analysis, or Test Hazards Assessment Review must be submitted to the Executive Secretary.

7.3. Preparing a Directed Energy Weapon Technical Safety Study.

7.3.1. The Safety Study is a detailed safety evaluation of a directed energy weapon and is used to document safety engineering findings and to submit safety recommendations for Board review. Reference **Attachment 2** for Safety Study requirements. A Safety Study is:

7.3.1.1. Prepared for directed energy weapons and related items of which the Board maintains oversight as specified in this Instruction. **(T-1)**

7.3.1.2. A document used to present only the necessary design and performance details required for weapon evaluation and not as a source data for directed energy weapons. **Note:** Data in a Safety Study may contain proprietary and/or privileged information. Consult servicing Staff Judge Advocate prior to disseminating a Safety Study that contains proprietary and/or privileged information.

7.3.1.3. Usually prepared following the start of the Development, Test, and Evaluation phase, or following the start of the Initial Operational Test and Evaluation portion of a combined Development, Test, and Evaluation phase/Initial Operational Test and Evaluation phase.

7.3.1.4. Reviewed by the Board and approved by the appropriate staff agencies prior to entry of production weapon into the AF and/or SF inventory. **(T-1)**

7.3.1.5. Forwarded to applicable staff agencies with the Board's recommendations for coordination. **(T-1)** Upon staff approval, Board recommendations become requirements levied on the specified action agencies. **(T-1)**

7.3.2. The safety study content is described in **Attachment 2** of this DAFI. It clarifies hazards and mitigations in place for the test or 'fielding', regarded as event-risk in MIL-STD-882E. There is neither a requirement that 'Tasks' described in MIL-STD-882E be used nor contracted out, but **Chapter 4** of the standard and descriptions of Tasks 204, 205 and 206 provide an example of identifying sub-system, system integration, and operating and support-based hazards.

7.3.3. For complex weapons, the 96th Test Wing System Safety Office, or by any other organization possessing sufficient safety engineering expertise as determined by the Board, will review hazards related to weapon system integrations to advise board members.

7.4. Preparing a Test Hazards Assessment Review.

7.4.1. A Test Hazards Assessment Review is the minimum analysis necessary before live testing of uncertified directed energy weapons. It is normally presented prior to operating the live system from a platform if the system could cause catastrophic or critical damage to the operating platform or injury to non-developmental personnel. A Test Hazards Assessment Review may be a simple point paper for lower risk and non-complex items, or it may be a comprehensive technical data package for a higher risk, complex system. For this reason, the Executive Secretary should be consulted regarding format and content.

7.4.2. Directed energy weapons must be reviewed by the Board before live fire testing as specified in this Instruction.

7.4.3. The live fire Test Hazard Assessment Review requirement does not prevent tests of inert or non-emanating weapons.

7.4.4. The intent of this evaluation is to mitigate danger to, or loss of, assets during live tests of uncertified directed energy weapons with non-developmental personnel and/or incidental personnel. Review and approval of a Safety Study or Supporting Analysis by the Board satisfies the requirement for a Test Hazards Assessment Review.

7.4.5. A Test Hazards Assessment Review must contain the following items.

7.4.5.1. Weapon system name and names of personnel involved in Review preparation.

7.4.5.2. A statement regarding the purpose and scope of the Review.

7.4.5.3. A physical and functional description of the item and sufficient analysis to ensure the item is safe for use within the controlled test environment.

7.4.5.4. A preliminary weapon safety analysis of the design, including preliminary comparisons to MIL-STD, North Atlantic Treaty Organization Standardized Agreements, failure analyses, and other safety evaluations performed to date, as applicable and as available.

7.4.5.5. The status of technical data, explosive ordnance disposal procedures, interim hazard classification, and hazards of electromagnetic radiation to ordnance assessment required for a live fire test.

7.4.5.6. A section summarizing the Review's conclusion(s) and recommendation(s) for test approval. This section should also list any actions deemed necessary to be accomplished prior to a live fire test.

7.4.6. A Test Hazards Assessment Review is normally prepared by 96th Test Wing System Safety Office, or by any other organization possessing sufficient safety engineering expertise as determined by the Board.

7.4.7. The Test Hazards Assessment Review should not be used as source data for directed energy weapons and should be considered to carry the same limitations on disclosure as other safety documentation used expressly for mishap prevention.

7.5. Preparing a Supporting System Safety Analysis.

7.5.1. When the preparing activity decides that support equipment and lower risk weapons of any complexity have only minor impact on safety, the Program Manager or acquiring activity may prepare, with the concurrence of the Executive Secretary, a Supporting Analysis instead of a complete Safety Study. However, the Board may direct that a complete Safety Study be prepared on the item in lieu of the Supporting Analysis. A Supporting Analysis is:

7.5.2. Needed to support a conclusion that a system, sub-component or modification of a system or sub-component has only a minor impact on safety.

7.5.3. Required for newly designed or modified unique or peculiar support equipment used with directed energy weapons. Staff agency review and approval of the Supporting Analysis is not required.

7.5.4. Normally prepared by 96th Test Wing System Safety Office, or by any other organization possessing sufficient safety engineering expertise as determined by the Board.

7.5.5. Not used as source data for directed energy weapons and should present only the necessary design and performance details required for system evaluation. **Note**: Data in a Supporting Analysis may contain proprietary and/or privileged information.

7.6. Preparing a Risk Assessment.

7.6.1. A Risk Assessment is typically prepared by the Program Manager or acquiring activity for rare instances when urgent timelines are not sufficient to support the normal Certification/Test Approval process.

7.6.2. If Emergency Operational Capability is requested by combatant commands to support an urgent military operation, the Program Manager or acquiring activity will submit a Risk Assessment review request through the lead user MAJCOM and/or FLDCOM to the Chairperson and Executive Secretary for Board coordination and approval recommendation.

7.6.3. The Emergency Operational Capability request must include a Residual Risk Analysis. A Residual Risk Analysis is an overall evaluation of a system's suitability for emergency operations from a safety perspective. It should provide all information necessary to make informed risk management decisions. The Residual Risk Analysis must include:

7.6.3.1. A preliminary hazard analysis using the approach outlined in MIL-STD-882E and documented in accordance with DAFI 91-202. **(T-1)** Although not required, the Safety Assessment Report (from Task 301)'s task description of MIL-STD-882E provides additional details that should be included, when available.

7.6.3.2. Recommendations and strategies to mitigate mishap risks exposed through training, operations, or maintenance.

7.6.3.3. A risk mitigation strategy approval by the appropriate Risk Acceptance Authority. **(T-1)** Determine the appropriate Risk Acceptance Authority using the highest mishap category of the initial risks (while recommended actions are being incorporated into the design) and residual risks (after all recommended actions have been incorporated). **(T-1)** Where risk of hazards cannot be adequately reduced, the Board-adjudicated risk assessment must be accepted by the appropriate authority determined IAW DAFI 91-202, under System Safety. **(T-1)**

7.6.4. For laser systems a description of the system, its functional operation and use, in accordance with A2.1.1 and A2.1.2 in **Attachment 2**, are required and the Program Manager or acquiring activity must provide documentation that the hazard evaluation in A2.1.3 has been scheduled or accomplished.

7.6.5. If approved, the Chairperson will provide documentation with the Risk Assessment to the Program Manager or acquiring activity. During operations conducted under a Risk Assessment in lieu of certification, data should be collected on safety related operational deficiencies and potential system improvements.

Chapter 8

INCORPORATION OF DESIGN SAFETY

8.1. Directed Energy System Design Safety Standards and Criteria.

8.1.1. Directed energy system design safety standards will incorporate a life cycle approach to ensure directed energy systems can be safely handled, stored, and operated in all environments the items can reasonably be expected to experience throughout its life cycle. In addition, directed energy systems will meet the requirements of AFI 91-208 for hazard of electromagnetic radiation to ordnance, and for hazards of electromagnetic radiation to fuel in accordance with MIL-STD-464C, DoD Instruction 3222.03, and DAFMAN 91-203.

8.1.2. Directed energy system design safety standards must be given equal consideration along with logistics and operational requirements.

8.1.3. Design safety standards have been developed for certain types of systems or components and must be followed. **(T-1)** See **Attachment 3** for examples of applicable standards.

8.2. Directed Energy System Design Safety Deviations.

8.2.1. For high-risk systems, deviations from directed energy system design safety standards can only be authorized with a recommendation by the Board and with concurrence of the Chairperson. Low-risk deviations may be authorized by AFSEC/SEW.

8.2.2. Deviations from directed energy system design safety standards will not be considered unless alternative design concepts or procedures are provided and meet the intent of the applicable standard.

8.2.3. Chairperson may elect to staff deviations to higher risk or complex systems to HAF and SAF for concurrence.

SEAN M. CHOQUETTE
Major General
Chief of Safety

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

References

Title 21, Code of Federal Regulations, Part 1040.10, *Laser Product*s

Title 21, Code of Federal Regulations, Part 1040.11, *Specific Purpose Laser Products*

FDA Exemption No. 76EL-01, *Department of Defense Exemption from the FDA Performance Standard for Laser Products*, 29 July 1976

FDA Laser Notice Number 9, *Exemption of Certain Military Laser Products from the FDA Radiation Safety Performance Standard for Laser Products*, 23 August 1976

FDA Laser Notice Number 50, *Laser Products – Conformance with IEC 60825-1 and IEC 60601-2-22; Guidance for Industry and FDA Staff*, 24 June 2007

FDA Laser Notice Number 52, *Guidance on the Department of Defense Exemption from the FDA Performance Standard for Laser Products; Guidance for Industry and FDA*, 12 July 2002

FDA Laser Notice Number 56, *Laser Products – Conformance with IEC 60825-1 Ed. 3 and*

IEC 60601-2-22 Ed. 3.1; Guidance for Industry and Food and Drug Administration Staff, 8 May 2019

Chairman of the Joint Chiefs of Staff Manual 3230.01A, *Joint Chiefs of Staff Directed Energy Weapon Initial Operational Employment Review and Approval Process*, 15 December 2021

DoD Instruction 3222.03, *Electromagnetic Environmental Effects (E3) Program*, 10 October 2017

DoD Instruction 5000.89_DAFI 99-103, *Capabilities-Based Test and Evaluation*, 8 December 2021

DoD Instruction 5000.69, *Joint Services Weapon and Laser System Safety Review Processes*, 10 August 2023

DoD Manual 5000.69, *Joint Services Weapon Safety Review (JSWSR) Process*, 15 October 2018

DoD Directive 2311.01, *DoD Law of War Program*, 2 July 2020

Department of Defense (DoD) Instruction 3200.19, *Non-Lethal Weapons (NLW) Human Effects Characterization*, 31 August 2018

DoD Instruction 6055.11, *Protecting Personnel from Electromagnetic Fields*, 12 May 2021

DoD Instruction 6055.15, *DoD Laser Protection Program*, 31 Aug 2018

Military Handbook 828C, *Range Laser Safety*, 31 March 2017

MIL-STD-464C, *Electromagnetic Environmental Effects, Requirements for Systems*, 1 December 2010

MIL-STD-882E, *System Safety*, 11 May 2012

MIL-STD-1425A, *Safety Design Requirements for Military Lasers and Associated Support Equipment*, 29 March 2010

Technical Order 11A-1-47, *DoD Ammunition and Explosives Hazard Classification Procedures*, 30 July 2012

AFI 33-322, *Records Management and Information Governance Program*, 23 March 2020

AFMAN 40-201, *Radioactive Materials (RAM) Management*, 28 March 2019

AFI 48-109, *Electromagnetic Field Radiation (EMFR) Occupational and Environmental Health Program*, 1 August 2014

AFI 48-127, *Occupational Noise and Hearing Conservation Program*, 26 February 2016

AFI 48-139, *Laser and Optical Radiation Protection Program*, 29 September 2014

DAFI 48-145, *Occupational and Environmental Health Program*, 21 September 2022

AFMAN 48-148, *Ionizing Radiation Protection*, 19 July 2020

AFI 63-101/20-101, *Integrated Life Cycle Management*, 30 June 2020

AFI 90-821, *Hazard Communication (HAZCOM) Program*, 13 May 2019

DAFI 91-202, *The US Air Force Mishap Prevention Program*, 12 March 2020

DAFI 91-204, *Safety Investigations and Reports*, 10 March 2021

DAFMAN 90-161, *Publishing Processes and Procedures*, 14 April 2022

DAFMAN 91-203, *Air Force Occupational Safety, Fire, and Health Standards*, 25 March 2022

AFI 91-208, *Hazards of Electromagnetic Radiation to Ordnance (HERO) Certification and Management*, 24 October 2019

AFJMAN 23-209, *Storage and Handling of Hazardous Materials*, 3 March 2020

AFMAN 13-212V1, *Range Planning and Operations*, 14 March 2023

AFMAN 91-221, *Weapons Safety Investigations and Reports*, 25 March 2020

AFMAN 91-222, *Space Safety Investigations and Reports*, 16 June 2019

AFPD 51-4, *Operations and International Law*, 24 July 2018

AFPD 91-4, *Directed Energy Weapons (DEW)*, 16 January 2020

Center for Disease Control, National Institute of Occupational Safety and Health Pocket Guide, **https://www.cdc.gov/niosh/npg/default.html**

AFRL-SW-WP-SR-2013-0011, *Technical Guide to Lasers and Optical Radiation*, August 2013,

Available from USAF School of Aerospace Medicine.

American National Standard Institute, Z136.1-2022, *Safe Use of Lasers*, 2022

American National Standard Institute, Z136.4-2021, *American National Standard Recommended Practice for Laser Safety Measurements for Hazard Evaluation*, 2021

American National Standard Institute, Z136.6-2015, *Safe Use of Lasers Outdoors*, 2015

Prescribed Forms

None

Adopted Forms

DAF Form 847, *Recommendation for Change of Publication*, 15 April 2022

Abbreviations and Acronyms

ACC—Air Combat Command

AETC—Air Education and Training Command

AF—Air Force

AFGSC—Air Force Global Strike Command

AFI—Air Force Instruction

AFMAN—Air Force Manual

AFMC—Air Force Materiel Command

AFOTEC—Air Force Operational Test and Evaluation Center

AFRL—Air Force Research Laboratory

AFSEC—Air Force Safety Center

AFPD—Air Force Policy Directive

AFRC—Air Force Reserve Command

AFSOC—Air Force Special Operations Command

AMC—Air Mobility Command

ANG—Air National Guard

CFR—Code of Federal Regulations

DAF—Department of the Air Force

DAFI—Department of the Air Force Instruction

DAFMAN—Department of the Air Force Manual

DoD—Department of Defense

EMFR—Electromagnetic Field Radiation

FDA—Food and Drug Administration

FLDCOM—Field Command

FLPPS—Federal Laser Product Performance Standards

HAF—Headquarters Air Force

HERO—Hazards of Electromagnetic Radiation to Ordnance

HQ—Headquarters

HPW—Human Performance Wing

IEC—International Electrotechnical Commission

JSWSR—Joint Services Weapon Safety Review

LSSWG—Laser System Safety Working Group

MAJCOM—Major Command

PACAF—Pacific Air Forces

PM—Program Manager

SSC—Space Systems Command

SG—Surgeon General

SOP—Standard Operating Procedures

SpOC—Space Operations Command

STARCOM—Space Training and Readiness Command

TTPs—Tactics, Techniques, and Procedures

USAFE-AFAFRICA—United States Air Forces in Europe and Africa

USAFSAM—United States Air Force School of Aerospace Medicine

USSF—United States Space Force

Office Symbols

648 AESS/CC—648th Aeronautical Systems Squadron

96 TW/SES—96 Test Wing Systems Safety Office

711 HPW—AFRL 711th Human Performance Wing

711 HPW/RHD—AFRL 711th Human Performance Wing Bioeffects Division

711 HPW/RHDO—AFRL 711th Human Performance Wing Optical Radiation Safety

AF/A3TI—Chief, Operational Training Infrastructure Division

AF/A4LM—AF Director of Logistics, Deputy Chief of Staff/Logistics, Installations and Mission Support (Integrated Life Cycle Management Policy Division)

AF/A4LW—AF Director of Logistics, Deputy Chief of Staff/Logistics, Installations and Mission Support (Nuclear Weapons Missile, and Munitions Division)

AF/A5D—Deputy Chief of Staff Air Force Futures, Center 2 - Capability Development

AFRL/RD—Directed Energy Directorate

AFRL/RDL—AFRL Directed Energy Directorate, Laser Division

AFRL/RXPJ—AFRL Hardened Materials Branch

AF/SG—Air Force Surgeon General

AFMC/SES—HQ AFMC System Safety

AFMRA/SG3PB—Air Force Medical Readiness Agency, Radiation Health Operations

AFOTEC/SE—Air Force Operational Test and Evaluation Center - Safety

AFSEC/SEW—Air Force Safety Center Weapons Safety Division

AF/SE—Department of the Air Force Chief of Safety

AF/TE—Director DAF Test and Evaluation

Detachment 3/SE—-AFRL Safety (Detachment 3/SE)

DCPH-D—Defense Center for Public Health – Dayton

DCPH-D/FEC—Flight Medicine Consulting Division

DCPH-D/OE—Occupational and Environmental Health Department

FLDCOM/SE—Field Command Safety Office

MAJCOM/SE—Major Command Safety Office

SAF/AQ—Assistant Secretary of the Air Force (Acquisition, Technology & Logistics)

SAF/SQ—Assistant Secretary of the Air Force for Space Acquisition and Integration

SAF/AQPM—Office of the Assistant Secretary of the AF for Acquisition, Director of Global Power

SAF/IEE—Deputy Assistant Secretary of the AF for Environment, Safety, and Occupational Health

USAFSAM—711 HPW United States Air Force School of Aerospace Medicine

USAFSAM/FEC—Flight Medicine Consulting Division

USAFSAM/OE—Occupational and Environmental Health Department

USSF/COO—Space Force Operations

USSF/CSRO—Plans and Requirements,

USSF/COO/O—Current Operations, ,

USSF/COO/X—Future Operations, ,

USSF/S3I—Space Integration, ,

USSF/S3Z—Special Programs

USSF/S4O—Mission Sustainment

USSF/S10N—Deterrence Operations

Terms

Acquiring Activity—Any unit, or organization subject to this Instruction that performs acquisition.

Acquisition—The conceptualization, initiation, design, development, test, contracting, production, deployment, integrated product support, modification, and disposal of weapons and other systems, supplies, or services (including construction) to satisfy DoD needs, intended for use in, or in support of, military missions.

Commercial Product—(1) a product, other than real property, that is of a type customarily used by the general public or by nongovernmental entities for purposes other than governmental purposes, and that has been sold, leased, or licensed to the general public; or has been offered for sale, lease, or license to the general public; or (2) a product that evolved from a product described in paragraph (1) of this definition through advances in technology or performance and that is not yet available in the commercial marketplace, but will be available in the commercial marketplace in time to satisfy the delivery requirements under a Government solicitation.

Commercially Available Off-The-Shelf Item—Any item of supply (including construction material) that meets the definition of commercial product (as defined in paragraph (1) of the definition of "commercial product" at FAR 2.101) that is sold in substantial quantities in the commercial marketplace and offered to the Government, under a contract or subcontract at any tier, without modification, in the same form in which it was sold in the commercial marketplace. This does not include bulk cargo, as defined in 46 U.S.C. 40102(4), such as agricultural products or petroleum products.

Component—Subsystem, item or element. A component is hardware, software, procedures, interfaces, or a combination of any of the four.

Damage—Non-transitory upset or burnout of a target sufficient to reduce its operational utility.

Developmental Personnel—Personnel who conduct work to ensure that system's design is satisfactory and that all technical specifications and contract requirements have been met. Work maybe done under controlled, laboratory conditions or conducted at government test facilities by government or combined government and contractor test teams.

Directed Energy—An umbrella term covering technologies that relate to the production of a beam or field of concentrated acoustic or electromagnetic energy or atomic or subatomic particles. Although acoustic energy is excluded from the Joint definition, it has effects and hazards closer to directed energy than conventional systems.

Directed Energy Device—A system that uses directed energy primarily for a purpose other than as a weapon.

Directed Energy Mishap—An Air Force mishap fitting one of the following subcategories:

1. Directed Energy Weapon. A mishap involving a directed energy weapon and/or unique directed energy weapon support equipment.
2. Directed Energy Device. A mishap involving a directed energy device. An example would be damage to an optical device by an aircraft laser range finder.

Directed Energy System—A system that uses directed energy to achieve a desired effect.

Directed Energy Weapon—A device that uses directed energy and is designed to kill, injure, disable or temporarily incapacitate people or destroy, damage, disable or temporarily incapacitate property or materiel.

DoD Exemption Notification—The DoD, or its components, are authorized to exempt laser manufacturers lasers from portions or the entirety of 21 CFR 1040.10 and 21 CFR 1040.11 in accordance with FDA Exemption No. 76EL-01DOD. The manufacturer must obtain an exemption letter from the DoD or an authorized acquiring service branch, such as the AF, to allow the use of the DoD exemption for a specific product. Exemption authority for the DoD was granted in accordance with 21 CFR 1010.

Emergency Operational Capability—A system currently under development (with limited capabilities or a limited number of systems) that could be temporarily used in an operational mode by warfighters during a crisis. The fielding of JSTARS during Desert Storm is an example.

Experimentation—The application of the experimental method to the solution of complex defense capability development problems, potentially across the full spectrum of conflict types, such as warfighting, peace enforcement, humanitarian relief, and peacekeeping.

Experimental Methods—The tools, techniques, manipulations, and perturbations that are used as part of the experiment and are used in data reduction and analysis.

Fielding—Placing a system into operational use with units in the field or fleet.

FDA accession number—FDA accession numbers are unique identifiers for reports in the FDA database and are provided in the DFA's Center for Devices and Radiological Health acknowledgement letters. An acknowledgement letter also indicates that the Center for Devices and Radiological Health has received the manufacturer's report of the laser system and has been placed in the appropriate database.

FDA-Compliant or FLPPS Compliant—System meets 21 CFR, or the equivalent clauses of IEC 60825-1 allowed by FDA Laser Notice 50 or FDA Laser Notice 56

Government-Off-The-Shelf Items—See "Non-developmental Items."

Hazard Classification—To identify the relevant data regarding the hazards of a chemical; review those data to ascertain the hazards associated with the chemical; and decide whether the chemical will be classified as hazardous according to the definition of hazardous chemical in accordance with AFI 90-821, *Hazard Communication (HAZCOM) Program*. In addition, classification for health and physical hazards includes the determination of the degree of hazard, where appropriate, by comparing the data with the criteria for health and physical hazards.

Higher Risk System—A directed energy system that does not meet the administrative certification requirements of **Chapter 6** and has a Risk Assessment Code level or Software Risk Level of serious or greater as determined by the Program Manager or acquiring activity.

Incidental Personnel—Personnel who are not developers or non-developmental personnel who may experience incidental exposure to or harm from a directed energy system such as non-system associated friendly and hostile combatants, non-combatants, and civilians.

Integral Parts—The components making up the finished product are part of the evaluation; however, it is the finished product, in all of its states (full up or panels off for maintenance), that is used to identify 'accessible' exposure. A second reason for this distinction is that suppliers may deliver parts 'intended for incorporation into a final product', and when the government (as the manufacturer) builds the final product, the evaluation for certification is based on the as-built design.

Ionizing Radiation—Any electromagnetic or particulate radiation capable of producing ions directly or indirectly in its passage through matter. Ionizing radiation includes gamma rays, X rays, alpha particles, beta particles, neutrons, protons, and other particles and electromagnetic waves capable of producing ions.

Lethality—The probability that a weapon will destroy or neutralize a target.

Live Fire—Any event where directed energy is intentionally emitted by a directed energy system, regardless of the purpose of the event. Includes development, test, evaluation, training, and operational activities.

Live Fire Test and Evaluation—A test process that provides a timely assessment of the survivability and/or lethality of a conventional weapon or conventional weapon system as it progresses through its design and development.

Low Risk System—A directed energy system that may not meet the administrative certification requirements of **Chapter 6** and has a Risk Assessment Code level or Software Risk Level of medium or less as determined by the Program Manager or acquiring activity.

Military Exempt Laser Systems—Those systems, regardless of hazard classification, used for combat, combat training, or are classified in the interests of national security. In addition, these systems are not 21 CFR 1040 compliant and are procured under a DoD Exemption Notification.

Military Specific Directed Energy Systems—Directed energy systems used for combat, combat training, or are classified in the interests of national security. May or may not be 21 CFR 1040 compliant.

Military Specific Laser Systems—Those systems, regardless of hazard classification, used for combat, combat training, or are classified in the interests of national security.

Modification—All physical and functional configuration changes to existing certified hardware and software; addition of new equipment; and new operational uses for existing equipment.

Non-developmental Items—Any previously developed item of supply used exclusively for government purposes by a federal agency, a State or local government, or a foreign government with which the United States has a mutual defense cooperation agreement, or any such item that requires only minor modifications or modifications of the type customarily available in the commercial marketplace to meet the requirements of the procuring department or agency. Any item of supply being produced that does not meet the previous requirements solely because the item is not yet in use is also considered a non-developmental item.

Non-developmental personnel—Individuals who are typical operators that validate that the system under test can effectively execute its mission in a realistic operational environment when operated against representative threats. These personnel verify that the system is built correctly in accordance with the specification and contract to validate that the system can successfully accomplish its mission in a realistic operational environment.

Non-Program of Record—An acquisition activity that is not a Program of Record. Examples of non-Program of Record include, but are not limited to, commercial product acquisition, commercially available off-the-shelf acquisition, Non-Developmental Item acquisition, rapid capability fielding and/or rapid development programs, Air Force research and development organizations, including Air Force Research Laboratory (AFRL) programs identified as solutions for rapid capability fielding and/or rapid development programs given to an organizational unit for evaluation. For non-Programs of Record, personnel within the acquiring activity may be tasked to perform Program Manager duties in support of the acquisition effort.

Program Manager—The designated individual with responsibility for and authority to accomplish program objectives for development, production, and sustainment to meet the user's operational needs.

Program of Record—Program as recorded in the current Future Years Defense Program or as updated from the last Future Years Defense Program by approved program documentation (e.g., Acquisition Program Baseline, acquisition strategy, or Selected Acquisition Report.

Safety—Freedom from conditions that can cause death, injury, occupational illness, damage or loss of equipment or property, or damage to the environment.

Safety Critical Functions—Functions that control the sequence leading to directed energy system activation and subsequent termination, (e.g., Targeting, Arming, Firing, Terminating, Monitoring, etc.).

Safety Critical Components—System components that control safety critical functions, produce extreme hazards, or components whose failure or fault would compromise safe operation of the entire system.

Safety Critical Software—Those computer software components and units whose errors can result in a potential hazard, or loss of predictability or control of a system.

Safety Evaluation—An evaluation of a directed energy system's safety and may be a Safety Study, Supporting Analysis, Test Hazards Assessment Review, or Risk Analysis**.**

System Safety—The application of engineering and management principles, criteria, and techniques to optimize safety within the constraints of operational effectiveness, time, and cost throughout all phases of the system life cycle.

System States—Control the safety critical functions and prevent the inadvertent or improper propagation of directed energy by the weapon, (e.g., Inactive, Ready, Active, and Maintenance). Alternate names and additional states may be employed.

Test—Any program or procedure that is designed to obtain, verify, or provide data for the evaluation of any of the following: progress in accomplishing developmental objectives; the performance, operational capability, and suitability of systems, subsystems, components, and equipment items; and the vulnerability and lethality of systems, subsystems, components, and equipment items.

Test and Evaluation—The act of generating empirical data during the research, development or sustainment of systems, and the creation of information through analysis that is useful to technical personnel and decision makers for reducing design and acquisition risks. The process by which systems are measured against requirements and specifications, and the results analyzed to gauge progress and provide feedback. These efforts are distinct from experimentation.

Weapon Energy—Anything used to power, fuel, or provide energy for a directed energy weapon. Any source, which may be used for both directed energy system and another activity, becomes weapon energy when it is loaded and consumed for exclusive directed energy system use. Examples of weapon energy include chemical, electrostatic, electrodynamic, explosive, gas, light, or ionizing sources. An example of a source becoming weapon energy is chemicals that may be used for industrial or directed energy system use. Certain ground safety and occupational health standards govern the industrial use of the chemicals; however, once the chemicals are loaded into a weapon for the sole purpose of providing energy for beam generation, they become weapon energy.

Attachment 2

DIRECTED ENERGY WEAPON TECHNICAL SAFETY STUDY INSTRUCTIONS

A2.1. Information. A Safety Study includes the following information, if applicable:

A2.1.1. A description of the directed energy weapon system. For military specific laser systems that are not compliant with MIL-STD-1425A and/or 21 CFR Part 1040, include a justification for each non-compliant design requirement.

A2.1.2. A sequential description of how the directed energy weapon system functions in its operational environment. This requirement may be satisfied with detailed Technical Orders, Concept of Operation or Employment, validated Tactics, Techniques, Procedures, or equivalent documentation.

A2.1.3. A hazard analysis of the weapon system according to MIL-STD-882E. This analysis must include, at a minimum, interfaces of the directed energy weapon system with other systems and subsystems, including test equipment, technical data, and components and software used to command, control, safe, arm, and/or fire the directed energy weapon system. For laser systems, a system hazard evaluation by an AFSEC/SEW and 711 HPW/RHD approved third party is required and is part of the overall hazard analysis.

A2.1.4. A summary of mishaps and undesirable design features of similar inventory directed energy weapon systems (lessons learned, if applicable). The mishap history may be obtained from AFSEC/SEW.

A2.1.5. A safety-oriented evaluation of the technical data generated during development of the directed energy weapon system, including storage, maintenance, operation, surveillance, inspection, demilitarization and disposal procedures, if applicable.

A2.1.6. Safety and Occupational Health (SOH) assessment in conjunction with DoD Component System Safety and HSI SMEs and HSI to meet the SOH requirements specified in DoDI 5000.95, *Human Systems Integration in Defense Acquisition*.

A2.1.7. Final or interim hazard classification data in accordance with AFI 90-821 and Technical Order 11A-1-47 as appropriate.

A2.1.8. Firefighting extinguishing agents, if applicable.

A2.1.9. Appendices containing essential information from specifications and test reports to support findings.

A2.1.10. Findings and conclusions of the preparing individual.

A2.1.11. Official Board Findings and recommendations (after Board review).

A2.1.12. Official Board Action items (after Board review).

A2.1.13. Other information necessary to define the level of safety incorporated in the item (for example, a determination if hazards associated with weapon energy have been appropriately characterized and risk reduced).

A2.1.14. A page for staff concurrence, coordination, or comments.

A2.1.15. An amendment or supplement if needed to reflect updated production or design changes

A2.1.16. The Safety Study cover indicates its status and its authorized distribution.

A2.1.17. Use a cover with the words "DRAFT" printed on it on the initial (draft) Safety Study furnished to Board members for review. This draft may contain (or have attached) copies of data and drawings. These data and drawings may be essential for the in-depth review required by the Board but are not necessary for further processing. In this event, remove the material after the Board's review and insert a note to indicate the availability and location of the material.

A2.1.18. At a minimum, A2.1.1, A2.1.2, and A2.1.3 must be provided for a laser weapon system.

A2.2. Distribution. If required per **paragraph 3.5**, studies may be distributed by hard copy, disk (CD/DVD), or e-mail. If the information in the study is manufacturer, or contractor, or government proprietary in nature, be sure to mark it as such and if sent electronically, encrypt it or password-protect the information/study.

A2.2.1. The draft discussed in **paragraph A2.1** above is distributed only to the originating agency, the Board Executive Secretary, Chairperson, and the Board members. Board members also may distribute it within their commands.

A2.2.2. After the Board has approved the study and made the necessary corrections, the Executive Secretary will add a section to the front of the study. This section shows the Board's recommendations and includes a signature page for concurrence coordination as required.

A2.2.3. Replace the cover with one annotated by the words "AIR STAFF CONCURRENCE COPY" if required. Forward seven copies to Chairperson for staff agency review and AF/SE approval if sent as hard copy or on disk.

A2.2.4. Coordination functions are discussed in **Chapter 3**.

A2.2.5. When approved by AF/SE, the Executive secretary will issue the final Safety Study edition. Replace the cover with one annotated with the words "USAF APPROVED SAFETY REPORT."

Attachment 3

APPROVED STANDARDS AND SPECIFICATIONS

A3.1. Overview.

A3.1.1. The following documents contain safety design and performance, test, and analysis criteria approved by the Board for the design and evaluation of directed energy systems.

A3.2. Standard or specification obsolescence.

A3.2.1. If the version cited is out of date or obsolete, the current version is administratively approved and incorporated into this Instruction.

A3.2.2. American National Standard Institute, Z136.1-2022, *Safe Use of Lasers*, 2022

A3.2.3. American National Standard Institute, Z136.4-2021, *American National Standard Recommended Practice for Laser Safety Measurements for Hazard Evaluation*, 2021

A3.2.4. American National Standard Institute, Z136.6-2015, *Safe Use of Lasers Outdoors*, 2015

A3.2.5. Center for Disease Control, National Institute of Occupational Safety and Health Pocket Guide, **https://www.cdc.gov/niosh/npg/default.html**

A3.2.6. Institute of Electrical and Electronics Engineers, C95.1-2019, *Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz*, 2019

A3.2.7. Institute of Electrical and Electronics Engineers, C95.1-2345, *Standard for Military Workplaces—Force Health Protection Regarding Personnel Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 GHz*, 2014

A3.2.8. Institute of Electrical and Electronics Engineers, C95.7-2014, *Recommended Practice for Radio Frequency Safety Programs, 3 kHz to 300 GHz*, 2014

A3.2.9. Military Handbook 828C, *Range Laser Safety*, 31 March 2017

A3.2.10. Military Handbook 454B, *General Guidelines for Electronic Equipment*, 12 December 2012

A3.2.11. Military Handbook 516C, *Airworthiness Certification Criteria*, 12 December 2014

A3.2.12. Military Performance Specification 28800F, *Test Equipment for Use with Electrical and Electronic Equipment, General Specification for, 24 June 1996*

A3.2.13. MIL-STD-461G, *Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment*, 11 December 2015

A3.2.14. MIL-STD-464C, *Electromagnetic Environmental Effects, Requirements for Systems*, 1 December 2010

A3.2.15. MIL-STD-810H, *Environmental Engineering Considerations and Laboratory Test*, 31 January 2019

A3.2.16. MIL-STD-882E, *System Safety*, 11 May 2012

A3.2.17. MIL-STD-1472H, *Human Engineering*, 15 September 2020

A3.2.18. MIL-STD-1425A, *Safety Design Requirements for Military Lasers and Associated Support Equipment*, 29 March 2010

A3.2.19. MIL-STD-1474E, *Noise Limits*, 15 April 2015

A3.2.20. MIL-STD-1760E, *Aircraft Stores Electrical Interconnection System*, 24 October 2007

A3.2.21. MIL-STD-2105D, *Hazard Assessment Tests for Nonnuclear Munitions*, 19 April 2011

Attachment 4

DIRECTED ENERGY SYSTEM CERTIFICATION FLOWCHARTS

Figure A4.1. Laser systems.

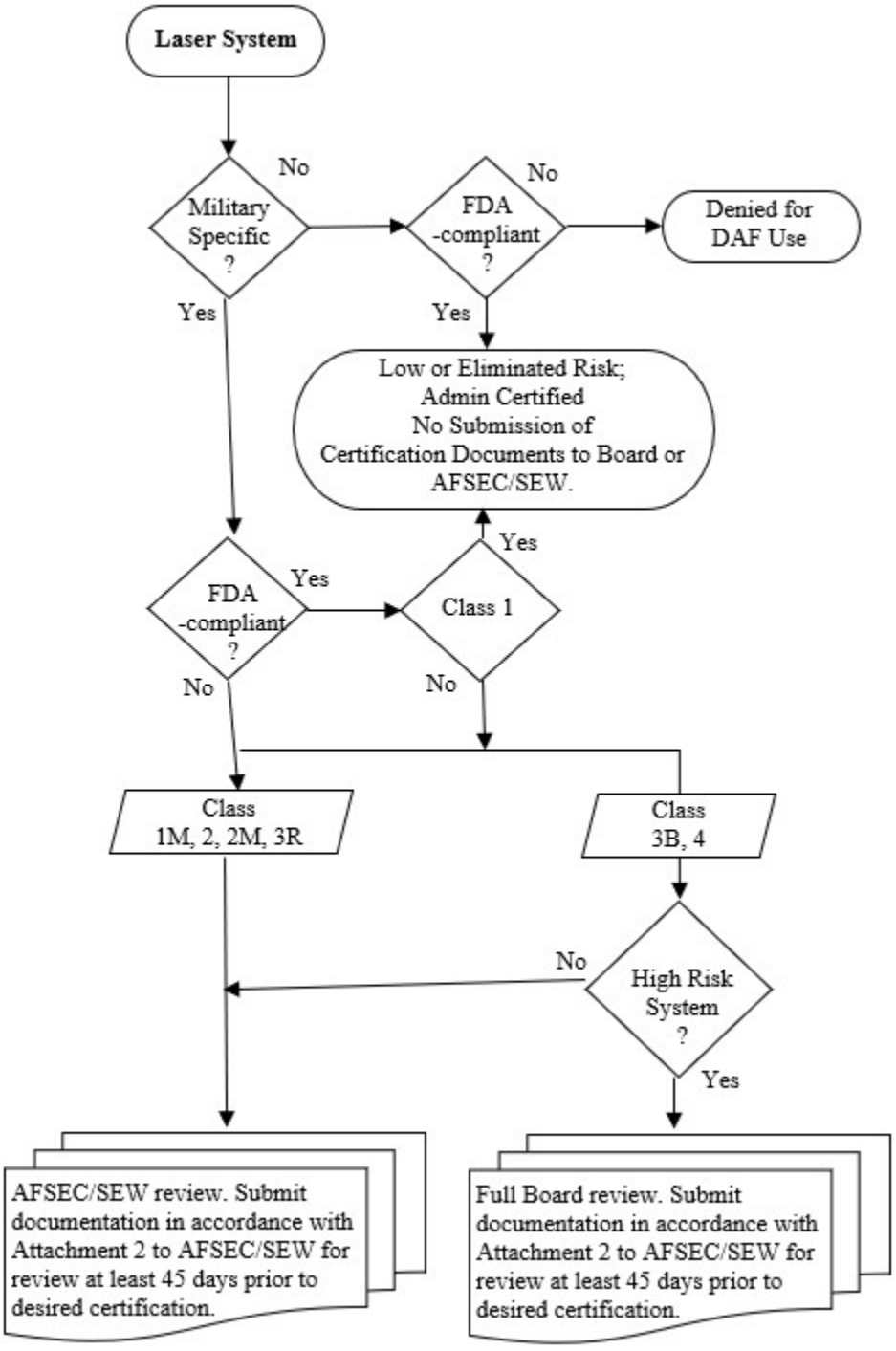


Figure A4.2. Electromagnetic Field Radiation directed energy systems.

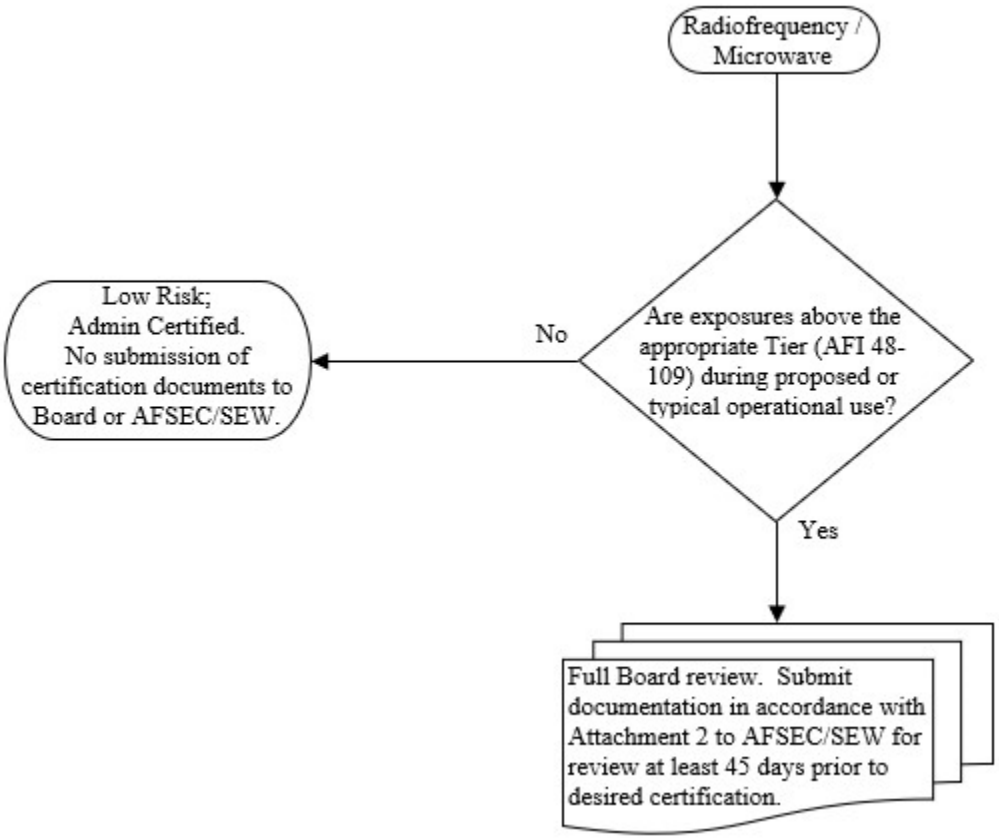


Figure A4.3. Ionizing radiation directed energy systems.

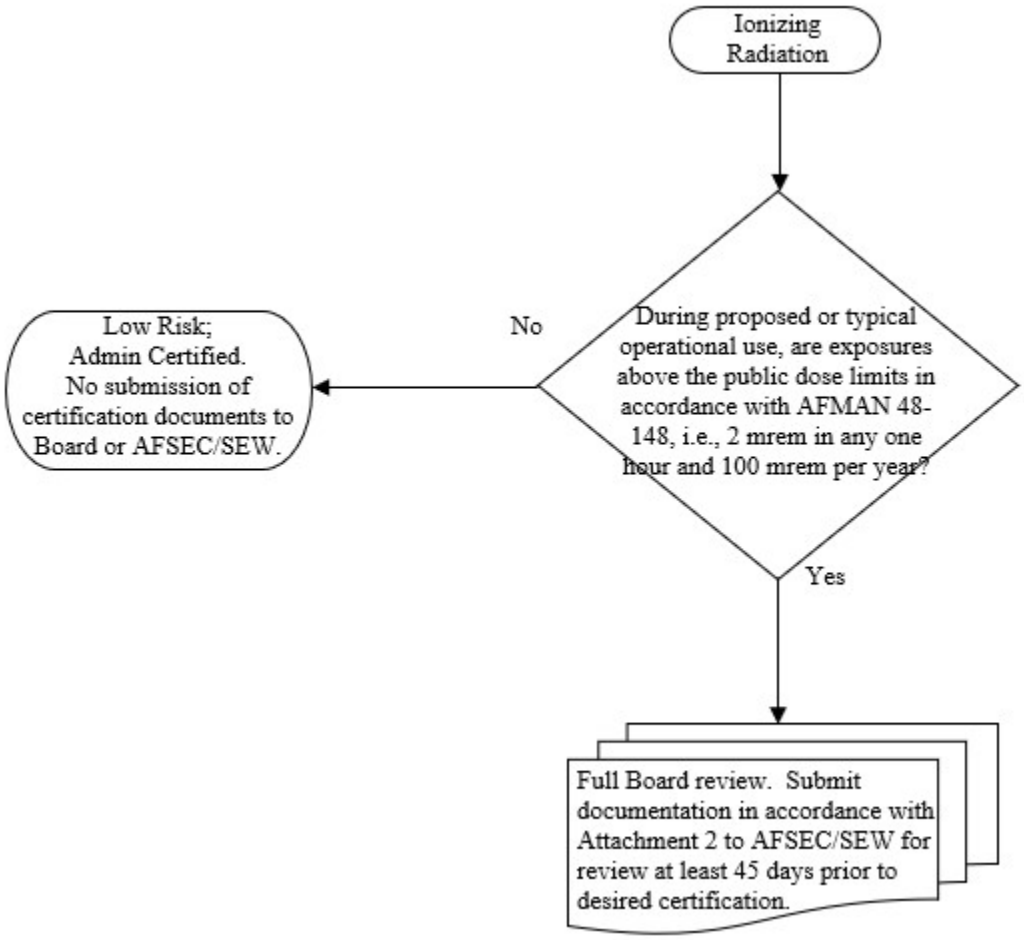
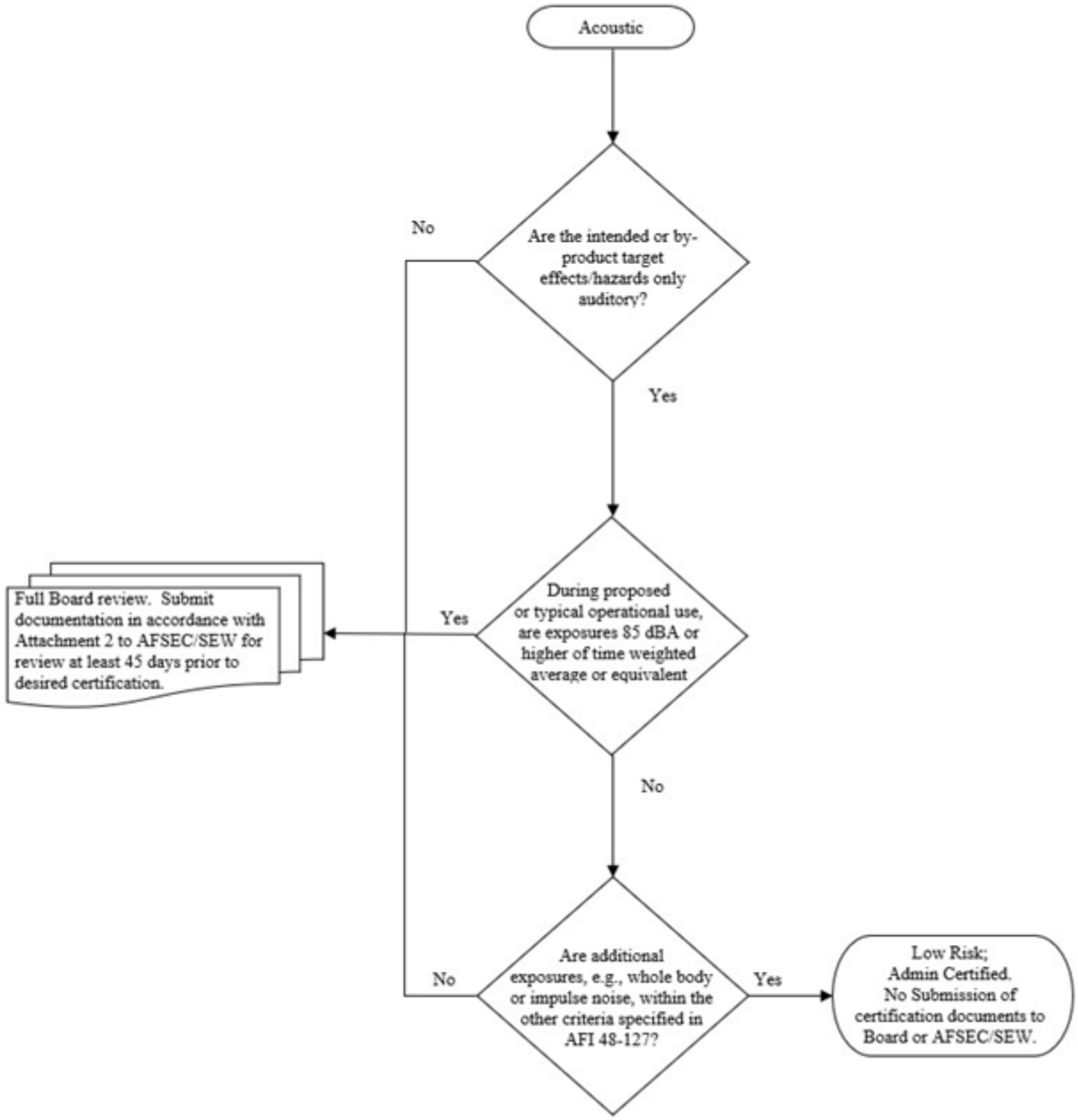


Figure A4.4. Acoustic directed energy systems.



Attachment 5

SAFETY EVALUATION GUIDANCE

Figure A5.1. Risk/Complexity and Safety Review Flowchart.