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 Weapon 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 and applies to all Air Force organizations and personnel assigned a mission or function involving directed energy systems, including the Air Force Reserve and the Air National Guard (ANG). This Instruction also applies to Air Force research and development organizations prior to capability fielding or operational testing by non-developmental personnel, including Air Force Research Laboratory (AFRL), commercial item, commercial-off-the-shelf, 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 office of primary responsibility listed above using the AF Form 847, Recommendation for Change of Publication;
route AF Forms 847 from the field through the appropriate chain of command. The authorities to waive wing/unit level requirements in this publication are identified with a Tier (“T-0, T-1, T-2, T-3”) number following the compliance statement. See AFI 33-360, *Publications and Forms Management*, for a description of the authorities associated with the Tier numbers. Submit requests for waivers through the chain of command to the appropriate Tier waiver approval authority, or alternately, to the requestor’s commander for non-tiered compliance items. Ensure all records created as a result of processes prescribed in this publication are maintained in accordance with Air Force Manual 33-363, *Management of Records*, and disposed of in accordance with the Air Force Records Disposition Schedule (RDS) 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 revising 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 Safety Program*, into the Directed Energy System Safety Program.

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Chapter 1

INTRODUCTION

1.1. Purpose.

1.1.1. This Instruction establishes the safety review and certification process for military specific directed energy systems regardless of the intended use of the system. References are incorporated throughout this Instruction. If the version cited is out of date or obsolete, the current version is administratively approved and incorporated into this Instruction. Note: With respect to medical activities within the Air Force, the Defense Health Agency, a combat support agency, will be responsible for administration and management in the upcoming years pursuant to recent National Defense Authorization Acts. The details of the scope of these responsibilities are still being worked and finalized and may impact Air Force Surgeon General and 711 HPW missions.

1.2. Overview.

1.2.1. This Instruction applies to military specific directed energy systems regardless of the intended use of the system.

1.2.1.1. A directed energy system may be a weapon or a device. Potential directed energy systems covered by this Instruction include but are not limited to military specific lasers, microwave and millimeter wave beams, acoustic systems, laser induced plasma channel systems, and atomic and subatomic particle beam weapons.

1.2.1.2. Directed energy weapons are designed to kill, injure, disable or temporarily incapacitate people or destroy, damage, disable or temporarily incapacitate property or materiel. The phrase “directed energy weapon” will only be used in this Instruction to specify a directed energy weapon specific requirement. Refer to DoD Dictionary of Military and Associated Terms and supporting information provided in Attachment 1. Guidance regarding joint weapon systems may be found in paragraphs 2.6.1.2, 3.3.5, and 6.8.

1.2.1.3. Directed energy devices use directed energy “primarily for a purpose 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 DoD Dictionary of Military and Associated Terms and supporting information provided in Attachment 1.

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

1.2.1.5. As a subset of directed energy systems with specific DoD mandated safety evaluation requirements, military specific lasers are defined as those systems, regardless of hazard classification, used for combat, combat training, or are classified in the interests of national security. Laser hazard classification, e.g. Class 1M, is determined in accordance with American National Standard Institute, Z136.1-2014, Safe Use of Lasers.

1.2.2. This AFI applies to both Program of Record and non-Program of Record acquisition activities 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 also applies to any directed energy system as referred by the Chairman of the Joint Chiefs of Staff Directed Energy Weapon Initial Operational Employment Review and Approval Process or at the request of a Directed Energy Safety Board quorum recommendation. The "Directed Energy Safety Board" may also be 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 fall under other Instructions.

1.2.3. Directed energy weapons and some non-weapon systems may create unique hazards and effects different from conventional and nuclear weapons requiring additional expertise to evaluate. Although acoustic energy is excluded from the Joint definition of directed energy, it has effects and hazards more similar to directed energy than to conventional systems. Thus, acoustic systems will follow the same safety policy as directed energy weapons. The hazards of these directed energy systems can span from levels that are considered safe for human exposure, levels that can induce pain but cause no permanent cell damage, to levels that would be fatal to humans or that destroy materiel.

1.2.4. Operations, training, use or test by non-developmental personnel not supervised by government developmental personnel of military specific directed energy systems on operational ranges for higher risk systems require Board review and safety approval prior to test. (T-I). Refer to AFMAN 13-212, Volume 1 for laser use on AF ranges.

1.2.5. Prior to entry of a new directed energy system into the AF inventory, regardless of source, a Headquarters Air Force (HAF) certification for operational use is required. Certification will normally be based on Board recommendations for higher risk systems. Certification requirements for lower and higher risk systems 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 and paragraph 5.5.
Chapter 2

ROLES AND RESPONSIBILITIES.

2.1. The Assistant Secretary of the Air Force (Acquisition) (SAF/AQ).

2.1.1. Ensures Program Managers and acquiring activities address directed energy health and safety issues early and throughout the acquisition and sustainment life cycle.

2.2. Air force Chief of Safety (AF/SE).

2.2.1. Oversees the AF directed energy system safety program.

2.2.2. Exercises safety certification authority for directed energy systems covered by this AFI. May delegate certification authority to the Board for lower risk systems.

2.2.3. Approves directed energy AFI 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 Air Force Chief of Weapon Safety, AFSEC/SEW, as the Chairperson unless otherwise designated.

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 CFR, Part 1040.10, Laser Products, and 21 CFR 1040.11, Specific Purpose Laser Products, current editions. May delegate this exemption authority to AFSEC/SEW. For the purpose of this Instruction, a laser will be called either a 21 CFR Part 1040 compliant or non-compliant system based upon requirements detailed in 21 CFR Part 1040.10 and 21 CFR Part 1040.11.

2.3. Headquarters Air Force Safety Center (HQ AFSEC).

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

2.3.2. Chief, Weapons Safety Division (AFSEC/SEW) manages AF directed energy certification processes for the AF/SE.

2.3.2.1. Chairs the Board unless otherwise designate 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. (T-1).

2.3.2.2. Maintains the official record of all directed energy certification documentation and risk assessment. (T-0).

2.3.2.3. Designates a voting member to the DoD Laser Systems Safety Working Group, Transmitted Electromagnetic Frequency Radiation Protection Working Group, and the Human Effect Review Board. (T-0).

2.3.2.4. Reviews MAJCOM directed energy AFI supplements and staffs documents through AF/SE. (T-1).

2.3.2.5. Ensures important directed energy safety issues are addressed at the AF Environment, Safety, and Occupational Health Council. (T-0).
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 or Surgeon General). (T-1).

2.3.2.9. Issues DoD Exemption Notifications through Program Manager or acquiring activities to manufacturers for military specific laser systems unable to comply with federal laser safety regulations. (T-0).

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

2.4.1.1. Provides a Board members as outlined in Chapter 3.

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

2.4.1.3. Ensures installation Bioenvironmental Engineering conducts health risk assessments of work areas where directed energy systems are used or maintained in accordance with AFI 48-145, Occupational and Environment Health Program. (T-0).

2.5.1. 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.

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

2.6.1.1. Provide Board members as outlined in Chapter 3.

2.6.1.2. Ensure directed energy systems are certified by the 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).

2.6.1.3. Ensure directed energy mishaps are reported in accordance with AFI 91-204, Safety Investigations and Reports. (T-0). Mishaps may also require investigation in accordance with AFI 48-139 and AFI 48-109, Electromagnetic Field Radiation (EMFR) Occupational and Environmental Health Program. (T-0).

2.6.1.4. Report directed energy safety developments or issues to the AF and organizational Environment, Safety, and Occupational Health Council. (T-0).

2.6.1.5. Ensure MAJCOM, wing, and unit level directed energy safety programs are established and maintained as appropriate. (T-1). Ensures that 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. (T-0). For more specific guidance on directed energy safety program requirements, see Chapter 4.
2.7.1. Air Force Materiel Command (AFMC), in addition to the roles and responsibilities in paragraph 2.6.1.

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

2.7.1.2. Conducts, through AFRL and consistent with AF 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.

2.7.1.2.1. Maintains technical expertise to evaluate directed energy health effects and safety in AF operations. The AFRL 711th Human Performance Wing Bioeffects Division (711 HPW/RHD), the 711 HPW United State Air Force School or Aerospace Medicine (USAFSAM), and AFRL Safety (Detachment 8/SE) are the subject matter experts for directed energy health effects and safety. The Directed Energy Directorate (AFRL/RD) maintains expertise in directed energy system engineering.

2.7.1.2.2. Conducts, through the Airman Systems Directorate (711 HPW/RH), research on the human effects of directed energy.

2.7.1.2.3. Maintains, through the Bioeffects Division (711 HPW/RHD), a repository of laser certifications for Air Force test and training ranges. In addition, 711 HPW/RHD maintains the capability to conduct independent laser hazard evaluations of laser systems and maintains a repository of hazard evaluations laser systems regardless of safety certification status. Provides evaluation information to the USAFSAM Occupational/Environmental Health Division for health risk assessment and accident/incident investigations and for distribution to Bioenvironmental Engineering personnel and/or laser safety officers to support requirements in paragraph 2.9.1.2.

2.7.1.2.4. Maintains expertise on directed energy personnel protective technologies for AF use and is responsible for conducting medical/health effects consulting and education/training through the USAFSAM. The USAFSAM also administers and maintains the DoD Electromagnetic Field Injury Hotline and Tri-Service Laser Injury Hotline to provide timely expert medical advice in the event of a potential overexposure to DoD personnel from electromagnetic field radiation and lasers. (T-0). USAFSAM also administers and maintains the Electromagnetic Field Radiation Exposure Registry and laser incident and accident reports. (T-0). The Tri-Service Laser Injury Hotline and DoD Electromagnetic Field Injury Hotline are answered by the Environment, Safety, and Occupational Health Service Center. Contact the Environment, Safety, and Occupational Health Service Center via telephone at Defense Switched Network 798-3764, commercial 937-938-3764, toll-free 1-888-232-ESOH (3764), or via email esoh.service.center@us.af.mil.

2.8.1. Program Managers and acquiring activities.

2.8.1.1. Comply with the directed energy certification process outlined in this Instruction. (T-0).

2.8.1.2. Request a Safety Certification Requirements Plan from the Board prior to fielding or operational testing with non-developmental personnel not supervised by government
developmental personnel. (T-1). Develops a System Certification Requirements Plan per paragraph 6.4. (T-1).

2.8.1.3. Identify a need for AFMC 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. (T-0). The Board determines the suitability of an organization’s safety engineering expertise. (T-1).

2.8.1.4. 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. (T-0). This notification should be requested as soon as the need is identified and may occur concurrently with Requirement Plans development or safety evaluations. Any subsequent modification to a military exempt laser product by the manufacturer requires a new DoD Exemption Notification. (T-0).

2.8.1.5. Ensure military specific laser systems comply with Military Standard 1425A, Safety Design Requirements for Military Lasers and Associated Support Equipment, or secures safety certification for non-compliant systems in accordance with this Instruction. (T-0).

2.9.1. Commanders or Directors.

2.9.1.1. For units that operate directed energy systems, execute a directed energy safety program in accordance with AFI 91-202, The US Air Force Mishap Prevention Program. (T-0).

2.9.1.2. Execute occupational health and safety plans in coordination with the installation Laser Safety Officer, Installation Occupational and Environmental Medicine Consultant, Bioenvironmental Engineering, and/or Public Health per AFI 48-139, AFI 48-109, and AFI 48-127, Occupational Noise and Hearing Conservation Program, respectively for laser, electromagnetic frequency, and acoustic energy directed energy system. (T-0).


2.11.1. Executive Secretary for the Board.

2.11.1.1. 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.

2.11.1.2. Is knowledgeable in public sector, AF, and DoD directed energy related directives, policies, and standards.

2.11.1.3. 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 3

DIRECTED ENERGY SAFETY BOARD


3.1.1. The Board provides the safety certification review and recommendation of military specific directed energy systems for use by AF personnel. (T-1). For systems developed in an acquisition Program of Record, non-Program of Record, or purchased as standardized systems, 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.

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

3.1.1.2. When requested by the responsible 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 review 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.

3.1.2. Board safety certification review and recommendation is required for each directed energy system prior to operational and training use by AF personnel. (T-1). Milestone Decision Authorities shall 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).

3.1.2.1. 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).

3.1.2.2. 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).

3.1.2.3. The Board reviews design safety evaluations for operational testing of uncertified directed energy systems when testing live systems on AF aircraft and ground platforms and/or involving AF 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 (SRB) process prior to conducting tests as outlined in this Instruction and AFI 99-103, Capabilities-Based Test and Evaluation. (T-1).

3.2. Chairperson and Member Duties.

3.2.1. The Chairperson:
3.2.1.1. 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.

3.2.1.2. Serves as technical lead for resolving any issues arising during staff agency coordination of the studies detailed in paragraph 5.5. (T-1).

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

3.2.1.4. Upon receipt of concurrences or successful resolution of non-concurrences, forwards signed approvals to the Executive Secretary in accordance with paragraphs 3.6 and 5.5. (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).

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

3.2.1.6. Reports unfavorable mishap trends identified for directed energy systems previously certified by the Board that may require reevaluation by the Board. (T-0).

3.2.1.7. On behalf of the 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).

3.2.2. Board member Major Commands and agencies must designate one primary and one alternate voting representative to serve at least three years (whenever possible) and be a Senior Master Sergeant select or higher, field grade officer select or higher, or a DoD civilian grade equivalent. (T-1). In the event a field grade officer select, Senior Master Sergeant select or higher, or DoD civilian equivalent is not available a waiver request from the MAJCOM/SE must be submitted to the Chairperson. 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. The primary objective for MAJCOMs 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’s 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 or agency’s position.

3.2.3. Minimum membership attendance must be at least 7 of the 13 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:

3.2.3.1. Headquarters (HQ) Air Combat Command (ACC) (T-1).

3.2.3.2. HQ Air Force Materiel Command (AFMC) (T-1).
3.2.3.3. HQ Air Mobility Command (AMC) (T-1).
3.2.3.4. HQ Pacific Air Forces (PACAF) (T-1).
3.2.3.5. HQ United States Air Forces in Europe and Africa (USAFE-AFAFRICA) (T-1).
3.2.3.6. HQ Air Education and Training Command (AETC) (T-1).
3.2.3.7. HQ Air Force Global Strike Command (AFGSC) (T-1).
3.2.3.8. HQ Air Force Reserve Command (AFRC) (T-1).
3.2.3.9. HQ Air Force Space Command (AFSPC) (T-1).
3.2.3.10. HQ Air Force Special Operations Command (AFSOC) (T-1).
3.2.3.11. Air National Guard (ANG) (T-1).
3.2.3.12. Air Force Operational Test and Evaluation Center (AFOTEC) (T-1).
3.2.3.13. Air Force Surgeon General (AF/SG) (T-1).

3.2.4. Advisory Personnel. Advisory personnel (e.g., Air Force Research Laboratory (AFRL) 711th Human Performance Wing (711 HPW/RHD), USAFSAM, AFRL Directed Energy Directorate (AFRL/RD), AFMC/96th Test Wing, Program Managers, Representatives of other services, 648th Aerospace Systems Squadron (648 AESS), 85 Engineering Installation Squadron, 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.

3.2.4.1. The Chairperson approves the composition of special ad hoc groups to provide Board related review and advisory services to special access programs. (T-1).
3.2.4.2. Individual Board members may invite advisors and consultants, and notify the Executive Secretary of those attendees well in advance of the meeting.
3.2.4.3. 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 organizations.
3.2.4.4. 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.
3.2.4.5. Other advisors whose attendance may be appropriate are representatives of the Air Force acquisition activity, the lead developmental test and evaluation organization, and the user organization or unit.

3.2.5. 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. The Board, however, reserves the prerogative to deliberate separately on select issues to achieve an Air Force position. The Board will provide guidance to Program Managers and acquiring activities regarding discrepancies between a joint review position and a Board position. (T-1). The Executive Secretary, per paragraph 3.5.6, 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 5.5.

3.3. Board Mission.

3.3.1. The Board, in accordance with AFI 91-202, functions as an overall design review authority and System Safety Group for directed energy systems and conducts assessments, approvals, and certifications throughout research, development, test and evaluation, production, deployment, and operational life cycle of a directed energy system. (T-1).

3.3.2. For directed energy systems intended for operational use by the AF, the Board:

   3.3.2.1. Reviews and establishes design safety and qualification test criteria, standards, and requirements for directed energy systems and related items. (T-1).
   
   3.3.2.2. Provides guidance to program management and acquiring activity authorities throughout the life cycle of directed energy system programs and ensures criteria for safety certification reviews receive adequate consideration during the design, development, test and evaluation, and operational deployment phases. (T-1).
   
   3.3.2.3. Maintains safety oversight through the certification process described in this AFI over all new or modified directed energy systems used by the AF regardless of source. (T-1).
   
   3.3.2.4. 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.

3.3.3. During a review of the safety evaluations for a system intended for operational use in the AF, the Board:

   3.3.3.1. Ensures directed energy systems are evaluated against AF safety criteria, standards, and requirements and that evaluations are based on analysis results and data obtained from engineering, development, and operational testing. (T-1).
   
   3.3.3.2. Verifies (through results of evaluations) that the required level of design and performance safety is achieved during all of a directed energy system’s life cycle. (T-1). An item’s life cycle includes all phases of development, test, production, and AF operational use (including transportation, handling, maintenance, employment, and disposal) from program initiation through item removal from the AF inventory.
3.3.3.3. Reviews the safety aspects of directed energy system 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).

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

3.3.4. For directed energy systems not intended for operational use by the AF, the Board:

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

3.3.4.2. When requested, reviews directed energy systems intended solely for foreign military sales in accordance with paragraph 3.1.1.

3.4. Technical Safety Functions.

3.4.1. The Board is charged with performing the following technical safety functions:

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

3.4.3. Identifying and evaluating hazards in the design of directed energy systems, subsystems, components or related items using the system safety engineering principles outlined in Military Standard 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 AF.

3.4.4. 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.

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

3.4.6. 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 systems, subsystems, components or related items.

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

3.5. Executive Secretary Duties.

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

3.5.2. Informs the Chairperson about Board activities and issues that might affect Board proceedings. (T-1).
3.5.3. Maintains a list of designated Board members and alternates. (T-1). The Executive Secretary also provides new member orientation as requested. (T-1).

3.5.4. Interacts with the Chairperson, members, AF 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).

3.5.5. 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).

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

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

3.5.7.1. Those duties specified in paragraph 5.1 for regular and special meetings.

3.5.7.2. Establishes meeting agendas. (T-1).

3.5.7.3. 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 paragraphs 6.2.2, 6.2.3, and 6.3. (T-1).

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

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

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

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

3.5.9.1. 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 for the 25 calendar day requirement when significant unavoidable delays in safety evaluation distribution arise. (T-1).

3.5.9.2. 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).

3.5.9.3. 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).

3.5.10. 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).
3.5.11. 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).

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

3.5.13. 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).

3.5.14. 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).

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

3.5.16. Forwards DoD Exemption Notification to program management and acquiring activities, manufacturers, and joint partners as appropriate once approved by AFSEC/SEW. (T-0).

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

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

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

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

3.5.19. 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 AF use, as appropriate.

3.5.20. Maintains all Board historical records, 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).

3.5.21. Maintains the Board certification database, prepares the catalogue of Board actions and distributes annual catalogue updates to Board members. (T-1).
Chapter 4

OPERATIONAL UNIT DIRECTED ENERGY SAFETY PROGRAM GUIDANCE


4.1.1. The directed energy safety program must be a component of the operational unit safety program as required by AFPD 91-2, Safety Programs, AFPD 91-4, and AFI 91-202. (T-0).

4.1.2.1. Unit Directed Energy Safety Program Functions.

4.1.2.2. For installations with directed energy weapons, base/wing Weapons Safety personnel will review directed energy weapon safety programs at least annually for each type of directed energy weapon system operated by the installation’s units in accordance with AFI 91-202. (T-0).

4.1.2.3. The operational unit will execute the directed energy system (laser, electromagnetic frequency radiation, or acoustical energy) occupational health and safety plans in accordance with the installation Laser Safety Officer, Installation Occupational and Environmental Medicine Consultant, Bioenvironmental Engineering, and /or Public Health per AFI 48-139, AFI 48-109, and AFI 48-127 respectively. (T-0).

4.1.2.4. In coordination with base/wing Safety personnel, operational units will evaluate and document unit radio frequency weapons, laser weapons, and other directed energy systems for operational compatibility with ordnance, electronics, and fuel storage likely to be in the operating and maintenance environment of the directed energy system in accordance with DoD Instruction 3222.03, Electromagnetic Environmental Effects (E3) Program, AFI 91-202, and AFMAN 91-201. (T-0).

4.1.2.5. Directed energy weapon mishaps must be reported and investigated according to the requirements and timelines defined in AFI 91-204 and AFMAN 91-221, Weapons Safety Investigations and Reports. (T-0). Utilize the appropriate guidance for the type of incident, i.e., when the mishap is categorized as a space incident use AFMAN 91-222, Space Safety Investigations and Report. Coordinate with the base/wing Chief of Safety for reporting an incident. (T-3). Weapon mishaps may also require reporting and investigation per paragraph 4.1.2.6.

4.1.2.6. The Chief of Safety shall coordinate with the installation Laser Safety Officer and/or Bioenvironmental Engineering in accordance with AFI 48-145, AFI 48-139, AFI 48-109, and AFI 48-127. (T-3).

4.1.2.7. Report injuries or suspected injuries or suspected over exposures from a directed energy system per AFI 48-139 or AFI 48-109 as applicable. (T-0). Contact the installation Laser Safety Officer and/or Bioenvironmental Engineering to report a directed energy system incident to the Tri-Service Laser Injury Hotline or DoD Electromagnetic Field Injury Hotline as appropriate. (T-0). Contact the Environment, Safety, and Occupational Health Service Center for assistance if there is no local Bioenvironmental Engineering support. (T-0). See paragraph 2.7.1.2.4 for Hotline and Environment, Safety, and Occupational Health Service Center contact information.
Chapter 5

ADMINISTRATIVE PROCEDURES

5.1. Administrative Procedures.

5.1.1. Meeting Frequency. Normally, meetings of the 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 use for unusual circumstances. Funding for Board member travel is at the member unit’s expense.

5.1.2. In addition to these regular Board meetings, special meetings may be held at the discretion of the Chairperson when required to support time-critical directed energy 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.

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

5.1.4. 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.

5.1.5. 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.

5.1.6. 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.

5.2. Protocol.

5.2.1. Members will make a concerted effort to reach unanimous agreement for each matter requiring a Board position.

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

5.3. Presentations.

5.3.1. 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.
5.3.2. Agencies preparing Board presentations should ensure essential supporting personnel (e.g., AF 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.

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

5.4. **Board Requirements.**

5.4.1. 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. (T-1).

5.4.2. Review related issues such as the potential requirement for shields and barricades during testing and the availability of required technical data. (T-1).

5.4.3. Identify areas of design safety deficiency relative to items under review. (T-1). Specify conditions for certification when such deficiencies are noted.

5.4.4. Develop or review design safety standards and recommend adoption for AF use as appropriate. (T-1).

5.4.5. Recommend policies, controls, and procedures to minimize hazards during directed energy system operations. (T-1).

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

5.5. **Meeting Minutes, Studies, and Board Actions.**

5.5.1. Minutes. For each meeting, document Board proceedings with a comprehensive set of minutes. (T-1). Minutes will typically include list 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 required additional actions.

5.5.1.1. If a directed energy system 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. (T-0). 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.

5.5.1.2. Board minutes certify directed energy systems studied are acceptable or not acceptable for further testing or use from a design safety viewpoint. (T-1). 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.

5.5.1.3. A Board certification recommendation, as captured in meeting minutes, constitute interim fulfillment of certification of directed energy system requirements and grant interim safety certification for directed energy systems or related items. Final certification is granted after appropriate staff agency concurrence and AF/SE approval per paragraph 5.5.1.6.

5.5.1.4. 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. (T-1). 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 system employment. (T-1).

5.5.1.5. Commanders may proceed with directed energy operations based on the interim certification and recommendations in Board meeting minutes per paragraph 5.5.1.3. Joint Chiefs of Staff concurrence may be as required for joint weapon systems. (T-0).

5.5.1.6. The Executive Secretary finalizes meeting minutes and updates any safety evaluations (amended to include Board findings and recommendations). (T-1). Also, the Executive Secretary submits minutes and the safety evaluations to the Chairperson to initiate the AF/SE and AF staff agency concurrence and approval process as appropriate. (T-1). The Chairperson will determine which staff agencies listed in paragraph 5.6 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.

5.5.1.7. 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).

5.5.2. Studies. Once notified of AF/SE approval of a Safety Study, the Executive Secretary issues the report in its final version and distributes it to Board members and associates, agencies responsible for implementing Board recommendations, and other interested organizations. (T-1).

5.5.2.1. 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 mean 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 action agency.

5.5.2.2. 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 the on 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.

5.5.2.3. On behalf of AF/SE, the Board determines when a recommended action item has been successfully completed.
5.5.2.4. In addition to duties specified in Chapter 3, the Board may delegate to the Executive Secretary the authority to close purely administrative action items or to close a given action item upon the completion of a specific event (e.g., the publication of a technical order). (T-1).

5.5.2.5. When all action items generated per paragraph 5.5.2.2 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.

5.6. Partnering Staff Agencies.

5.6.1. The following staff agencies may receive copies of Board actions at the discretion of the Chairperson: Office of the Assistant Secretary of the AF for Acquisition, 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 the AF Deputy Chief of Staff for Operations, Directorate for Force Application, AF/A5R-C.

5.6.2. 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. (T-1). No response within the prescribed 30 calendar day period from a staff agency constitutes concurrence. The Chairperson, per paragraph 3.2.1.4, works with the appropriate staff agencies to resolve non-concurrences. The Executive Secretary, per paragraphs 3.5.6 and 5.5.1.4, communicates operational impacts to Program Manager and acquiring activities.
Chapter 6

CERTIFICATION, STUDIES, TEST, AND SAFETY STANDARD FUNCTION

6.1. Overview.

6.1.1. Board design safety certification action is required for directed energy systems prior to entry into the AF operational inventory and is accomplished through review of various safety evaluations and 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.


6.2.1. For many directed energy systems, there are already robust safety and health reviews and/or mature controls developed prior to fielding these systems. Personnel exposure standards as detailed in paragraphs 6.2.1.1 through 6.2.3 below, establish the level of rigor required for the Board’s review. 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-off-the-shelf items used for their designed purpose and in accordance with manufacturer instructions are administratively certified. (T-0).

6.2.1.2. Personnel operating the system are not exposed to a hazardous material over an action or compliance level during proposed or typical operational use. (T-0). 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 are required to use whichever of the Occupational Safety and Health Administration’s or National Institute for Occupational Safety and Health’s exposure levels is most restrictive. (T-0).

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 Nuclear Regulatory Commission, AFI 40-201, Radioactive Materials (RAM) Management, and AFI 48-148, Ionizing Radiation Protection requirements. (T-0).

6.2.1.4. Exposure to acoustic hazards is under the 85 decibels A-weighted time weighted average or equivalent exposure times and any other criteria specified in AFI 48-127 during proposed or typical operational use. (T-0). Exception: A Program Manager or acquiring activity must request Board requirements for certification if an acoustic directed energy system is intended to or will produce non-auditory target effects or hazards. (T-0).
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. (T-0). The directed energy system also meets the requirements of Military Standard 464C, *Electromagnetic Environmental Effects, Requirements for Systems*, DoD Instruction 3222.03, and AFI 91-203, *Air Force Consolidated Occupational Safety Instruction*, regarding hazards of electromagnetic radiation to fuel and AFI 91-208, *Hazzards of Electromagnetic Radiation to Ordnance (HERO) Certification and Management*. (T-0).


6.2.2. Military specific Class 1, 1M, 2, 2M, or 3R laser systems compliant with 21 CFR Part 1040 are considered administratively certified. (T-0). 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. (T-1). 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 an assessment as appropriate.

6.2.3. Military specific Class 1, 1M, 2, 2M, or 3R laser systems not compliant with 21 CFR Part 1040 will not be administratively certified, but may be certified by AFSEC/SEW. (T-0). 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. (T-1).

6.3. **Non-Administrative Certification.** Reference Attachment 4 for certification process flowcharts.

6.3.1. Certification is based on the directed energy system Technical Safety Study, alternately the “Safety Study”, or a Supporting System Safety Analysis, alternately the “Supporting Analysis”, reviewed during a regular or special meeting. (T-1). Results from the Safety Study will be the basis for Board certification recommendations. Directed energy system certifications are requested from Program Managers and acquiring activities or through the lead user MAJCOM/SE to HQ AFSEC/SEW.

6.3.1.1. The Safety Study is a comprehensive safety evaluation of a directed energy system 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.

6.3.1.2. The Supporting Analysis is a less comprehensive safety evaluation than the Safety Study and is typically prepared for support equipment and lower risk systems of any complexity that have a minor impact on safety. Like the Safety Study, the Supporting Analysis must fully support Board positions. Although the Supporting Analysis is not subject to HAF approval after Board review (except as noted below in paragraph 6.3.5), the Supporting Analysis should not be used as the basis for Board 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.
6.3.2. A directed energy system review and certification under Board purview may not require a Safety Study, Safety Study supplement, Supporting Analysis, or Test Hazards Assessment Review (e.g., addition of a lower risk or well understood sub-system to an existing system). For such actions, the Board may delegate certification recommendation to the Executive Secretary, to include the discretion to tailor required documentation. Each item certified by the Executive Secretary will be approved through the use of an Executive Secretary Letter. (T-1). 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 subsequent to the previous meeting.

6.3.3. The Chairperson and Board members will be provided the draft edition of the Safety Study or Supporting Analysis in sufficient time prior to the scheduled meeting to allow proper review within the members’ MAJCOMs. 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 review, then the item in question will be removed from the meeting agenda.

6.3.4. 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.

6.3.5. Following formal review of the draft safety study, Board design safety conclusions and certification recommendations are included in the Safety Study and Supporting Analysis. AFSEC/SEW may then forward the Safety Study and Supporting Analysis to HAF and SAF for concurrence for a higher risk system in accordance with paragraph 5.5.


6.4.1. The Safety Certification Requirements Plan, or alternately the “Safety Plan”, is developed by the Board when requested by a Program Manager or acquiring activity. (T-1). The Safety Plan identifies to the Program Manager or acquiring activity what certification tasks need to be accomplished in order to achieve safety certification. The Safety Plan also identifies the documentation needed to support the certification evaluations. (T-1). The Safety Plan is then forwarded to the Program Manager or acquiring activity who develops the System Certification Requirements Plan with guidance and support from the Board as needed. The Board may also forward a draft or final copy of the Safety Plan to other stakeholders or interested parties for review and input.

6.4.2. The System Certification Requirements Plan, alternately the “System Plan”, is developed by the Program Manager or acquiring activity and contains the details regarding how and when the Program Manager or acquiring activity will meet the certification requirements identified in the Safety Plan. (T-1). The System Plan defines the requirements, assigns the roles and responsibilities, and defines all of the activities and tasks required to achieve safety certification. Each System Plan is tailored to meet the needs of the particular acquisition activity. As program changes are encountered and incorporated into the acquisition process,
their impact on the safety certification process is reviewed and the System Plan is updated accordingly. (T-1). When complete, the Program Manager or acquiring activity submits the System Plan to the Board for review and approval. If the Board does not approve the plan as complete or acceptable, the Board will provide feedback to the Program Manager or acquiring activity for modification of the System Plan. (T-1).

6.5. Systems and Components to be Evaluated.

6.5.1. Aspects of directed energy systems, such as integral and add-on components, software, commercial items, and commercial-off-the-shelf items will be evaluated as integral parts of the systems to which they belong. (T-0). The following directed energy systems and components, except as noted, are within the purview of the Board:

6.5.1.1. Command, Control, Firing, Safing, Arming, and Target-Detecting Devices. All components used to command, control, safe, arm, and/or fire directed energy systems. (T-0). This category also includes components of directed energy systems used to establish and control system states, such as detecting a target and issuing signals for initiation of directed energy.

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

6.5.1.3. Support and Test Equipment. All handling, storage, test, maintenance, and transport equipment for use with or in support of directed energy systems, including locally manufactured equipment, data scanners, and 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 systems, subsystems, components, and software must be evaluated. (T-0).

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

6.5.1.5. Power generation management systems. (T-1).

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

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

6.6. Test Evaluation Functions.

6.6.1. 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.

6.6.2. 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.

6.6.3. 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 systems that are potentially more hazardous and complex.

6.6.4. 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.

6.7. Safety Standards and Functions.

6.7.1. The Board is the AF focal point for the development and/or adoption of design and performance safety standards for directed energy systems.

6.7.2. 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 AF 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.

6.7.3. In its capacity as the AF 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 systems. 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. (T-0).


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

6.8.1.1. If joint directed energy systems are to be used by AF personnel, the respective agencies must follow the instructions outlined in this Instruction for the desired systems in order to support a review by the Board in conjunction with other service safety review boards. (T-1).

6.8.1.2. When the Board Executive Secretary receives a request for joint service review of directed energy systems that will not be used by AF personnel, the Executive Secretary may reply that no Board review is required.

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

6.8.3. The Chairperson may assign members to an AF review group as needed to review joint directed energy systems for AF or non-AF use.
Chapter 7

SAFETY STUDIES AND REVIEWS

7.1. Overview.

7.1.1. 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 Military Standard 882E. Application of Military Standard 882E techniques provides assurance that directed energy systems and associated support and test equipment items, other directed energy system 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 system’s life cycle. Reference Attachment 5 for guidance regarding required safety evaluations.


7.2.1. The Program Manager or acquiring activity responsible for procuring or modifying directed energy systems (Program Executive Officers, Designated Acquisition Commanders, System Program Directors, Product Group Managers, Joint Program Offices, etc.), including all directed energy systems and related items specified in paragraph 3.4, is also responsible for ensuring the requirements of this chapter are satisfied. (T-1). These responsibilities include:

7.2.1.1. Ensuring a directed energy system item requiring Board study and review is identified to the Executive Secretary and designated system safety engineers early in the design or acquisition process. (T-1). 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. (T-1).

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. (T-1). 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. (T-1). 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. (T-1).

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. (T-1).


7.3.1. The Safety Study is a detailed safety evaluation of a directed energy system 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:

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

7.3.3. Prepared by a HQ AFMC system safety engineering organization or by any other organization possessing sufficient safety engineering expertise as determined by the Board. (T-1).

7.3.4. A document used to present only the necessary design and performance details required for system evaluation and not as a source data for directed energy systems. Note: Data in a Safety Study may contain proprietary and/or privileged information.

7.3.5. 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.

7.3.6. Reviewed by the Board and approved by the appropriate staff agencies prior to entry of production items into the AF inventory. (T-1).

7.3.7. 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).

7.4. 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 systems. (T-1). 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 systems must be reviewed by the Board before live fire testing as specified in this Instruction. (T-1).

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

7.4.4. The intent of this evaluation is to mitigate danger to, or loss of, assets during live tests of uncertified directed energy systems 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. System name and names of personnel involved in Review preparation. (T-1).

7.4.5.2. A statement regarding the purpose and scope of the Review. (T-1).

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. (T-1).

7.4.5.4. A preliminary system safety analysis of the system, including preliminary comparisons to Military Standard, North Atlantic Treaty Organization Standardized Agreements, failure analyses, and other safety evaluations performed to date, as applicable and as available. (T-1).

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. (T-1).

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 the deemed necessary to be accomplished prior to a live fire test. (T-1).

7.4.6. A Test Hazards Assessment Review is prepared by a HQ AFMC system safety engineering organization or by any other organization possessing sufficient safety engineering expertise as determined by the Board. (T-1).

7.4.7. The Test Hazards Assessment Review should not be used as source data for directed energy systems 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 systems 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. (T-1). A Supporting Analysis is:

7.5.2. Needed to support a conclusion that a system or item or modification of a system or item 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 systems. (T-1). Staff agency review and approval of the Supporting Analysis is not required.

7.5.4. Prepared by a HQ AFMC system safety engineering organization or by any other organization possessing sufficient safety engineering expertise as determined by the Board. (T-1).

7.5.5. Not used as source data for directed energy systems 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 to the Chairperson for Board coordination and certification recommendation. (T-1).

7.6.3. The Emergency Operational Capability request must include a Residual Risk Analysis. (T-1). 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 risk analysis using the approach outlined in Military Standard 882E and documented in accordance with AFI 91-202. (T-1).

7.6.3.2. Recommendations and strategies to mitigate mishap risks exposed through training, operations or maintenance. (T-1).

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). Refer to Military Standard 882E and to DoD Instruction 5000.02, Operation of the Defense Acquisition System, and AFI 63-101/20-101, Integrated Life Cycle, to determine the required mishap Risk Acceptance Authority. (T-0).

7.6.4. The Program Manager or acquiring activity will submit the operational necessity, the scope of intended use, and the period of time required to be excluded from the normal Certification or Test Approval process to the Executive Secretary. (T-1). The Executive Secretary will then distribute as appropriate.

7.6.5. 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. (T-1).

7.6.6. If approved, the Chairperson will provide documentation with the Risk Assessment to the Program Manager or acquiring activity. (T-1). 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


8.1.1. 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. (T-0). In addition, directed energy systems will meet the requirements of Hazards of Electromagnetic Radiation to Ordnance certification in accordance with AFI 91-208 and Hazards of Electromagnetic Radiation to Fuel in accordance with Military Standard 464C, DoD Instruction 3222.03, and AFI 91-203. (T-0).

8.1.2. Directed energy system design safety standards must be given equal consideration along with logistics and operational requirements. (T-0).

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.


8.2.1. Deviations from directed energy system design safety standards are authorized only with the Board’s recommendation and concurrence of the Chairperson. (T-1).

8.2.2. Deviations from directed energy system design safety standards will not be considered unless alternative design concepts or procedures are provided, meet the intent of the applicable standard, and are approved by the Board. (T-1).

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

JOHN T. RAUCH JR, Major General, USAF
Chief of Safety
Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

References
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, 30 September 2014
AFI 48-145, Occupational and Environmental Health Program, 11 July 18
AFI 91-203, Air Force Consolidated Occupational Safety Instruction, 15 June 2012
AFI 91-204, Safety Investigations and Reports, 27 April 2018
AFI 91-208, Hazards of Electromagnetic Radiation to Ordnance (HERO) Certification and Management, 1 February 2017
AFI 99-103, Capabilities-based Test and Evaluation, 6 April 2017
AFJMAN 23-209, Storage and Handling of Hazardous Materials, 13 January 1999
AFMAN 13-212V1, Range Planning and Operations, 22 June 2018
AFMAN 33-363, Management of Records, 1 March 2008
AFMAN 91-201, Explosives Safety Standards, 21 March 2017
AFMAN 91-221, Weapons Safety Investigations and Reports, 21 August 2015
AFMAN 91-222, Space Safety Investigations and Reports, 22 December 2016
AFCJ 91-4, Directed Energy Weapons (DEW), 31 August 2017
American National Standard Institute, Z136.6-2015, Safe Use of Lasers Outdoors, 2015
Center for Disease Control, National Institute of Occupational Safety and Health Pocket Guide, [https://www.cdc.gov/niosh/npg/default.html](https://www.cdc.gov/niosh/npg/default.html)
Chairman of the Joint Chiefs of Staff Manual 3230.01A, Joint Chiefs of Staff Directed Energy Weapon Initial Operational Employment Review and Approval Process, 7 October 2015
DoD Dictionary of Military and Associated Terms, June 2018
DoD Instruction 3222.03, *Electromagnetic Environmental Effects (E3) Program*, 10 October 2017
FDA Exemption No. 76EL-01, *Department of Defense Exemption from the FDA Performance Standard for Laser Products*, 1976
Title 21, Code of Federal Regulations, Part 1040.10, *Laser Products*
Title 21, Code of Federal Regulations, Part 1040.11, *Specific Purpose Laser Products*

**Prescribed Forms**

None

**Adopted Forms**

AF Form 847, *Recommendation for Change of Publication*, 22 September 2009

**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
AFSPC—Air Force Space Command
AMC—Air Mobility Command
ANG—Air National Guard
CFR—Code of Federal Regulations
DoD—Department of Defense
EMFR—Electromagnetic Field Radiation
FDA—Food and Drug Administration
HAF—Headquarters Air Force
HERO—Hazards of Electromagnetic Radiation to Ordnance
HQ—Headquarters
HPW—Human Performance Wing
JSWSR—Joint Services Weapon Safety Review
MAJCOM—Major Command
PACAF—Pacific Air Forces
SG—Surgeon General
SRB—Safety Review Board
USAFE-AFAFRICA—United States Air Forces in Europe and Africa
USAFSAM—United States Air Force School of Aerospace Medicine

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 Item—any item, other than real property, that is of a type customarily used for nongovernmental 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 any item evolved 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 the time to satisfy the delivery requirements under
a government solicitation. Also included in this definition are services in support of a commercial item of a type offered and sold competitively in substantial quantities in the commercial marketplace based on established catalog or market prices for specific tasks performed under standard commercial terms and conditions; this does not include services that are sold based on hourly rates without an established catalog or market price for a specified service performed.

**Commercial-Off-The-Shelf-Item**—An item 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 marketplace. This does not include bulk cargo such as agricultural products or petroleum.

**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 more similar to directed energy than to 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**—The ability of a system currently under development (a system with limited capabilities or a limited number of systems) that could be deployed in an operational mode by warfighters during a crisis situation. 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 peace-keeping.

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 entered into the appropriate database.

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.

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 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.

Lower 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 in order 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 item acquisition, commercial-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 so as 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 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 system. For military specific laser systems that are not compliant with Military Standard 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 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 system according to Military Standard 882E. This analysis must include, at a minimum, interfaces of the directed energy 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 system. For laser systems, a system hazard evaluation by an AFSEC/SEW and 711 HPW 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 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 system, including storage, maintenance, operation, surveillance, inspection, demilitarization and disposal procedures, if applicable.

A2.1.6. Occupational health and environmental health assessment by Bioenvironmental Engineering, if required.

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. Findings and recommendations (after Board review).


A2.1.13. Other information necessary to define the level of safety incorporated in the item (for example, a determination if a 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 system.

A2.2. Distribution. If required per paragraph 5.5, 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 5.

A2.2.5. When approved by all required parties, 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.


A3.2.3. American National Standard Institute, Z136.4-2010, American National Standard Recommended Practice for Laser Safety Measurements for Hazard Evaluation, 2010


A3.2.6. Institute of Electrical and Electronics Engineers, C95.1-2005, Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz, 2005

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


A3.2.15. Military Standard 810G(1), Environmental Engineering Considerations and Laboratory Test, 14 April 2014


Attachment 4

DIRECTED ENERGY SYSTEM CERTIFICATION FLOWCHARTS

Figure A4.1. 21 CFR Part 1040 compliant military specific laser systems.

- Laser System
  - Military specific?
  - No → 21 CFR 1040 compliant?
    - No → Denied for Air Force use
    - Yes → Minimal Risk; Admin Certified. No submission of certification documents to Board or AFSEC/SEW.
  - Yes → 21 CFR 1040 compliant?
    - No → See Figure A4.2
    - Yes → Class 1
- Class 1
  - Minimal Risk; Admin Certified. No submission of certification documents to Board or AFSEC/SEW.

- Class 1M, 2, 2M, 3R
  - AFSEC/SEW review. Submit documentation in accordance with Attachment 2 to AFSEC/SEW for review at least 45 days prior to desired certification.

- Class 3B, 4
  - Full Board review. Submit documentation in accordance with Attachment 2 to AFSEC/SEW for review at least 45 days prior to desired certification.
Figure A4.2. 21 CFR Part 1040 non-compliant military specific laser systems.
Figure A4.3. Electromagnetic Field Radiation directed energy systems.
Figure A4.4. Ionizing radiation directed energy systems.

**Diagram Description:**
- **Ionizing Radiation**
- **Yes**
- **No**

**Minimal Risk:**
Admin Certified. No submission of certification documents to Board or AFSEC/SEW.

**During proposed or typical operational use, are exposures below the public dose limits in accordance with AFI 48-148, i.e. 2 mrem in any one hour and 100 mrem per year?**

**Yes**

**Full Board review. Submit documentation in accordance with Attachment 2 to AFSEC/SEW for review at least 45 days prior to desired certification.**
Figure A4.5. Acoustic directed energy systems.
Attachment 5

SAFETY ASSESSMENT GUIDANCE

Figure A5.1. Lower and Higher Risk/Complexity and Safety Review Flowcharts.

Figure A5.2. Rapid Fielding and System Component Modification Flowcharts.