

MARINE AIR GROUND TASK FORCE TRAINING COMMAND, MARINE CORPS AIR GROUND  
COMBAT CENTER STANDARD OPERATING PROCEDURES FOR  
LASER HAZARDS CONTROL

Ref: (a) MCO 5100.29B  
(b) MCO 5104.1C  
(c) ANSI Z136.1  
(d) ANSI Z136.6  
(e) MIL-HDBK-828A  
(f) MIL-STD-882D  
(g) CCO P3500.4G

1. Situation. As directed by guidance in references (a) through (g) this SOP provides the policy, assigns responsibility and presents the requirements for the Marine Air Ground Task Force Training Command (MAGTFTC), Marine Corps Air Ground Combat Center (MCAGCC) Laser Hazards Control Program. This SOP serves as the local principal source directive for policy and guidance in the identification and control of laser radiation hazards in accordance with the references.

2. Mission. This SOP provides the basic requirements of the MAGTFTC, MCAGCC Laser Hazard Control Program. Certain requirements or provisions of this order may not be feasible during war time or combat operations, but should be adhered to the maximum extent possible to ensure safe laser operations.

3. Execution

a. Commander's Intent and Concept of Operations

(1) Commander's Intent

(a) To enhance unit and individual readiness by maintaining a safe environment for laser operations.

(b) To ensure that Marines involved in laser operations are aware of the inherent dangers associated with the type of laser they are using.

(c) That Marines utilizing laser systems are cognizant of the personal protective equipment required for the safe operation of that system.

(2) Concept of Operations. The MAGTFTC, MCAGCC Laser Hazards Control Program will consist of the following elements.

(a) Regulations. The following MAGTFTC, MCAGCC Orders, all pertaining to different disciplines of laser safety, establish the regulations which will be adhered to by all units operating aboard MAGTFTC, MCAGCC.

1. Laser Range Operations: CCO P3500.4G.

2. General Laser Safety: CCO 5104.1A.

(b) Laser Classification and Labeling. Each laser will be classified and labeled before use. This classification system is based upon the ability of the laser to cause skin and eye damage.

1. Class 1. This class is eye/skin safe under all operating conditions.

2. Class 1M. This class is safe for viewing by the naked eye but may be hazardous to view with the aid of optical instruments. In

general, the use of magnifying glasses increases the hazard from a widely-diverging beam (eg LEDs and bare laser diodes). Binoculars or telescopes increase the hazard from a wide, collimated beam (such as those used in open-beam telecommunications systems. Both classes 1 and 1M can be visible, invisible or both.

3. Class 2. These are visible lasers. This class is safe for accidental viewing under all operating conditions. However, it may not be safe for should one deliberately stare into the beam for a time greater than 0.25sec by overcoming their natural aversion to a bright light (blink response).

4. Class 2M. These are visible lasers. This class is safe for accidental viewing with the naked eye, as long as the natural aversion response is not overcome as with class 2 but may be hazardous (even for accidental viewing)when viewed with the aid of optics as with class 1M.

Radiation in classes 2 and 2M are visible but also contain an invisible element, subject to certain conditions.

Classes 1M and 2M broadly replace the old class 3A. Prior to the 2110 amendment there were class 3B lasers but were eye-safe when viewed without optics. These lasers are now class 1M or 2M under the new classification.

5. Class 3R. Radiation in this class is considered low risk, but potentially hazardous. The class limit for 3R is 5X the applicable class 1(for invisible radiation) or class 2(for visible radiation). Hence, CW visible lasers emitting between 1 and 5 mW are normally class 3R. Visible class 3R is similar to class 3A in the old classification.

6. Class 3B. Radiation in this class is very likely to be dangerous. For a CW laser the maximum output into the eye must not exceed 500 mW. The radiation can be a hazard to either the eye or skin depending on the operating wave length of the laser. Viewing of the diffuse reflection is safe.

7. Class 4. This is the highest level of laser radiation. Radiation in this class is very dangerous and even viewing of a diffuse reflection could be hazardous. Class 4 beams, depending upon the wave length of the laser, are capable of setting fire to materials being lased.

"Embedded" lasers will be classified as to the engineering classification assigned by the manufacturer.

Generally speaking, lasers are point sources while LEDs are extended sources. Extended sources have higher MPEs than point sources.

8. The Federal Performance Standard for Light Emitting Products published in the 21 CFR, Part 1040, issues safety design requirements for the manufacture of lasers for commercial and military applications. Some of these design requirements are incompatible with operational military use, therefore, an exemption has been granted exclusively to DOD for "military exempt lasers", which are defined as lasers designed for actual combat; combat training operations or which are classified in the interest of national security.

9. Regardless of military exemption, lasers used aboard MAGTFTC MCAGCC will be classified according to ANSI Z136.1, and to the extent practical, control measures recommended will be applied. In most cases,

laser classification and hazard warning labels are affixed directly to the laser by the manufacturer.

10. The Laser Safety Review Board (LSRB), per reference (b), is an independent authority on laser safety. Its composition includes representatives from the Commandant of the Marine Corps (CMC) Safety Division (SD), Chief of Naval Operations, Bureau of Medicine and Surgery (BUMED), Naval Safety Center and the five systems commands (including Commander, Marine Corps System Command) under the chairmanship of the Safety Office (OOF), Space and Naval Warfare System Command (SPAWARSSYSCOM). The LSRB has been established, in part, to assure that laser safety criteria are incorporated in the development phase and before fielding of Marine Corps Class 3/Class 4 laser systems and all military exempt laser systems (regardless of their classification). LSRB proceedings officially establish the safe viewing distances, laser protective eyewear requirements and other parameters necessary to define laser control requirements.

(c) Laser System Safety Officer (LSSO)

1. The MAGTF/TC, MCAGCC LSSO shall be designated, in writing, by the Commanding General (CG).

2. Regimental or battalion unit LSSOs shall be designated, in writing, by the unit commanding officer.

3. Responsibilities and duties of the MAGTF/TC MCAGCC/Unit LSSO shall be formally documented to ensure that lasers are operated safely.

4. The MAGTF/TC, MCAGCC LSSO shall have direct access to the CG and have the authority to suspend, restrict or stop the operation of a laser or laser system.

5. The unit LSSO shall have direct access to the unit commanding officer and have the authority to suspend, restrict or stop the operation of a laser or laser system.

(d) Protective Equipment

1. Appropriate laser protective equipment (e.g., eyewear, clothing, barriers, screens, etc.) shall be worn by all personnel involved in laser operations aboard MAGTF/TC, MCAGCC.

2. Laser eye protection (LEP) shall provide enough optical densities (at the operating wavelengths for both unaided and optically aided viewing) to ensure that the applicable Maximum Permissible Exposure (MPE) is not exceeded. The MPE represents levels of visible and invisible laser radiation to which a person may be exposed without hazardous effects or adverse biological changes occurring in the eyes or skin and are published in ANSI Z136.

a. Eyewear shall be labeled or identified for intended laser use and inspected periodically to ensure its integrity. Any degradation such as cracks or bleaching shall result in replacement. Notify all concerned personnel, including SPAWARSSYSCOM (OOF) of any defective eyewear. Due to the classified nature of most military exempt lasers, wavelength and optical densities may not be present in some LEP, although coding numeration sufficient to determine applicability to the specific laser may be found.

b. Ground Laser Eye Protection (GLEP) for Marine Corps ground forces currently consists of the sun, wind and dust goggles with green

or brown laser filter inserts and the M22 laser-hardened binoculars. Marine Corps aviators are provided with laser protective eyewear procured through the Naval Air Systems Command. Available GLEP is published in E0410-BA-GYD-010\LASER.

c. LEP has been developed for normal training and combat operations and is laser and distance specific. It is not to be used in place of the specified protective goggles for laser maintenance procedures or for use in laser laboratories, since the degree of protection afforded may be inadequate or marginal within short distances of the laser exit aperture.

d. The nominal ocular hazard distance (NOHD) is the distance beyond which exposure will be less than the MPE for the eyes. Decreasing range from a laser beam within the NOHD increases the probability and severity of induced eye damage. The use of specific LEP will allow safe operation by personnel within the NOHD when lasers emitting the appropriate wavelength are being used.

e. Personnel using unfiltered magnifying optical sights are placed at greater risk of eye injury from viewing laser beams or their specular reflection since the magnifying power of the optical device effectively moves the eye closer to the laser source. This risk does not usually occur when viewing lasers through night vision goggles (NVG) or other imaging devices where there is no direct path for the laser to reach the eyes. An exception is the "Cat's Eyes" NVG where laser light has uninterrupted access to the wearer's eyes. Representative NOHDs for Marine Corps lasers and NOHDs for optically aided viewing are found in SPAWARINST 5100.12B. MPE criteria should not be employed, nor NOHD calculated without proper training.

(e) Safety Inspections and Surveys

1. Laser ranges are required by reference (b) to be surveyed, certified and recertified every three years or after range modifications by a Category I LSSO or through a SPARWARISYSCOM (OOF) designated laboratory or support contractor, on a cost reimbursable basis.

2. Laser radiation hazard surveys and evaluations shall be performed on laser ranges to determine the degree of laser radiation hazard and to recommend proper controls. These hazard surveys and evaluations shall be repeated whenever changes occur or at least every three years. Initial range surveys should be conducted by a SPARWARISYSCOM (OOF) designated laboratory or support contractor.

3. Hazard surveys and evaluations will determine specific bearings, headings, buffer zones and other laser control limits necessary to terminate or attenuate laser beams within the range or controlled airspace to prevent exposure of unprotected personnel both on and off the range from laser radiation more than the MPEs.

4. Laser ranges are certified and recertified by a SPARWARISYSCOM designated laboratory or support contractor.

(f) Medical Surveillance Program. Medical surveillance for all laser personnel will fall under the cognizance of the Naval Hospital Twentynine Palms (NHTP), Occupational Health Department. Unit LSSOs will notify the MAGTFTC, MCAGCC LSSO of any recommendations for assignment of personnel from their unit to the Medical Surveillance Program. Inclusion into the laser medical surveillance program will be determined by Industrial Hygiene assessments and the MAGTFTC, MCAGCC LSSO.

1. Overexposure to laser radiation shall be immediately reported to the NHTP, Occupational Health Department and the MAGTFTC MCAGCC LSSO.

2. Personnel enrolled into the laser medical surveillance shall fall into one of two categories:

a. Personnel who routinely work with Class 3 or 4 lasers. These are normally personnel who usually work in research and development, laser repair and maintenance, or in engineering/construction lasers.

b. Incidental personnel whose work makes it probable that they may exceed the applicable MPE. Operators of fielded military laser systems, technicians performing testing and personnel performing demonstrations/training fall into this category.

3. As a minimum, medical surveillance evaluations include laser and visual acuity eye examination. At the discretion of the NHTP, Occupational Health Department, additional test may be required.

(g) Laser Overexposure Incidents

1. Suspected or observed laser eye injuries require a complete medical eye examination conducted by an ophthalmologist or optometrist, very soon after the exposure. Prompt examination is important since medical intervention may help to mediate certain injury conditions and the distinctiveness of very mild or minor retinal lesions may begin to fade shortly after exposure. Color retinal photographs are preferred as a record for documentation. Suspected or observed overexposure to laser radiation shall be reported to the NHTP, Occupational Health Department.

2. Reference (e) requires a message report for a laser overexposure or suspected laser eye injury to be sent to BUMED WASHINGTON DC//MED 02// as soon as possible. CMC (SD) will be included as additional addressee. A formal report, as detailed in reference (e), shall be forwarded within 30 days. A copy of the laser overexposure evaluation will be sent to CMC (SD) as the centralized point for permanent retention of laser over exposure incidents occurring throughout the Marine Corps. The MAGTFTC MCAGCC LSSO may contact CMC (SD) for recommendations on availability of experts whose services may be procured to assist in evaluating and assessing a laser overexposure incident.

3. If a laser overexposure incident is caused by lasers not belonging to United States forces, refer to MCO 3430.3C.

(h) Laser Inventory. The MAGTFTC, MCAGCC LSSO will maintain all necessary records required by reference (c), and maintain a list of all lasers and their locations aboard MAGTFTC, MCAGCC. A report will be submitted annually (by 31 December) listing all local military exempt lasers and Class 3b and Class 4 nonexempt lasers to the Commanding General, Marine Corps Logistics Base (MCLB) (Code 136), Albany, Georgia.

(i) Warning Devices and Signs. Laser warning devices and signs shall be posted at appropriate locations to protect unsuspecting personnel from laser radiation, per references (b) through (d).

(j) Documented Safety Duties for MAGTFTC, MCAGCC LSSO, Unit LSSOs and Laser Supervisors. The safety responsibilities of personnel who supervise laser operations shall be documented. Those duties include such functions as safety planning for the installation of laser systems, providing

and enforcing operational procedures, ensuring employees receive appropriate training, investigating incidents, and logging laser firings when appropriate. ANSI Z136.1, shall be the source document for establishing the necessary basic safety duties. The Unit LSSO/supervisor shall submit this information to the MAGTFTC, MCAGCC LSSO.

(k) Emergency Provisions. The emergency operating procedures or emergency shutdown procedures shall be posted at each laser installation in a location that is safely accessible to personnel rendering emergency aid. Emergency medical technicians and firefighters shall be trained in laser hazards and controls.

(l) Laser Safety Committee. The MAGTFTC, MCAGCC Laser Safety Committee shall be composed of the following personnel: MAGTFTC, MCAGCC LSSO (Chairman); MAGTFTC, MCAGCC Laser Range Safety Officer; Unit LSSOs; Tactical Training Exercise Control Group LSSO/Safety Officer; NHTP Industrial Hygiene Officer; and, Fire Department Safety Officer. The Combat Center Laser Safety Committee shall convene whenever a laser mishap, incident or situation occurs aboard the MAGTFTC MCAGCC.

(m) Unattenuated Laser Systems. Force-on-force training exercises involving unattenuated laser systems are not authorized aboard MAGTFTC MCAGCC.

(n) Technical Assistance

1. Laser System Safety Officers can obtain assistance and guidance concerning laser radiation hazards from:

Commandant of the Marine Corps (Safety Division)  
Headquarters, United States Marine Corps  
2 Navy Annex  
Washington, DC 20380-1775  
DSN 224-1202, Commercial (703) 614-1202

2. Technical and laser measuring assistance can be obtained with the understanding that on-site visits may involve cost reimbursements:

a. For evaluation of laser related weapon systems and certification of laser firing ranges, contact:

Naval Surface Warfare Center (H11)  
Dahlgren, VA 22448-5000  
DSN 249-8171, Commercial (703) 663-8171,

or

Naval Air Warfare Center  
China Lake, CA 93555  
DSN 469-1662, Commercial (619) 939-1662

b. Assistance request letters should be addressed to:

Commander  
Space and Naval Warfare Systems Command (OOF)  
Washington, DC 20363-5100

3. For industrial or laboratory laser applications and laser hazard surveys, contact:

Radiation Health Division  
Naval Environmental Health Center  
Norfolk, VA 23513-2167

DSN 564-4657, Commercial (804) 444-4657, ext 413

a. Assistance request letters should be addressed to:

Bureau of Medicine and Surgery  
(MED-02)  
Washington, DC 20372-5120

4. For technical information on laser eyewear selection and specifications, contact:

Naval Air Warfare Systems Center (NAWSC)  
(Code 6023)  
Vision Laboratory  
Warminster, PA 18974  
DSN 441-2634, Commercial (215) 441-2634

a. Assistance request letters for obtaining laboratory measurements for proposed laser protective eyewear should be forwarded to:

Naval Air Warfare Systems Center (NAWSC)  
(Code 6023)  
Vision Laboratory  
Warminster, PA 18974