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WgO 5100.2E
DOSS
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WING ORDER 5100.2E

From: Commanding General
To: Distribution List

Subj: LASER HAZARDS CONTROL PROGRAM

Ref: (a) SECNAVINST 5100.14C
(b) OPNAVINST 5100.27/MCO 5104.1A
(c) BUMEDINST 6470.23
(d) ANSI Z136.1-2000 American National Standard for Safe Use of Lasers
(e) EO410-BA-GYD-010 (1993) Laser Safety Technical Manual
(f) MIL-HDBK-828 (1993) Military Handbook: Laser Range Safety
(g) OPNAVINST 3710.7S

Encl: (1) Summary of References and Definitions
(2) 3d MAW Laser Safety Organization
(3) 3d MAW Laser Standing Operating Procedures
(4) Safety Procedures for Laser Range Use
(5) Suspected Laser Overexposure/Near Miss Incident Plan
(6) Laser System Data Worksheet
(7) Annual Laser Safety Compliance Inspection Checklist

1. Purpose. To provide 3d Marine Aircraft Wing (3d MAW) policy and assign responsibilities for the safe operational use of laser systems within 3d MAW per references (a) through (g).

2. Cancellation. WgO 5100.2D.

3. Applicability. This Order applies to all 3d MAW activities operating military exempt, Class 3B or Class 4 laser systems.

4. Background. Laser systems continue to proliferate within the military, increasing the potential for laser overexposure injuries. This concentrated form of energy can be transmitted, focused, and absorbed by biological tissues. Specifically, the eyes and skin are highly susceptible to laser energy. Due to the refractive capability of the eye, laser energy can become exponentially intensified and subsequently damage critical structures within the eye. Laser effects to the skin are

similar to that of the sun. When either the eyes or skin, that energy is transformed into heat absorbs laser energy. Heat overload serves as the primary mechanism for laser overexposure injury. Current fleet operational laser systems typically do not operate in the high output ranges required to damage the skin, however, the eyes remain extremely vulnerable. To ensure the safe and effective use of lasers, Bureau of Medicine and Surgery, MED 212, 2300 E. Street, NW, Washington, DC 20372-5300 is appointed the Administrative Lead Agent (ALA) for laser safety in the Navy and Marine Corps.

5. Policy. This Order highlights and clarifies various sections of the references, however, in no way supersedes the established directives. It is recommended that references (a) through (g) be fully reviewed by Laser Hazard Control Program personnel to ensure compliance. A summary of references and definitions is found in enclosure (1). The policy of 3d MAW in organizing and managing a local Laser Hazard Control Program is as follows:

a. Command Organization. Each 3d MAW command shall clearly formalize their Laser Hazard Control Program organizational structure as outlined in enclosure (2). The Administrative Laser Safety Officer (ALSO), Laser System Safety Officers (LSSOs), Laser Safety Supervisors (LSSUPs) (if indicated), Laser Operators and Laser Boresight Personnel responsibilities shall be defined within this organizational structure. Each squadron that operates military exempt, Class 3B and/or Class 4 laser systems shall designate one command ALSO. A unit may also elect to designate additional LSSOs and or LSSUPs as necessary to meet operational needs. The ALSO and LSSOs shall be designated in writing by the squadron Commanding Officer. The ALSO is solely responsible for establishing the command Laser Hazard Control Program. The ALSO shall have direct access to the Commanding Officer on all issues pertaining to laser operations and safety. All ALSOs and LSSOs shall be certified graduates of an ALA and Lead Navy Technical Laboratory (LNTL) ALSO/LSSO course. Local courses may be available through the Group or Wing Laser System Safety Officer. The command ALSO is responsible for the administration of the command Laser Hazard Control Program in accordance with reference (b).

b. Training. All command Laser Operators and Laser Boresight Personnel shall complete a formalized command level certification training syllabus prior to system operation. Upon laser operator certification, the individual shall be added to

the command Certified Laser Operator List and authorized system use. In addition, the ALSO shall ensure all laser operators meet the annual refresher training requirements delineated in reference (b).

c. Medical Surveillance Program. The Command ALSO shall ensure all personnel required to be enrolled in medical surveillance in accordance with reference (c) have undergone an appropriate eye examination, and the results of the exam are placed in the member's medical record. Enrollment is limited to those who are clearly at risk from exposure to laser radiation Using the protocol outlined in reference (c), a medical examiner shall perform Medical Surveillance Examinations.

d. Laser Operations. All mission commanders shall review enclosures (3), (4), and system specific Standing Operating Procedures in order to brief mission personnel on applicable information prior to each laser mission. For laser system maintenance or open beam boresight procedures, the squadron LSSUP shall review enclosure (3) and the system specific SOPs prior to laser ground firing.

e. Laser Eye Protection (LEP). Aircrew operating in or with aircraft possessing laser capability and in use shall use LEP in accordance with reference (g), Laser System Review Board Proceedings for the in use laser system, laser system flight clearance, and range regulations. The command ALSO shall ensure that LEP currently available meets the optical density and wavelength requirements for the laser systems in use. Night Vision Devices are not to be considered LEP. Command laser protective visors, spectacles or goggles with the correct wavelength and optical density shall be identified or coded for use and periodically inspected for damage in accordance with enclosure (2), section 4 of reference (b).

f. Suspected Laser Overexposure/Near Miss Incident. If a laser eye injury is suspected or observed, as soon as possible, an ophthalmologist or optometrist shall conduct a complete medical eye examination. Immediate recognition and examination of an injury is critical for prudent treatment and enhances prognosis. The squadron LSSO shall report and investigate all suspected laser overexposure incidents, per references (b) and (c). Immediate notification shall be initiated with a 3d MAW FLASH Report. Make the initial report of medical examination (including negative findings) within four hours after completion

to BUMED (MED 212) by telephone (COMM 202-762-3448 DSN 762-3448), FAX (COMM 202-762-0931 DSN 762-0931). In addition, the command shall submit a written report to the Chief, Bureau of Medicine and Surgery (MED 212) via the Commanding General 3d MAW within 30 days. Enclosure (5) provides definitive guidance for the initial response to a suspected laser overexposure incident.

g. Inventory. In accordance with reference (b), all 3d MAW commands shall maintain a current inventory of all military exempt, class 3B and class 4 lasers assigned to that command. Additionally, the Command ALSO should maintain Laser System Data Worksheets on each laser system used within the command. Laser System Data Worksheets, enclosure (6), serve as an excellent resource for mission/operation planning and mishap reporting.

h. Safety Audit. Laser Hazards Control Programs shall receive local laser safety audit annually. The audit may coincide with the 3d MAW Commanding General Inspection Program and should be conducted by 3d MAW or Group ALSO or TLSO. Enclosure (7) provides basic guidance. Laser facilities and ranges shall be surveyed annually by a TLSO and re-certified every three years.

6. Summary of Action. This revision contains a substantial number of changes and should be reviewed in its entirety.

G. A. YINGLING, JR.
Chief of Staff

DISTRBUTION: L1/L2/L3

SUMMARY OF REFERENCES AND DEFINITIONS

Ref	Title	Description
(a)	SECNAVINST 5100.14C	Defines Navy Military Exempt Laser Program. Applies to the design, use, and disposal of all equipment and systems capable of producing laser radiation, including laser fiber optics.
(b)	OPNAVINST 5100.27/MCO 5104.1A	Prescribes OPNAV/CMC policy and guidance in the identification and control of laser radiation hazards. Includes the requirements for a laser Systems Safety Officer (LSSO), issues guidance on establishing a Laser Hazard Control Program for commands utilizing Class-3B and Class-4 lasers, laser standing operating procedures and safety regulations, personnel safety training, operator medical surveillance, laser eye protection, laser warning signs, and administrative protective control measures.
(c)	BUMEDINST 6470.23	Establishes medical surveillance requirements and notification procedures for suspected laser overexposure injuries.
(d)	ANSI Z136.1 American National Standard for the Safe Use of Lasers (NOTAL)	Issues maximum permissible exposure (MPE) limits and establishes laser standards for defining safety control measures necessary for each laser class.
(e)	EO410-BA-GYD-010 (1993) Laser Safety Technical Manual	Technical information on measurements, calculations and biological effects. Provides laser system safety parameters.
(f)	MIL-HDBK-82 (1993) Military Handbook: Laser Range Safety	Provides procedures for laser system use on DOD ranges.
(g)	OPNAVINST 3710.7S	Chapter 8 delineates CNO policy on the use of laser eye protection for aircrew.

DEFINITIONS

Laser. An acronym for Light Amplification by the Stimulated Emission of Radiation. Any device, which can be made to produce or amplify electromagnetic radiation in the x-ray, ultraviolet, visible, and infrared or other portion of the spectrum primarily by the process of controlled, stimulated emission of photons.

Laser Classifications. All laser systems are categorized to identify the biological threat and the subsequent level of laser safety controls required for their safe and effective use. Classification ranges from Class 1 lasers that are inherently safe for direct beam viewing to Class 4 lasers that pose the greatest biological threat and require the strictest safety control measures. Laser system classifications are typically labeled on the exterior of the system and are identified for normal system operation only. When a laser system is disassembled for maintenance or when protective features are removed, the laser classification may default to a more hazardous class.

Military Exempt Laser. Laser systems that are designated for combat, combat training, or classified in the interest of national security are exempted from the regulatory obligations of the Federal Performance Standard for Light Emitting Products 21 Code of Federal Regulations Part 1040 per reference (a).

Maximum Permissible Exposure (MPE). The level of laser radiation to which a person may be exposed without hazardous effect or adverse biological changes in the eyes or skin.

Nominal Ocular Hazard Distance (NOHD). The distance along the axis of the unobstructed beam from the laser to the human eye beyond which the irradiance or radiant exposure during normal operation is not expected to exceed the MPE.

All other essential terms relating to lasers are further defined in references (a) to (f).

3D MAW LASER SAFETY ORGANIZATION

1. Technical Laser Safety Officer (TLSO). Graduate of an approved ALA/LNTL TLSO course, TLSOs may receive qualification to instruct ALSO courses, perform annual safety audits and perform other duties as outlined in reference (b).

2. Administrative Laser Safety Officer (ALSO). This individual shall be designated in writing by the Commanding Officer following successful completion of an ALA LNTL approved ALSO course. The squadron ALSO shall have direct access to the Commanding Officer on all issues pertaining to laser operations and safety. The ALSO shall be responsible for the proper administration of the command's Laser Hazard Control Program. Specific ALSO responsibilities are delineated in reference (b).

3. Laser System Safety Officer(s) (LSSO). Designated in writing by the Commanding Officer following successful completion of an ALA and LNTL approved ALSO course. The LSSO shall assist the ALSO in the administration of the Command Laser Hazards Control Program.

4. Laser Safety Supervisor(s) (LSSUP). These individuals shall assist in supervising maintenance and ordnance (boresighting) adherence to squadron laser safety policy. Typically, a Staff Sergeant or above that works in conjunction with the Aircraft Maintenance, Ordnance or the Avionics Division and who has completed an ALA and LNTL approved ALSO course. Laser Safety Supervisors shall be designated in writing by the Commanding Officer. LSSUPs shall:

a. Establish laser safety procedures in conjunction with ALSO, system technical representatives, the Aviation Maintenance Officer and the Avionics Officer for all maintenance and ordnance boresight procedures involving lasers.

b. Assist ALSO with the training of preventative maintenance and ordnance personnel assigned to maintain or boresight laser systems.

c. Supervise all laser ground firings to ensure implementation of the standard operating procedures and safety regulations outlined in enclosure (2).

3. Certified Laser Operators. Prior to laser usage, command personnel that will be in direct control of a laser system during operations, maintenance, or boresighting shall complete the following requirements to obtain command laser operator certification:

a. Introductory and annual refresher formalized classroom training on basic laser mechanics, laser biohazards, LEP procedures, specific laser system operating characteristics and command SOP.

b. ALSO placement into the Medical Surveillance Program, reference (c). Typically, aircrew (personnel behind fielded laser systems), maintenance and ordnance personnel are not enrolled in the Medical Surveillance Program.

c. ALSO placement on the command laser operator certification list.

3D MAW LASER STANDING OPERATING PROCEDURES

1. Operational Airborne Laser Firing

a. Mission planning and briefing. The mission commander (certified laser operator) shall ensure adherence to the following procedures for all laser missions:

(1) Contact squadron ALSO/LSSO or Range Laser Safety Officer for specific laser range safety procedures and regulations for the applicable laser range complex for use during mission planning.

(2) Ensure compliance with the 3d MAW Safety Procedures for Laser Ranges outlined in enclosure (4) and the applicable laser system procedures.

(3) Using appropriate Laser System Data Worksheets (see enclosure (6)) brief mission personnel on the appropriate LEP (laser system, wavelength and optical density) to be used (when required) as determined by the LSSO.

(4) Ensure the laser firing is logged in accordance with the laser range regulations and squadron SOP.

b. Authorized laser firing areas. Only certified and approved indoor and outdoor ranges may be used for any laser firing.

2. Maintenance or Open Beam Boresight Ground Laser Firing. The following procedures shall be used when lasers are fired on the ground during open beam boresighting procedures.

a. Field expedient boresighting will only take place with ALSO approval and at least a LSSUP present. Only trained personnel shall conduct field boresight operation when a certified indoor range is unavailable and boresight retention of the system has been compromised.

b. A LSSUP shall be present during all ground laser firings.

c. During all laser firings there shall be a minimum of two (2) individuals present in the laser area. All non-essential

personnel shall vacate the spaces during ground laser firings. Additionally, only certified laser operators shall be authorized to trigger the laser system during the ground firing. All personnel present shall be familiar with the laser safety regulations and the specific system shut-down procedures.

d. The LSSUP shall ensure the lasing area is properly labeled and secured during all laser firings.

e. All personnel present during laser firings shall utilize LEP sufficient to protect from the laser system in use.

f. Laser Firing Procedures

(1) LSSUP shall ensure all personnel have donned LEP if required.

(2) LSSUP shall give command to "**ARM LASER**".

(3) LSSUP shall give a five count to "**FIRE**".

(4) LSSUP shall give command to "**CEASE FIRE**".

(5) Upon cease firing, the LSSUP shall give command to "**DISARM laser**" and ensure the laser is properly stowed with batteries removed/power supply disabled.

(6) LSSUP can then give command to "**DOFF LEP**" if used.

(7) ALSO/LSSO, LSSUP, or appointed designee shall ensure the maintenance or boresight ground laser firing is logged with the squadron ALSO/LSSO.

3. Laser Firing Logs. Following all laser firings, the certified laser operator shall ensure accurate laser firing records are submitted as required by the Range Laser Safety Officer and command ALSO per reference (b). Laser Safety Supervisor shall log all ground laser firings (i.e., boresight) with the Command ALSO. Copies of this documentation shall be maintained by the command ALSO for three years.

SAFETY PROCEDURES FOR LASER RANGE USE

1. In addition to the usual requirements for prior permission, target identification, and adherence to scheduled target times, the following precautions shall apply to laser range operations and for laser targets:

a. Only targets surveyed and approved may be lased by 3d MAW aircraft or laser systems. All lasing must be within the laser certification parameters of the range being used.

b. A clearing pass over the target is required for the purpose of target identification and to ensure no unauthorized vehicles or personnel are in the target area or buffer zone.

c. Lasing specular reflectors (shiny surfaces) can cause inadvertent redirection of the beam. For example, standing water could conceivably reflect the beam outside the permissible lasing area. Lasing of specular reflectors shall be avoided. The target and vicinity should be inspected on the clearing pass with this in mind.

d. The beam should not leave the buffer zone. In no case shall the beam be directed at or above the horizon.

e. Deliberate lasing of wildlife is strictly forbidden.

f. Lasing shall not be allowed until the target has been positively identified.

2. Additional procedures are required for lasing manned targets. The lasing of manned targets shall be permitted only when the following criteria is met:

a. The mission commander or forward air controller has verification from target personnel that they have the proper laser eye protection (LEP), and all personnel have been briefed concerning its use and the possible consequences of not using LEP.

b. In accordance with range procedures, positive two-way radio communication is established immediately prior to each laser firing, and permission to fire is received from the mission commander.

3. The mission commander shall act as a laser safety observer, ensuring that safe operating procedures are implemented. He shall:

a. Provide adequate control of the target area to ensure unauthorized personnel do not enter the area. Laser operations shall cease when unauthorized personnel enter the operating area.

b. Maintain radio contact with ground units to ensure protective eyewear is worn during laser operations.

c. Report any suspected unprotected exposure or suspected laser overexposure incident shall be immediately to the squadron ALSO.

d. Insure all laser firings are logged and reported to appropriate range and command personnel.

SUSPECTED LASER OVEREXPOSURE/NEAR MISS INCIDENT PLAN

1. Purpose. To provide guidance for either a suspected or an observed laser overexposure incident in accordance with BUMEDINST 6470.23.

2. Action. If a laser eye injury is suspected or observed, a complete medical eye examination must be conducted by an ophthalmologist or optometrist, as soon as practical following the overexposure. The ALSO/LSSO/LSSUP shall ensure the following steps are completed during the initiation of reporting procedures.

MEDICAL TREATMENT

_____1. Seek immediate medical treatment.

IMMEDIATE NOTIFICATION

_____1. Contact squadron ALSO: _____

_____2. Contact MAG Laser Safety Officer: _____
____MAG Laser Safety Officer (ALSO/TLSO) shall notify:
_____3d MAW Laser Safety Officer _____
_____BUMED (MED-212) _____
_____Naval Safety Center _____

_____3. Submit 3DMAW FLASH report to 3d MAW via the MAG.

IMMEDIATE INVESTIGATION

_____1. A/C & BUNO (IF APPLICABLE): _____

_____2. Laser system: _____

_____3. Laser wavelength and mode of operation or power setting: _____

_____4. Estimated duration of exposure: _____

_____5. Estimated distance from aperture of laser: _____

ENCLOSURE (5)

____6. Operations at the time of incident: _____

_____

_____

____7. LEP used: _____

____8. Extent of injuries as determined by medical treatment facility/flight surgeon: _____

_____

_____

REPORTING

____1. Within four (4) hours of completion of medical evaluation, results of said evaluation to BUMED (MED-212).

____2. Complete written follow-on report to BUMED (MED-212) within 30 days of incident. Send copies to: Naval Safety Center, HQMC Safety Division and LNTL.

LASER SYSTEM DATA WORKSHEET

1. **Laser System:**

2. **Class:**

3. **Number of Systems Held by Command:**

4. **Military Exempt: Y N**

5. **Serial Numbers:**

6. **Physical Location of Systems:**

7. **Individual Responsible for Disposition:**

8. **Laser Characteristics:**
   Wavelength:
   Beam Diameter (at 1/e pt):
   Beam Divergence (at 1/e pt):
   MAX Power (CW):
   Energy per Pulse:
   Pulse Duration:
   PRF:

9. **Nominal Ocular Hazard Distance:**
   Single Pulse (Rangefinder Mode):
   Multi Pulse (Designator Mode):
   7x50 Binocular Aided:
   8cm Optics:
   12cm Optics:

10. **Required Optical Density (OD) for LEP:**
    Unaided:
    Aided:

11. **Diffuse Reflection Hazard: Y N**

12. **Skin Hazard: Y N**

13. **Assigned Buffer Zone:**
    Day:
    Static:
    Night:
    Moving:

ENCLOSURE (6)

ANNUAL LASER SAFETY COMPLIANCE INSPECTION CHECKLIST

PROGRAM ADMINISTRATION

1. Does the command have class 3B, 4, or military exempt lasers?

2. Is a written Command Laser Hazard Control Program established?

3. Has an ALSO been designated in writing by the squadron CO, and does he/she have direct access to the Commanding Officer?

4. Has the ALSO received formal training in laser safety from the ALA/NLTL and is a certificate on file?

5. Does the ALSO have sufficient technical competence and authority to approve or disapprove the local use of lasers?

6. Are appropriate references available in squadron spaces?

7. Have LSSOs and LSSUPs been properly trained and designated to assist the ALSO?

8. Has each local laser in use been approved or submitted for safety approval to higher authority by the ALSO?

9. Does the ALSO maintain a list of all lasers and their characteristics?

10. Is an inventory of Class 3B 4, and military exempt lasers available and current?

11. Have local laser safety regulations been established to include standard operating procedures?

12. Have safety responsibilities been written for LSSUPs/LSSOs including normal installation planning, operational procedures, accident investigation, and a log of all laser firings?

13. Are all local laser programs audited at least annually?

TRAINING

1. Have all personnel utilizing lasers had formal initial classroom training about the potential hazards associated with

accidental exposure to lasers? Are rosters or lists of certified users maintained?

2. Is refresher training of laser personnel performed at least annually? Is training documented?

MEDICAL SURVEILLANCE

1. Are all laser personnel enrolled in the appropriate medical surveillance program?

2. Are the required examinations performed prior to laser system use and following any suspected laser injury?

OPERATIONS

1. Are lasers missions and operations briefed in accordance with current operating procedures and instructions?

2. Are laser firing logs maintained by the ALSO?

LASER EYE PROTECTION

1. Is appropriate Laser Eye Protection available for use?

2. Is the LEP properly labeled or coded, periodically inspected, and evaluated?

OVEREXPOSURE/NEAR MISS INCIDENT

1. Are local laser radiation accidents investigated and appropriate corrective actions initiated?

2. Was a medical evaluation performed and reported to BUMED, and was the investigation report submitted within thirty days of the incident?

FACILITIES

1. Are laser facilities and ranges inspected annually and certified every 3 years?

2. Are warning signs placed in appropriate locations to protect unsuspecting personnel from laser radiation?

3. Are reflective surfaces such as mirrors, shiny metal, etc. removed from laser operating (boresighting) areas?

4. Are laser systems safeguarded from inappropriate/incidental firing (labeled, powered-off, etc.)?