

Chapter 9**USE OF LASERS ON MOD LAND RANGES****INTRODUCTION**

0901. **Policy.** Joint Service Publication (JSP) 390 sets down mandatory instructions on laser safety for the UK Armed Services, MOD Establishments, MOD Agencies, MOD owned/Contractor operated establishments and contractors using MoD facilities. The Military Laser Safety Committee (MLSC) sets policy, approves standards and directs the Military Laser Safety Review Panel (MLSRP). The MLSRP, under direction of the MLSC, approves and advises on the use of lasers on MOD Ranges and establishments. This Chapter provides an overview and direction of the policy for the use of Lasers on MOD Land Ranges. In particular the following are covered:

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LASER CLASSIFICATION AND HAZARDS

0902. **Introduction.** The lasers most likely to be encountered in a service environment include; designators and rangefinders, illuminators, aimers and pointers, identification systems, fibre and free space based communication systems and high-energy lasers.

0903. Lasers are classified according to the emission wavelength and output energy produced. In general the higher the classification number, the more hazardous the laser. All laser products are currently assigned to one of seven classes, which are summarised below. Classification should be marked on the equipment in accordance with the British Standard BS EN 60825-1:2007.

- a. **Class 1.** Class 1 lasers are those that are safe under all reasonably foreseeable conditions of operation. This class is limited to very low power lasers or totally enclosed laser systems, and are not considered hazardous to the eye even if viewed through magnifying optics.
- b. **Class 1M.** Class 1M lasers produce either highly divergent or large diameter beams. They are not hazardous to the unaided eye, but may be hazardous if magnifying optics are employed within the beam. Class 1M lasers are common in fibre optic communication systems.

c. **Class 2.** Class 2 lasers operate in the visible part of the electromagnetic spectrum (400nm to 700nm). Protection is normally afforded by the eye's natural aversion response to bright light, even if viewed through magnifying optics.

d. **Class 2M.** Class 2M lasers operate in the visible part of the electromagnetic spectrum. Protection is normally afforded by the eye's natural aversion response to bright light, but the laser may be hazardous if magnifying optics are employed within the beam.

e. **Class 3R.** Class 3R lasers may be hazardous through direct accidental viewing (ie the eye is illuminated for a short period of time), to the unaided eye and if magnifying optics are employed within the beam. The actual risk of injury following short exposures is small.

f. **Class 3B.** Class 3B lasers are hazardous through direct viewing or with the use of optical aids. Reflections from polished or wet surfaces (specular reflections) can be hazardous.

g. **Class 4.** Class 4 lasers are capable of causing serious injury to both eye and skin if viewed directly with the naked eye or with viewing aids. Specular and diffuse reflections from such lasers can also be hazardous. They may also constitute a fire hazard.

0904. **Hazardous Situations.** It is hazardous to view, or even to glance at, the source of a potentially hazardous class of laser when within the prescribed hazard distance. Magnifying optics have the effect of increasing the hazard distance.

0905. **Hazards to the Skin.** There is generally no hazard to the skin from Class 1, 1M, 2, 2M and Class 3R lasers. Class 4 lasers can burn the skin and may present a fire hazard.

0906. **Indirect Hazards.** The components of a laser system can create hazards to the person; power supplies have the potential to cause severe electric shock. Other components such as power supplies, plasma tubes and discharge lamps may produce noise, X-ray or RF hazards. Some systems require chemical mixes or produce particulates which can be toxic.

LASER HAZARD ASSESSMENT

0907. **Introduction.** The MLRSP is tasked to advise the MOD on the technical and practical aspects of laser safety. Lasers fired on a MOD Range or training area must have a Military Laser System Safety Assessment Certificate (MLSSAC) issued by the MLSRP. As part of the MLSSAC, the MLSRP will stipulate the controls to be applied for the safe use of the laser.

0908. **Maximum Permissible Exposure (MPE).** The MPE is an internationally agreed level of laser radiation to which a person may be exposed without suffering adverse effects. MPE levels are used to determine hazard distances.

0909. **Nominal Ocular Hazard Distance (NOHD).** The NOHD is the distance along the axis of the laser beam beyond which the laser energy density is below the MPE. It is practice to modify the NOHD to include a safety factor for atmospheric effects (scintillation) that may produce higher energy zones in the beam. In addition, the NOHD may be modified to take account of the use of magnifying optics and filters.

0910. **Hazard Zone.** This is the zone in which a person could be at risk from laser radiation. The dimensions of the laser hazard zone are dependent on the NOHD, the angular divergence of the beam, the pointing accuracy of the laser and hazardous reflections. The pointing accuracy depends on the mounting and control system, the platform stability and whether the laser is engaging a moving or stationary target.

RANGE AND DRY TRAINING AREA SAFETY

0911. **General.** Class 1M, Class 2M, Class 3R, Class 3B and Class 4 lasers present potential hazards to MOD personnel and to the general public, as the laser beam hazard often extends beyond the boundary of the range or training area, and especially when the beam may be viewed through magnifying optical instruments. Where the hazard extends beyond the range boundary, or where persons may be located in the hazard zone, it is essential that either the laser beam should be terminated by a natural/man-made feature (back-stop) or that adequate surveillance is maintained over the entire hazard zone. If no suitable back-stop is available, the MLSRP will assess the hazard to military or civilian persons and a Military Laser Range Safety Clearance Certificate (MLRSCC) must be sought. For trials of Class 1M, Class 2M, Class 3R, Class 3B and Class 4 lasers a Military Laser Trial Safety Clearance Certificate must be sought from the MLSRP.

0912. **Restrictions.** Where two-sided exercises take place lasers are to be restricted to Class 1 or Class 2 (excluding Class 1M and Class 2M without prior consultation with the MLSRP).

0913. **Operating Procedures and Instructions.** The laser operator ultimately controls the safe use of a specific laser. Operators must be familiar with their laser's potential hazards as well as Personal Protection Equipment (PPE) requirements and operational and range control measures. It is the responsibility of the platform Integrated Project Team to ensure that documentation detailing procedures and training for a safe operating regime are provided. Safety related information may be promulgated through Material Regulations for the Army, Army Equipment Support Publications (AESP), Air Publications and Safety Bulletins. The following points are to be considered:

- a. **Firing.** Lasers in Class 1M and 2M (for optical aids), Class 3R, Class 3B and Class 4 should be treated as weapons. Whenever they are to be fired, the warning procedures adopted for conventional weapon firings must be applied. In circumstances where laser equipment must be left unattended, it is to be Made Safe to avoid the risk of its accidental firing.
- b. **Preparation of Targets.** All targets for Class 1M and 2M (for optical aids), Class 3R, Class 3B or Class 4 laser operations are to be of a matt/non-glossy surface and must be free from glass surfaces such as windscreens, periscopes, mirrors, etc. Special instructions must be issued if a Class 4 laser is to be used.
- c. **Preparation of Ground.** Ground over which a Class 1M and 2M (for optical aids), Class 3R, Class 3B or Class 4 laser is fired is to be clear of flat shiny surfaces that might produce reflections. It should be noted that these reflections could occur from large water surfaces, small still-water puddles or from icy surfaces.
- d. **Airborne, Air to Surface Laser Systems.** Airborne lasers must only be operated in the area designated and within the altitude band prescribed by the MLSRP for the laser operation.

0914. **Personnel in a Hazard Zone.** Whenever possible the laser hazard area should be clear of all personnel during laser operations. If it is essential to fire a Class 1M and 2M (for optical aids), Class 3R, Class 3B or Class 4 laser when persons are known to be in the hazard zone one or more of the following protection measures must be used:

- a. **Use of Protective Goggles/Glasses.** Personnel must only wear authorised laser protective goggles or glasses that give the appropriate protection for a specific laser's output energy/power and wavelength. These need to be inspected and certified to be in good condition. All authorised goggles must be marked with the appropriate wavelength band.
- b. **Warned but Unprotected Personnel.** Personnel who do not wear laser protective eyewear should turn their back on the laser and must not look in the direction of the laser when it is being fired. There must be an effective communication system between the laser firing point and all unprotected persons.
- c. **Use of optical aids.** In the case of class 1M and 2M the prohibiting the use of optical aids (Binoculars etc) during firing should be sufficient.

LASER SAFETY OFFICER (LSO) DUTIES

0915. **Appointment.** Where Class 1M and 2M (for optical aids), Class 3R, Class 3B and Class 4 lasers are to be fired on ranges, a LSO is to be appointed by the Range Administrating Unit (RAU), or Head of Establishment/Site. The Commanding Officer (CO) or Head of Establishment/Site will lay down the detailed responsibilities.

0916. **Planning and Control.** It is the responsibility of the LSO to ensure that laser operations on ranges include the following measures:

- a. The preparation and publication of Standard Operating Procedures and Standing Orders that take account of the requirements of the MLSSAC.
- b. Ensuring that all range staff are instructed in the safety precautions and SOP to be followed.
- c. Identification and marking of suitable sites from which laser operations may be conducted.
- d. Provision of suitable targets or target area with back-stops (natural or man-made).
- e. Determining whether there is a need to establish control and/or surveillance of the air or sea space within the laser hazard zone.
- f. Ensuring that the laser user reports any suspected overexposure to laser radiation to the appropriate medical authority at the earliest opportunity.
- g. Location of the Unit/Establishment Medical Officer or appropriate medical authority.

LASER INCIDENT AND ACCIDENT REPORTING

0917. **General.** For reporting purposes the terms 'laser incident' and 'laser accident' have the following meanings:

- a. **Laser Incident.** A laser incident is an occurrence arising from the operation or functioning of laser equipment that could have resulted in injury to personnel.
- b. **Laser Accident.** A laser accident is an occurrence arising from the operation or functioning of laser equipment that results in injury to personnel.

0918. **Procedure.** Following a suspected overexposure, the User should inform the CO or Head of Establishment/Site immediately. The CO or Head of Establishment/Site should institute a full investigation of the circumstances of the accident or incident. The individual is to be referred to the unit or establishment medical officer, who should make a preliminary examination and initiate a laser accident/incident report. In the event of an accident/incident the following actions should be taken:

- a. Any individual suffering actual or suspected overexposure is to be referred immediately to the unit or establishment medical officer or appropriate medical authority or, if not available, to the emergency services.
- b. Suspend all operations in the laser hazard area and secure and quarantine all lasers that were in use at the time of the accident/incident.
- c. Ensure that the accident conditions are left unaltered pending investigation.
- d. Inform the MLSRP.

ASSESSMENT OF RANGES FOR LASER USE

0919. **General.** The MLSRP as directed by the MLSC is responsible for assessing and advising on the suitability of MOD land ranges for specified lasers and for their operation, e.g. land-land, land-air. If a Range is judged suitable, an appropriate entry may be made in the Schedule of the Range's MOD Form 904 by the Range Authorising Officer.

USE OF LASERS ON MOD LAND RANGES BY VISITING FORCES

0920. **Requirement.** Before permission is given for lasers to be used on a MOD range by foreign forces, the MLSRP should be contacted.

TRAINING

0921. **General.** LSO for MOD ranges should have attended the approved laser safety course at the Defence College of Management and Technology (DCMT), Shrivenham.

0922. **Laser Safety Course.** The two-day laser safety course at DCMT is held three times a year and can accommodate up to 20 students of Officer, SNCO or MOD Civilian equivalent status. Applications for vacancies should be submitted at least 10 weeks in advance through the appropriate Service Training Officer to:

The Academic Registrar
The Defence Academy of the United Kingdom
Defence College of Management and Technology
Cranfield University
Shrivenham
Swindon
SN6 8LA