**DEPARTMENT OF THE AIR FORCE**
**AIR FORCE RESEARCH LABORATORY**
**FT SAM HOUSTON TEXAS**

MEMORANDUM FOR RECORD 23 August 2017

FROM: 711 HPW/RHDO
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SUBJECT: Laser Eye Protection Selection Guidance

1. Introduction

1.1 Purpose: To provide guidance for the selection of Laser Eye Protection (LEP) for Air Force (AF) Primary Training Ranges (PTR). This letter shall serve as an interim guidance in the absence of a general AF or DoD policy. This guidance is intended for ground personnel in a training environment, not in deployed settings. Aircrew LEP is addressed in AFI 11-301 Volume 4 *Aircrew Laser Eye Protection (ALEP)*.

1.2 Background: Due to the increased use of new and existing laser systems and evolving laser safety standards, the AF constantly evaluates hazards associated with laser use. In conjunction with these hazard evaluations, LEP requirements must be periodically updated. 711 HPW/RHDO, in accordance with AFI 13-212 *Range Planning and Operations,* performs certifications for the safe use of lasers on all AF PTRs every three fiscal years. This survey contains the currently approved systems for use on all AF PTRs and the associated wavelength and LEP optical density (OD) for those laser systems.

1.3 Scope: This letter addresses the procedures for selecting LEP to meet the safety needs of PTR personnel working with lasers. Included is a short tutorial regarding the parameters associated with LEP, a description of the various types of LEP, and common production formats. Guidance for LEP use on training ranges by personnel, and instructions for interpreting the contents of a range survey report or laser hazard evaluation is given. Also provided is a partial list of LEP vendors and their products, as well as important points of contact for further issues associated with laser hazards or LEP. Note that the data contained in Attachments 1 and 2 are current as of the date of this memo and are subject to change.

2. LEP Tutorial

2.1 Laser Wavelength: The common units of measurement for laser wavelength are the nanometer (nm) and the micrometer (µm). The wavelengths associated with the visible spectrum are accepted as 400-700nm (0.4 to 0.7 µm). Values between 400 and 500nm are violet to blue in color, 500 to 600nm are green to yellow, and 600 to

700nm are orange to red. Some military-specific lasers commonly known as “Dazzlers” or “Ocular Interrupters” can be useful Hail and Warning devices and operate in the visible spectrum. These are typically lasers with short hazard distances (< 40 m) and are considered Operator-Controlled devices with no LEP requirement for the user.

Wavelengths shorter than about 400 nm are considered “ultraviolet” (UV). Lasers that operate in this spectrum are not commonly considered military specific.

Wavelengths longer than about 700 nm are termed “infrared” (IR). Wavelengths in the IR and UV ranges are invisible to the human eye, but can still be hazardous. Most military-specific lasers used for target designation/marking operate at the IR wavelength of 1064nm. Other lasers used for pointing or illumination commonly operate between 800nm to 860nm. Laser rangefinders commonly operate at 1540nm. If a laser does not emit visible light, it can still be dangerous. Invisible does not mean safe. “Training modes” at 1540nm and 1570nm are not always “eye-safe” lasers. These wavelengths can still pose a hazard to the human eye. Attachment 1 lists the systems approved for use on all AF-PTRs and their wavelengths of operation and LEP optical density requirement.

2.2 Optical Density: OD is a measure of how much of the laser light will be attenuated or reduced by the LEP. OD is a function of wavelength, power or energy, and viewing condition (aided or unaided) —it is not a constant. The OD scale is a logarithmic scale. More precisely, the OD is the logarithm of the reciprocal of the transmission of a filter. Table 1 illustrates the relationship between the amount of light transmitted and the OD value. Specifications for LEP generally indicate the OD values at several common wavelengths of laser operation. Figure 1 shows a protection curve of a common commercial LEP spectacle across the visible and near-infrared wavelength spectrum. A protection curve is a graph of wavelength vs. OD for a specific LEP filter. The curve shows that a particular LEP protects to an OD for specific wavelengths. Figure 2 shows the OD specifications for typical commercial LEP printed on the side shield. Military issued LEP will often not have the OD printed on it; it is determined from the protection curve paperwork that is supplied by the manufacturer.

| Optical Density (OD) | Percent Transmitted | Attenuation or Reduction Factor |
|---|---|---|
| 1 | 10% | 10 |
| 2 | 1% | 100 |
| 3 | 0.1% | 1000 |
| 4 | 0.01% | 10000 |
| 5 | 0.001% | 100000 |
| 6 | 0.0001% | 1000000 |

**Table 1:** OD, transmission and attenuation.


**Figure 1:** OD vs. Wavelength chart for a common LEP spectacle.


**Figure 2:** OD values at particular wavelengths as indicated on the LEP.

2.3 Daytime (Photopic) Vision and Nighttime (Scotopic) Vision Transmission: LEP is also characterized by the total amount of light that is transmitted in the wavelength range of human daytime and nighttime vision. The term Photopic refers to the daytime range of vision, while Scotopic refers to the range of nighttime vision. The two ranges are slightly different. For example, LEP with a high transmission would appear highly transparent and will provide good general daytime visibility. In contrast, a low transmission would appear dark and may hinder operational capabilities, especially at night. A typical rule of thumb is that a scotopic transmission of 40% or greater is needed for nighttime operations. For most LEP, light transmission is specified by the manufacturer as visible light transmission or VLT which corresponds to daytime transmission. If scotopic transmission data are not available, LEP for nighttime operations should have a VLT of at least 50%.

2.4 Protection Mechanisms: There are several physical mechanisms of attenuation used in LEP. The two most common attenuation mechanisms used are absorption and reflection.

2.4.1 Absorptive Technologies: By embedding an absorptive dye in a plastic, or by using a special glass with a semiconductor or mineral content, a filter can be made that has optical absorption properties. In these materials, the laser light is

absorbed throughout the thickness of the filter and the laser energy is dissipated as heat. The amount of dye, semiconductor, or mineral in the material determines the optical properties such as the OD and transmission at various wavelengths. The most common type of LEP commercially available use absorptive technology (see Attachment 2). A wide variety of dyes have been employed to obtain effective LEP solutions for many typical applications.

2.4.2 Reflective Technologies. Other types of LEP employ what is known as a reflective technology. In these types of LEP, the laser energy is reflected away from the wearer, rather than being absorbed in the material. Constructing very thin layers of dielectric materials on glass or polycarbonate makes reflective types of LEP. These thin layers can be designed to form a reflective coating with specific OD and wavelength characteristics.

2.5 LEP Format:

2.5.1 Spectacles (Figure 3): The spectacle form of LEP appears to be common sunglasses in most instances, only with colored or sometimes clear lenses. This type of LEP only provides protection from laser radiation when the observer is looking directly at the laser system. No protection is offered from light incident around the sides of the frames. Although common for aviators wearing helmets, this type of LEP is not recommended for ground-based personnel because it is common to inadvertently look around the sides of the frames. The user is not protected against laser exposures from the side that can cause damage to peripheral vision. The laser light must go through the lens for the user to have protection. If using this type of LEP, it is important to verify that the spectacles are indeed specifically designated LEP and not common sunglasses or yellow "shooters" glasses.

**Figure 3:** Spectacle format for LEP

2.5.2 Wrap-Around Spectacles (Figure 4): Similar to the spectacles described in Section 2.5.1, this type of spectacle includes the "side-shielding" of the eyes from laser radiation. This format usually provides more effective coverage than an ordinary spectacle. Wrap-around spectacles can also be obtained that fit over prescription glasses. This type of LEP, along with the goggle, is recommended for use by ground-based personnel on ranges. Many plastic dye-based LEP types are available in this format. Also, it is often possible to obtain exchangeable LEP filters in a variety of laser wavelengths for a specific frame type.

**Figure 4:** Wrap-Around Spectacle format for LEP

2.5.3 Goggles (Figure 5): The goggle offers greater coverage than the wrap-around spectacle format. The wearer is protected from laser radiation incident from the sides because there is a complete barrier between the filters and the user's head. Most goggles have an opaque side, which can obstruct peripheral vision. Many LEP glass filters must be mounted in this form. Often, it is possible to obtain exchangeable filters for goggles if a variety of laser wavelengths are being used and one filter is not adequate to protect against all lasers simultaneously. This type of LEP is also recommended as a good form for ground-based personnel. In addition, they can usually be worn over prescription spectacles, but this should be verified with the manufacturer.

**Figure 5:** Goggle format for LEP.

2.6 Standards: There are a variety of standards that apply to laser eye protection that should be specified when procuring devices. To ensure good optical quality, devices must conform to ANSI Z80.1, "American National Standard for Ophthalmics - Prescription Ophthalmic Lenses." ANSI Z136.7, "American National Standard for Testing and Labeling of Laser Protective Equipment," provides recommendations for the testing and labeling of laser protective materials and protective equipment such as eye protection. In addition, to comply with OSHA requirements for workplace hazards, all laser eyewear shall be clearly labeled with optical density values and wavelengths for which protection is afforded. LEP suppliers may advise that a military exemption provides for the use of laser eye protection without such labels. However, this exemption should not be applied to the routine use of LEP by AF personnel on training ranges. LEP that is not labeled with the protection provided should not be

used unless there are clear markings so that the user can determine the optical density values and wavelengths for which protection is afforded.

3. Selection of LEP

3.1 General: LEP must be selected so that it meets the requirements of the user. No single LEP solution will provide effective protection against every laser system. The goal should be to obtain LEP that protects against the widest possible variety of laser systems that will be used on the range, while maintaining an acceptable visible light transmission. It may be necessary to purchase more than one type of LEP to meet all of the requirements for a particular range.

3.2 Steps in LEP Selection: The following steps should be followed when selecting LEP for use on the range. They are intended to be general guidance. Detailed questions may be referred to 711 HPW/RHDO.

STEP 1. Determine the wavelengths of operation for all laser systems to be used on the range. 711 HPW/RHDO maintains a list of all laser systems approved for use on AF PTRs, along with their wavelengths and OD requirements (see Attachment 1).

STEP 2. Determine the maximum OD at each wavelength for the systems. Be sure to use the aided viewing OD if binoculars or telescopes will be allowed during laser operations. Add the maximum OD required at each wavelength to the list created in STEP 1.

STEP 3. Review available OD by wavelength tables in Attachment 2 for LEP products from the vendors that have been identified as possible suppliers. This is not a complete list, and other suppliers are available. If you have an alternate recommendation, this can be used, but the general guidance provided here is still applicable. Make a list of LEP frames and filters that meet the OD requirements at all wavelengths listed. If no one LEP solution can meet all OD and wavelength requirements, break the requirements into subsets until a minimum number of LEP products are found. Attachment 2 has separate tables for each eyewear frame.

STEP 4. Of the LEP filters which meet the OD-wavelength requirements identified as available from the various vendors, select LEP that have an acceptable level of daytime and/or nighttime visible light transmission. A good rule is that any LEP intended for night use should have a visible light transmission (VLT) of at least 40%. This transmission level may not always be achievable, but the nearest value available should be pursued, and if possible, be evaluated by the user prior to purchase.

STEP 5. Of the LEP which meet the OD-wavelength requirements and have acceptable visible light transmission values, choose a style that properly protects the users under operating conditions. Users needing eyeglasses should consider selecting a style of LEP that can comfortably accommodate wearing their glasses. Any users using military field systems should purchase LEP that effectively protects the peripheral vision.

STEP 6. Other factors that must be considered include the durability of the LEP under fielded conditions. It may be necessary to select LEP with good resistance to scratches and breakage. Some LEP may be required to also perform as safety goggles, protecting from ballistic projectiles or other debris. If ballistic protection is an important factor, then it is recommended that consideration be given to choosing a frame that is listed on the Army's Authorized Protective Eyewear List (APEL). Only eyewear passing the Army's stringent ballistic fragmentation (MIL-PRF 32432 and ANSI Z87.1 2010) makes the list. However, the APEL may not include ballistics tests on laser protective lenses, and additional advice should be sought from the manufacturer. The APEL list as of July 2017 is provided in Attachment 3. The list is updated periodically and the current list should be consulted. It can be found on the Program Executive Office (PEO) Soldier website: www.peosoldier.army.mil/equipment/eyewear/.

STEP 7. The use of night vision goggles (NVGs) require that the LEP be compatible with the device. NVGs do not provide complete protection from a laser, unless they COMPLETELY cover both eyes. Indirect view NVGs (i.e., 4949's or ANVIS) protect the user's field of vision through the NVGs, but not around the NVG tubes. Cat's Eyes, or direct view, type NVGs provide no eye protection from lasers unless the combining elements are coated with absorptive filters at laser hazard wavelengths. NVG intensifier tubes can be damaged by direct laser illumination. Damage levels vary with laser wavelength and NVG tube type. Many damage levels are classified. It should be noted that some LEP formats, especially goggles, are somewhat uncomfortable to wear for extended periods of time. Lens surfaces may fog in some environments. Another important factor is that color vision is often seriously compromised, in some instances, warning or indicator lights of certain colors are not visible.

STEP 8. Cost can vary significantly among the various types of LEP, and is certainly a consideration when purchasing any equipment. For example, the cost of the LEP listed In Attachment 2 range between $100 and $400. The trade-off between performance and cost must be carefully weighed when selecting LEP.

STEP 9. Contact information has been provided for each eyewear brand. Price, ordering information, and detailed specifics can be obtained from these individuals.

4. Use of LEP on Ranges

4.1 LEP Maintenance. The Range Laser Safety Officer (RLSO) should be assigned the duty of maintaining LEP for the range personnel. Operational units using the range for laser operations should have their own LSO to obtain and maintain LEP that travels with the unit. The RLSO is responsible for insuring that the LEP and range approved laser systems are routinely checked for compatibility. Operational units using the range should obtain a listing of the approved laser systems for that range.

4.2 LEP Storage. LEP should be stored such that it is not damaged by environmental conditions or inadvertent scratching of the lenses. LEP should be

regularly inspected for physical damage and replaced in the instance that the lenses or filters become scratched or clouded.

4.3 LEP Training. Range personnel should be properly trained in the use of the LEP by the RLSO. This training should include when and where to wear the LEP and how to properly store it.

4.4. LEP and Color Vision. An important factor to be aware of is how color vision can be seriously compromised when wearing LEP devices. In some instances, warning or indicator lights of certain colors may not be visible or even appear to saturate or shift in color or hue after wearing LEP over a short period of time. Be sure to take note of relevant scenery and pertinent reading materials before performing operations that will be accomplished when wearing LEP devices. Lastly, it is important to note that the color of the LEP lens does not determine the wavelength of protection. Always be certain to check the list of wavelength ranges and protection levels before wearing them in the field.

5. Procurement

5.1 Procurement of LEP will differ depending on local and MAJCOM directives. Units must determine the best method of procurement. The following suggestions are offered:

5.1.1 Customer Service or Individual Equipment at Base Supply can use the list made from Attachment 2 to research and buy LEP for units. LEP may be found in the 8465 Stock Class, Individual Equipment. It can also be found in the 4240 Stock Class, Safety and Rescue Equipment. Note: The listing of LEP in a Stock Class does not imply that the LEP will meet the user needs. Compare specifications with those determined in Attachment 2.

5.1.2 Units with an IMPAC card may wish to contact the vendors listed in Attachment 2 to make purchases.

6. Point of Contact

Any questions or comments regarding this memo should be directed to 711 HPW/RHDO by emailing 711HPW.RHDO.USAFLaserSafety@us.af.mil or calling 1-210-539-2375 (DSN 389-2375).

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Attachments

1. Safety Information for USAF and Non-USAF Laser Systems
2. List of Potential LEP Suppliers and Products
3. Army Authorized Protective Eyewear List (APEL)

# Attachment 1: Safety Information for USAF and Non-USAF Laser Systems

| Laser System | Mode | Wavelength (nm) | Unaided NOHD (km) | 7X50 Binoculars NOHD (km) | 12-cm Optics NOHD (km) | Buffer Angle (mrad) | Unaided OD | Aided OD | Platform type |
|---|---|---|---|---|---|---|---|---|---|
| AC-130U ALLTV | Designator | 860 | 0.28 | 1.64 | 8.37 | 5 | 3.0 | 2.9 | Fixed Wing |
| AC-130U LIA | Illuminator | 807 | 0.10 | 0.70 | 1.64 | 5 | 3.3 | 5.2 | Fixed Wing |
| AC-130U LTD/RF | Combat | 1064 | 3.10 | 18.00 | 29.00 | 5 | 0.8 | 3.4 | Fixed Wing |
| ACP-2 | Pointer | 836 | 0.00 | - | - | 10 | 1.9 | - | Man Transportable |
| ACP-2A | Pointer | 800-850 | 0.14 | 0.97 | 2.25 | 10 | 2.2 | 2.2 | Man Transportable |
| ACP-2B | Pointer | 836 | 0.16 | 0.93 | 2.20 | 10 | 2.5 | 2.3 | Man Transportable |
| AIM-1/D | Pointer | 800-850 | 0.08 | 0.46 | - | 10 | 1.7 | 1.7 | Man Transportable |
| AIM-1/DLR | Pointer | 830 | 0.24 | 1.56 | 3.55 | 10 | 2.5 | 2.5 | Man Transportable |
| AIM-1/EXL | Pointer | 800-850 | 0.09 | 0.68 | 1.60 | 10 | 1.7 | 1.7 | Fixed Wing |
| AIM-1/EXL/MLR | Pointer | 830 | 0.09 | 0.68 | 1.60 | 10 | 1.7 | 1.7 | Man Transportable |
| AIM-1/MLR | Pointer | 800-851 | 0.09 | 0.68 | 1.60 | 10 | 1.7 | 1.7 | Rotary Wing |
| AN/AAQ-28 LITENING GEN 4/SE | Combat | 1064 | 26.62 | 63.40 | 86.16 | 5 | 4.8 | 5.6 | Fixed Wing |
| AN/AAQ-28 LITENING GEN 4/SE | Marker | 804 | 0.25 | 1.41 | 3.23 | 5 | 2.8 | 2.7 | Fixed Wing |
| AN/AAQ-28 LITENING GEN 4/SE | Training | 1570 | 0.17 | 1.06 | 2.46 | 5 | 0.8 | 2.4 | Fixed Wing |
| AN/AAQ-14 LANTIRN | Combat | 1064 | 20.50 | 146.00 | 352.00 | 5 | 4.0 | 5.4 | Fixed Wing |
| AN/AAQ-14 LANTIRN | Training | 1540 | 0.00 | 0.18 | 0.58 | 5 | 0.0 | 1.2 | Fixed Wing |
| AN/AAQ-16D AESOP | Designator | 1064 | 10.00 | 36.00 | - | 10 | 5.1 | 5.1 | Rotary Wing |
| AN/AAQ-22 NTIS (UH-1N) | Designator | 1064 | 0.72 | 4.00 | 8.60 | 5 | 4.1 | 5.3 | Rotary Wing |
| AN/AAQ-24 LAIRCM | SLTA (1x) | 950-10600 | 0.04 | 0.19 | - | 5 | 2.5 | 2.5 | Fixed Wing |
| AN/AAQ-24 LAIRCM | SLTA (2x) | 950-10600 | 0.06 | 0.26 | - | 5 | 2.5 | 2.5 | Fixed Wing |
| AN/AAQ-24 LAIRCM | GLTA (1x) | 950-10600 | 0.04 | 0.16 | - | 5 | 2.5 | 2.5 | Fixed Wing |
| AN/AAQ-24 LAIRCM | GLTA (2x) | 950-10600 | 0.05 | 0.22 | - | 5 | 2.5 | 2.5 | Fixed Wing |
| AN/AAQ-28 LITENING II | Designator | 1064 | 12.00 | 43.00 | 69.00 | 5 | 4.1 | 5.4 | Fixed Wing |
| AN/AAQ-28 LITENING II | Marker | 808 | 0.19 | 1.33 | 3.07 | 5 | 2.6 | 2.9 | Fixed Wing |
| AN/AAQ-33 ATP Sniper XR | Training | 1570 | 0.00 | 0.60 | 1.47 | 2 | 0.0 | 1.5 | Fixed Wing |
| AN/AAQ-33 ATP Sniper XR | Marker | 804 | 0.25 | 1.41 | 3.23 | 2 | 2.8 | 2.7 | Fixed Wing |
| AN/AAQ-33 ATP Sniper XR | Combat | 1064 | 15.60 | 44.80 | 65.00 | 2 | 3.9 | 5.3 | Fixed Wing |
| AN/AAQ-33 ATP-SE | LTM | 808 | 1.22 | 6.32 | - | 5 | 1.9 | 3.1 | Fixed Wing |
| AN/AAQ-33 ATP-SE | Tactical | 1064 | 21.70 | 55.14 | - | 5 | 3.9 | 5.3 | Fixed Wing |
| AN/AAQ-33 ATP-SE | Training | 1570 | 0.00 | 1.48 | - | 5 | 0.0 | 1.6 | Fixed Wing |
| AN/AAQ-39 CLDR (AC-130U) | Combat | 1064 | 20.42 | 54.34 | - | 5 | 4.0 | 5.2 | Fixed Wing |
| AN/AAQ-39 CLDR (AC-130U) | Training | 1570 | 0.00 | 0.00 | - | 5 | 0.0 | 0.0 | Fixed Wing |
| AN/AAQ-39 CLDR (AC-130U) | Alignment | 830 | 0.46 | 2.86 | - | 5 | 0.8 | 1.3 | Fixed Wing |
| AN/AAQ-39 GMS-2 (AC 130U) | Tactical | 1064 | 17.65 | 48.65 | 69.43 | 2 | 4.1 | 5.4 | Fixed Wing |
| AN/AAQ-39 GMS-2 (AC 130U) | Training | 1570 | 0.00 | 0.00 | 0.24 | 2 | 0.0 | 0.2 | Fixed Wing |
| AN/AAQ-39 GMS-2 (AC 130U) | Marker | 860 | 0.28 | 1.60 | 3.65 | 2 | 3.0 | 2.9 | Fixed Wing |
| AN/AAQ-40 EOTS (F-35) | "CONTACT THIS OFFICE" | | | | | | | | |
| AN/AAS-37 (OV-10D NOS) | Designator | 1064 | 11.20 | 45.00 | 59.00 | 5 | 5.2 | 5.6 | Fixed Wing |
| AN/AAS-44 LAMPS (UH-1N) | Rangefinder | 1064 | 19.97 | 52.67 | 78.11 | 5 | 4.1 | 5.3 | Rotary Wing |
| AN/AAS-44 LAMPS (UH-1N) | Designator | 1064 | 22.36 | 56.67 | 82.73 | 5 | 4.3 | 5.4 | Rotary Wing |
| AN/AAS-52 MQ-1 Predator MTS | LRD | 1060 | 39.07 | 81.29 | 105.70 | 2 | 4.3 | 5.4 | Fixed Wing |
| AN/AAS-52 MQ-1 Predator MTS | LTM | 850 | 0.31 | 1.79 | 4.06 | 2 | 2.9 | 2.9 | Fixed Wing |
| AN/AAS-52 MTS-A Firefly | Illuminator | 532 | 1.05 | 6.28 | 12.88 | 2 | 4.1 | 4.1 | Fixed Wing |
| AN/AAS-52 MTS-A Firefly | Illuminator | 1064 RLE | 1.05 | 6.28 | 12.88 | 2 | 1.5 | 1.5 | Fixed Wing |
| AN/AAS-52 MTS-A Firefly | Illuminator (Hi-Beam Laser System w/ 1.1 mrad Divergence) | 532 | 0.20 | 1.29 | 2.97 | 5 | 2.5 | 2.5 | Fixed Wing |
| AN/AASQ-36 Star SAFIRE II (MC-130H) | Pointer/Illuminator | 830 | 0.36 | 2.06 | 4.62 | 5 | 2.2 | 2.0 | Fixed Wing |
| AN/AAT-3A (AC130H) PAVE SPECTRE | Illuminator | 860 | 0.79 | 0.55 | 1.34 | 5 | 3.3 | 5.2 | Fixed Wing |
| AN/ASQ-153 Pave Spike (F-4E) | Designator | 1064 | 10.00 | 20.42 | - | 5 | 4.2 | 5.6 | Fixed Wing |
| AN/AVQ-19/19A CLDR (AC-130H) | Training | 1570 | 0.00 | 2.29 | 5.40 | 5 | 0.0 | 1.6 | Fixed Wing |
| AN/AVQ-19/19A CLDR (AC-130H) | Tactical | 1064 | 28.10 | 65.70 | 88.60 | 5 | 3.7 | 5.3 | Fixed Wing |
| AN/DAS-1A MQ-9 Reaper MTS-B | LRD | 1060 | 46.61 | 91.26 | 116.47 | 5 | 3.8 | 5.4 | Fixed Wing |
| AN/DAS-1A MQ-9 Reaper MTS-B | LTM | 860 | 0.32 | 1.83 | 4.14 | 5 | 3.0 | 2.9 | Fixed Wing |
| AN/GAQ-T1 LD82LB | Designator | 1064 | 12.50 | 38.00 | 52.00 | 5 | 4.6 | 5.5 | Man Transportable |
| AN/GVS-5 | Rangefinder | 1064 | 2.70 | 13.00 | 27.00 | 10 | 3.7 | 4.4 | Man Transportable |
| AN/KAX-1A MARFLIR Pointer | Pointer | 820- 840 | 0.64 | 4.00 | 8.20 | 5 | 2.5 | 2.5 | Vehicle Mounted (ground-to-ground) |
| AN/MAD-1 HPMF | Pointer | 830 | 0.68 | 3.74 | 9.14 | 5 | 2.5 | 2.3 | Vehicle Mounted |
| AN/MAD-1 HPMF | Rangefinder | 1540 | 0.00 | 0.00 | 0.00 | 5 | 0.0 | 0.0 | Vehicle Mounted |
| AN/PAQ-1 LWLD | Designator | 1064 | 7.00 | 15.00 | 43.00 | 10 | 4.2 | 5.8 | Man Transportable |
| AN/PAQ-3 MULE | Designator | 1064 | 20.00 | 53.00 | 78.00 | Tripod - 5 | 3.9 | 5.6 | Man Transportable |
| AN/PAQ-3 MULE | Designator | 1064 | 20.00 | 53.00 | 78.00 | Day-10 | 3.9 | 5.6 | Man Transportable |
| AN/PAQ-3 MULE | Designator | 1064 | 20.00 | 53.00 | 78.00 | Night-15 | 3.9 | 5.6 | Man Transportable |

# Attachment 1: Safety Information for USAF and Non-USAF Laser Systems

| Laser System | Mode | Wavelength (nm) | Unaided NOHD (km) | 7X50 Binoculars NOHD (km) | 12-cm Optics NOHD (km) | Buffer Angle (mrad) | Unaided OD | Aided OD | Platform type |
|---|---|---|---|---|---|---|---|---|---|
| AN/PAQ-3 MULE | Rangefinder | 1064 | 12.00 | 37.00 | 60.00 | Tripod - 5 | 3.9 | 5.6 | Man Transportable |
| AN/PAQ-3 MULE | Rangefinder | 1064 | 12.00 | 37.00 | 60.00 | Day -10 | 3.9 | 5.6 | Man Transportable |
| AN/PAQ-3 MULE | Rangefinder | 1064 | 12.00 | 37.00 | 60.00 | Night -15 | 3.9 | 5.6 | Man Transportable |
| AN/PAQ-3 MULE | Rangefinder w/ 12dB Filter | 1064 | 3.30 | 16.00 | 31.00 | Tripod - 5 | 3.9 | 5.6 | Man Transportable |
| AN/PAQ-3 MULE | Rangefinder w/ 12dB Filter | 1064 | 3.30 | 16.00 | 31.00 | Day-10 | 3.9 | 5.6 | Man Transportable |
| AN/PAQ-3 MULE | Rangefinder w/ 12dB Filter | 1064 | 3.30 | 16.00 | 31.00 | Night-15 | 3.9 | 5.6 | Man Transportable |
| AN/PAS-24 RECON III | Pointer | 820 | 0.27 | 1.50 | 3.42 | 10 | 2.1 | 2.1 | Man Transportable |
| AN/PEQ-1 SOFLAM | Designator | 1064 | 22.00 | 61.00 | 83.00 | Tripod - 5 | 3.8 | 5.3 | Man Transportable |
| AN/PEQ-1 SOFLAM | Designator | 1064 | 22.00 | 61.00 | 83.00 | Day-10 | 3.8 | 5.3 | Man Transportable |
| AN/PEQ-1 SOFLAM | Designator | 1064 | 22.00 | 61.00 | 83.00 | Night-15 | 3.8 | 5.3 | Man Transportable |
| AN/PEQ-15 ATPIAL (LA-5) | Visible Aim | 605 | 0.08 | 0.52 | - | 10 | 0.7 | 0.7 | Man Transportable |
| AN/PEQ-15 ATPIAL (LA-5) | IR Aim | 820 | 0.19 | 1.13 | - | 10 | 1.7 | 1.5 | Man Transportable |
| AN/PEQ-15 ATPIAL (LA-5) | IR Illuminator | 820 | 0.06 | 0.34 | - | 10 | 1.9 | 1.7 | Man Transportable |
| AN/PEQ-15 ATPIAL UHP (LA-5) | Visible | 625-655 | 0.17 | 1.12 | 2.63 | 10 | 1.4 | 1.4 | Man Transportable |
| AN/PEQ-15 ATPIAL UHP (LA-5) | IR Pointer | 820-850 | 0.08 | 0.48 | 1.14 | 10 | 0.8 | 0.8 | Man Transportable |
| AN/PEQ-15 ATPIAL UHP (LA-5) | IR Illuminator | 820-850 | 0.60 | 3.30 | 7.44 | 10 | 2.5 | 2.5 | Man Transportable |
| AN/PEQ-1B SOFLAM/GLTD II | Designator | 1064 | 19.50 | 64.60 | 104.60 | Tripod -5 | 4.3 | 5.3 | Man Transportable |
| AN/PEQ-1B SOFLAM/GLTD II | Designator | 1064 | 19.50 | 64.60 | 104.60 | Day-10 | 4.3 | 5.3 | Man Transportable |
| AN/PEQ-1B SOFLAM/GLTD II | Designator | 1064 | 19.50 | 64.60 | 104.60 | Night -15 | 4.3 | 5.3 | Man Transportable |
| AN/PEQ-1C SOFLAM | Designator | 1064 | 16.80 | 47.10 | 71.50 | Tripod -5 | 4.0 | 5.2 | Man Transportable |
| AN/PEQ-1C SOFLAM | Designator | 1064 | 16.80 | 47.10 | 71.50 | Day-10 | 4.0 | 5.2 | Man Transportable |
| AN/PEQ-1C SOFLAM | Designator | 1064 | 16.80 | 47.10 | 71.50 | Night-15 | 4.0 | 5.2 | Man Transportable |
| AN/PEQ-2 ITPIAL | Illuminator | 850 | 0.26 | 1.81 | 4.71 | 10 | 2.0 | 2.0 | Man Transportable |
| AN/PEQ-2A TPIAL | IR Aim | 830 | 0.13 | 0.76 | - | 5 | 1.6 | 1.4 | Man Transportable |
| AN/PEQ-2A TPIAL | IR Illuminator | 830 | 0.13 | 0.76 | - | 5 | 1.6 | 1.4 | Man Transportable |
| AN/PEQ-16A MIPIM | Aim Laser | 605-665 | 0.07 | 0.52 | - | 10 | 0.70 | 0.65 | Man Transportable |
| AN/PEQ-16A MIPIM | IR-Low | 820-859 | 0.02 | 0.00 | - | 10 | 0.02 | 0.00 | Man Transportable |
| AN/PEQ-16A MIPIM | IR-High | 820-860 | 0.20 | 1.19 | - | 10 | 1.65 | 1.50 | Man Transportable |
| AN/PEQ-16A MIPIM | IR Illuminator-High | 820-859 | 0.02 | 0.09 | - | 10 | 0.72 | 0.60 | Man Transportable |
| AN/PEQ-16A MIPIM | IR Illuminator-Low | 820-860 | 3.64 | 3.38 | - | 10 | 1.83 | 1.67 | Man Transportable |
| AN/PSQ-18A Grenade Sight | Aim Lo | 830 | 0.00 | 0.00 | - | 10 | 0.0 | - | Man Transportable |
| AN/PSQ-18A Grenade Sight | Dual Lo | 830 | 0.00 | 0.00 | - | 10 | 0.5 | - | Man Transportable |
| AN/PSQ-18A Grenade Sight | Dual Hi | 830 | 0.03 | 0.19 | - | 10 | 1.5 | - | Man Transportable |
| AN/PSQ-23 STORM RWS | Range Finder | 1570 | 0.00 | 0.00 | 0.00 | 10 | 0.0 | 0.0 | Man Transportable |
| AN/PSQ-23 STORM RWS | Visible | 635 | 0.18 | 1.16 | 2.66 | 10 | 1.2 | 1.2 | Man Transportable |
| AN/PSQ-23 STORM RWS | MILES | 894 | 0.01 | 0.02 | 0.04 | 10 | 0.5 | 0.5 | Man Transportable |
| AN/PSQ-23 STORM RWS | IR | 830 | 0.22 | 1.25 | 2.88 | 10 | 1.9 | 1.9 | Man Transportable |
| AN/PSQ-23A STORM-PI | IR | 830 | 0.23 | 1.29 | - | 10 | 1.9 | 1.9 | Man Transportable |
| AN/PSQ-23A STORM-PI | Visible | 635 | 0.14 | 0.88 | - | 10 | 1.2 | 1.2 | Man Transportable |
| AN/PSQ-23A STORM-PI | Miles | 894 | 0.01 | 0.05 | - | 10 | 0.0 | 0.0 | Man Transportable |
| AN/PSQ-23A STORM-PI | Rangefinder | 1570 | 0.00 | 0.00 | - | 10 | 0.0 | 0.0 | Man Transportable |
| AN/PVS-6 MELIOS | Rangefinder | 1540 | 0.00 | 0.01 | 0.04 | 10 | 0.0 | 0.4 | Man Transportable |
| AN/TVQ-2 G/VLLD | Designator | 1064 | 44.20 | 316.00 | 756.00 | 5 | 3.7 | 6.2 | Man Transportable |
| AN/VAS-7 | Pointer | 820 | 0.69 | 3.80 | 8.17 | 10 | 2.5 | 2.5 | Man Transportable |
| AN/VAS-7 | Rangefinder | 1570 | 0.00 | 0.00 | 0.00 | 10 | 0.0 | 0.0 | Man Transportable |
| Avian Dissuader | Illuminator | 659 | 0.73 | 4.67 | 10.27 | 10 | 1.7 | 1.7 | Man Transportable |
| BRITE STAR DP TFU | Pointer | 830 | 1.17 | 6.17 | - | 5 | 2.2 | 3.3 | Fixed Wing |
| BRITE STAR DP TFU | Designator | 1064 | 15.20 | 47.80 | - | 5 | 3.7 | 4.7 | Fixed Wing |
| BRITE STAR DP TFU | Pointer | 830 | 15.30 | 48.50 | - | 5 | 2.2 | 3.3 | Fixed Wing |
| BRITE STAR DP TFU | Designator | 1064 | 15.30 | 48.50 | - | 5 | 3.7 | 4.7 | Fixed Wing |
| BRITE STAR DP TFU | Range Finder | 1570 | 0.00 | 0.00 | - | 5 | 0.0 | 0.0 | Fixed Wing |
| BRITE STAR DP TFU (export version) | Pointer | 830 | 1.17 | 6.17 | - | 5 | 2.2 | 3.3 | Fixed Wing |
| BRITE STAR DP TFU (export version) | Designator | 1064 | 15.20 | 47.80 | - | 5 | 3.7 | 4.7 | Fixed Wing |
| BRITE STAR DP TFU (export version) | Pointer | 830 | 15.30 | 48.50 | - | 5 | 2.2 | 3.3 | Fixed Wing |
| BRITE STAR DP TFU (export version) | Designator | 1064 | 15.30 | 48.50 | - | 5 | 3.7 | 4.7 | Fixed Wing |
| BRITE STAR DP TFU (export version) | Range Finder | 1570 | 0.00 | 0.00 | - | 5 | 0.0 | 0.0 | Fixed Wing |
| CLD | Marker | 1064 | 9.70 | 38.00 | 58.00 | 10 | 4.5 | 5.4 | Man Transportable |
| CLIP | IR Illuminator Pointer | 830 | 0.26 | 2.86 | 6.40 | 10 | 2.4 | 2.9 | Man Transportable |
| CROWS II-Kongsberg LRF | Rangefinder | 916 | 0.00 | 0.00 | 0.00 | 5 | 0.0 | 0.0 | Vehicle Mounted |
| CT25KAM | - | 905 | 0.00 | 0.19 | 0.48 | 10 | 0.0 | 1.6 | Ceilometer |
| CVL (Carbine Visible Laser) | Pointer | 630 | 0.05 | 0.35 |  | 10 | 1.1 | - | Man Transportable |
| Dissuader | Illuminator | 650 | 0.00 | 0.12 |  | 10 | 0.0 | 1.7 | Man Transportable |
| Eagle-Owl | Rangefinder | 1571 | 0.02 | 0.11 | 0.32 | 5 | 1.8 | 1.8 | Rotary Wing |

# Attachment 1: Safety Information for USAF and Non-USAF Laser Systems

| Laser System | Mode | Wavelength (nm) | Unaided NOHD (km) | 7X50 Binoculars NOHD (km) | 12-cm Optics NOHD (km) | Buffer Angle (mrad) | Unaided OD | Aided OD | Platform type |
|---|---|---|---|---|---|---|---|---|---|
| ELRF-1MC Laser | Rangefinder | 1540 | - | 0.00 | 0.00 | 5 | 0.0 | 0.0 | Vehicle Mounted |
| FATS II | Pointer | 794 | 0.00 | 0.04 | 0.10 | 10 | 0.0 | 1.8 | Man Transportable |
| FLIR Star SAFIRE 380HD | Rangefinder | 1570 | 0.00 | 0.00 | - | 5 | 0.0 | 0.0 | Fixed Wing |
| FLIR Star SAFIRE 380HD | Illuminator | 810 | 0.10 | 0.70 | - | 5 | 3.2 | 3.1 | Fixed Wing |
| FLIR Star SAFIRE 380HD | Pointer | 850 | 0.40 | 2.40 | - | 5 | 2.4 | 2.2 | Fixed Wing |
| FLIR Star SAFIRE 380HDc (LP) | Designator | 852 | 0.42 | 2.35 | - | 5 | 2.4 | 2.2 | Fixed Wing |
| FLIR Star SAFIRE 380HDc (LRF) | Designator | 1574 | 0.00 | 0.00 | - | 5 | 0.0 | 0.0 | Fixed Wing |
| FLIR Star SAFIRE 380HDc(LI) | Designator | 808 | 0.13 | 0.73 | - | 5 | 3.2 | 3.1 | Fixed Wing |
| FLIR2000 (UH-1N) | Illuminator | 794 | 0.53 | 3.50 | 7.60 | 5 | 2.2 | 2.2 | Rotary Wing |
| GBD II | Pointer | 532 | 0.12 | 0.84 | 2.00 | 10 | 2.2 | 2.2 | Man Transportable |
| GBD III | Pointer | 532 | 1.46 | 8.33 | 16.30 | 10 | 2.4 | 2.4 | Man Transportable |
| GBD IIIC | Pointer | 532 | 0.07 | 0.45 | - | 10 | 2.3 | 2.3 | Man Transportable |
| GBD IIIC | Pointer w/Diffuser | 532 | 0.01 | 0.05 | - | 10 | 2.2 | 2.2 | Man Transportable |
| GCP-1/1A | Pointer | 830 | 0.12 | 0.84 | - | 10 | 1.8 | 1.8 | Man Transportable |
| GCP-1B | Pointer | 835 | 0.30 | 2.10 | 5.10 | 10 | 2.4 | 2.4 | Man Transportable |
| GCP-1C | Pointer | 832 | 0.69 | 3.83 | 8.23 | 10 | 2.5 | 2.4 | Man Transportable |
| GCP-1D | Pointer | 870 | 0.28 | 1.89 | 4.28 | 10 | 2.4 | 2.9 | Man Transportable |
| GCP-1H | Pointer | 870 | 0.28 | 1.89 | 4.28 | 10 | 2.4 | 2.9 | Man Transportable |
| GCP-2A | Pointer | 807-817 | 0.25 | 1.73 | 4.24 | 10 | 2.2 | 4.7 | Man Transportable |
| GCP-2B | Pointer | 840 | 0.20 | 1.10 | - | 10 | 2.6 | 2.6 | Man Transportable |
| GLARE MOUT 532P-M | Pointer | 532 | 0.02 | 0.11 | 0.30 | 10 | 2.1 | 2.1 | Man Transportable |
| GLBI (Green Laser Baton Illuminator) | Pointer | 531 | 0.01 | 0.02 | - | 10 | 0.4 | 1.9 | Man Transportable |
| GRIIP / LA-4PEQ | IR | 860 | 1.75 | 8.75 | 17.07 | 5 | 3.1 | 3.0 | Fixed Wing |
| GRIIP / LA-4PEQ | Vis | 532 | 0.11 | 0.70 | 1.63 | 5 | 2.4 | 2.4 | Fixed Wing |
| HALT | Pointer | 652 | 0.00 | 0.13 | - | 10 | 0.0 | 1.7 | Man Transportable |
| HAVIS (M16 Aiming light) | Pointer | 850 | 0.01 | 0.03 | - | 10 | 1.7 | - | Man Transportable |
| HI-BEAM Overt Laser Signaling System AC 130H (HBLOSS) | Illuminator | 532 RLE | 1.43 | 9.20 | - | 5 | 4.1 | 4.0 | Fixed Wing |
| HI-BEAM Overt Laser Signaling System AC 130H (HBLOSS) | Illuminator | 1064 | 1.43 | 9.20 | - | 5 | 1.5 | 1.3 | Fixed Wing |
| HLM 2 | IR Marker | 1064 | 5.90 | 23.00 | 38.00 | 10 | 5.0 | 5.0 | Man Transportable |
| HLM 2 | IR Pointer | 840 | 0.18 | 1.06 | 2.50 | 10 | 2.0 | 2.0 | Man Transportable |
| HLM 2 | Visible Pointer | 650 | 0.05 | 0.34 | 0.83 | 10 | 1.0 | 1.0 | Man Transportable |
| HLM CSLLaM LA-10u/PEQ | Pointer | 658 | 0.05 | 0.34 | 0.83 | 10 | 0.9 | 0.9 | Man Transportable |
| HLM CSLLaM LA-10u/PEQ | Marker | 1064 | 5.90 | 23.00 | 38.00 | 10 | 5.0 | 5.0 | Man Transportable |
| IDWS MiniPOP | Rangefinder | 1532 | 0.00 | 0.00 | 0.00 | N/A | 0.0 | 0.0 | Rotary Wing |
| ILM-500-R | Rangefinder | 905 | 0.00 | 69.00 | - | 5 | 0.00 | 0.60 | Fixed Wing |
| IRADS (F-117A) | Designator | 1064 | 18.50 | 130.00 | 329.00 | 5 | 4.5 | 6.0 | Fixed Wing |
| IZLID 1000 Stealth | Pointer | 978 | 0.14 | 0.96 | 2.20 | 10 | 2.2 | 2.7 | Man Transportable |
| IZLID 1000(P)-A1 | Pointer | 856 | 0.85 | 4.76 | 10.20 | 10 | 3.0 | 3.0 | Man Transportable |
| IZLID 200P | Pointer | 820-850 | 0.34 | 1.94 | - | - | 2.5 | | Man Transportable |
| IZLID I (Model #424-100) | Pointer | 827 | 0.32 | 2.18 | 4.88 | 10 | 2.2 | 2.2 | Man Transportable |
| IZLID II | Pointer | 867 | 0.24 | 1.68 | 3.82 | 10 | 2.1 | 2.8 | Man Transportable |
| IZLID II Stealth | Pointer | 976 | 0.06 | 0.44 | 1.00 | 10 | 1.1 | 1.6 | Man Transportable |
| IZLID ULTRA (Model #434P) | Pointer | 835 | 0.75 | 4.10 | 8.70 | 10 | 3.2 | 3.2 | Man Transportable |
| IZLID-1P | Pointer | 830 | 0.32 | 1.89 | 4.27 | 10 | 2.2 | 2.2 | Man Transportable |
| Javelin (Field Tactical Trainer) | Pointer | 905 | 0.01 | 0.02 | 0.04 | 10 | 1.0 | 1.1 | Man Transportable |
| LA-17/PEQ D-PILS NIR | Pointer/Illuminator | 825-855 | 0.41 | 2.70 | - | 10 | 2.3 | 2.3 | Man Transportable |
| LA-17/PEQ D-PILS SWIR | Pointer/Illuminator | 1400-1600 | 0.05 | 0.27 | - | 10 | 0.9 | 0.9 | Man Transportable |
| LA-17/PEQ D-PILS Visible | Pointer/Illuminator | 625-645 | 0.18 | 1.10 | - | 10 | 1.8 | 1.8 | Man Transportable |
| LA-7/PEQ SCAR EGLM | Pointer | 905 | 0.04 | 0.24 | 0.65 | - | 0.6 | 0.5 | Man Transportable |
| LAKEODD (EOD aiming lasers) | M6X | 640 | 0.03 | 0.22 | 0.52 | - | 0.7 | 0.7 | Man Transportable |
| LAKEODD (EOD aiming lasers) | SL-150 | 630 | 0.02 | 0.10 | 0.30 | - | 0.7 | 0.7 | Man Transportable |
| LAKEODD (EOD aiming lasers) | PAN | 656 | 0.02 | 0.10 | 0.30 | - | 0.7 | 0.7 | Man Transportable |
| Laser Light Target Designator (LLTD) | Designator | 1064 | 7.00 | 15.00 | 42.00 | 10 | 4.0 | 4.9 | Man Transportable |
| LaserGrips LG-202IR | Pointer | 850 | 0.02 | 0.15 | 0.36 | 10 | 0.6 | 0.6 | Man Transportable |
| LP-1000 | Pointer | 836 | 0.70 | 3.70 | 7.90 | 10 | 2.8 | 3.2 | Man Transportable |
| LPL-30 | Pointer | 800-850 | 0.09 | 0.68 | 1.60 | 10 | 1.7 | 1.7 | Man Transportable |
| LRR-104 (Mark V) | Designator | 1064 | 0.87 | 5.50 | 12.00 | 10 | 3.7 | 3.7 | Man Transportable |
| LRTV | Rangefinder | 1560 | 0.00 | 0.00 | 0.00 | 10 | 0.0 | 0.0 | Man Transportable |
| LRTV | Pointer | 828 | 0.00 | 0.00 | 0.00 | 10 | 0.0 | 0.0 | Man Transportable |
| LTE | GBD-III-3MR | 532 | 0.14 | 0.83 | 1.94 | 10 | 2.3 | 2.3 | Fixed Wing |
| LTE | IZLID 1000P | 860 | 0.14 | 0.83 | 1.94 | 10 | 2.9 | 3.0 | Fixed Wing |
| M-931 | Pointer | 850 | 0.01 | 0.16 | 0.40 | 10 | 0.7 | 0.8 | Man Transportable |

# Attachment 1: Safety Information for USAF and Non-USAF Laser Systems

| Laser System | Mode | Wavelength (nm) | Unaided NOHD (km) | 7X50 Binoculars NOHD (km) | 12-cm Optics NOHD (km) | Buffer Angle (mrad) | Unaided OD | Aided OD | Platform type |
|---|---|---|---|---|---|---|---|---|---|
| MANTIS (Multi-Adaptable Night Tactical Imaging System) | Pointer | 827 | 0.10 | 0.70 | 1.60 | 10 | 2.2 | 2.2 | Man Transportable |
| MARK VII | Rangefinder | 1570 | 0.00 | 0.00 | 0.00 | 10 | 0.0 | 0.0 | Man Transportable |
| MILES | Training | multiple | 0.03 | - | - | - | 0.6 | 0.6 | Man Transportable |
| MILES 2000 | Training | multiple | 0.01 | 0.04 | - | - | 0.0 | 0.0 | Man Transportable |
| MTS-B HD/TLA | LTM | 860 | 0.40 | 2.20 | - | 5 | 3.0 | 2.9 | Fixed Wing |
| MTS-B HD/TLA | Designator | 1064 | 28.00 | 71.00 | - | 5 | 3.6 | 5.0 | Fixed Wing |
| MTS-B HD/TLA | Rangefinder | 1572 | 0.00 | 1.40 | - | 5 | 0.0 | 1.1 | Fixed Wing |
| MWSS | Training | 266 | 0.65 | 0.65 | 0.65 | 2 | 7.6 | 7.6 | Vehicle Mounted (ground to air) |
| MX-10 L0032 | MELT LRF | 1535 | 0.00 | 0.00 | - | 5 | 0.0 | 0.0 | Fixed Wing |
| MX-10 L0033 | DDLI Dual (Both Modes) | 820-864 | 0.44 | 2.56 | - | 5 | 3.0 | 2.9 | Fixed Wing |
| MX-10 L0034 | DDLI Dual (Both Modes) | 820-864 | 0.44 | 2.56 | - | 5 | 3.0 | 2.9 | Fixed Wing |
| MX-10 L0034 | MELT LRF | 1535 | 0.00 | 0.00 | - | 5 | 0.0 | 0.0 | Fixed Wing |
| MX-15 / MX-15i / MX-15Di L0009 | WDLI | 835-865 | 0.06 | 0.37 | - | 5 | 3.1 | 3.1 | Fixed Wing |
| MX-15 / MX-15i / MX-15Di L0009 | LRF | 1540 | 0.00 | 0.00 | - | 5 | 0.0 | 0.0 | Fixed Wing |
| MX-15 / MX-15i / MX-15Di L0010 | NDLI | 835-865 | 0.57 | 2.22 | - | 5 | 3.2 | 3.2 | Fixed Wing |
| MX-15 / MX-15i / MX-15Di L0010 | LRF | 1540 | 0.00 | 0.00 | - | 5 | 0.0 | 0.0 | Fixed Wing |
| MX-15 / MX-15i / MX-15Di L0011 | UNDLI | 835-865 | 0.77 | 4.33 | - | 5 | 2.9 | 2.9 | Fixed Wing |
| MX-15 / MX-15i / MX-15Di L0011 | LRF | 1540 | 0.00 | 0.00 | - | 5 | 0.0 | 0.0 | Fixed Wing |
| MX-15 Di / L0039 / 44583-22 | SWLS - OPO | 1570 | 0.00 | 0.00 | 0.00 | 5 | 4.3 | 5.3 | Fixed Wing |
| MX-15 Di / L0039 / 44583-22 | SWLS - Tactical | 1064 | 26.55 | 62.83 | 86.05 | 5 | 0.0 | 0.0 | Fixed Wing |
| MX-15 Di / L0039 / 44583-22 | DWLI - OPSL | 532 | 0.78 | 4.70 | 10.06 | 5 | 3.9 | 3.8 | Fixed Wing |
| MX-15 Di / L0039 / 44583-22 | DWLI - NIR | 861 | 0.45 | 2.48 | 5.62 | 5 | 3.1 | 3.1 | Fixed Wing |
| MX-15 Di / L0039 / 44583-29 | DWLI | 532 | 0.78 | 4.70 | - | 5 | 3.9 | 3.8 | Fixed Wing |
| MX-15 Di / L0039 / 44583-29 | DWLI NIR | 861 | 0.45 | 2.48 | - | 5 | 3.1 | 3.1 | Fixed Wing |
| MX-15 Di / L0039 / 44583-29 | SWLS Tactical | 1064 | 26.55 | 62.83 | - | 5 | 4.3 | 5.3 | Fixed Wing |
| MX-15 Di / L0039 / 44583-29 | SWLS OPO | 1570 | - | - | - | 5 | 0.0 | 0.0 | Fixed Wing |
| MX-15 Dia L0018 | CLDR | 1064 | 19.85 | 53.37 | - | 5 | 4.9 | 5.5 | Fixed Wing |
| MX-15 Dia L0018 | NDLI | 835-865 | 0.39 | 2.22 | - | 5 | 3.2 | 3.2 | Fixed Wing |
| MX-15 Dia L0018 | LRF | 1540 | 0.00 | 0.00 | - | 5 | 0.0 | 0.0 | Fixed Wing |
| MX-15 Dia L0029 | CLDR | 1064 | 19.85 | 50.37 | - | 5 | 4.9 | 5.5 | Fixed Wing |
| MX-15 Dia L0029 | NDLI | 835-865 | 0.39 | 2.22 | - | 5 | 3.2 | 3.2 | Fixed Wing |
| MX-15Dia L0031 | CLDR | 1064 | 19.85 | 53.37 | - | 5 | 4.9 | 5.5 | Fixed Wing |
| MX-15Dia L0031 | NDLI | 835-865 | 0.39 | 2.22 | - | 5 | 3.2 | 3.2 | Fixed Wing |
| MX-15Dia L0031 | LRF | 1540 | 0.00 | 0.00 | - | 5 | 0.0 | 0.0 | Fixed Wing |
| MX-15i Demo L0026 | HPVLI | 532 RLE | 45.78 | 321.79 | - | 5 | 4.0 | 3.9 | Fixed Wing |
| MX-15i Demo L0026 | NDLI | 835-865 | 0.57 | 2.22 | - | 5 | 3.2 | 3.1 | Fixed Wing |
| MX-15i Demo L0027 | HPVLI | 1064 | 45.78 | 321.79 | - | 5 | 1.3 | 1.2 | Fixed Wing |
| MX-20 L0012 | WDLI | 835-865 | 0.06 | 0.37 | - | 5 | 3.2 | 3.1 | Fixed Wing |
| MX-20 L0012 | LRF | 1540 | 0.00 | 0.00 | - | 5 | 0.0 | 0.0 | Fixed Wing |
| MX-20 L0013 | NDLI | 835-865 | 0.39 | 2.22 | - | 5 | 3.2 | 3.2 | Fixed Wing |
| MX-20 L0013 | LRF | 1540 | 0.00 | 0.00 | - | 5 | 0.0 | 0.0 | Fixed Wing |
| MX-20 L0014 | UNDLI | 835-865 | 0.77 | 4.33 | - | 5 | 2.9 | 2.9 | Fixed Wing |
| MX-20 L0014 | LRF | 1540 | 0.00 | 0.00 | - | 5 | 0.0 | 0.0 | Fixed Wing |
| MX-20D L0023 | SLWS - OPO | 1064 | 0.08 | 0.90 | - | 5 | 2.4 | 2.0 | Fixed Wing |
| MX-25D L0058 | SWLS-ED OPO | 1570 | 0.00 | 0.80 | - | 2 | 0.0 | 1.2 | Fixed Wing |
| MX-25D L0058 46051-03 | OPSL | 532 | 0.72 | 4.10 | - | 2 | 3.8 | 3.7 | Fixed Wing |
| MX-25D L0058 46051-03 | NIR | 860 | 0.45 | 2.50 | - | 2 | 2.6 | 3.1 | Fixed Wing |
| MX-25D L0058 46051-03 | SWLS-ED Tactical | 1064 | 35.00 | 82.80 | - | 2 | 3.9 | 5.1 | Fixed Wing |
| MX-Di w/HD L0021 | NDLI | 835-865 | 1.39 | 2.22 | - | 5 | 3.2 | 3.2 | Fixed Wing |
| MX-Di w/HD L0021 | SWLS - Tactical | 1064 | 27.88 | 66.49 | - | 5 | 4.6 | 5.4 | Fixed Wing |
| MX-Di w/HD L0021 | SLWS - OPO | 1570 | 0.08 | 0.86 | - | 5 | 0.3 | 1.7 | Fixed Wing |
| MX-Di w/HD L0022 | SLWS - OPO | SLE: 1064 | 0.08 | 0.86 | - | 5 | 2.4 | 2.0 | Fixed Wing |
| NITE EAGLE (UH-1N) | Designator | 1064 | 15.00 | 45.00 | 65.00 | 5 | 4.1 | 5.2 | Rotary Wing |
| NITE EYE | Pointer | 980 | 0.09 | 0.68 | 1.60 | 10 | 1.7 | 1.7 | Man Transportable |
| OWL | Pointer | 830 | 0.07 | - | - | 10 | 1.6 | 1.6 | Man Transportable |
| PLRF 15 | Laser Range Finder | 1550 | 0.00 | 0.00 | 0.00 | 15 | 0.0 | 0.0 | Man Transportable |
| PLRF 15C | Laser Range Finder | 1550 | 0.00 | 0.00 | 0.00 | 15 | 0.0 | 0.0 | Man Transportable |
| PLRF 25C | Laser Range Finder | 1550 | 0.00 | 0.00 | 0.00 | 15 | 0.0 | 0.0 | Man Transportable |
| PLRF 25C BT | Laser Range Finder | 1550 | 0.00 | 0.00 | 0.00 | 15 | 0.0 | 0.0 | Man Transportable |
| SABER-203 | Pointer | 650 | 0.01 | - | - | 10 | 0.9 | - | Man Transportable |
| Talon XR AN-VAS-8 | Rangefinder | 1574 | 0.00 | 0.00 | 0.00 | 5 | 0.0 | 0.0 | Vehicle Mounted |
| Talon XR AN-VAS-8 | Pointer | 808 | 0.48 | 2.63 | 5.80 | | 2.3 | 2.9 | Vehicle Mounted |

# Attachment 1: Safety Information for USAF and Non-USAF Laser Systems

| Laser System | Mode | Wavelength (nm) | Unaided NOHD (km) | 7X50 Binoculars NOHD (km) | 12-cm Optics NOHD (km) | Buffer Angle (mrad) | Unaided OD | Aided OD | Platform type |
|---|---|---|---|---|---|---|---|---|---|
| TD-100 | Pointer | 850 | 0.10 | 0.10 | - | 10 | 1.1 | | Man Transportable |
| TD-100 | Pointer | 632.8 | | | - | | 0.3 | | Man Transportable |
| TD-100A | Pointer | 850 | 0.10 | 0.10 | - | 10 | 1.1 | | Man Transportable |
| TD-100A | Pointer | 670 | 0.10 | 0.10 | - | 10 | 0.6 | | Man Transportable |
| TGO/IR (Model 2300A) | Pointer | 810 | 0.01 | 0.07 | 0.18 | 10 | 2.3 | 3.5 | Man Transportable |
| Type 163 LTD | Designator | 1064 | 14.81 | 42.95 | 63.32 | Tripod-5 | 4.3 | 4.9 | Man Transportable |
| Type 163 LTD | Designator | 1064 | 14.81 | 42.95 | 63.32 | Handheld-10 | 4.3 | 4.9 | Man Transportable |
| Vector IV/ Viper | Rangefinder | 1550 | 0.00 | 0.00 | 0.00 | 10 | 0.0 | 0.0 | Man Transportable |
| Vectronix AG (PLRF 15) | PLRF | 1550 | 0.00 | 0.00 | 0.00 | 10 | 0.0 | 0.0 | Man Transportable |
| Vectronix AG (PLRF 15-C) | PLRF | 1550 | 0.00 | 0.00 | 0.00 | 10 | 0.0 | 0.0 | Man Transportable |
| VITAL-100 | Training | 819.2 | 0.01 | 0.00 | 0.00 | 10 | 0.1 | 0.0 | Man Transportable |
| VITAL-100 | Combat | 819.2 | 0.30 | 1.77 | 4.12 | 10 | 2.2 | 2.1 | Man Transportable |
| VITAL-2 | Pointer | 816.6 | 0.01 | 0.00 | 0.00 | 10 | 0.0 | 0.0 | Man Transportable |
| VSLIM | IR Illuminator | 815-845 | 0.54 | 3.07 | 6.76 | 10 | 3.4 | 3.4 | Man Transportable |
| X2 TASER CEW | Pointer | 630-680 | 0.03 | 0.20 | - | 15 | 0.7 | 0.7 | Man Transportable |
| X26 Taser Laser Pointer | Pointer | 655 | 0.02 | 0.15 | - | 15 | 1.0 | 1.0 | Man Transportable |
| X26P TASER ECD | Pointer | 630-680 | 0.03 | 0.17 | - | 15 | 0.7 | 0.7 | Man Transportable |

1. Air Force policy is to maintain aircraft separation of 100 ft. Navy prohibits tandem or buddy aircraft lasing.
2. Air Force assigns a 2 milliradian buffer zone to LANTIRN; Navy assigns a 5 milliradian buffer zone
3. Assume that built-in safety filter only protects against the wavelength of the laser in which it is installed and that it does not protect against other laser wavelengths.
4. Items are listed alphabetically by system.

WARNING! THIS HAZARD DATA COULD CHANGE SINCE DOD HAS NO CONTROL OF MANUFACTURING OF THESE PRODUCTS CHECK WITH THE MANUFACTURER TO VERIFY

# Attachment 2: List of Potential LEP Suppliers and Products

| | | |
|---|---|---|
| **Manufacturer:** | Honeywell | |
| **Website:** | http://www.honeywellsafety.com | |
| **Point of Contact:** | Linda Adessi, Government Specialist Contracts and Sales; Phone: 401-323-2573; email: linda.adessi@honeywell.com | |
| **Frame Format:** |  **1. UVEX XC** |  **2. UVEX Genesis** |
| **RX Insert compatible:** | No | No |

| Filter Name | OD @ Wavelength | VLT |
|---|---|---|
| Filter 102 (31-80102) | >3 @ 800-839nm<br>>4 @ 840-864nm<br>>5 @ 865-1063nm | 35% |
| Filter 103 (31-80103) | >7 @ 1064nm<br>>5 @ 10,600nm<br>>7 @ 190-532nm | 50% |
| Filter 108 (31-80108) | >9 @ 190-420nm<br>>1 @ 670nm<br>>5 @ 770-810nm<br>>7 @ 810-1100nm<br>>10 @ 1064nm<br>>5 @ 9,000-11,100nm<br>>7 @ 10,600nm | 32% |
| Filter 111 (31-80111) | >9 @ 190-520nm<br>>7 @ 520-532nm<br>>3 @ 710-750nm<br>>5 @ 750-800nm<br>>6 @ 800-850nm<br>>7 @ 850-1080nm<br>>7 @ 10600nm<br>>5 @ 9,000-11100nm | 14% |
| Filter 127 (31-21127) | >1.5 @ 900-1800nm<br>>7 @ 980-1064nm | 25% |
| Filter 131 (31-80131) | >6 @ 810nm<br>>5 @ 800-820nm<br>>3 @ 821-830nm<br>>7 @ 2775-3780nm | 72% |
| Filter 136 (31-80136) | >4 @ 532nm<br>>7 @ 190-515nm<br>>7 @ 780-805nm<br>>7 @ 1064nm<br>>5 @ 770-825nm<br>>4 @ 765-1095nm | 23% |
| Filter 137 (31-80137) | >9 @ 190-400nm<br>>3 @ 810-840nm<br>>4 @ 841-869nm<br>>5 @ 870-919nm<br>>7 @ 920-1064nm & 10600nm | 55% |

| **Manufacturer:** | Honeywell (continued from previous page) | |
|---|---|---|
| Filter 155 (31-80155) | >7 @ 190-380nm<br>>3-3.5 @ 532nm<br>>7 @ 1064nm<br>> 5 @ 10,600nm | 40% |
| Filter 162 (31-80162) | >6 @ 800 - 825nm<br>>6 @ 920 - 1064nm<br>>6 @ 10,600nm | 57% |
| Filter 163 (31-80163) | >2 @ 529-535nm<br>>2 @ 657-663nm<br>>2 @ 668-674nm | 26% |

| **Manufacturer:** | Revision | |
|---|---|---|
| **Website:** | http://www.revisionmilitary.com | |
| **Point of Contact:** | Ervin Tate, Director of Sales; Phone: 210-347-1382; Email: etate@revisionmilitary.com | |
| **Frame Formats:** |  <br>**1. Sawfly** |  <br>**2. Stingerhawk** |
| **RX Insert compatible:** | Yes | Yes |

| **Filter Name** | **OD @ Wavelength** | **VLT / SLT** |
|---|---|---|
| E2-5 | >4 @ 820-850nm<br>>5 @ 1064nm | 55% / 38% |
| GF-8 | >3 @ 532nm<br>>2 @ 808nm | 50% / 25% |
| V6-10 (Vital) | >6 @ 694nm<br>>4 @ 1064nm | 45% / 40% |
| C5-6-10 (Critical) | >5 @ 405nm<br>>5 @ 445nm<br>>4 @ 532nm<br>>6 @ 694nm<br>>5 @ 1064nm | 18% / 4% |

| **Manufacturer:** | Kentek |
|---|---|
| **Website:** | http://www.kenteklaserstore.com/laser-eyewear-search-tool.aspx |
| **Point of Contact:** | Karen Brown, Sales Accountant; Phone: 603-223-4900; Email: kbrown@kentklaserstore.com |
| **Frame Format:** |  <br>**1. Wrap Spectacle** |
| **RX Insert compatible:** | Yes |

| **Filter Name/Part Number** | **OD @ Wavelength** | **VLT** |
|---|---|---|
| KCM-5904 | >6 @ 190-390nm<br>>5 @ 785-830nm<br>>6 @ 800-818nm<br>>5 @ 2700-2950nm | 61% |

# Attachment 2: List of Potential LEP Suppliers and Products

| | |
|---|---|
| **Manufacturer:** | Newport |
| **Website:** | https://www.newport.com/c/laser-safety-glasses |
| **Point of Contact:** | Tina Lopez, Senior Customer Service Representative; Phone: 877-835-9620; Email: tina.lopez@newport.com |
| **Frame Format:** |  **1. XC-Semi-Rimless** |
| **RX Insert compatible:** | No |

| Filter Name/Part Number | OD @ Wavelength | VLT |
|---|---|---|
| 31-80108 | >1 @ 670nm<br>>5 @ 770–810nm<br>>7 @ 810–1100nm<br>>10 @ 1064nm<br>>5 @ 9–11.1nm<br>>10 @ 1064nm | 32% |
| 31-80155 | >3-3.5 @ 532nm<br>> 7 @ 1064nm<br>> 7 @ 190–380nm<br>> 5 @ 10,600nm | 40% |
| 31-80137 | > 4 @ 841-869nm<br>> 5 @ 870-919nm<br>> 7 @ 920-1064nm<br>> 7 @ 1060 nm<br>> 4.2 @ 1065-1088nm | 68% |
| 31-80111 | > 7 @ 520-532nm<br>> 3 @ 710-750nm<br>> 5 @ 750-800nm<br>> 6 @ 800-850nm<br>> 7 @ 850-1080nm<br>> 7 @ 10,600nm<br>> 5 @ 9,000-11,100nm | 8% |

| | | | |
|---|---|---|---|
| **Manufacturer:** | ESS | | |
| **Website:** | http://www.esseyepro.com | | |
| **Point of Contact:** | Chris Dawson, Government Sales Representative; Phone: 877-726-4072; Email: csinfo@esseyepro.com | | |
| **Frame Formats:** |  **1. Crossbow** |  **2. Crosshair** |  **3. Rollbar** |
| **RX Insert compatible:** | Yes | Yes | No |

| Filter Name/Part Number | OD @ Wavelength | VLT |
|---|---|---|
| 740-0453 | >4 @ 694; 900-1064nm | 49% |
| 740-0454 | >4 @ 820-1090nm | 57% |
| 740-0428 | >5 @ 1064nm<br>>4 @ 820-1090nm | 57% |

# Attachment 2: List of Potential LEP Suppliers and Products

| | | | |
|---|---|---|---|
| **Manufacturer:** | Laservision | | |
| **Website:** | http://www.lasersafety.com/eyewear | | |
| **Point of Contact:** | Abdalla Sammaneh, Key Account Representative; Phone: 651-357-1821; Email: a.sammaneh@lasersafety.com | | |
| **Frame Formats:** |  **1. F16** |  **2. F24** |  **3. F29** |
| **RX Insert compatible:** | No | No | No |

| Filter Name/Part Number | OD @ Wavelength | VLT |
|---|---|---|
| P5CO2 | >4 @ 810-900nm<br>>6 @ 900-980nm<br>>7 @ 980-1064nm<br>>6 @ 1064-1080nm | 60% |
| P5L02 | >6 @ 190-536nm<br>>3 @ 780-810nm<br>>4 @ 810-900nm<br>>6 @ 900-980nm<br>>7 @ 980-1065nm<br>>6 @ 1065-1080nm | 30% |
| P5H01 | >4 @ 770-800nm<br>>6 @ 800-980nm<br>>7 @ 980-1065nm<br>>5 @ 1065-1100nm | 35% |

| | |
|---|---|
| **Manufacturer:** | Laser Safety Industries |
| **Website:** | http://www.lasersafetyindustries.com |
| **Point of Contact:** | Jeremy Erickson, Sales Representive; Phone: 1-888-752-7370, Email: Jerickson@lasersafetyindustries.com |
| **Frame Formats:** |  **1. Sports Wrap** |
| **RX Insert compatible:** | No |

| Filter Name/Part Number | OD @ Wavelength | VLT |
|---|---|---|
| 100-38-115 | >2-3 @ 630-680nm<br>>4 @ 680-730nm<br>>6 @ 690-700nm | 50% |
| 100-38-130 | >5 @ 850-1100nm<br>>7 @ 1064nm | 26% |

# Attachment 2: List of Potential LEP Suppliers and Products

| | | | |
|---|---|---|---|
| **Manufacturer:** | NoIR: Laser Shield | | |
| **Website:** | http://noirlaser.com | | |
| **Point of Contact:** | Lori Fredericks, Sales Manager; Phone: 1-800-521-9746, Email: Lori.fredericks@noir.com | | |
| **Frame Formats:** |  **1. Frame #34** |  **2. #45** |  **3. #46** |
| **RX Insert compatible:** | Yes | No | No |

| **Filter Name/Part Number** | **OD @ Wavelength** | **VLT** |
|---|---|---|
| CYN | >5 @ 730-1085<br>>7 @ 755<br>>7 @ 1064 OD | 36% |
| YG3 | >4 @ 808-840<br>>4 @ 840-950<br>>7 @ 950-1080<br>>5 @ 1080-1090 | 59% |

| | | |
|---|---|---|
| **Manufacturer:** | Smith Optics | |
| **Website:** | http://www.smithoptics.com/us/ | |
| **Point of Contact:** | Mike Torres, Sales Manager; Phone: 208-720-8868; Email: mike.torres@smithoptics.com | |
| **Frame Formats:** |  **1. Aegis Arc** | |
| **RX Insert compatible:** | Yes | |

| **Filter Name/Part Number** | **OD @ Wavelength** | **VLT** |
|---|---|---|
| Echo Laser Lens | >4 @ 820nm<br>>6 @ 820nm<br>>5 @ 1064nm | 50% |

| | | |
|---|---|---|
| **Manufacturer:** | Oakley Standard Issue | |
| **Website:** | http://www.oakleysi.com | |
| **Point of Contact:** | Valerie Sanchez; Phone: 800-525-4334, 855-610-9597 (bulk); Email: standardissue@oakley.com | |
| **Frame Formats:** |  **1. SI Ballistic M Frame 2.0** |  **2. SI Ballistic M Frame 3.0** |
| **RX Insert compatible:** | Yes | Yes |

| **Filter Name/Part Number** | **OD @ Wavelength** | **VLT** |
|---|---|---|
| Laser Strike Lens | Contact Vendor for more information. Filters are ITAR regulated. | |

# Attachment 2: List of Potential LEP Suppliers and Products

| | | |
|---|---|---|
| **Manufacturer:** | Wiley | |
| **Website:** | wiley.com/tactical | |
| **Point of Contact:** | Brett Patzner; Phone: 1-888-203-4521; Email: bpatzner@wileyx.com | |
| **Frame Format:** |  **1. X Valor** |  **2. X Vapor** |
| **RX Insert compatible:** | No | Yes |

| **Filter Name/Part Number** | **OD @ Wavelength** | **VLT** |
|---|---|---|
| N/A | Contact Vendor for additional information. Vendors produce lenses on case by case basis. Delivery time of lenses can be > 90 days. | |