DSAC Sub-committee on the Medical Implications of Less-lethal Weapons (DOMILL).

Statement on the medical implications of the LTLE System when fitted to the SA80A2 Individual Weapon and used as a warning device to determine intent.

Background

1. The DSAC\textsuperscript{1} Sub-committee on the Medical Implications of Less-lethal Weapons (DOMILL) was requested by the Dismounted Close Combat Integrated Project Team (DCC IPT) to prepare this statement on the proposed use of the LTLE (Less-Than-Lethal-Effect) System when fitted to the SA80A2 Individual Weapon and used as a warning device to determine the intent of potentially hostile individuals. This statement is an independent view for the Ministry of Defence on the medical implications of use of the LTLE System, which has been proposed as a solution to Urgent Operational Requirement AO1235.\textsuperscript{2}

2. DOMILL reports to the Secretary of State for Defence to provide:
   a. Advice on the biophysical, biomechanical, pathological and clinical aspects of generic classes of less-lethal weapons (LLWs);
   b. Independent statements on the medical implications of use of specific LLW systems given specific guidance to users;
   c. Advice on the risk of injury from specific LLW systems striking specific areas of the body in a format that will assist users in making tactical decisions, and developing guidance to users to minimise the risk of injury.

3. DOMILL was asked in February 2008 to produce a medical statement on the risk of use of the LTLE System in accordance with the policy, training and guidance.

The Less-Than-Lethal Visual Warning Effect

4. \textbf{Role}: The LTLE System is a weapon-mounted laser-based device that is designed to be used by the soldier to warn local nationals whose behaviour is perceived to be placing both the soldier and the local national at risk. The system comprises a small, battery-powered, laser flashlight that emits either a continuous or flashing beam of light that may be aimed at specific individuals. The laser is attached to the soldier’s personal weapon (specifically, the SA80A2 in the current configuration of the LTLE System). The desired outcome is to improve the ability of UK soldiers to respond to potentially life-threatening situations with a clearly understood visual warning, thus minimising the risk of loss of life due to escalation of force.

5. \textbf{Requirement}: LTLE is a new technology developed and tested as an addition to existing escalation of force options. LTLE provides a visual warning to local nationals in the vicinity of UK military personnel on operations. When used in conjunction with a public information campaign,\textsuperscript{3} the intention is that LTLE will provide a means of warning targeted individuals that their actions are being construed as potentially offensive. When targeted by the LTLE beam, the civilians should realise that their behaviour is regarded as threatening and alter their actions accordingly. The overall requirement is to reduce the need for military personnel to escalate force with more aggressive options (for example, warning shots, mini-flares, lethal shots).

\textsuperscript{1} Defence Scientific Advisory Council — a non-departmental public body that provides independent advice to the Secretary of State for Defence on matters of concern to the Ministry of Defence.
\textsuperscript{2} UOR AO1235 refers specifically to the units manufactured by THALES Air Defence Limited to drawing reference S32-85-0001 Issue AA.
\textsuperscript{3} The military terminology is "INFO-OPS campaign".
6. **Timescales**: LTLE has been developed and procured as an Urgent Operational Requirement and has been trialled in OP HERRICK theatre. The system was granted a waiver for use on 4 April 2008 by Minister (DES). This waiver was conditional upon an assessment by DOMILL of any medical implications associated with its use. Members of DOMILL were introduced to the LTLE System at a meeting on 17 April 2008, where a preliminary medical assessment of the device was made which was conveyed on the same day to DCC IPT. DOMILL’s initial view was that the risks of the system causing injury were low if used within the policy and guidance provided for review, and DOMILL agreed to produce a formal medical statement within 6 weeks following a more considered review of the available evidence.

**Technical approach**

7. The approach was to examine the output of the LTLE System and generate a technical plan that would address the issues associated with this type of device. This included examining:

   a. Equipment design – to consider any design features that may affect the consistency of performance and power output.
   b. Training – to determine whether sufficient risk mitigation was inherent in the training and certification of users.
   c. Equipment management – to ensure that equipment manufacture was properly controlled and the performance of each device tested.
   d. Policy and guidance – to assess whether use of the system was controlled in a defined escalation of force process and controlled under appropriate rules of engagement.
   e. Accuracy – to ensure that the system was discriminating and the risks of injury to bystanders was minimised.
   f. Psychological, physiological and physical effects of the system – to determine the factors of safety inherent in the system design.
   g. Secondary effects – to consider impact on vehicle drivers and their passengers and on people using magnifying optical equipment.

8. A technical plan was developed that examined each of these areas, and personnel from Dstl (Dept. of Biomedical Sciences and Dept. of Sensors and Countermeasures) considered the implications for each of the issues outlined in the technical plan. A briefing document was prepared for DOMILL summarising the system and its intended use.

9. Dstl on behalf of DOMILL reviewed:

   a. The Urgent Statement of User Requirement (USUR) for a Less-Than-Lethal Warning Effect (HQBRTFOR/3363/20, dated 19 February 2007);
   b. THALES Air Defence Limited, THALES LTLE System, System Specification, GTD1962 Issue A01 (Draft, 18 February 2008);
   c. The Military Laser Safety Committee Certificate for the System (MLSCC/385/1/1);
   d. The Infantry Trials and Development Unit Trials Report (ITDU Report Number 02/08);
   e. Lessons identified from the use of Danger Light Warning Device (SCIAD/3364/Trials/EOF, dated 2 January 2008 and DSCIAD/Trials TA01, dated 3 January 2008);

\footnote{Document reference D/SIT/06/01/10/07 dated 17 April 2008.}

DSTL/BSC/27/06/02 Version 1.0
f. THALES Air Defence Limited ‘System Parameters’;
g. Training Documents (available only in draft form);
h. Communications from THALES in response to system-specific questions raised by Dstl (THALES Letter Rjg sec 2259 dated 8 April 2008);
i. Responses from the DCC IPT to questions raised by Dstl;
j. Responses from Scientific Advisors and Equipment Capability Branches.

The results of this review were presented to DOMILL on 17 April 2008.

10. Although DOMILL would normally only review final system designs, in view of the operational urgency for the LTLE System it was agreed that draft documentation would be acceptable in this instance. However, it was imperative that any changes by the manufacturer to the system needed to be reported back to DOMILL to determine whether they had any bearing on the medical factors associated with the system’s use.

11. In addition to the activities outlined above, an independent (non-DOMILL) Professor of Ophthalmology, who has considerable expertise in the ocular effects of lasers, was consulted about the risks of the LTLE System. A discussion was held on the approach undertaken in the review of this system. No risks were identified over-and-above those already highlighted in the technical plan.

Conclusions

12. Ocular injury to individuals is unlikely at distances greater than the estimated nominal ocular hazard distance (NOHD).^5

13. Ocular injury at distances less than the NOHD is possible and, therefore, people who are within the NOHD should not be exposed to the LTLE beam. However, in practice, it was considered that exposure within the NOHD was very unlikely as, at this short range, more aggressive escalation of force measures are likely to have been initiated. The risk of benign local nationals not reacting to the LTLE warning light should be mitigated through an information campaign.

14. Ocular injury through magnifying optics remains a possibility within the extended optical hazard distance (EOHD). However, it is deemed unlikely that a benign local national would use such equipment in the planned theatre of deployment.

15. The risk of injury to the skin is low, given that the estimated skin hazard distance is considerably less than the NOHD.

16. Overall, the risk of ocular injury arising from operation of the LTLE device would appear to be very low, given the implementation of suitable operator training and control and an effective local information campaign. However, the system and training recommendations made below are intended to increase confidence in the equipment and its safe and effective use, and to mitigate risks further.

Recommendations

17. The LTLE System should undergo further environmental testing to ensure that it performs in accordance with the manufacturer’s output specification over an expanded temperature range than currently tested.

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^5 There are two ocular hazard distances of relevance to the LTLE device; the nominal ocular hazard distance (NOHD), which applies to the un-aided eye, and the Extended Ocular Hazard Distance (EOHD), which applies to an individual using magnifying optics (specifically, 10 x 50 binoculars) to view the laser source. The NOHD and EOHD are estimates of the minimum distance from a laser that avoids ocular (retinal) injury. NOHDs and EOHDs for military lasers are estimated using the criteria defined in the Ministry of Defence Joint Service Publication, JSP 390. JSP 390 gives a longer range than British Standard, BS EN 60825-1, which is widely used for civilian laser applications.
18. Techniques should be incorporated in training and use so that operators are in no doubt of the state of the system (off/standby/on, warning/torch, continuous/pulsed). A review of the LTLE design should be undertaken to determine whether improvements can be made to facilitate operator recognition of the operational state of the device.

19. Techniques to aid range estimation should be incorporated during use to minimise further the risk of people being targeted within the nominal ocular hazard distance.

20. Confirmation should be provided to DOMILL that there are no residual issues with LTLE being aligned to the SA80A2 sight, or that design modifications are proposed to eliminate any of the difficulties reported in trials.

21. Users should be taught about the risk of ocular damage when viewing the LTLE beam through magnifying optics, and the consequences of using the system under these circumstances.

22. In the event that coalition forces are operating in the vicinity of UK military users of LTLE systems, they should be advised of potential ocular hazards arising from use of magnifying optics.

23. A review of the use of the system should be undertaken to determine whether both operating modes (warning and torch) are necessary. If both modes are not required, consideration should be given to disabling unused modes. The review should also consider whether the continuous and pulsed sub-modes are both required and which of these sub-modes is likely to exert the most effective warning effect.

24. Formal training should include:

   a. Care and maintenance of the LTLE unit;
   b. Mounting, alignment and checking of alignment of the unit to the SA80A2;
   c. Use of LTLE in daylight and darkness, including operator usage with Night Vision equipment;
   d. Reporting use of the device and outcomes;
   e. Potential adverse outcomes (including use on vehicle drivers, use on people with magnifying optics, and use against night vision equipment – including aircrew);
   f. Instruction of the actual NOHD and EOHD and the implications of use within these distances;
   g. Reporting of equipment malfunction or other difficulties in use;
   h. The legal framework of use;
   i. Medical implications of use;
   j. Examples of system success and failures (either system failures or personnel failing to react).

This training should include a timescale for refresher training.

25. The LTLE system should not be used without an appropriate information campaign, which must include the reasons for use, and warning people not to use magnifying optics to look at service personnel.

26. This system should not be regarded as a replacement for other warning systems, and the interoperability of systems should be considered (for example, the ability, particular in dark conditions, to read warning signs may be impaired during and after ocular exposure to the LTLE beam).
27. A review should be undertaken on the use of the system and this should be reported back to DOMILL every 6 months.

28. A review of the effectiveness of the system should be undertaken, but this should attempt to capture the effectiveness of LTLE in isolation from other warning and escalation of force measures that may have been used.

29. Use of the system should be recorded, and this should include any exposures that occur within the ocular hazard distances, or that inadvertently target coalition forces.

30. Any modifications to the system or associated documentation from those already provided should be reported to DOMILL.

31. DOMILL should be informed of any complaints of ocular injury. Ophthalmological admissions in the areas of operations should be monitored and any adverse or unexpected injuries with use should be reported to DOMILL.

[signed on original]

Chairman, DOMILL.