

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

Statement on the medical implications of use of the L21A2 Baton Round fired from the 37 mm L127A1 Less Lethal Gun fitted with the EOTech 552 Holographic Weapon Sight.

Background

1. The DSAC¹ Sub-committee on the Medical Implications of Less-lethal Weapons (DOMILL) has been requested by MOD to prepare this statement, which addresses the medical issues surrounding the proposed use by UK forces of the L21A2 Baton Round fired from the 37 mm L127A1 Less Lethal Gun fitted with the EOTech 552 Holographic Weapon Sight (HWS) in public order disturbances in Op HERRICK.
2. The Gun Riot 37 mm L67A4 gun² firing the L5A7 Baton Round³ is currently deployed in Op HERRICK. There is an Urgent Operational Requirement to enhance the public order equipment in this theatre.⁴ Initially, the proposed replacement for the L67A4/L5A7 was the Gun Riot 37 mm L104A1 gun (fitted with the L18A1/A2 optical sight) firing the L21A1 Baton Round, this system being available to forces in Iraq.⁵ Unfortunately, the environmental conditions in Afghanistan, coupled with considerations of the future availability of the L104A1, necessitated the development of an alternative system. In conjunction with the manufacturer of the L104A1 gun (Heckler & Koch GmbH), MOD proposed that the L67A4 replacement in Afghanistan would be the Heckler & Koch GLM 37 mm gun fitted with the EOTech 552 HWS.⁶ This weapon is now designated the L127A1 Less Lethal Gun 37 mm (hereafter referred to as the 'Sideloader').
3. The principal differences between the L104A1 and 'Sideloader' guns are as follows:
 - a. For insertion of the L21 cartridge, the L104A1 barrel pivots vertically while the barrel of the 'Sideloader' pivots horizontally (i.e. the barrel breaks to the user's left).
 - b. The L104A1 has a steel barrel while the 'Sideloader' has an anodized aluminium alloy barrel (the barrels of both weapons have the same internal dimensions). The lower friction of the 'Sideloader' barrel may result in a greater muzzle velocity of the L21A1 Baton Round.
 - c. The sights of the two guns are different and are located at different heights above the barrel.
 - d. The centres of the shoulder-rests for the two guns are at different distances below the barrel centre-line. This may lead to a different motion of the gun upon firing that could influence the trajectory of the L21 Baton Round.
 - e. The L104A1 has a single-action trigger with the barrel locking catch lever on top of the hammer. The 'Sideloader' has a double-action trigger with the barrel release lever situated next to the trigger.
4. During trials to compare the muzzle velocity of the L21A1 Baton Round when fired from the

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.

² In the UK, the L67A1 gun was replaced by the L104A1 on 1st June 1994. It fired the L5A5 Baton Round. The sights on the L67 weapon are iron sights.

³ The L5A7 is a cylindrical plug of polyurethane. The L21A1 round replaced the L5A7 in the UK in June 2001.

⁴ Ministry of Defence Urgent Operational Requirement No. AO1093.

⁵ The system available to police forces in the UK (and to the military in support of UK policing) is the L104A1 gun (fitted with the L18A1/A2 sight) firing the L60A1 Attenuating Energy Projectile (AEP). The AEP is designed to reduce the consequences of head impact. The AEP replaced the L21A1 on 21st June 2005. The designated environmental operating temperature range for the AEP precludes its use in Ops TELIC and HERRICK, but there is a desire to extend the operating temperature range of the system.

⁶ EOTech HWS Part No. 552.A65/1 (NATO Stock No. 1240-01-492-5264.)

two guns, it was apparent that the velocity at the 'Sideloader' muzzle was greater than that at the L104A1 muzzle. A charge weight adjustment was made to reduce the average velocity of the L21 from the 'Sideloader'. This L21 cartridge incorporating the lower charge weight was designated L21A2. The L21A2 round is only for use in the 'Sideloader'.⁷

Scope of the statement

5. This statement addresses the medical implications of use of the L21A2 Baton Round fired from the 'Sideloader' gun fitted with the EOTech 552 HWS. The medical implications of use of this system are compared with those of the L21A1 Baton Round fired from the L104A1 gun fitted with the L18A1/A2 sight. This latter system was originally intended to be the replacement for the L67A4/L5A7 System (see section 2).

Guidance

6. Use of the L67A4/L5A7 System in Afghanistan is subject to compliance with the UK Manual of National Rules of Engagement.⁸ CARD A of this manual gives "*Guidance for opening fire for Service personnel authorised to carry arms and ammunition on duty*", and is the overarching guidance for use of firearms. CARD D specifically addresses the use of public order equipment (e.g. CS smoke, batons, baton rounds). This medical statement assumes that users of the 'Sideloader' System (gun, sight and ammunition) will comply with this guidance and will receive training at a level comparable with that given to users of the L104A1 Weapon System.

Extant medical statements

7. There have been four main DSAC statements to Ministers addressing use in the UK of less-lethal systems employing kinetic energy against individual aggressors, whether acting on their own or as part of a group:
 - a. The comparative injury potential of the L5A7 Baton Round fired from the L104A1 employing battle-sights, was compared to the L21A1 Baton Round fired using the L18A1 sight.⁹ This statement, issued in August 2000, addressed use of the system at 20 m and beyond, principally in public order disturbances.¹⁰
 - b. A second statement, issued in May 2002, on the L104A1/L21A1 System addressed its use at ranges of 1-20 m.¹¹ This statement was driven by an operational decision to use the weapon as a less-lethal alternative to conventional firearms, which would normally involve engagement at closer ranges than those used in public order control.
 - c. DOMILL issued a third statement commenting on a review by MOD of the operational use in the UK from June 2001 to May 2003 of the L21A1 Baton Round fired from the L104A1.¹²
 - d. The round currently used in the UK is the L60A1 Attenuating Energy Projectile (AEP). The AEP is designed to reduce the peak forces to the head (should impact inadvertently occur in this area) and was developed following DSAC recommendations to undertake research on energy attenuation systems for baton rounds.⁹ A statement was released in March 2005 comparing the injury potential of the AEP and L21A1 fired from the L104A1.¹³

⁷ The trials are discussed in more detail below (sections 8-14).

⁸ JSP 398 (2004). United Kingdom Manual of National Rules of Engagement.

⁹ Defence Scientific Advisory Council statement on the comparative injury potential of the L5A7 Baton Round fired from the L104 Anti-riot gun using the battle-sights, and the L21A1 Baton Round fired using the XL18E3 optical sight. 21 August 2000.

¹⁰ An additional statement in May 2003 addressed the risks associated with the ricochet of L21A1 rounds.

¹¹ Defence Scientific Advisory Council statement on the use of the L21A1 Baton Round at ranges less than 20m. 13 March 2002.

¹² DSAC Sub-committee on the Medical Implications of Less-lethal Weapons (DOMILL). Statement on the review by MOD of medical issues arising from use of the L21A1 Baton Round from June 2001- May 2003.

¹³ DSAC Sub-committee on the Medical Implications of Less-lethal Weapons (DOMILL). Statement on the comparative injury potential of the Attenuating Energy Projectile (AEP) L60A1, and the L21A1 Baton Round. 23 March 2005.

Technical approach

8. The Defence Science and Technology Laboratory (Dstl) has undertaken trials to compare the ballistics in flight of L21 Baton Rounds fired from the L104A1 and 'Sideloader' guns. The trials involved:
 - a. A comparison of the velocity, mean point of impact and dispersion of the L21A1 (at three environmental temperatures) from the two types of gun (with guns clamped in a rest).
 - b. An assessment of the velocity of reduced-charge L21 ammunition to address the high L21 velocities observed in the clamped weapon trials with the L21A1 fired from the 'Sideloader'. The reduced-charge ammunition was designated L21A2.
 - c. Manned (unclamped) firing trials comparing the velocity, accuracy and dispersion of appropriately zeroed L104A1/L21A1 and 'Sideloader'/L21A2 Systems.¹⁴
- Trials were also undertaken to assess the wear of the alloy barrel of the 'Sideloader', the adequacy of the available adjustments to the sight and the performance of the emergency sight.
9. This medical statement is based on data from the above trials together with a review of medical outcomes following operational use of the L104A1/L21A1 System in the UK.

Results

10. L21A2 rounds fired from the 'Sideloader' and L21A1 rounds fired from the L104A1 exhibited very similar average muzzle velocities.
11. The variability of the muzzle velocity of rounds fired from the 'Sideloader' was less than that of rounds fired from the L104A1.
12. With clamped weapons, L21A2 rounds fired from the 'Sideloader' showed a lower dispersion in the vertical axis at extended range than L21A1 rounds fired from the L104A1.¹⁵
13. With manned firings at 20 m and beyond there was no difference between the mean points of impact of the two systems. However, at all ranges, batons from the 'Sideloader' displayed a greater dispersion around the mean.¹⁶
14. A conservative estimate of the probability of L21 batons entering the head area of a small adult (height in the 5th percentile) showed that, although the absolute risk was low, the risk from 'Sideloader' batons was greater risk than the risk from L104A1 batons. Using a simple modelling tool, the estimated increased risk for 'Sideloader' batons ranged from 1.4- to 3.2-fold that of L104A1 batons (increase dependent upon operational range). There is a large error associated with these estimates and they do not necessarily represent the true operational increased risk. An audit of about 450 firings of the L104A1/L21A1 System in Great Britain and Northern Ireland confirmed that the incidence of head impact and serious injury was low.

Conclusions

15. It is not possible to predict accurately the risk of head impact arising during operational use of the 'Sideloader'/L21A2 System. However, the operational trials, mathematical modelling and audit of L104A1/L21A1 firings in the UK suggest that the risk will be low.
16. In practice, the risk of an impact to the head from an L21A2 Baton Round fired from the 'Sideloader' gun equipped with the EOTech 552 HWS sight is considered to be low, but is likely to be greater than that from the L21A1 round fired from the L104A1 gun.
17. The overall risk of serious injury or death from the 'Sideloader' System is likely to be low,

¹⁴ The trial was conducted with the L18A1/A2 sights fitted to the L104A1 and the EOTech 552 HWS sight fitted to the 'Sideloader' (L127A1).

¹⁵ The vertical dispersion around the mean point of impact has a notable effect on the risk of inadvertent impact to the head.

¹⁶ This contrasts with the clamped weapon firings in which the rounds from the 'Sideloader' displayed less dispersion than those from the L104A1.

when the system is used in conjunction with comparable levels of guidance, training, zeroing and rules of engagement as that used for the L104A1 Weapon System.

18. Use of the L67 gun in the UK ceased in 1994, and the L5A7 Baton Round was replaced in 2001. The accuracy and consistency of the 'Sideloader' and L104A1 Systems will be superior to the L67A4/L5A7 System currently deployed in Afghanistan. The risk of an impact to a vulnerable area (head and chest) will be reduced by deployment and use of either of the two systems firing the L21 Baton Round.

Recommendations

19. An audit should be undertaken of the first year of operational use of the 'Sideloader' System in Afghanistan. The audit should address the site of impact on the body of the L21A2 and any injuries attributed to the system. DOMILL should be advised immediately of any deaths or serious injuries arising from use of the 'Sideloader' System, and any that have arisen during use of the currently deployed system. Wear and tear of the system should be monitored, and a record of weapon firing should be maintained.
20. DOMILL should be advised of any changes in:
 - a. The design, specification or performance of the 'Sideloader' System (gun, sight or ammunition).
 - b. The guidance to users and training practices.¹⁷
 - c. The policy and practice of deployment, including deviations from zeroing policy, use and audit.
21. DOMILL supports MOD's desire to improve the design of the L60A1 Attenuating Energy Projectile round to enable use in elevated environmental temperatures.

[signed on original]

Chairman, DOMILL.

¹⁷ This includes any changes impacting on the assumptions made in this statement.