# Addressing the body armour challenge

**Anthony G Williams**
**Derbyshire** 22/xx/2017

- **Body armour is becoming better, cheaper, and more available, and the best grades can resist conventional military rifle ammunition**
- **New armour-piercing ammunition for both rifles and pistols is being developed in order to address this problem**

Anthony G Williams: 1699874

**9x19 ball; 9x19 Russian AP; 6.5x25 CBJ ball; 6.5x25 CBJ HET; 5.7x28; 4.6x30.**

Body armour designe06 to resist bullets has been in existence for a long time, and is in widespread use with militaries and law enforcement organisations (LEOs). Despite this, relatively little attention has been given to defeating it. However, its commercial availability at decreasing prices makes it more likely that not just military combatants but also terrorists and criminals will take advantage of the protection it affords. Faced with adversaries protected in this way, what can military personnel and law enforcement officers do about it?

Body armour comes in various grades resistant to different levels of attack, and there is no international agreement on ballistic testing criteria or how to categorise results. The most widely used classification system is that developed by the US National Institute of Justice (NIJ), which is used by all LEOs in the United States and also in many other countries. This classifies armour in terms of the type of ammunition it will defeat, and those of greatest relevance are: Level IIA – defeats military-standard lead-cored 9 mm full metal jacket (FMJ) ball; Level II raises the threat to high velocity 9 mm ball, such as that used by sub-machine guns (SMGs); Level IIIA – defeats virtually all lead-cored pistol ball ammunition, plus soft-nosed jacketed .44 Magnum pistol loads; Level III – defeats 7.62 mm NATO lead-cored FMJ rifle and machine gun (MG) ammunition; and Level IV – defeats 7.62 mm armour-piercing (AP) rifle/MG ammunition with hardened steel cores.

Military standards differ from LEOs – and between countries – so direct comparisons are difficult. There are also complicating factors, which need to be noted: different loadings of any one type of ammunition (for example 5.56 mm NATO) can vary significantly in penetration capabilities; the resistance of armour may be affected by being damaged or even just routine wear and tear; and resisting multiple hits is much more difficult than single hits.

The only Western rifle ammunition currently adopted for military service that is likely to defeat Level IV is the tungsten alloy-cored AP type, such as the US 5.56 mm M995 or 7.62 mm M993, but this is not generally issued due to its high cost. It does, however, provide the infantry with a solution to the potential problem of dealing with opponents in high-grade armour. The US Army has recently stated that it is developing new AP bullets to replace those used with M993 (and possibly M995) rounds, but details are not yet available.

Even so, armour is evolving steadily, so even higher-performance ammunition may need to be issued in the future, possibly using saboted sub-calibre bullets, akin to the armour-piercing discarding-sabot (APDS) used in larger calibres such as the .50 calibre (12.7 mm) Saboted Light Armour Penetrator (SLAP).

Such ammunition in 7.62 mm NATO calibre has already been developed by Winchester Olin (as the M948 SLAP) and a version of this has seen military service, in Swedish Army PSG-90 sniper rifles. Sweden was primarily interested in the flat trajectory and short flight time achieved by the very-high velocity tungsten alloy sub-calibre bullets (about 1,220 m/s for the M948), but they would probably have no difficulty in penetrating Level IV armour.

Saboted tungsten alloy rifle ammunition is also being developed by CBJ Tech of Sweden, initially in 7.62 mm NATO and .300 Blackout (BLK), a more compact round, which is achieving some success with special forces. The .300 BLK CBJ fires a 6 g tungsten alloy core projectile (plus a 1 g sabot) at 725 m/s from a 406 mm barrel; the 7.62x51 CBJ fires a similar type of projectile at a muzzle velocity (MV) of 850-1,015 m/s depending on the barrel length (457-610 mm).

While there are answers to body armour available – at a price – for use in rifles and MGs, those using pistols or SMGs have a much harder problem due to the low power of the ammunition. This was recognised some time ago by NATO, which in 1990 began defining the characteristics of ammunition required to replace the NATO standard 9x19 pistol/SMG round. The key to this was the ability to penetrate a specified level of body armour (named the CRISAT target [Collaborative Research Into Small Arms Technology project]), defined as a 1.6 mm titanium plate and 20 layers of Kevlar, while retaining sufficient energy to incapacitate the person wearing the armour, out to a range of 150 m. The CRISAT target was said to match the resistance of contemporary Russian Army body armour.

## Rival rounds

This specification resulted by the end of the 1990s in two rivals: FN's 5.7x28 round, as chambered in the P90 SMG and subsequently the Five-seveN pistol, and Heckler & Koch's 4.6x30 cartridge, available in the MP7 machine pistol (effectively a small SMG). Both rely on firing small-calibre, copper-plated or steel-cored bullets at a relatively high MV to provide their penetration capabilities. No agreement could be reached on which to choose, so both have

been adopted but only on a limited scale: the 9 mm NATO round remains more popular, and has just been re-selected by the US armed forces for their new M17 Modular Handgun System, without any reference to penetrating armour. One problem faced by the 5.7 mm and 4.6 mm rounds is that body armour has moved on since they were developed, so the original CRISAT target has become outdated.

So, do users of pistols and SMGs have to accept that, faced by an opponent in body armour, they just have to hope that they can score effective hits outside the area protected by the armour? This is unlikely to prove a realistic approach, given that the practical accuracy of pistol shooting in the stress of combat is so poor that hitting the target anywhere at all is an achievement. Can anything be done to improve the penetration of the universal 9 mm weapons?

Armour-piercing 9 mm ammunition does exist and has been adopted by the Russian Army. In general they use bullets with either an enclosed or exposed steel penetrator: if hitting an unprotected target, the bullet holds together, but against armour, the penetrator separates from the body of the bullet and penetrates by itself. Many of these rounds should penetrate Level IIIA armour but their performance against high level armour is questionable and would depend on the exact round.

A different solution was proposed by CBJ Tech some years ago, and it is still being developed and improved. This initially involved a new cartridge – the 6.5x25 CBJ – which fires saboted tungsten alloy-cored ammunition. The round is the same size overall as the 9 mm NATO, and it can be used in 9 mm weapons by changing the barrel; unmodified 9 mm magazines can be used. This has a number of advantages over the 5.7 and 4.6 mm rounds: the compatibility with 9 mm means that new weapons do not have to be acquired (and the guns can be converted from 6.5x25 CBJ back to 9 mm if required); at the same gas pressure the greater base area of the sabot gives the propellant gases more area to work on and hence force applied to the bullet, so the cartridge works better in short barrels than the 5.7 mm – and especially the 4.6 mm; and the tungsten-alloy bullet has impressive penetration.

CBJ Tech: 1699873

**7.62x51 AP; 7.62x51 M948 SLAP; 7.62x51 CBJ; .300 BLK CBJ; 6.5x25 CBJ ball.**

## Propellant development

CBJ Tech states that recent development work with propellants has resulted in the following MVs being measured for the 6.5x25 CBJ from different barrel lengths (bullet weight 2 g plus 0.5 g sabot): 97.5 mm barrel – 720 m/s, 114 mm – 750 m/s, 125 mm – 770 m/s, 150 mm – 800 m/s, 200 mm – 840 m/s, 250 mm – 870 m/s, and 300 mm barrel – 900 m/s.

This compares with claimed figures for the FN 5.7 mm SS190 ball (2 g) of 650 m/s from a 122 mm barrel (Five-seveN) and 715 m/s from a 264 mm barrel (P90); and for the HK 4.6 mm Ultimate Combat ball (2 g) of 720 m/s from a 180 mm barrel (MP7).

The target normally used for penetration testing by CBJ Tech is a plate of 8 mm thick steel armour of 400 HB hardness from a Russian MT-LB light armoured vehicle. The 7.62 mm M80 ball merely splashes against it, 5.56 mm NATO SS109 (with a hardened steel penetrator in the nose) gouges out a shallow depression, but the 6.5x25 tungsten-alloy ball punches a hole clear through it at an impact velocity of 720 m/s. This means that pistols with a standard length barrel (such as a Glock 17 with 114 mm barrel) will penetrate that armour at a range of up to 25 m; compact SMGs with a 150 mm barrel will penetrate at up to 50 m; and SMGs with a 200+ mm barrel will penetrate out to 100 m.

The disadvantage of the 6.5x25 CBJ ball round is that, like the most effective rifle/MG ammunition, it relies on tungsten alloy to penetrate high-grade body armour; and tungsten is not only costly but also a strategic material in potentially limited supply. The difference with the 6.5x25 CBJ is that while automatic infantry rifles and MGs get through vast quantities of ammunition in combat, pistols and SMGs are essentially self-defence weapons, which are rarely fired in anger. This applies even more so to LEOs. The cost of individual rounds is therefore much less of a factor.

CBJ Tech has also developed various other bullet types for the 6.5x25 CBJ calibre, less costly but still effective against Level IIIA and CRISAT armour. This includes steel-cored saboted ammunition (also suitable for training) and solid brass full-calibre High Energy Transfer (HET) projectiles stated to be capable, when fired from pistols, of penetrating NIJ Level IIIA armour out to at least 25 m.

Given the proliferation of body armour, now including high-grade types, all militaries and LEOs should have a plan for dealing with this problem when it arises, as it inevitably will. ■